



City of Palmer

PALMER, ALASKA

Wastewater Treatment Facility Improvements Project - Phase II

Bid Documents **Volume 1 of 4** Specifications

May 25, 2021

HDR Project No. 10022766



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TABLE OF CONTENTS

Volumes 1 and 2 – Specifications

DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 07 - SEALS AND SIGNATURES

00 45 18 - BIDDER'S NONCOLLUSION AND DEBARMENT AFFIDAVIT

USDA CONTRACT FORMS

C-111 - ADVERTISEMENT FOR BIDS

C-200 - INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACTS

C-200A - ATTACHMENT - AK WAGE RATES

C-410 - BID FORM FOR CONSTRUCTION CONTRACTS

C-430 - BID BOND FORM

C-451 - QUALIFICATIONS STATEMENT

C-510 - NOTICE OF AWARD

C-520 - AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR
CONSTRUCTION CONTRACT (STIPULATED PRICE)

C-520A - EXHIBIT A-3 CONSENT DECREE

C-550 - NOTICE TO PROCEED

C-610 - PERFORMANCE BOND

C-615 - PAYMENT BOND

C-620 - APPLICATION FOR PAYMENT

C-625 - CERTIFICATE OF SUBSTANTIAL COMPLETION

C-700 - STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION
CONTRACT

C-800 - SUPPLEMENTARY CONDITIONS

C-940 - WORK CHANGE DIRECTIVE

C-941 - CHANGE ORDER

C-942 - FIELD ORDER

CERTIFICATE OF OWNER'S ATTORNEY AND AGENCY CONCURRENT (RUS
BULLETIN 1780-26)

CERTIFICATION FOR CONTRACTS, GRANTS, AND LOANS (USDA RD 1940-Q)

CERTIFICATION REGARDING DEBARMENT (USDA FORM AD-1048)

COMPLIANCE STATEMENT (USDA FORM RD 400-6)

CONTRACTOR AIS CERTIFICATION (USDA 1780-35 Exhibit C)

ENGINEER'S CERTIFICATE OF FINAL PLANS AND SPECS

EXAMPLE MANUFACTURER AIS CERTIFICATION (USDA 1780-35 Exhibit D)

TEMPORARY CONSTRUCTION SIGN

DIVISION 01 — GENERAL REQUIREMENTS

01 11 00 - SUMMARY OF WORK

01 22 00 - MEASUREMENT AND PAYMENT

01 25 13 - PRODUCT SUBSTITUTIONS

01 29 73 - SCHEDULE OF VALUES (LUMP SUM PROJECTS)

01 30 00 - SPECIAL CONDITIONS

01 33 00 - SUBMITTALS

01 33 04 - OPERATION AND MAINTENANCE MANUALS

01 35 05 - ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS

01 45 03 - QUALITY ASSURANCE

01 45 25 - TESTING CONCRETE STRUCTURES FOR WATERTIGHTNESS

01 45 33 - SPECIAL INSPECTIONS AND TESTING PROGRAM
01 61 03 - EQUIPMENT BASIC REQUIREMENTS
01 65 50 - PRODUCT DELIVERY, STORAGE, AND HANDLING
01 71 21 - SPECIALTY ENGINEERING REQUIREMENTS
01 73 20 - OPENINGS AND PENETRATIONS IN CONSTRUCTION
01 73 29 - DEMOLITION, CUTTING AND PATCHING
01 74 13 - CLEANING
01 75 00 - FACILITY START-UP
01 77 23 - CONTRACT CLOSEOUT

DIVISION 03 — CONCRETE

03 05 05 - CONCRETE TESTING AND INSPECTION
03 11 13 - FORMWORK
03 15 19 - ANCHORAGE TO CONCRETE
03 21 00 - REINFORCEMENT
03 31 30 - CONCRETE, MATERIALS AND PROPORTIONING
03 31 31 - CONCRETE MIXING, PLACING, JOINTING, AND CURING
03 35 00 - CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS
03 61 00 - CLARIFIER GROUT

DIVISION 05 — METALS

05 12 00 - STRUCTURAL STEEL
05 14 00 - STRUCTURAL ALUMINUM
05 50 00 - METAL FABRICATIONS
05 52 05 - STEEL RAILINGS

DIVISION 06 — WOOD, PLASTICS, AND COMPOSITES

06 82 00 - FIBERGLASS REINFORCED PLASTIC FABRICATIONS

DIVISION 07 — THERMAL AND MOISTURE PROTECTION

07 14 00 - FLUID APPLIED WATERPROOFING
07 21 00 - BUILDING INSULATION
07 26 00 - UNDER SLAB VAPOR RETARDER
07 92 00 - JOINT SEALANTS

DIVISION 08 — OPENINGS

08 31 13 - ACCESS DOORS AND FRAMES

DIVISION 09 — FINISHES

09 96 00 - HIGH PERFORMANCE INDUSTRIAL COATINGS

DIVISION 10 — SPECIALTIES

10 14 00 - IDENTIFICATION DEVICES

DIVISION 23 — HEATING VENTILATING AND AIR CONDITIONING

23 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING AND HVAC
EQUIPMENT
23 80 00 - HVAC EQUIPMENT

DIVISION 25 — INTEGRATED AUTOMATION

25 14 05 - LOCAL CONTROL STATIONS AND MISCELLANEOUS ELECTRICAL
DEVICES

DIVISION 26 — ELECTRICAL

26 01 26 - ELECTRICAL TESTS
26 05 00 - ELECTRICAL WORK, GENERAL

26 05 05 - ELECTRIC MOTORS
26 05 19 - WIRE AND CABLES
26 05 26 - GROUNDING
26 05 33 - ELECTRICAL RACEWAY SYSTEMS
26 05 43 - UNDERGROUND RACEWAY SYSTEMS
26 05 48 - SEISMIC BRACING SYSTEMS
26 09 16 - CONTROL EQUIPMENT ACCESSORIES
26 24 16 - PANELBOARDS
26 27 26 - WIRING DEVICES
26 28 00 - OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES
26 32 14 - ENGINE GENERATOR DIESEL
26 36 05 - HEAVY-DUTY SAFETY SWITCHES
26 50 00 - LIGHTING

DIVISION 31 — EARTHWORK

31 10 00 - SITE CLEARING
31 23 00 - EARTHWORK
31 23 33 - TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES
31 25 00 - SOIL EROSION AND SEDIMENT CONTROL

DIVISION 32 — EXTERIOR IMPROVEMENTS

32 91 13 - TOPSOILING AND FINISHED GRADING
32 92 00 - SEEDING, SODDING AND LANDSCAPING

DIVISION 33 — UTILITIES

33 05 16 - PRECAST CONCRETE MANHOLE STRUCTURES

DIVISION 40 — PROCESS INTERCONNECTIONS

40 05 00 - PIPE AND PIPE FITTINGS BASIC REQUIREMENTS
40 05 07 - PIPE SUPPORT SYSTEMS
40 05 17 - PIPE COPPER
40 05 19 - PIPE DUCTILE
40 05 23 - PIPE STAINLESS STEEL
40 05 25 - PIPE UNDERGROUND, PREFABRICATED, INSULATED AND
JACKETED
40 05 31 - PIPE PLASTIC
40 05 33 - PIPE POLYETHYLENE (HDPE)
40 05 35 - PIPE ARCTIC
40 05 51 - VALVES BASIC REQUIREMENTS
40 05 52 - MISCELLANEOUS VALVES
40 05 59 - FABRICATED STAINLESS STEEL SLIDE GATES
40 05 61 - GATE VALVES
40 05 62 - PLUG VALVES
40 05 63 - BALL VALVES
40 05 64 - BUTTERFLY VALVES
40 05 66 - CHECK VALVES
40 41 13 - HEAT TRACING CABLE
40 42 00 - PIPE, DUCT AND EQUIPMENT INSULATION
40 90 00 - INSTRUMENTATION FOR PROCESS CONTROL BASIC
REQUIREMENTS
40 90 05 - CONTROL LOOP DESCRIPTIONS
40 91 10 - PRIMARY METERS AND TRANSMITTERS
40 94 43 - PROGRAMMABLE LOGIC CONTROLLER (PLC) CONTROL SYSTEM

40 97 00 - CONTROL AUXILIARIES
40 98 00 - CONTROL PANELS AND ENCLOSURES

DIVISION 43 — PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT

43 21 00 - PUMPING EQUIPMENT BASIC REQUIREMENTS
43 21 23 - WET PIT PREROTATION SCREW CENTRIFUGAL IMMERSIBLE NON-CLOG PUMPING SYSTEM
43 23 17 - PUMPING EQUIPMENT VORTEX (TORQUE-FLOW)
43 24 16 - PUMPING EQUIPMENT SUMP

DIVISION 46 — WATER AND WASTEWATER EQUIPMENT

46 43 24 - SLUDGE COLLECTION CIRCULAR SPIRAL SCRAPER-TYPE
46 73 18 - ALUMINUM FLAT PANEL COVERS

Volume 2 – Geotechnical Report

Volume 3 – Drawings

Volume 4 – Standard Details




DIVISION 00

**PROCUREMENT AND CONTRACTING
REQUIREMENTS**



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SECTION 00 01 07
SEALS AND SIGNATURES

| | |
|---|---|
|  <p>The seal is circular with a rope-like border. The outer ring contains the text "STATE OF ALASKA" at the top and "REGISTERED PROFESSIONAL ENGINEER" at the bottom. Inside the ring, there is a five-pointed star, the number "49TH" to its left, and the name "JONATHAN RYAN MOYERS" and "No. CE-12718" below it. A handwritten signature in blue ink is written across the center, and the date "5/25/21" is handwritten in blue ink below the license number.</p> | <p>I hereby certify that the technical material and data contained in these documents for the City of Palmer Wastewater Treatment Facility Improvements Project were prepared under my supervision and direction and that I am a duly registered Professional Engineer under the laws of the State of Alaska</p> <p>J. Ryan Moyers May 25, 2021</p> <p>My license renewal date is December 31, 2021.</p> |
|---|---|

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SECTION 00 45 18

BIDDER'S NONCOLLUSION AND DEBARMENT AFFIDAVIT

For
City of Palmer Wastewater Treatment Facility Improvements Project
For
City of Palmer

STATE OF ALASKA _____

_____ -

I, the undersigned, an authorized representative of _____
_____ being first duly sworn on oath hereby certify that the Bid submitted is a genuine
and not a sham or collusive Bid, or made in the interest or on behalf of any person not
therein named; and I further state that the said firm, association or corporation
(hereinafter referred to as "Firm") has not directly or indirectly inducted or solicited any
Bidder on the above work or supplies to put in a sham Bid, or any other person or
corporation to refrain from bidding; and that said Firm, has not in any manner sought by
collusion to secure to the Firm, an advantage over other bidder or bidders.

I further certify that, except as noted below, the Firm or any person in a controlling
capacity associated therewith or any position involving the administration of federal
funds; is not currently under suspension, debarment, voluntary exclusion, or
determination of ineligibility by any federal agency; has not been suspended, debarred,
voluntarily excluded or determined ineligible by any federal agency within the past 3
years; does not have a proposed debarment pending; and has not been indicted,
convicted or had a civil judgment rendered against said person or Firm, by a court of
competent jurisdiction in any matter involving fraud or official misconduct within the past
three years.

Exceptions noted:

Signed: _____

Title: _____

Subscribed and sworn to before me this _____ day of _____
_____, 2017.

(Seal or Stamp)

Notary Public for _____

Residing at: _____

My Commission Expires _____

END OF SECTION

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USDA CONTRACT FORMS

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City of Palmer, Alaska
Palmer, Alaska
Wastewater Treatment Facility Improvements Project – Phase II

ADVERTISEMENT FOR BIDS

Sealed Bids for the construction of the **Wastewater Treatment Facility Improvements Project – Phase II** will be received, by **the City of Palmer, Alaska** at the office of the **Palmer City Hall, 231 W Evergreen Avenue, Palmer Alaska**, until **2:00 p.m.** local time on **June 24, 2021**, at which time the Bids received will be publicly opened and read. The Project consists of constructing new secondary clarifiers, a waste activated sludge pumping station, a scum pump station, and associated electrical, SCADA, mechanical and civil work. Additional work for upgrades at the existing facility will include demolition, modifications to existing lagoons, piping upgrades, and installation of new equipment, and subsidiary and incidental work in accordance with the plans and specifications.

Bids will be received for a single prime Contract. Bids shall be on a lump sum basis, with additive alternate bid items as indicated in the Bid Form.

American Iron and Steel

Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Materials.

The following waivers apply to this Contract: De Minimis, Minor Components, Pig iron and direct reduced iron

Bid documents will be available starting June 1st, 2021 in electronic format only.

Documents may be downloaded at www.palmerak.org or a CD may be picked up from Palmer Public Works at 1316 S Bonanza Street, Palmer. There is no fee for bid documents.

At the current time, the City of Palmer has no means to record who has downloaded bid documents via their website. Prospective bidders should contact the City of Palmer Public Works Department at 907-745-3400 to be added to the plan holders list. Revised drawings will be issued to plan holders only, as necessary with addenda.

A mandatory Pre-Bid conference will be held at the Palmer City Hall, 231 W Evergreen Avenue, Palmer Alaska, at 10:00 AM June 8, 2021 and a site visit will be conducted after the Pre-Bid Conference at Palmer Wastewater Treatment Facility: Location: 1802 S. Brooks Road, Palmer, Alaska. Attendance at the pre-bid conference is mandatory and lack of attendance at the pre-bid conference shall disqualify the Bidder.

Bid security shall be furnished in accordance with the Instructions to Bidders.

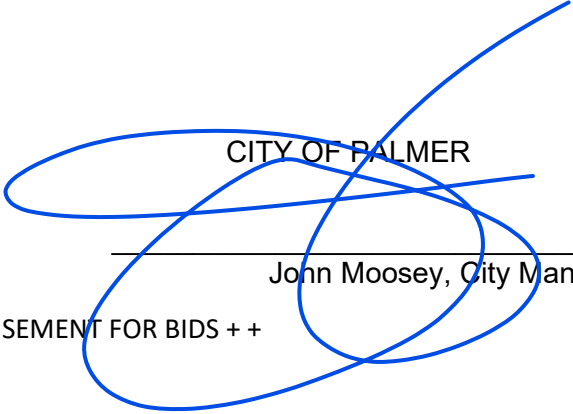
The City reserves the right to reject any or all bids and to waive irregularities or informalities in any of the bids when in its best interest.

Questions regarding this "Advertisement for Bids" should be submitted in writing via email to:

Ryan Moyers, PE Project
Manager HDR
Engineering, Inc. 2525 C
Street
Suite # 500
Anchorage, AK 99503-2633
Phone (907) 644-2000
E-mail : Ryan.Moyers@hdrinc.com

Dated this 27th day of May, 2021

CITY OF PALMER



John Moosey, City Manager

+ + END OF ADVERTISEMENT FOR BIDS + +

INSTRUCTIONS TO BIDDERS

ARTICLE 1 – DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. *Issuing Office* – The office from which the Bidding Documents are to be issued.
 - B. *Successful Bidder* - *The lowest responsible Bidder submitting a responsive bid to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award.*
 - C. *Owner* – *City of Palmer, Alaska*

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

- 2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid.
- 2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

- 3.01 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit the **EJCDC Form C- 451 Qualifications Statement** with its Bid (a) written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and (b) the following additional information:
- A. Evidence of Bidder's authority to do business in the state where the Project is located.
 - B. Bidder's state or other contractor license number, if applicable.
 - C. Subcontractor and Supplier qualification information; coordinate with provisions of Article 12 of these Instructions, "Subcontractors, Suppliers, and Others."
 - D. Other required information regarding qualifications
- 3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.
- 3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.
- 3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.01 *Site and Other Areas*

- A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

4.02 *Existing Site Conditions*

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify:
 - a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.
 - b. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
 - c. reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
 - d. Technical Data contained in such reports and drawings.
2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.
3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.
4. Geotechnical Baseline Report: The Bidding Documents contain a Geotechnical Baseline Report (GBR). The GBR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations ("Baseline Conditions"). The GBR is a Contract Document.

The Baseline Conditions in the GBR are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the Baseline Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the GBR, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are baselined.

Nothing in the GBR is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.

- B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or adjacent to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.
- C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

ARTICLE 5 – BIDDER’S REPRESENTATIONS

5.01 It is the responsibility of each Bidder before submitting a Bid to:

- A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;
- B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;
- C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work including but not limited to American Iron and Steel requirements as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference which apply to the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.
- D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;
- E. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder’s safety precautions and programs;

- F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;
- G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;
- H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;
- I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and
- J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 6 – PRE-BID CONFERENCE

6.01 A mandatory pre-Bid conference will be held at the Palmer City Hall, 231 W Evergreen Avenue, Palmer Alaska, at 10:00 AM June 8, 2021 and a site visit will be conducted after the Pre-Bid Conference at Palmer Wastewater Treatment Facility Location: 1802 S. Brooks Road, Palmer, Alaska. Representatives of Owner and Engineer will be present to discuss the Project. Attendance at the pre-bid conference is mandatory and lack of attendance at the pre-bid conference shall disqualify the Bidder. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

- 7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

ARTICLE 8 – BID SECURITY

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of five percent of Bidder's maximum Total Lump Sum Bid price (Total of Lump Sum Bid Items A-E) and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.
- 8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the

required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.

- 8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.
- 8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

ARTICLE 9 – CONTRACT TIMES

- 9.01 The number of days within which, or the dates by which, the Work is to be substantially completed, and completed and ready for final payment, are set forth in the Agreement.

9.01

ARTICLE 10 – LIQUIDATED DAMAGES

- 10.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 11 – SUBSTITUTE AND “OR-EQUAL” ITEMS

- 11.01 The Contract for the Work, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those “or-equal” or substitute materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an “or-equal” or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer at least 15 days prior to the date for receipt of Bids in the case of a proposed substitute and 5 days prior in the case of a proposed “or-equal.” Each such request shall comply with the requirements of Paragraphs 7.04 and 7.05 of the General Conditions. Each such request shall include Manufacturer's Certification letter for compliance with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner. Substitutes and “or-equal” materials and equipment may be proposed by Contractor in accordance with Paragraphs 7.04 and 7.05 of the General Conditions after the Effective Date of the Contract.

- 11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as

supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of “or-equal” or substitution requests are made at Bidder’s sole risk.

- 11.03 If an award is made, Contractor shall be allowed to submit proposed substitutes and “or-equals” in accordance with the General Conditions..

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 12.01 If required by the Bid Documents, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work:

- A. Electrical Subcontractor
- B. Instrumentation and Controls Subcontractor
- C. Mechanical and Piping Systems Subcontractor
- D. HVAC Subcontractor
- E. Concrete Work Subcontractor

If requested by Owner, such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall submit a substitute, Bidder’s Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

- 12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.
- 12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual. Or entity against whom the Contractor has a reasonable objection.
- 12.04 The Contractor shall not award work to Subcontractor (s) in excess of the limits stated in SC 7.06.

ARTICLE 13 – PREPARATION OF BID

- 13.01 The Bid Form is included with the Bidding Documents.
- A. All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

- B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”
- 13.02 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown.
- 13.03 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The partnership’s address for receiving notices shall be shown.
- 13.04 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the firm’s address for receiving notices shall be shown.
- 13.05 A Bid by an individual shall show the Bidder’s name and address for receiving notices.
- 13.06 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture’s address for receiving notices shall be shown.
- 13.07 All names shall be printed in ink below the signatures.
- 13.08 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
- 13.09 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.
- 13.10 The Bid shall contain evidence of Bidder’s authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder’s state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 – BASIS OF BID

14.01 *Lump Sum*

- A. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid Form.

[or]

14.02 *Allowances*

- A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

ARTICLE 15 – SUBMITTAL OF BID

- 15.01 Five (5) copies of the Bid shall be submitted in one sealed envelope or container, which shall contain the items of information listed in Section C-410 Bid Form. With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.

- 15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to: City of Palmer, Palmer City Hall, 231 W Evergreen Avenue, Palmer Alaska
- 15.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

- 16.01 A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.
- 16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.
- 16.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 – OPENING OF BIDS

- 17.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

- 18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

- 19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

- 19.02 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.
- 19.03 Evaluation of Bids
- A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.
 - B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form. To determine the Bid prices for purposes of comparison, Owner shall announce to all bidders a “Base Bid plus alternates” budget after receiving all Bids, but prior to opening them. For comparison purposes alternates will be accepted, following the order of priority established in the Bid Form, until doing so would cause the budget to be exceeded. After determination of the Successful Bidder based on this comparative process and on the responsiveness, responsibility, and other factors set forth in these Instructions, the award may be made to said Successful Bidder on its base Bid and any combination of its additive alternate Bids for which Owner determines funds will be available at the time of award.
- 19.04 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.
- 19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 20 – BONDS AND INSURANCE

- 20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner’s requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

ARTICLE 21 – SIGNING OF AGREEMENT

- 21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 22 – SALES AND USE TAXES

- 22.01 Contractor shall be responsible for all taxes and duties arising out of the sale of the Goods and the furnishing of any Special Services. Refer to Paragraph SC-7.09 of the Supplementary Conditions for additional information.

ARTICLE 23 – CONTRACTS TO BE ASSIGNED (NOT USED)

ARTICLE 24 – FEDERAL REQUIREMENTS

- 24.01 Federal requirements at Article 19 of the Supplementary Conditions apply to this Contract.
- 24.02 Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. The de minimis and minor components waiver apply to this contract.

ARTICLE 25 – WAGE RATE REQUIREMENTS

- 25.01 If the contract price is in excess of \$100,000, provisions of the Contract Work Hours and Safety Standards Act at 29 CFR 5.5(b) shall apply.
- 25.02 This project has federal funding and State of Alaska Davis-Bacon wage rates apply. Copies of State certified payroll records must be submitted monthly with the Application for Payment.
- 25.03 The Contractor is hereby made aware that the provisions of Title 36 of the Alaska Statutes and Title 8 of the Alaska Administrative Code will be enforced on the project. The Contractor will be required to become familiar with the State Statute and pay his/her labor the local prevailing wage rates. The most recent State of Alaska, Department of Labor-Laborer’s and Mechanics Minimum Rates of Pay will be used with any updated changes throughout the entire duration of this project. Current State of Alaska, Department of Labor wages rates can be obtained from the State of Alaska website (<http://www.labor.state.ak.us/lss/pamp600.htm>) and have been attached to this Section.



PAMPHLET No. 600

Title 36. Public Contracts
AS 36.05

Laborers' and Mechanics' MINIMUM RATES OF PAY

Effective April 1, 2021

Issue 42

DEPARTMENT OF LABOR
AND WORKFORCE DEVELOPMENT
Wage and Hour Administration

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April 1, 2021

TO ALL CONTRACTING AGENCIES:

At the Alaska Department of Labor and Workforce Development, our goal is putting Alaskans to work. This pamphlet is designed to help contractors awarded public construction contracts understand the most significant laws of the State of Alaska pertaining to prevailing wage.

This pamphlet identifies current prevailing wage rates for public construction contracts (any construction projects awarded for the State of Alaska or its political subdivisions, such as local governments and certain non-profit organizations). Because these rates may change in a subsequent determination, please be sure you are using the appropriate rates. The rates published in this edition become effective April 1, 2021.

The prevailing wage rates contained in this pamphlet are applicable to public construction projects with a final bid date of April 11, 2021, or later. As the law now provides, these rates will remain stable during the life of a contract or for 24 calendar months, whichever is shorter. **The 24-month period begins on the date the prime contract is awarded.** Upon expiration of the initial 24-month period, the latest wage rates issued by the department shall become effective for a subsequent 24-month period or until the original contract is completed, whichever occurs first. This process shall be repeated until the original contract is completed.

The term "original contract" means the signed contract that resulted from the original bid and any amendments, including changes of work scope, additions, extensions, change orders, and other instruments agreed to by the parties that have not been subject to subsequent open bid procedures.

If a higher federal rate is required due to partial federal funding or other federal participation, the higher rate must be paid.

For additional copies of this pamphlet go to: <http://labor.state.ak.us/lss/pamp600.htm>

For questions regarding prevailing wage or employment preference requirements, please contact the nearest Wage and Hour office. These offices are listed on Page x.

Sincerely,

A handwritten signature in black ink that reads "Tamika L. Ledbetter".

Dr. Tamika L. Ledbetter
Commissioner

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Table of Contents

Excerpts from Alaska Law

| | |
|---|----|
| Sec. 36.05.005. Applicability..... | iv |
| Sec. 36.05.010. Wage rates on public construction. | iv |
| Sec. 36.05.040. Filing schedule of employees, wages paid and other information | iv |
| Sec. 36.05.045. Notice of work and completion; withholding of payment | iv |
| Sec. 36.05.060. Penalty for violation of this chapter | v |
| Sec. 36.05.070. Wage rates in specifications and contracts for public works | v |
| Sec. 36.05.080. Failure to pay agreed wages..... | v |
| Sec. 36.05.090. Payment of wages from withheld payments and listing contractors who violate contracts | v |
| Sec. 36.05.900. Definition.. .. | vi |

Excerpts from Alaska Administrative Code

| | |
|--|-----|
| 8 AAC 30.051. Purpose | vi |
| 8 AAC 30.052. Board and lodging; remote sites | vi |
| 8 AAC 30.054. Per diem instead of board and lodging | vi |
| 8 AAC 30.056. Alternative arrangement | vii |
| 8 AAC 30.900. General definitions (selected excerpts)..... | vii |

Additional Information

| | |
|--|------|
| Per Diem | vii |
| Laborer Classification Clarification..... | viii |
| Apprentice Rates..... | viii |
| Fringe Benefit Plans..... | viii |
| Special Prevailing Wage Rate Determination..... | ix |
| Alaska Employment Preference Information..... | ix |
| Labor Standards and Safety Notice Requests | x |
| Debarment List | x |

Wage Rates Pages 1-26

Note to Readers: The statutes and administrative regulations listed in this publication were taken from the official codes, as of the effective date of the publication. However, there may be errors or omissions that have not been identified and changes that occurred after the publication was printed. This publication is intended as an informational guide only and is not intended to serve as a precise statement of the statutes and regulations of the State of Alaska. To be certain of current laws and regulations, please refer to the official codes.

EXCERPTS FROM ALASKA LAW

Sec. 36.05.005. Applicability.

This chapter applies only to a public construction contract that exceeds \$25,000.

Sec. 36.05.010. Wage rates on public construction.

A contractor or subcontractor who performs work on a public construction contract in the state shall pay not less than the current prevailing rate of wages for work of a similar nature in the region in which the work is done. The current prevailing rate of wages is that contained in the latest determination of prevailing rate of wages issued by the Department of Labor and Workforce Development at least 10 days before the final date for submission of bids for the contract. The rate shall remain in effect for the life of the contract or for 24 calendar months, whichever is shorter. At the end of the initial 24-month period, if new wage determinations have been issued by the department, the latest wage determination shall become effective for the next 24-month period or until the contract is completed, whichever occurs first. This process shall be repeated until the contract is completed.

Sec. 36.05.040. Filing schedule of employees, wages paid, and other information.

All contractors or subcontractors who perform work on a public construction contract for the state or for a political subdivision of the state shall, before the Friday of every second week, file with the Department of Labor and Workforce Development a sworn affidavit for the previous reporting period, setting out in detail the number of persons employed, wages paid, job classification of each employee, hours worked each day and week, and other information on a form provided by the Department of Labor and Workforce Development.

Sec. 36.05.045. Notice of work and completion; withholding of payment.

- (a) Before commencing work on a public construction contract, the person entering into the contract with a contracting agency shall designate a primary contractor for purposes of this section. Before work commences, the primary contractor shall file a notice of work with the Department of Labor and Workforce Development. The notice of work must list work to be performed under the public construction contract by each contractor who will perform any portion of work on the contract and the contract price being paid to each contractor. The primary contractor shall pay all filing fees for each contractor performing work on the contract, including a filing fee based on the contract price being paid for work performed by the primary contractor's employees. The filing fee payable shall be the sum of all fees calculated for each contractor. The filing fee shall be one percent of each contractor's contract price. The total filing fee payable by the primary contractor under this subsection may not exceed \$5,000. In this subsection, "contractor" means an employer who is using employees to perform work on the public construction contract under the contract or a subcontract.
- (b) Upon completion of all work on the public construction contract, the primary contractor shall file with the Department of Labor and Workforce Development a notice of completion together with payment of any additional filing fees owed due to increased contract amounts. Within 30 days after the department's receipt of the primary contractor's notice of completion, the department shall inform the contracting agency of the amount, if any, to be withheld from the final payment.
- (c) A contracting agency
 - (1) may release final payment of a public construction contract to the extent that the agency has received verification from the Department of Labor and Workforce Development that
 - (A) the primary contractor has complied with (a) and (b) of this section;
 - (B) the Department of Labor and Workforce Development is not conducting an investigation under this title; and
 - (C) the Department of Labor and Workforce Development has not issued a notice of a violation of this chapter to the primary contractor or any other contractors working on the public construction contract; and

- (2) shall withhold from the final payment an amount sufficient to pay the department's estimate of what may be needed to compensate the employees of any contractors under investigation on this construction contract, and any unpaid filing fees.
- (d) The notice and filing fee required under (a) of this section may be filed after work has begun if
 - (1) The public construction contract is for work undertaken in immediate response to an emergency; and
 - (2) The notice and fees are filed not later than 14 days after the work has begun.
- (e) A false statement made on a notice required by this section is punishable under AS 11.56.210.

Sec. 36.05.060. Penalty for violation of this chapter.

A contractor who violates this chapter is guilty of a misdemeanor and upon conviction is punishable by a fine of not less than \$100 nor more than \$1,000, or by imprisonment for not less than 10 days nor more than 90 days, or by both. Each day a violation exists constitutes a separate offense.

Sec. 36.05.070. Wage rates in specifications and contracts for public works.

- (a) The advertised specifications for a public construction contract that requires or involves the employment of mechanics, laborers, or field surveyors must contain a provision stating the minimum wages to be paid various classes of laborers, mechanics, or field surveyors and that the rate of wages shall be adjusted to the wage rate under AS 36.05.010.
- (b) Repealed by §17 ch 142 SLA 1972.
- (c) A public construction contract under (a) of this section must contain provisions that
 - (1) the contractor or subcontractors of the contractor shall pay all employees unconditionally and not less than once a week;
 - (2) wages may not be less than those stated in the advertised specifications, regardless of the contractual relationship between the contractor or subcontractors and laborers, mechanics, or field surveyors;
 - (3) the scale of wages to be paid shall be posted by the contractor in a prominent and easily accessible place at the site of the work;
 - (4) the state or a political subdivision shall withhold so much of the accrued payments as is necessary to pay to laborers, mechanics, or field surveyors employed by the contractor or subcontractors the difference between
 - (A) the rates of wages required by the contract to be paid laborers, mechanics, or field surveyors on the work; and
 - (B) the rates of wages in fact received by laborers, mechanics, or field surveyors.

Sec. 36.05.080. Failure to pay agreed wages.

Every contract within the scope of AS 36.05.070 shall contain a provision that if it is found that a laborer, mechanic, or field surveyor employed by the contractor or subcontractor has been or is being paid a rate of wages less than the rate of wages required by the contract to be paid, the state or its political subdivision may, by written notice to the contractor, terminate the contractor's right to proceed with the work or the part of the work for which there is a failure to pay the required wages and to prosecute the work to completion by contract or otherwise, and the contractor and the contractor's sureties are liable to the state or its political subdivision for excess costs for completing the work.

Sec. 36.05.090. Payment of wages from withheld payments and listing contractors who violate contracts.

- (a) The state disbursing officer in the case of a state public construction contract and the local fiscal officer in the case of a political subdivision public construction contract shall pay directly to laborers, mechanics, or field surveyors from accrued payments withheld under the terms of the contract the wages due laborers, mechanics, or field surveyors under AS 36.05.070.
- (b) The state disbursing officer or the local fiscal officer shall distribute to all departments of the state government and to all political subdivisions of the state a list giving the names of persons who have disregarded their obligations to employees. A person appearing on this list and a firm, corporation, partnership, or association in which the person has an interest may not work as a contractor or

subcontractor on a public construction contract for the state or a political subdivision of the state until three years after the date of publication of the list. If the accrued payments withheld under the contract are insufficient to reimburse all the laborers, mechanics, or field surveyors with respect to whom there has been a failure to pay the wages required under AS 36.05.070, the laborers, mechanics, or field surveyors have the right of action or intervention or both against the contractor and the contractor's sureties conferred by law upon persons furnishing labor or materials, and in the proceedings it is not a defense that the laborers, mechanics, or field surveyors accepted or agreed to accept less than the required rate of wages or voluntarily made refunds.

Sec. 36.05.900. Definition.

In this chapter, "contracting agency" means the state or a political subdivision of the state that has entered into a public construction contract with a contractor.

EXCERPTS FROM ALASKA ADMINISTRATIVE CODE

*****Notice:** Regulations relating to board and lodging and per diem went into effect on November 25, 2018. The new regulations are excerpted here***

8 AAC 30.051. Purpose. The purpose of 8 AAC 30.052 – 8 AAC 30.056 is to ensure that wages paid to laborers, mechanics, and field surveyors do not fall below the prevailing rate of pay.

8 AAC 30.052. Board and lodging; remote sites. (a) A contractor on a public construction project located 65 or more road miles from the international airport closest to the project area in either Fairbanks, Juneau, or Anchorage, or that is inaccessible by road in a two-wheel drive vehicle, shall provide adequate board and lodging to each laborer, mechanic, or field surveyor while the person is employed on the project. If commercial lodging facilities are not available, the contractor shall provide temporary lodging facilities. Lodging facilities must comply with all applicable state and federal laws. For a highway project, the location of the project is measured from the midpoint of the project.

(b) A contractor is not required to provide board and lodging:

(1) to a laborer, mechanic, or field surveyor who is a domiciled resident of the project area; or

(2) on a laborer, mechanic, or field surveyor's scheduled days off, when the person can reasonably travel between the project and the person's permanent residence; for the purposes of this paragraph, "scheduled day off" means a day in which a person does not perform work on-site, is not required to remain at or near the job location for the benefit of the contractor, and is informed of the day off at least seven days before the day off.

(c) Upon a contractor's written request, the commissioner may waive the requirements of (a) of this section where:

(1) the project is inaccessible by road in a two-wheel drive vehicle, but the laborer, mechanic, or field surveyor can reasonably travel between the project and the person's permanent residence within one hour; or

(2) a laborer, mechanic, or field surveyor is not a domiciled resident of the project area, but has established permanent residence, with the intent to remain indefinitely, within 65 road miles of the project, or for a highway project, the mid-point of the project.

8 AAC 30.054. Per diem instead of board and lodging. (a) A contractor may pay a laborer, mechanic, or field surveyor per diem instead of providing board and lodging, when the following conditions are met:

(1) the department determines that per diem instead of board and lodging is an established practice for the work classification; the department shall publish and periodically revise its determinations in the pamphlet *Laborers' and Mechanics' Minimum Rates of Pay*;

(2) the contractor pays each laborer, mechanic, or field surveyor the appropriate per diem rate as published and periodically revised in the pamphlet *Laborers' and Mechanics' Minimum Rates of Pay*; and

(3) the contractor pays the per diem to each laborer, mechanic, or field surveyor on the same day that wages are paid.

(b) A contractor may not pay per diem instead of board and lodging on a highway project located

- (1) west of Livengood on the Elliot Highway, AK-2;
- (2) on the Dalton Highway, AK-11;
- (3) north of milepost 20 on the Taylor Highway, AK-5;
- (4) east of Chicken on the Top of the World Highway; or
- (5) south of Tetlin Junction to the Alaska-Canada border on the Alaska Highway, AK-2.

8 AAC 30.056. Alternative arrangement. Upon a contractor’s written request, the commissioner may approve an alternative board and lodging or per diem arrangement, provided

- (1) the arrangement does not reduce the laborer, mechanic, or field surveyor’s wages below the prevailing wage rate; and
- (2) the laborer, mechanic, or field surveyor voluntarily enters into and signs the written arrangement; a labor organization representing laborers, mechanics, or field surveyors may enter into the written agreement on their behalf.

8 AAC 30.900. General definitions (selected excerpts only):

In this chapter and in AS 36

- (22) “domiciled resident” means a person living within 65 road miles of a public construction project, or in the case of a highway project, the mid-point of the project, for at least 12 consecutive months prior to the award of the public construction project;
- (23) “employed on the project” means the time period from the date the laborer, mechanic, or field surveyor first reports on-site to the project through the final date the person reports on-site to the project.

ADDITIONAL INFORMATION

PER DIEM

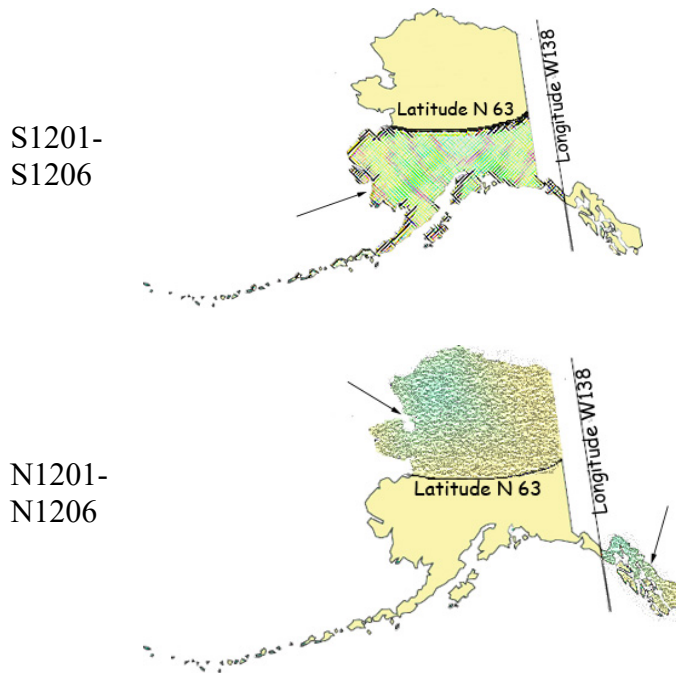
Notice: New regulations relating to board and lodging and per diem went into effect on November 25, 2018. The regulations provide a comprehensive set of requirements for the provision of board and lodging or per diem for workers on remote projects. Please refer to Alaska Administrative Code 8 AAC Chapter 30 and read the chapter carefully.

The Alaska Department of Labor and Workforce Development has determined that per diem is an established work practice for certain work classifications. These classifications are indicated throughout the Pamphlet by an asterisk (*) under the classification title. If all of the conditions of 8 AAC 30.054 are met, an employer may pay workers in these classifications per diem instead of providing board and lodging on a remote project.

Per Diem Rate: As of May 1st, 2019, the minimum per diem rate is \$100.00 per day, or part thereof, the worker is employed on the project. In the event that a contractor provides lodging facilities, but no meals, the department will accept a payment of \$48 per day for meals to meet the per diem requirements.

LABORER CLASSIFICATION CLARIFICATION

The laborer rates categorized in class code S1201-S1206 apply in one area of Alaska; the area that is south of N63 latitude and west of W138 Longitude. The laborer rates categorized in class code N1201-N1206 apply in two areas of Alaska; the Alaska areas north of N63 latitude and east of W138 longitude. The following graphic representations should assist with clarifying the applicable wage rate categories:



APPRENTICE RATES

Apprentice rates at less than the minimum prevailing rates may be paid to apprentices according to an apprentice program which has been registered and approved by the Commissioner of the Alaska Department of Labor and Workforce Development in writing or according to a bona fide apprenticeship program registered with the U.S. Department of Labor, Office of Apprenticeship Training. **Any employee listed on a payroll at an apprentice wage rate who is not registered as above shall be paid the journeyman prevailing minimum wage in that work classification.** Wage rates are based on prevailing crew makeup practices in Alaska and apply to work performed regardless of either the quality of the work performed by the employee or the titles or classifications which may be assigned to individual employees.

FRINGE BENEFIT PLANS

Contractors/subcontractors may compensate fringe benefits to their employees in any one of three methods. The fringe benefits may be paid into a union trust fund, into an approved benefit plan, or paid directly on the paycheck as gross wages.

Where fringe benefits are paid into approved plans, funds, or programs including union trust funds, the payments must be contributed at least monthly. If contractors submit their own payroll forms and are paying fringe benefits into approved plans, funds, or programs, the employer's certification must include, in addition to those requirements of 8 AAC 30.020(c), a statement that fringe benefit payments have been or will be paid at least monthly. Contractors who pay fringe benefits to a plan must ensure the plan is one approved by the Internal Revenue Service and that the plan meets the requirements of 8 AAC 30.025 (eff. 3/2/08) in order for payments to be credited toward the prevailing wage obligation.

SPECIAL PREVAILING WAGE RATE DETERMINATION

Special prevailing wage rate determinations may be requested for special projects or a special worker classification if the work to be performed does not conform to traditional public construction for which a prevailing wage rate has been established under 8 AAC 30.050(a) of this section. Requests for special wage rate determinations must be in writing and filed with the Commissioner at least 30 days before the award of the contract. An applicant for a special wage rate determination shall have the responsibility to support the necessity for the special rate. An application for a special wage rate determination filed under this section must contain:

- (1) a specification of the contract or project on which the special rates will apply and a description of the work to be performed;
- (2) a brief narrative explaining why special wage rates are necessary;
- (3) the job class or classes involved;
- (4) the special wage rates the applicant is requesting, including survey or other relevant wage data to support the requested rates;
- (5) the approximate number of employees who would be affected; and
- (6) any other information which might be helpful in determining if special wage rates are appropriate.

Requests made pursuant to the above should be addressed to:

Director
Alaska Department of Labor and Workforce Development
Labor Standards and Safety Division
Wage and Hour Administration
P.O. Box 111149
Juneau, AK 99811-1149

-or-

Email: statewide.wagehour@alaska.gov

EMPLOYMENT PREFERENCE INFORMATION

In October 2019, the Alaska Attorney General issued a formal opinion stating that the Alaska Statutes 36.10.150 of the State’s 90% Employment Preference law, also known as the Alaska Resident Hire law, violates both the U.S. and Alaska Constitutions. As a result, the state has stopped all enforcement activity.

A copy of the Attorney General opinion is found here:

http://law.alaska.gov/pdf/opinions/opinions_2019/19-005_AK-hire.pdf

**Alaska Department of Labor and Workforce Development
Labor Standards and Safety Division
Wage and Hour Administration
Web site: <http://labor.state.ak.us/lss/pamp600.htm>**

Anchorage

1251 Muldoon Road, Suite 113
Anchorage, Alaska 99504-2098
Phone: (907) 269-4900

Email:
statewide.wagehour@alaska.gov

Juneau

PO Box 111149
Juneau, Alaska 99811
Phone: (907) 465-4842

Email:
statewide.wagehour@alaska.gov

Fairbanks

Regional State Office Building
675 7th Ave., Station J-1
Fairbanks, Alaska 99701-4593
Phone: (907) 451-2886

Email:
statewide.wagehour@alaska.gov

LABOR STANDARDS AND SAFETY NOTICE REQUESTS

If you would like to receive Wage and Hour Administration or Mechanical Inspection **regulation notices** or **publications information**, they are available via electronic mail, by signing up in the GovDelivery System, <https://public.govdelivery.com/accounts/AKDOL/subscriber/new> and selecting topics *LSS – Wage and Hour – Forms and Publications*, *LSS – Mechanical Inspection Regulations*, or *LSS – Wage and Hour Regulations*.

Publications are also available online at <http://labor.alaska.gov/lss/home.htm>

DEBARMENT LIST

AS 36.05.090(b) states that “the state disbursing officer or the local fiscal officer shall distribute to all departments of the state government and to all political subdivisions of the state a list giving the names of persons who have disregarded their obligations to employees.”

A person appearing on the following debarment list and a firm, corporation, partnership, or association in which the person has an interest may not work as a contractor or subcontractor on a public construction contract for the state or a political subdivision of the state for three years from the date of debarment.

Company Name

Debarment Expires

No companies are currently debarred.

Laborers' & Mechanics' Minimum Rates of Pay

| Class Code | Classification of Laborers & Mechanics | BHR | H&W | PEN | TRN | Other | Benefits | THR |
|------------|--|-----|-----|-----|-----|-------|----------|-----|
|------------|--|-----|-----|-----|-----|-------|----------|-----|

Boilermakers

*See per diem note on last page

| | | | | | | | | |
|--------------|--------------------------|-------|------|-------|------|------------|------------|-------|
| A0101 | Boilermaker (journeyman) | 47.03 | 8.57 | 17.02 | 1.90 | VAC | SAF | 78.36 |
| | | | | | | 3.50 | 0.34 | |

Bricklayers & Blocklayers

*See per diem note on last page

| | | | | | | | | |
|--------------|------------|-------|------|-------|------|----------------|--|-------|
| A0201 | Blocklayer | 42.16 | 9.00 | 10.05 | 0.62 | L&M | | 62.03 |
| | | | | | | 0.20 | | |

Bricklayer
 Marble or Stone Mason
 Refractory Worker (Firebrick, Plastic, Castable, and Gunitite Refractory Applications)
 Terrazzo Worker
 Tile Setter

| | | | | | | | | |
|--------------|----------------------|-------|------|-------|------|----------------|--|-------|
| A0202 | Tuck Pointer Caulker | 42.16 | 9.00 | 10.05 | 0.62 | L&M | | 62.03 |
| | | | | | | 0.20 | | |

Cleaner (PCC)

| | | | | | | | | |
|--------------|------------------------|-------|------|-------|------|----------------|--|-------|
| A0203 | Marble & Tile Finisher | 35.99 | 9.00 | 10.05 | 0.62 | L&M | | 55.86 |
| | | | | | | 0.20 | | |

Terrazzo Finisher

| | | | | | | | | |
|--------------|---------------------|-------|------|------|------|----------------|------|-------|
| A0204 | Torginal Applicator | 40.10 | 9.83 | 8.50 | 0.55 | L&M | 0.87 | 60.00 |
| | | | | | | 0.15 | | |

Carpenters, Region I (North of 63 latitude)

*See per diem note on last page

| | | | | | | | | |
|--------------|------------------------|-------|-------|-------|------|----------------|------------|-------|
| N0301 | Carpenter (journeyman) | 38.34 | 10.08 | 15.23 | 1.10 | L&M | SAF | 64.95 |
| | | | | | | 0.10 | 0.10 | |

Lather/Drywall/Acoustical

Carpenters, Region II (South of N63 latitude)

*See per diem note on last page

| | | | | | | | | |
|--------------|------------------------|-------|-------|-------|------|----------------|------------|-------|
| S0301 | Carpenter (journeyman) | 38.34 | 10.08 | 15.77 | 1.10 | L&M | SAF | 65.49 |
| | | | | | | 0.10 | 0.10 | |

Lather/Drywall/Acoustical

Cement Masons

*See per diem note on last page

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pens fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Cement Masons
 *See per diem note on last page

| | | | | | | | | |
|--------------|---------------------|-------|------|-------|------|--|------------------------|-------|
| A0401 | Group I, including: | 39.38 | 8.70 | 11.80 | 1.43 | | L&M 0.10 | 61.41 |
|--------------|---------------------|-------|------|-------|------|--|------------------------|-------|

- Application of Sealing Compound
- Application of Underlayment
- Building, General
- Cement Finisher
- Cement Mason (journeyman)
- Concrete
- Concrete Paving
- Concrete Polishing
- Concrete Repair
- Curb & Gutter, Sidewalk
- Curing of All Concrete
- General Concrete Pour Tender
- Grouting & Caulking of Tilt-Up Panels
- Grouting of All Plates
- Patching Concrete
- Screed Pin Setter
- Screeder or Rodder
- Spackling/Skim Coating

| | | | | | | | | |
|--------------|----------------------|-------|------|-------|------|--|------------------------|-------|
| A0402 | Group II, including: | 39.38 | 8.70 | 11.80 | 1.43 | | L&M 0.10 | 61.41 |
|--------------|----------------------|-------|------|-------|------|--|------------------------|-------|

- Form Setter

| | | | | | | | | |
|--------------|-----------------------|-------|------|-------|------|--|------------------------|-------|
| A0403 | Group III, including: | 39.38 | 8.70 | 11.80 | 1.43 | | L&M 0.10 | 61.41 |
|--------------|-----------------------|-------|------|-------|------|--|------------------------|-------|

- Concrete Saw Cutter Operator (All Control Joints and Self-powered)
- Curb & Gutter Machine
- Floor Grinder
- Pneumatic Power Tools
- Power Chipping & Bushing
- Sand Blasting Architectural Finish
- Screed & Rodding Machine Operator
- Troweling Machine Operator (all concrete surfaces)

| | | | | | | | | |
|--------------|----------------------|-------|------|-------|------|--|------------------------|-------|
| A0404 | Group IV, including: | 39.38 | 8.70 | 11.80 | 1.43 | | L&M 0.10 | 61.41 |
|--------------|----------------------|-------|------|-------|------|--|------------------------|-------|

- Acoustical or Imitation Acoustical Finish
- Application of All Composition Mastic
- Application of All Epoxy Material
- Application of All Plastic Material
- Finish Colored Concrete
- Guniting Nozzleman

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Cement Masons
 *See per diem note on last page

| | | | | | | | | |
|--------------|---|-------|------|-------|------|--|------------------------|-------|
| A0404 | Group IV, including: | 39.38 | 8.70 | 11.80 | 1.43 | | L&M 0.10 | 61.41 |
| | Hand Powered Grinder | | | | | | | |
| | Preparing, scratching and browsing of all ceilings and walls, finished with terrazo or tile | | | | | | | |
| | Tunnel Worker | | | | | | | |

| | | | | | | | | |
|--------------|---|-------|------|-------|------|--|------------------------|-------|
| A0405 | Group V, including: | 39.38 | 8.70 | 11.80 | 1.43 | | L&M 0.10 | 61.41 |
| | Casting and finishing | | | | | | | |
| | EIFS Systems | | | | | | | |
| | Finishing of all interior and exterior plastering | | | | | | | |
| | Fireproofing (Pryocrete, Cafco, Albi-Clad, sprayed fiberglass) | | | | | | | |
| | Gypsum, Portland Cement | | | | | | | |
| | Kindred material and products | | | | | | | |
| | Operation and control of all types of plastering machines, including power tools and floats, used by the industry | | | | | | | |
| | Overcoating and maintenance of interior/exterior plaster surfaces | | | | | | | |
| | Plasterer | | | | | | | |
| | Veneer plastering process (Rapid Plaster, U.S.G. "Imperial Systems", and Pabcoat Systems") | | | | | | | |
| | Venetian plaster and color-integrated Italian/Middle-Eastern line plaster | | | | | | | |

Culinary Workers

| | | | | | | | | |
|--------------|-------------------|-------|------|------|--|--|------------|-------|
| A0501 | Baker/Cook | 28.37 | 7.31 | 7.56 | | | LEG | 43.24 |
| A0503 | General Helper | 25.07 | 7.31 | 7.56 | | | LEG | 39.94 |
| | Housekeeper | | | | | | | |
| | Janitor | | | | | | | |
| | Kitchen Helper | | | | | | | |
| A0504 | Head Cook | 28.97 | 7.31 | 7.56 | | | LEG | 43.84 |
| A0505 | Head Housekeeper | 25.45 | 7.31 | 7.56 | | | LEG | 40.32 |
| | Head Kitchen Help | | | | | | | |

Dredgemen
 *See per diem note on last page

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pens fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

| Class Code | Classification of Laborers & Mechanics | BHR | H&W | PEN | TRN | Other | Benefits | THR |
|------------|--|-----|-----|-----|-----|-------|----------|-----|
|------------|--|-----|-----|-----|-----|-------|----------|-----|

Dredgemen
*See per diem note on last page

| | | | | | | | | |
|--------------|---|-------|-------|-------|------|----------------|------|-------|
| A0601 | Assistant Engineer | 41.76 | 10.70 | 13.50 | 1.00 | L&M | | 67.11 |
| | Craneman | | | | | 0.10 | 0.05 | |
| | Electrical Generator Operator (primary pump/power barge/dredge) | | | | | | | |
| | Engineer | | | | | | | |
| | Welder | | | | | | | |
| A0602 | Assistant Mate (deckhand) | 40.60 | 10.70 | 13.50 | 1.00 | L&M | | 65.95 |
| | | | | | | 0.10 | 0.05 | |
| A0603 | Fireman | 41.04 | 10.70 | 13.50 | 1.00 | L&M | | 66.39 |
| | | | | | | 0.10 | 0.05 | |
| A0605 | Leverman Clamshell | 44.29 | 10.70 | 13.50 | 1.00 | L&M | | 69.64 |
| | | | | | | 0.10 | 0.05 | |
| A0606 | Leverman Hydraulic | 42.53 | 10.70 | 13.50 | 1.00 | L&M | | 67.88 |
| | | | | | | 0.10 | 0.05 | |
| A0607 | Mate & Boatman | 41.76 | 10.70 | 13.50 | 1.00 | L&M | | 67.11 |
| | | | | | | 0.10 | 0.05 | |
| A0608 | Oiler (dredge) | 41.04 | 10.70 | 13.50 | 1.00 | L&M | | 66.39 |
| | | | | | | 0.10 | 0.05 | |

Electricians
*See per diem note on last page

| | | | | | | | | | |
|--------------|---|-------|-------|-------|------|----------------|------|------------|-------|
| A0701 | Inside Cable Splicer | 42.02 | 14.05 | 13.90 | 0.95 | L&M | | LEG | 71.27 |
| | | | | | | 0.20 | 0.15 | | |
| A0702 | Inside Journeyman Wireman, including: | 41.69 | 14.05 | 14.14 | 0.95 | L&M | | LEG | 71.18 |
| | Technicians (including use of drones in electrical construction) | | | | | 0.20 | 0.15 | | |
| A0703 | Power Cable Splicer | 60.79 | 14.05 | 19.01 | 0.95 | L&M | | LEG | 95.20 |
| | | | | | | 0.25 | 0.15 | | |
| A0704 | Tele Com Cable Splicer | 50.53 | 14.05 | 16.67 | 0.95 | L&M | | LEG | 82.55 |
| | | | | | | 0.20 | 0.15 | | |
| A0705 | Power Journeyman Lineman, including: | 59.04 | 14.05 | 18.96 | 0.95 | L&M | | LEG | 93.40 |
| | Power Equipment Operator | | | | | | | | |
| | Technician (including use of drones in electrical construction) | | | | | | | | |
| A0706 | Tele Com Journeyman Lineman, including: | 48.78 | 14.05 | 16.61 | 0.95 | L&M | | LEG | 80.74 |
| | Technician (including use of drones in telecommunications construction) | | | | | 0.20 | 0.15 | | |
| | Tele Com Equipment Operator | | | | | | | | |

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| Class Code | Classification of Laborers & Mechanics | BHR | H&W | PEN | TRN | Other | Benefits | THR |
|------------|--|-----|-----|-----|-----|-------|----------|-----|
|------------|--|-----|-----|-----|-----|-------|----------|-----|

Electricians
*See per diem note on last page

| | | | | | | | | |
|--------------|---|-------|-------|-------|------|-----|-----|-------|
| A0707 | Straight Line Installer - Repairman | 48.78 | 14.05 | 16.61 | 0.95 | L&M | LEG | 80.74 |
| A0708 | Powderman | 57.04 | 14.05 | 18.90 | 0.95 | L&M | LEG | 91.34 |
| A0710 | Material Handler | 26.57 | 13.76 | 5.30 | 0.15 | L&M | LEG | 46.08 |
| A0712 | Tree Trimmer Groundman | 28.37 | 14.05 | 12.59 | 0.15 | L&M | LEG | 55.46 |
| A0713 | Journeyman Tree Trimmer | 37.30 | 14.05 | 12.86 | 0.15 | L&M | LEG | 64.66 |
| A0714 | Vegetation Control Sprayer | 40.85 | 14.05 | 12.97 | 0.15 | L&M | LEG | 68.32 |
| A0715 | Inside Journeyman Communications CO/PBX | 40.27 | 14.05 | 13.85 | 0.95 | L&M | LEG | 69.47 |

Elevator Workers
*See per diem note on last page

| | | | | | | | | |
|--------------|-------------------------------|-------|-------|-------|------|-----|-----|--------|
| A0802 | Elevator Constructor | 42.76 | 15.88 | 19.31 | 0.64 | L&M | VAC | 83.87 |
| A0803 | Elevator Constructor Mechanic | 61.08 | 15.88 | 19.31 | 0.64 | L&M | VAC | 104.23 |

Heat & Frost Insulators/Asbestos Workers
*See per diem note on last page

| | | | | | | | | |
|--------------|---|-------|------|-------|------|-----|--|-------|
| A0902 | Asbestos Abatement-Mechanical Systems | 38.68 | 9.24 | 11.01 | 1.20 | SAF | | 60.25 |
| A0903 | Asbestos Abatement/General Demolition All Systems | 38.68 | 9.24 | 11.01 | 1.20 | SAF | | 60.25 |
| A0904 | Insulator, Group II | 38.68 | 9.24 | 11.01 | 1.20 | SAF | | 60.25 |
| A0905 | Fire Stop | 38.68 | 9.24 | 11.01 | 1.20 | SAF | | 60.25 |

IronWorkers
*See per diem note on last page

| | | | | | | | | |
|--------------|-------------------------|-------|------|-------|------|-----|-----|-------|
| A1101 | Ironworkers, including: | 38.87 | 9.51 | 24.28 | 0.74 | L&M | IAF | 73.84 |
|--------------|-------------------------|-------|------|-------|------|-----|-----|-------|

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IronWorkers
*See per diem note on last page

| | | | | | | L&M | IAF | |
|--------------|-------------------------|-------|------|-------|------|------|------|-------|
| A1101 | Ironworkers, including: | 38.87 | 9.51 | 24.28 | 0.74 | 0.20 | 0.24 | 73.84 |
| | Bender Operators | | | | | | | |
| | Bridge & Structural | | | | | | | |
| | Hangar Doors | | | | | | | |
| | Hollow Metal Doors | | | | | | | |
| | Industrial Doors | | | | | | | |
| | Machinery Mover | | | | | | | |
| | Ornamental | | | | | | | |
| | Reinforcing | | | | | | | |
| | Rigger | | | | | | | |
| | Sheeter | | | | | | | |
| | Signalman | | | | | | | |
| | Stage Rigger | | | | | | | |
| | Toxic Haz-Mat Work | | | | | | | |
| | Welder | | | | | | | |

| | | | | | | L&M | IAF | |
|--------------|---|-------|------|-------|------|------|------|-------|
| A1102 | Helicopter | 39.87 | 9.51 | 24.28 | 0.74 | 0.20 | 0.24 | 74.84 |
| | Helicopter (used for rigging and setting) | | | | | | | |
| | Tower (energy producing windmill type towers to include nacelle and blades) | | | | | | | |

| | | | | | | L&M | IAF | |
|--------------|-------------------------|-------|------|-------|------|------|------|-------|
| A1103 | Fence/Barrier Installer | 35.37 | 9.51 | 23.93 | 0.74 | 0.20 | 0.24 | 69.99 |

| | | | | | | L&M | IAF | |
|--------------|-----------------------|-------|------|-------|------|------|------|-------|
| A1104 | Guard Rail Layout Man | 36.11 | 9.51 | 23.93 | 0.74 | 0.20 | 0.24 | 70.73 |

| | | | | | | L&M | IAF | |
|--------------|----------------------|-------|------|-------|------|------|------|-------|
| A1105 | Guard Rail Installer | 36.37 | 9.51 | 23.93 | 0.74 | 0.20 | 0.24 | 70.99 |

Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)
*See per diem note on last page

| | | | | | | L&M | LEG | |
|--------------|--|-------|------|-------|------|------|------|-------|
| N1201 | Group I, including: | 32.00 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 63.31 |
| | Asphalt Worker (shovelman, plant crew) | | | | | | | |
| | Brush Cutter | | | | | | | |
| | Camp Maintenance Laborer | | | | | | | |
| | Carpenter Tender or Helper | | | | | | | |
| | Choke Setter, Hook Tender, Rigger, Signalman | | | | | | | |
| | Concrete Labor (curb & gutter, chute handler, curing, grouting, screeding) | | | | | | | |
| | Crusher Plant Laborer | | | | | | | |
| | Demolition Laborer | | | | | | | |

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Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)

*See per diem note on last page

| | | | | | | L&M | LEG | |
|--------------|---|-------|------|-------|------|------|------|-------|
| N1201 | Group I, including: | 32.00 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 63.31 |
| | Ditch Digger | | | | | | | |
| | Dumpman | | | | | | | |
| | Environmental Laborer (hazard/toxic waste, oil spill) | | | | | | | |
| | Fence Installer | | | | | | | |
| | Fire Watch Laborer | | | | | | | |
| | Flagman | | | | | | | |
| | Form Stripper | | | | | | | |
| | General Laborer | | | | | | | |
| | Guardrail Laborer, Bridge Rail Installer | | | | | | | |
| | Hydro-seeder Nozzleman | | | | | | | |
| | Laborer, Building | | | | | | | |
| | Landscaper or Planter | | | | | | | |
| | Laying of Mortarless Decorative Block (retaining walls, flowered decorative block 4 feet or less - highway or landscape work) | | | | | | | |
| | Material Handler | | | | | | | |
| | Pneumatic or Power Tools | | | | | | | |
| | Portable or Chemical Toilet Serviceman | | | | | | | |
| | Pump Man or Mixer Man | | | | | | | |
| | Railroad Track Laborer | | | | | | | |
| | Sandblast, Pot Tender | | | | | | | |
| | Saw Tender | | | | | | | |
| | Slurry Work | | | | | | | |
| | Steam Cleaner Operator | | | | | | | |
| | Steam Point or Water Jet Operator | | | | | | | |
| | Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer) | | | | | | | |
| | Tank Cleaning | | | | | | | |
| | Utiliwalk & Utilidor Laborer | | | | | | | |
| | Watchman (construction projects) | | | | | | | |
| | Window Cleaner | | | | | | | |

| | | | | | | L&M | LEG | |
|--------------|---|-------|------|-------|------|------|------|-------|
| N1202 | Group II, including: | 33.00 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 64.31 |
| | Burning & Cutting Torch | | | | | | | |
| | Cement or Lime Dumper or Handler (sack or bulk) | | | | | | | |
| | Certified Erosion Sediment Control Lead (CESCL Laborer) | | | | | | | |
| | Choker Splicer | | | | | | | |
| | Chucktender (wagon, air-track & hydraulic drills) | | | | | | | |
| | Concrete Laborer (power buggy, concrete saws, pumpcrete nozzleman, vibratorman) | | | | | | | |
| | Culvert Pipe Laborer | | | | | | | |

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Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)

*See per diem note on last page

| | | | | | | | | |
|--------------|----------------------|-------|------|-------|------|----------------|------------|-------|
| N1202 | Group II, including: | 33.00 | 8.95 | 20.66 | 1.30 | L&M | LEG | 64.31 |
|--------------|----------------------|-------|------|-------|------|----------------|------------|-------|

- Cured Inplace Pipelayer
- Environmental Laborer (asbestos, marine work)
- Floor Preparation, Core Drilling
- Foam Gun or Foam Machine Operator
- Green Cutter (dam work)
- Gunite Operator
- Hod Carrier
- Jackhammer/Chipping Gun or Pavement Breaker
- Laser Instrument Operator
- Laying of Mortarless Decorative Block (retaining walls, flowered decorative block over 4 feet - highway or landscape work)
- Mason Tender & Mud Mixer (sewer work)
- Pilot Car
- Pipelayer Helper
- Plasterer, Bricklayer & Cement Finisher Tender
- Powderman Helper
- Power Saw Operator
- Railroad Switch Layout Laborer
- Sandblaster
- Scaffold Building & Erecting
- Sewer Caulker
- Sewer Plant Maintenance Man
- Thermal Plastic Applicator
- Timber Faller, Chainsaw Operator, Filer
- Timberman

| | | | | | | | | |
|--------------|-----------------------|-------|------|-------|------|----------------|------------|-------|
| N1203 | Group III, including: | 33.90 | 8.95 | 20.66 | 1.30 | L&M | LEG | 65.21 |
|--------------|-----------------------|-------|------|-------|------|----------------|------------|-------|

- Bit Grinder
- Camera/Tool/Video Operator
- Guardrail Machine Operator
- High Rigger & Tree Topper
- High Scaler
- Multiplate
- Plastic Welding
- Slurry Seal Squeegee Man
- Traffic Control Supervisor
- Welding Certified (in connection with laborer's work)

| | | | | | | | | |
|--------------|------------|-------|------|-------|------|----------------|------------|-------|
| N1204 | Group IIIA | 37.18 | 8.95 | 20.66 | 1.30 | L&M | LEG | 68.49 |
|--------------|------------|-------|------|-------|------|----------------|------------|-------|

- Asphalt Raker, Asphalt Belly Dump Lay Down

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Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)

*See per diem note on last page

| | | | | | | L&M | LEG | |
|--------------|--|-------|------|-------|------|------|------|-------|
| N1204 | Group IIIA | 37.18 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 68.49 |
| | Drill Doctor (in the field) | | | | | | | |
| | Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills) | | | | | | | |
| | Pioneer Drilling & Drilling Off Tugger (all type drills) | | | | | | | |
| | Pipelayers | | | | | | | |
| | Powderman (Employee Possessor) | | | | | | | |
| | Storm Water Pollution Protection Plan Specialist (SWPPP Specialist) | | | | | | | |
| | Traffic Control Supervisor, DOT Qualified | | | | | | | |

| | | | | | | L&M | LEG | |
|--------------|------------------------|-------|------|-------|------|------|------|-------|
| N1205 | Group IV | 21.57 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 52.88 |
| | Final Building Cleanup | | | | | | | |
| | Permanent Yard Worker | | | | | | | |

| | | | | | | L&M | LEG | |
|--------------|--|-------|------|-------|------|------|------|-------|
| N1206 | Group IIIB | 40.97 | 6.24 | 20.66 | 1.30 | 0.20 | 0.20 | 69.57 |
| | Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours) | | | | | | | |
| | Federal Powderman (Responsible Person in Charge) | | | | | | | |
| | Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones) | | | | | | | |
| | Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours) | | | | | | | |
| | Stake Hopper | | | | | | | |

Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

| | | | | | | L&M | LEG | |
|--------------|--|-------|------|-------|------|------|------|-------|
| S1201 | Group I, including: | 32.00 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 63.31 |
| | Asphalt Worker (shovelman, plant crew) | | | | | | | |
| | Brush Cutter | | | | | | | |
| | Camp Maintenance Laborer | | | | | | | |
| | Carpenter Tender or Helper | | | | | | | |
| | Choke Setter, Hook Tender, Rigger, Signalman | | | | | | | |
| | Concrete Labor (curb & gutter, chute handler, curing, grouting, screeding) | | | | | | | |
| | Crusher Plant Laborer | | | | | | | |
| | Demolition Laborer | | | | | | | |
| | Ditch Digger | | | | | | | |
| | Dumpman | | | | | | | |
| | Environmental Laborer (hazard/toxic waste, oil spill) | | | | | | | |
| | Fence Installer | | | | | | | |

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pens fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

| | | | | | | L&M | LEG | |
|--------------|---|-------|------|-------|------|------|------|-------|
| S1201 | Group I, including: | 32.00 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 63.31 |
| | Fire Watch Laborer | | | | | | | |
| | Flagman | | | | | | | |
| | Form Stripper | | | | | | | |
| | General Laborer | | | | | | | |
| | Guardrail Laborer, Bridge Rail Installer | | | | | | | |
| | Hydro-seeder Nozzleman | | | | | | | |
| | Laborer, Building | | | | | | | |
| | Landscaper or Planter | | | | | | | |
| | Laying of Mortarless Decorative Block (retaining walls, flowered decorative block 4 feet or less - highway or landscape work) | | | | | | | |
| | Material Handler | | | | | | | |
| | Pneumatic or Power Tools | | | | | | | |
| | Portable or Chemical Toilet Serviceman | | | | | | | |
| | Pump Man or Mixer Man | | | | | | | |
| | Railroad Track Laborer | | | | | | | |
| | Sandblast, Pot Tender | | | | | | | |
| | Saw Tender | | | | | | | |
| | Slurry Work | | | | | | | |
| | Steam Cleaner Operator | | | | | | | |
| | Steam Point or Water Jet Operator | | | | | | | |
| | Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer) | | | | | | | |
| | Tank Cleaning | | | | | | | |
| | Utiliwalk & Utilidor Laborer | | | | | | | |
| | Watchman (construction projects) | | | | | | | |
| | Window Cleaner | | | | | | | |
| S1202 | Group II, including: | 33.00 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 64.31 |
| | Burning & Cutting Torch | | | | | | | |
| | Cement or Lime Dumper or Handler (sack or bulk) | | | | | | | |
| | Certified Erosion Sediment Control Lead (CESCL Laborer) | | | | | | | |
| | Choker Splicer | | | | | | | |
| | Chucktender (wagon, air-track & hydraulic drills) | | | | | | | |
| | Concrete Laborer (power buggy, concrete saws, pumpcrete nozzleman, vibratorman) | | | | | | | |
| | Culvert Pipe Laborer | | | | | | | |
| | Cured Inplace Pipelayer | | | | | | | |
| | Environmental Laborer (asbestos, marine work) | | | | | | | |
| | Floor Preparation, Core Drilling | | | | | | | |
| | Foam Gun or Foam Machine Operator | | | | | | | |

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Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

| | | | | | | L&M | LEG | |
|--------------|----------------------|-------|------|-------|------|------|------|-------|
| S1202 | Group II, including: | 33.00 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 64.31 |

- Green Cutter (dam work)
- Gunite Operator
- Hod Carrier
- Jackhammer/Chipping Gun or Pavement Breaker
- Laser Instrument Operator
- Laying of Mortarless Decorative Block (retaining walls, flowered decorative block over 4 feet - highway or landscape work)
- Mason Tender & Mud Mixer (sewer work)
- Pilot Car
- Pipelayer Helper
- Plasterer, Bricklayer & Cement Finisher Tender
- Powderman Helper
- Power Saw Operator
- Railroad Switch Layout Laborer
- Sandblaster
- Scaffold Building & Erecting
- Sewer Caulker
- Sewer Plant Maintenance Man
- Thermal Plastic Applicator
- Timber Faller, Chainsaw Operator, Filer
- Timberman

| | | | | | | L&M | LEG | |
|--------------|-----------------------|-------|------|-------|------|------|------|-------|
| S1203 | Group III, including: | 33.90 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 65.21 |

- Bit Grinder
- Camera/Tool/Video Operator
- Guardrail Machine Operator
- High Rigger & Tree Topper
- High Scaler
- Multiplate
- Plastic Welding
- Slurry Seal Squeegee Man
- Traffic Control Supervisor
- Welding Certified (in connection with laborer's work)

| | | | | | | L&M | LEG | |
|--------------|------------|-------|------|-------|------|------|------|-------|
| S1204 | Group IIIA | 37.18 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 68.49 |

- Asphalt Raker, Asphalt Belly Dump Lay Down
- Drill Doctor (in the field)
- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)
- Pioneer Drilling & Drilling Off Tugger (all type drills)

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pens fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

| | | | | | | | | |
|--------------|------------|-------|------|-------|------|----------------|------------|-------|
| S1204 | Group IIIA | 37.18 | 8.95 | 20.66 | 1.30 | L&M | LEG | 68.49 |
| | | | | | | 0.20 | 0.20 | |

- Pipelayers
- Powderman (Employee Possessor)
- Storm Water Pollution Protection Plan Specialist (SWPPP Specialist)
- Traffic Control Supervisor, DOT Qualified

| | | | | | | | | |
|--------------|----------|-------|------|-------|------|----------------|------------|-------|
| S1205 | Group IV | 21.57 | 8.95 | 20.66 | 1.30 | L&M | LEG | 52.88 |
| | | | | | | 0.20 | 0.20 | |

- Final Building Cleanup
- Permanent Yard Worker

| | | | | | | | | |
|--------------|------------|-------|------|-------|------|----------------|------------|-------|
| S1206 | Group IIIB | 40.97 | 6.24 | 20.66 | 1.30 | L&M | LEG | 69.57 |
| | | | | | | 0.20 | 0.20 | |

- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours)
- Federal Powderman (Responsible Person in Charge)
- Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones)
- Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours)
- Stake Hopper

Millwrights

*See per diem note on last page

| | | | | | | | | |
|--------------|-------------------------|-------|-------|-------|------|----------------|------|-------|
| A1251 | Millwright (journeyman) | 40.77 | 10.08 | 12.28 | 1.10 | L&M | | 64.68 |
| | | | | | | 0.40 | 0.05 | |

| | | | | | | | | |
|--------------|-------------------|-------|-------|-------|------|----------------|------|-------|
| A1252 | Millwright Welder | 41.77 | 10.08 | 12.28 | 1.10 | L&M | | 65.68 |
| | | | | | | 0.40 | 0.05 | |

Painters, Region I (North of N63 latitude)

*See per diem note on last page

| | | | | | | | | |
|--------------|---------------------|-------|------|-------|------|----------------|--|-------|
| N1301 | Group I, including: | 34.19 | 8.71 | 14.30 | 1.08 | L&M | | 58.35 |
| | | | | | | 0.07 | | |

- Brush
- General Painter
- Hand Taping
- Hazardous Material Handler
- Lead-Based Paint Abatement
- Roll

| | | | | | | | | |
|--------------|----------------------|-------|------|-------|------|----------------|--|-------|
| N1302 | Group II, including: | 34.71 | 8.71 | 14.30 | 1.08 | L&M | | 58.87 |
| | | | | | | 0.07 | | |

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Painters, Region I (North of N63 latitude)

*See per diem note on last page

| | | BHR | H&W | PEN | TRN | Other | L&M | Benefits | THR |
|--------------|--------------------------------|-------|------|-------|------|-------|-----|----------|-------|
| N1302 | Group II, including: | 34.71 | 8.71 | 14.30 | 1.08 | 0.07 | | | 58.87 |
| | Bridge Painter | | | | | | | | |
| | Epoxy Applicator | | | | | | | | |
| | General Drywall Finisher | | | | | | | | |
| | Hand/Spray Texturing | | | | | | | | |
| | Industrial Coatings Specialist | | | | | | | | |
| | Machine/Automatic Taping | | | | | | | | |
| | Pot Tender | | | | | | | | |
| | Sandblasting | | | | | | | | |
| | Specialty Painter | | | | | | | | |
| | Spray | | | | | | | | |
| | Structural Steel Painter | | | | | | | | |
| | Wallpaper/Vinyl Hanger | | | | | | | | |

| | | | | | | | | | |
|--------------|------------------------------------|-------|------|-------|------|------|--|--|-------|
| N1304 | Group IV, including: | 39.80 | 8.71 | 17.71 | 1.05 | 0.05 | | | 67.32 |
| | Glazier | | | | | | | | |
| | Storefront/Automatic Door Mechanic | | | | | | | | |

| | | | | | | | | | |
|--------------|------------------------------|-------|------|------|------|------|--|--|-------|
| N1305 | Group V, including: | 28.63 | 8.71 | 5.02 | 0.83 | 0.07 | | | 43.26 |
| | Carpet Installer | | | | | | | | |
| | Floor Coverer | | | | | | | | |
| | Heat Weld/Cove Base | | | | | | | | |
| | Linoleum/Soft Tile Installer | | | | | | | | |

Painters, Region II (South of N63 latitude)

*See per diem note on last page

| | | BHR | H&W | PEN | TRN | Other | L&M | Benefits | THR |
|--------------|----------------------------|-------|------|-------|------|-------|-----|----------|-------|
| S1301 | Group I, including : | 31.33 | 8.71 | 15.15 | 1.08 | 0.07 | | | 56.34 |
| | Brush | | | | | | | | |
| | General Painter | | | | | | | | |
| | Hand Taping | | | | | | | | |
| | Hazardous Material Handler | | | | | | | | |
| | Lead-Based Paint Abatement | | | | | | | | |
| | Roll | | | | | | | | |
| | Spray | | | | | | | | |

| | | | | | | | | | |
|--------------|--------------------------|-------|------|-------|------|------|--|--|-------|
| S1302 | Group II, including : | 32.58 | 8.71 | 15.15 | 1.08 | 0.07 | | | 57.59 |
| | General Drywall Finisher | | | | | | | | |
| | Hand/Spray Texturing | | | | | | | | |
| | Machine/Automatic Taping | | | | | | | | |

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| Class Code | Classification of Laborers & Mechanics | BHR | H&W | PEN | TRN | Other | Benefits | THR |
|--|---|-------|-------|-------|------|-------|------------------------|---------------------------|
| Painters, Region II (South of N63 latitude) | | | | | | | | |
| *See per diem note on last page | | | | | | | | |
| S1302 | Group II, including : | 32.58 | 8.71 | 15.15 | 1.08 | | L&M 0.07 | 57.59 |
| | Wallpaper/Vinyl Hanger | | | | | | | |
| S1303 | Group III, including : | 32.68 | 8.71 | 15.15 | 1.08 | | L&M 0.07 | 57.69 |
| | Bridge Painter | | | | | | | |
| | Epoxy Applicator | | | | | | | |
| | Industrial Coatings Specialist | | | | | | | |
| | Pot Tender | | | | | | | |
| | Sandblasting | | | | | | | |
| | Specialty Painter | | | | | | | |
| | Structural Steel Painter | | | | | | | |
| S1304 | Group IV, including: | 40.01 | 8.71 | 16.75 | 1.08 | | L&M 0.07 | 66.62 |
| | Glazier | | | | | | | |
| | Storefront/Automatic Door Mechanic | | | | | | | |
| S1305 | Group V, including: | 28.63 | 8.71 | 5.02 | 0.83 | | L&M 0.07 | 43.26 |
| | Carpet Installer | | | | | | | |
| | Floor Coverer | | | | | | | |
| | Heat Weld/Cove Base | | | | | | | |
| | Linoleum/Soft Tile Installer | | | | | | | |
| Piledrivers | | | | | | | | |
| *See per diem note on last page | | | | | | | | |
| A1401 | Piledriver | 38.34 | 10.08 | 15.23 | 1.10 | | L&M 0.10 | IAF 0.10 64.95 |
| | Assistant Dive Tender | | | | | | | |
| | Carpenter/Piledriver | | | | | | | |
| | Rigger | | | | | | | |
| | Sheet Stabber | | | | | | | |
| | Skiff Operator | | | | | | | |
| A1402 | Piledriver-Welder/Toxic Worker | 39.34 | 10.08 | 15.23 | 1.10 | | L&M 0.10 | IAF 0.10 65.95 |
| A1403 | Remotely Operated Vehicle Pilot/Technician | 42.65 | 10.08 | 15.23 | 1.10 | | L&M 0.10 | IAF 0.10 69.26 |
| | Single Atmosphere Suit, Bell or Submersible Pilot | | | | | | | |
| A1404 | Diver (working) **See note on last page | 82.45 | 10.08 | 15.23 | 1.10 | | L&M 0.10 | IAF 0.10 109.06 |

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| Class Code | Classification of Laborers & Mechanics | BHR | H&W | PEN | TRN | Other | Benefits | THR |
|------------|--|-----|-----|-----|-----|-------|----------|-----|
|------------|--|-----|-----|-----|-----|-------|----------|-----|

Piledrivers
*See per diem note on last page

| | | | | | | | | |
|--------------|--|-------|-------|-------|------|-----|-----|-------|
| A1405 | Diver (standby) **See note on last page | 42.65 | 10.08 | 15.23 | 1.10 | L&M | IAF | 69.26 |
| A1406 | Dive Tender **See note on last page | 41.65 | 10.08 | 15.23 | 1.10 | L&M | IAF | 68.26 |
| A1407 | Welder (American Welding Society, Certified Welding Inspector) | 43.90 | 10.08 | 15.23 | 1.10 | L&M | IAF | 70.51 |

Plumbers, Region I (North of N63 latitude)
*See per diem note on last page

| | | | | | | | | |
|--------------|-----------------------|-------|-------|-------|------|-----|-----|-------|
| N1501 | Journeyman Pipefitter | 41.91 | 11.25 | 17.20 | 1.50 | L&M | S&L | 72.51 |
| | Plumber | | | | | | | |
| | Welder | | | | | | | |

Plumbers, Region II (South of N63 latitude)
*See per diem note on last page

| | | | | | | | | |
|--------------|-----------------------|-------|-------|-------|------|-----|--|-------|
| S1501 | Journeyman Pipefitter | 41.00 | 11.13 | 15.02 | 1.55 | L&M | | 68.90 |
| | Plumber | | | | | | | |
| | Welder | | | | | | | |

Plumbers, Region IIA (1st Judicial District)
*See per diem note on last page

| | | | | | | | | |
|--------------|-----------------------|-------|-------|-------|------|-----|--|-------|
| X1501 | Journeyman Pipefitter | 38.82 | 13.37 | 11.75 | 2.50 | L&M | | 66.68 |
| | Plumber | | | | | | | |
| | Welder | | | | | | | |

Power Equipment Operators
*See per diem note on last page

| | | | | | | | | |
|--------------|---|-------|-------|-------|------|-----|--|-------|
| A1601 | Group I, including: | 42.53 | 10.70 | 13.50 | 1.00 | L&M | | 67.88 |
| | Asphalt Roller: Breakdown, Intermediate, and Finish | | | | | | | |
| | Back Filler | | | | | | | |
| | Barrier Machine (Zipper) | | | | | | | |
| | Beltcrete with Power Pack & similar conveyors | | | | | | | |
| | Bending Machine | | | | | | | |
| | Boat Coxswain | | | | | | | |
| | Bulldozer | | | | | | | |
| | Cableways, Highlines & Cablecars | | | | | | | |

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Power Equipment Operators

*See per diem note on last page

| | L&M | | | | | | |
|--|----------------|-------|-------|------|------|------|-------|
| A1601 Group I, including: | 42.53 | 10.70 | 13.50 | 1.00 | 0.10 | 0.05 | 67.88 |
| Cleaning Machine | | | | | | | |
| Coating Machine | | | | | | | |
| Concrete Hydro Blaster | | | | | | | |
| Cranes (45 tons & under or 150 feet of boom & under (including jib & attachments)) | | | | | | | |
| (a) Hydralifts or Transporters, (all track or truck type) | | | | | | | |
| (b) Derricks | | | | | | | |
| (c) Overhead | | | | | | | |
| Crushers | | | | | | | |
| Deck Winches, Double Drum | | | | | | | |
| Ditching or Trenching Machine (16 inch or over) | | | | | | | |
| Drag Scraper, Yarder, and similar types | | | | | | | |
| Drilling Machines, Core, Cable, Rotary and Exploration | | | | | | | |
| Finishing Machine Operator, Concrete Paving, Laser Screed, Sidewalk, Curb & Gutter Machine | | | | | | | |
| Grade Checker and/or Line and Grade including Drone | | | | | | | |
| Helicopters | | | | | | | |
| Hover Craft, Flex Craft, Loadmaster, Air Cushion, All-Terrain Vehicle, Rollagon, Bargecable, Nodwell, & Snow Cat | | | | | | | |
| Hydro Ax, Feller Buncher & similar | | | | | | | |
| Hydro Excavation (Vac-Truck and Similar) | | | | | | | |
| Loaders (2 1/2 yards through 5 yards, including all attachments): | | | | | | | |
| (a) Forklifts (with telescopic boom & swing attachment) | | | | | | | |
| (b) Front End & Overhead, (2-1/2 yards through 5 yards) | | | | | | | |
| (c) Loaders, (with forks or pipe clamp) | | | | | | | |
| (d) Loaders, (elevating belt type, Euclid & similar types) | | | | | | | |
| Material Transfer Vehicle (Elevating Grader, Pickup Machine, and similar types) | | | | | | | |
| Mechanic, Welder, Bodyman, Electrical, Camp & Maintenance Engineer | | | | | | | |
| Micro Tunneling Machine | | | | | | | |
| Mixers: Mobile type with hoist combination | | | | | | | |
| Motor Patrol Grader | | | | | | | |
| Mucking Machine: Mole, Tunnel Drill, Horizontal/Directional Drill Operator and/or Shield | | | | | | | |
| Off-Road Hauler (including Articulating and Haul Trucks) | | | | | | | |
| Operator on Dredges | | | | | | | |
| Piledriver Engineer, L.B. Foster, Puller or similar paving breaker | | | | | | | |
| Plant Operator (Asphalt & Concrete) | | | | | | | |
| Power Plant, Turbine Operator 200 k.w & over (power plants or combination of power units over 300 k.w.) | | | | | | | |

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pens fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Power Equipment Operators
 *See per diem note on last page

| | | | | | | | | |
|--------------|---------------------|-------|-------|-------|------|----------------|--|-------|
| A1601 | Group I, including: | 42.53 | 10.70 | 13.50 | 1.00 | L&M | | 67.88 |
|--------------|---------------------|-------|-------|-------|------|----------------|--|-------|

- Remote Controlled Equipment
- Scraper (through 40 yards)
- Service Oiler/Service Engineer
- Shot Blast Machine
- Shovels, Backhoes, Excavators with all attachments, and Gradealls (3 yards & under)
- Sideboom (under 45 tons)
- Sub Grader (Gurries & similar types)
- Tack Tractor
- Truck Mounted Concrete Pump, Conveyor/Tele-belt, & Creter
- Wate Kote Machine

| | | | | | | | | |
|--------------|----------------------|-------|-------|-------|------|----------------|--|-------|
| A1602 | Group IA, including: | 44.29 | 10.70 | 13.50 | 1.00 | L&M | | 69.64 |
|--------------|----------------------|-------|-------|-------|------|----------------|--|-------|

- Camera/Tool/Video Operator (Slipline)
- Certified Welder, Electrical Mechanic, Camp Maintenance Engineer, Mechanic (over 10,000 hours)
- Cranes (over 45 tons or 150 feet including jib & attachments)
 - (a) Clamshells & Draglines (over 3 yards)
 - (b) Tower Cranes
- Licensed Water/Waste Water Treatment Operator
- Loaders (over 5 yards)
- Motor Patrol Grader, Dozer, Grade Tractor (finish: when finishing to final grade and/or to hubs, or for asphalt)
- Power Plants (1000 k.w. & over)
- Profiler, Reclaimer, and Roto-Mill
- Quad
- Scrapers (over 40 yards)
- Screed
- Shovels, Backhoes, Excavators with all attachments (over 3 yards)
- Sidebooms (over 45 tons)
- Slip Form Paver, C.M.I. & similar types
- Topside (Asphalt Paver, Slurry machine, Spreaders, and similar types)

| | | | | | | | | |
|--------------|----------------------|-------|-------|-------|------|----------------|--|-------|
| A1603 | Group II, including: | 41.76 | 10.70 | 13.50 | 1.00 | L&M | | 67.11 |
|--------------|----------------------|-------|-------|-------|------|----------------|--|-------|

- Boiler - Fireman
- Cement Hogs & Concrete Pump Operator
- Conveyors (except those listed in Group I)
- Hoists on Steel Erection, Towermobiles & Air Tuggers
- Horizontal/Directional Drill Locator
- Locomotives, Rod & Geared Engines

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pens fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Power Equipment Operators

*See per diem note on last page

| | | | | | | | | |
|-----------------------------------|-------|-------|-------|------|------|------|----------------|-------|
| A1603 Group II, including: | | | | | | | L&M | |
| | 41.76 | 10.70 | 13.50 | 1.00 | 0.10 | 0.05 | | 67.11 |

- Mixers
- Screening, Washing Plant
- Sideboom (cradling rock drill, regardless of size)
- Skidder
- Trenching Machines (under 16 inches)
- Water/Waste Water Treatment Operator

| | | | | | | | | |
|------------------------------------|-------|-------|-------|------|------|------|----------------|-------|
| A1604 Group III, including: | | | | | | | L&M | |
| | 41.04 | 10.70 | 13.50 | 1.00 | 0.10 | 0.05 | | 66.39 |

- "A" Frame Trucks, Deck Winches
- Bombardier (tack or tow rig)
- Boring Machine
- Brooms, Power (sweeper, elevator, vacuum, or similar)
- Bump Cutter
- Compressor
- Farm Tractor
- Forklift, Industrial Type
- Gin Truck or Winch Truck (with poles when used for hoisting)
- Hoists, Air Tuggers, Elevators
- Loaders:
 - (a) Elevating-Athey, Barber Greene & similar types
 - (b) Forklifts or Lumber Carrier (on construction job sites)
 - (c) Forklifts, (with tower)
 - (d) Overhead & Front End, (under 2-1/2 yards)
- Locomotives: Dinkey (air, steam, gas & electric) Speeders
- Mechanics, Light Duty
- Oil, Blower Distribution
- Posthole Digger, Mechanical
- Pot Fireman (power agitated)
- Power Plant, Turbine Operator, (under 200 k.w.)
- Pumps, Water
- Roller (other than Asphalt)
- Saws, Concrete
- Skid Hustler
- Skid Steer (with all attachments)
- Stake Hopper
- Straightening Machine
- Tow Tractor

| | | | | | | | | |
|-----------------------------------|-------|-------|-------|------|------|------|----------------|-------|
| A1605 Group IV, including: | | | | | | | L&M | |
| | 34.83 | 10.70 | 13.50 | 1.00 | 0.10 | 0.05 | | 60.18 |

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pens fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Power Equipment Operators

*See per diem note on last page

| | | | | | | | | |
|-----------------------------------|--|-------|-------|-------|------|------|----------------|-------|
| A1605 Group IV, including: | | | | | | | L&M | |
| | | 34.83 | 10.70 | 13.50 | 1.00 | 0.10 | 0.05 | 60.18 |

- Crane Assistant Engineer/Rig Oiler
- Drill Helper
- Parts & Equipment Coordinator
- Spotter
- Steam Cleaner
- Swamper (on trenching machines or shovel type equipment)

Roofers

*See per diem note on last page

| | | | | | | | | |
|------------------------------------|--|-------|-------|------|------|------|----------------|-------|
| A1701 Roofer & Waterproofer | | | | | | | L&M | |
| | | 44.62 | 12.75 | 3.91 | 0.81 | 0.10 | 0.06 | 62.25 |

| | | | | | | | | |
|--------------------------------------|--|-------|-------|------|------|------|----------------|-------|
| A1702 Roofer Material Handler | | | | | | | L&M | |
| | | 31.23 | 12.75 | 3.91 | 0.81 | 0.10 | 0.06 | 48.86 |

Sheet Metal Workers, Region I (North of N63 latitude)

*See per diem note on last page

| | | | | | | | | |
|-------------------------------------|--|-------|-------|-------|------|------|----------------|-------|
| N1801 Sheet Metal Journeyman | | | | | | | L&M | |
| | | 48.64 | 11.50 | 14.11 | 1.65 | 0.12 | | 76.02 |

- Air Balancing and duct cleaning of HVAC systems
- Brazing, soldering or welding of metals
- Demolition of sheet metal HVAC systems
- Fabrication and installation of exterior wall sheathing, siding, metal roofing, flashing, decking and architectural sheet metal work
- Fabrication and installation of heating, ventilation and air conditioning ducts and equipment
- Fabrication and installation of louvers and hoods
- Fabrication and installation of sheet metal lagging
- Fabrication and installation of stainless steel commercial or industrial food service equipment
- Manufacture, fabrication assembly, installation and alteration of all ferrous and nonferrous metal work
- Metal lavatory partitions
- Preparation of drawings taken from architectural and engineering plans required for fabrication and erection of sheet metal work
- Sheet Metal shelving
- Sheet Metal venting, chimneys and breaching
- Skylight installation

Sheet Metal Workers, Region II (South of N63 latitude)

*See per diem note on last page

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pens fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Sheet Metal Workers, Region II (South of N63 latitude)

*See per diem note on last page

| | | | | | | | L&M | |
|--------------|------------------------|-------|-------|-------|------|------|-----|-------|
| S1801 | Sheet Metal Journeyman | 43.20 | 11.50 | 14.09 | 1.68 | 0.43 | | 70.90 |

- Air Balancing and duct cleaning of HVAC systems
- Brazing, soldering or welding of metals
- Demolition of sheet metal HVAC systems
- Fabrication and installation of exterior wall sheathing, siding, metal roofing, flashing, decking and architectural sheet metal work
- Fabrication and installation of heating, ventilation and air conditioning ducts and equipment
- Fabrication and installation of louvers and hoods
- Fabrication and installation of sheet metal lagging
- Fabrication and installation of stainless steel commercial or industrial food service equipment
- Manufacture, fabrication assembly, installation and alteration of all ferrous and nonferrous metal work
- Metal lavatory partitions
- Preparation of drawings taken from architectural and engineering plans required for fabrication and erection of sheet metal work
- Sheet Metal shelving
- Sheet Metal venting, chimneys and breaching
- Skylight installation

Sprinkler Fitters

*See per diem note on last page

| | | | | | | | L&M | |
|--------------|------------------|-------|-------|-------|------|------|-----|-------|
| A1901 | Sprinkler Fitter | 47.35 | 10.55 | 18.05 | 0.52 | 0.25 | | 76.72 |

Surveyors

*See per diem note on last page

| | | | | | | | L&M | |
|--------------|------------------|-------|-------|-------|------|------|-----|-------|
| A2001 | Chief of Parties | 45.16 | 11.83 | 13.14 | 1.15 | 0.10 | | 71.38 |

| | | | | | | | L&M | |
|--------------|-------------|-------|-------|-------|------|------|-----|-------|
| A2002 | Party Chief | 43.57 | 11.83 | 13.14 | 1.15 | 0.10 | | 69.79 |

| | | | | | | | L&M | |
|--------------|---|-------|-------|-------|------|------|-----|-------|
| A2003 | Line & Grade Technician/Office Technician/GPS, Drones | 42.97 | 11.83 | 13.14 | 1.15 | 0.10 | | 69.19 |

| | | | | | | | L&M | |
|--------------|--|-------|-------|-------|------|------|-----|-------|
| A2004 | Associate Party Chief (including Instrument Person & Head Chain Person)/Stake Hop/Grademan | 40.85 | 11.83 | 13.14 | 1.15 | 0.10 | | 67.07 |

| | | | | | | | L&M | |
|--------------|--|-------|-------|-------|------|------|-----|-------|
| A2006 | Chain Person (for crews with more than 2 people) | 36.51 | 11.83 | 13.14 | 1.15 | 0.10 | | 62.73 |

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Truck Drivers

*See per diem note on last page

| | | | | | | | L&M | |
|--------------|---|-------|-------|-------|------|------|-----|-------|
| A2101 | Group I, including: | 41.94 | 11.83 | 13.14 | 1.15 | 0.10 | | 68.16 |
| | Air/Sea Traffic Controllers | | | | | | | |
| | Ambulance/Fire Truck Driver (EMT certified) | | | | | | | |
| | Boat Coxswain | | | | | | | |
| | Captains & Pilots (air & water) | | | | | | | |
| | Deltas, Commanders, Rollagons, & similar equipment (when pulling sleds, trailers or similar equipment) | | | | | | | |
| | Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) over 40 yards up to & including 60 yards | | | | | | | |
| | Helicopter Transporter | | | | | | | |
| | Liquid Vac Truck/Super Vac Truck | | | | | | | |
| | Material Coordinator or Purchasing Agent | | | | | | | |
| | Ready-mix (over 12 yards up to & including 15 yards) (over 15 yards to be negotiated) | | | | | | | |
| | Semi with Double Box Mixer | | | | | | | |
| | Tireman, Heavy Duty/Fueler | | | | | | | |
| | Water Wagon (250 Bbls and above) | | | | | | | |
| A2102 | Group 1A including: | 43.21 | 11.83 | 13.14 | 1.15 | 0.10 | | 69.43 |
| | Dump Trucks (including rockbuggy, side dump, belly dump & trucks with pups) over 60 yards up to & including 100 yards (over 100 yards to be negotiated) | | | | | | | |
| | Jeeps (driver under load) | | | | | | | |
| | Lowboys, including tractor attached trailers & jeeps, up to & including 12 axles (over 12 axles or 150 tons to be negotiated) | | | | | | | |
| A2103 | Group II, including: | 40.68 | 11.83 | 13.14 | 1.15 | 0.10 | | 66.90 |
| | All Deltas, Commanders, Rollagons, & similar equipment | | | | | | | |
| | Batch Trucks (8 yards & up) | | | | | | | |
| | Batch Trucks (up to & including 7 yards) | | | | | | | |
| | Boom Truck/Knuckle Truck (over 5 tons) | | | | | | | |
| | Cacasco Truck/Heat Stress Truck | | | | | | | |
| | Construction and Material Safety Technician | | | | | | | |
| | Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) over 20 yards up to & including 40 yards | | | | | | | |
| | Gin Pole Truck, Winch Truck, Wrecker (truck mounted "A" frame manufactured rating over 5 tons) | | | | | | | |
| | Mechanics | | | | | | | |
| | Oil Distributor Driver | | | | | | | |
| | Partsman | | | | | | | |
| | Ready-mix (up to & including 12 yards) | | | | | | | |
| | Stringing Truck | | | | | | | |

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Truck Drivers

*See per diem note on last page

| | | | | | | | | |
|--------------|---|-------|-------|-------|------|--|------------------------|-------|
| A2103 | Group II, including: | 40.68 | 11.83 | 13.14 | 1.15 | | L&M 0.10 | 66.90 |
| | Turn-O-Wagon or DW-10 (not self loading) | | | | | | | |
| A2104 | Group III, including: | 39.86 | 11.83 | 13.14 | 1.15 | | L&M 0.10 | 66.08 |
| | Boom Truck/Knuckle Truck (up to & including 5 tons) | | | | | | | |
| | Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) over 10 yards up to & including 20 yards | | | | | | | |
| | Expeditor (electrical & pipefitting materials) | | | | | | | |
| | Gin Pole Truck, Winch Truck, Wrecker (truck mounted "A" frame manufactured rating 5 tons & under) | | | | | | | |
| | Greaser - Shop | | | | | | | |
| | Semi or Truck & Trailer | | | | | | | |
| | Thermal Plastic Layout Technician | | | | | | | |
| | Traffic Control Technician | | | | | | | |
| | Trucks/Jeeps (push or pull) | | | | | | | |
| A2105 | Group IV, including: | 39.28 | 11.83 | 13.14 | 1.15 | | L&M 0.10 | 65.50 |
| | Air Cushion or similar type vehicle | | | | | | | |
| | All Terrain Vehicle | | | | | | | |
| | Buggymobile | | | | | | | |
| | Bull Lift & Fork Lift, Fork Lift with Power Boom & Swing Attachment (over 5 tons) | | | | | | | |
| | Bus Operator (over 30 passengers) | | | | | | | |
| | Cement Spreader, Dry | | | | | | | |
| | Combination Truck-Fuel & Grease | | | | | | | |
| | Compactor (when pulled by rubber tired equipment) | | | | | | | |
| | Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) up to & including 10 yards | | | | | | | |
| | Dumpster | | | | | | | |
| | Expeditor (general) | | | | | | | |
| | Fire Truck/Ambulance Driver | | | | | | | |
| | Flat Beds, Dual Rear Axle | | | | | | | |
| | Foam Distributor Truck Dual Axle | | | | | | | |
| | Front End Loader with Fork | | | | | | | |
| | Grease Truck | | | | | | | |
| | Hydro Seeder, Dual Axle | | | | | | | |
| | Hyster Operators (handling bulk aggregate) | | | | | | | |
| | Loadmaster (air & water operations) | | | | | | | |
| | Lumber Carrier | | | | | | | |
| | Ready-mix, (up to & including 7 yards) | | | | | | | |
| | Rigger (air/water/oilfield) | | | | | | | |

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Truck Drivers
 *See per diem note on last page

| | | | | | | L&M | |
|--------------|------------------------------|-------|-------|-------|------|------|-------|
| A2105 | Group IV, including: | 39.28 | 11.83 | 13.14 | 1.15 | 0.10 | 65.50 |
| | Tireman, Light Duty | | | | | | |
| | Track Truck Equipment | | | | | | |
| | Truck Vacuum Sweeper | | | | | | |
| | Warehouseperson | | | | | | |
| | Water Truck (Below 250 Bbls) | | | | | | |
| | Water Truck (straight) | | | | | | |
| | Water Wagon, Semi | | | | | | |

| | | | | | | L&M | |
|--------------|---|-------|-------|-------|------|------|-------|
| A2106 | Group V, including: | 38.52 | 11.83 | 13.14 | 1.15 | 0.10 | 64.74 |
| | Buffer Truck | | | | | | |
| | Bull Lifts & Fork Lifts, Fork Lifts with Power Boom & Swing Attachments (up to & including 5 tons) | | | | | | |
| | Bus Operator (up to 30 passengers) | | | | | | |
| | Farm Type Rubber Tired Tractor (when material handling or pulling wagons on a construction project) | | | | | | |
| | Flat Beds, Single Rear Axle | | | | | | |
| | Foam Distributor Truck Single Axle | | | | | | |
| | Fuel Handler (station/bulk attendant) | | | | | | |
| | Gear/Supply Truck | | | | | | |
| | Gravel Spreader Box Operator on Truck | | | | | | |
| | Hydro Seeders, Single axle | | | | | | |
| | Pickups (pilot cars & all light-duty vehicles) | | | | | | |
| | Rigger/Swamper | | | | | | |
| | Tack Truck | | | | | | |
| | Team Drivers (horses, mules, & similar equipment) | | | | | | |

Tunnel Workers, Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)
 *See per diem note on last page

| | | | | | | L&M | LEG | |
|--------------|--|-------|------|-------|------|------|------|-------|
| N2201 | Group I, including: | 35.20 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 66.51 |
| | Brakeman | | | | | | | |
| | Mucker | | | | | | | |
| | Nipper | | | | | | | |
| | Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer) | | | | | | | |
| | Topman & Bull Gang | | | | | | | |
| | Tunnel Track Laborer | | | | | | | |

| | | | | | | L&M | LEG | |
|--------------|-------------------------|-------|------|-------|------|------|------|-------|
| N2202 | Group II, including: | 36.30 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 67.61 |
| | Burning & Cutting Torch | | | | | | | |

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Tunnel Workers, Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)
 *See per diem note on last page

| | | | | | | L&M | LEG | |
|--------------|---|-------|------|-------|------|------|------|-------|
| N2202 | Group II, including: | 36.30 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 67.61 |
| | Certified Erosion Sediment Control Lead (CESCL Laborer) | | | | | | | |
| | Concrete Laborer | | | | | | | |
| | Floor Preparation, Core Drilling | | | | | | | |
| | Jackhammer/Chipping Gun or Pavement Breaker | | | | | | | |
| | Laser Instrument Operator | | | | | | | |
| | Nozzlemen, Pumpcrete or Shotcrete | | | | | | | |
| | Pipelayer Helper | | | | | | | |

| | | | | | | L&M | LEG | |
|--------------|-----------------------|-------|------|-------|------|------|------|-------|
| N2203 | Group III, including: | 37.29 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 68.60 |
| | Miner | | | | | | | |
| | Retimberman | | | | | | | |

| | | | | | | L&M | LEG | |
|--------------|--|-------|------|-------|------|------|------|-------|
| N2204 | Group IIIA, including: | 40.90 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 72.21 |
| | Asphalt Raker, Asphalt Belly Dump Lay Down | | | | | | | |
| | Drill Doctor (in the field) | | | | | | | |
| | Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills) | | | | | | | |
| | Pioneer Drilling & Drilling Off Tugger (all type drills) | | | | | | | |
| | Pipelayer | | | | | | | |
| | Powderman (Employee Possessor) | | | | | | | |
| | Storm Water Pollution Protection Plan Specialist (SWPPP Specialist) | | | | | | | |
| | Traffic Control Supervisor, DOT Qualified | | | | | | | |

| | | | | | | L&M | LEG | |
|--------------|--|-------|------|-------|------|------|------|-------|
| N2206 | Group IIIB, including: | 45.07 | 6.24 | 20.66 | 1.30 | 0.20 | 0.20 | 73.67 |
| | Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours) | | | | | | | |
| | Federal Powderman (Responsible Person in Charge) | | | | | | | |
| | Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones) | | | | | | | |
| | Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours) | | | | | | | |
| | Stake Hopper | | | | | | | |

Tunnel Workers, Laborers (The area that is south of N63 latitude and west of W138 longitude)
 *See per diem note on last page

| | | | | | | L&M | LEG | |
|--------------|---------------------|-------|------|-------|------|------|------|-------|
| S2201 | Group I, including: | 35.20 | 8.95 | 20.66 | 1.30 | 0.20 | 0.20 | 66.51 |
| | Brakeman | | | | | | | |
| | Mucker | | | | | | | |

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Tunnel Workers, Laborers (The area that is south of N63 latitude and west of W138 longitude)
 *See per diem note on last page

| | | | | | | | | | |
|--------------|---------------------|-------|------|-------|------|--|----------------|------------|-------|
| S2201 | Group I, including: | 35.20 | 8.95 | 20.66 | 1.30 | | L&M | LEG | 66.51 |
|--------------|---------------------|-------|------|-------|------|--|----------------|------------|-------|

- Nipper
- Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)
- Topman & Bull Gang
- Tunnel Track Laborer

| | | | | | | | | | |
|--------------|----------------------|-------|------|-------|------|--|----------------|------------|-------|
| S2202 | Group II, including: | 36.30 | 8.95 | 20.66 | 1.30 | | L&M | LEG | 67.61 |
|--------------|----------------------|-------|------|-------|------|--|----------------|------------|-------|

- Burning & Cutting Torch
- Certified Erosion Sediment Control Lead (CESCL Laborer)
- Concrete Laborer
- Floor Preparation, Core Drilling
- Jackhammer/Chipping Gun or Pavement Breaker
- Laser Instrument Operator
- Nozzlemen, Pumpcrete or Shotcrete
- Pipelayer Helper

| | | | | | | | | | |
|--------------|-----------------------|-------|------|-------|------|--|----------------|------------|-------|
| S2203 | Group III, including: | 37.29 | 8.95 | 20.66 | 1.30 | | L&M | LEG | 68.60 |
|--------------|-----------------------|-------|------|-------|------|--|----------------|------------|-------|

- Miner
- Retimberman

| | | | | | | | | | |
|--------------|------------------------|-------|------|-------|------|--|----------------|------------|-------|
| S2204 | Group IIIA, including: | 40.90 | 8.95 | 20.66 | 1.30 | | L&M | LEG | 72.21 |
|--------------|------------------------|-------|------|-------|------|--|----------------|------------|-------|

- Asphalt Raker, Asphalt Belly Dump Lay Down
- Drill Doctor (in the field)
- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)
- Pioneer Drilling & Drilling Off Tugger (all type drills)
- Pipelayer
- Powderman (Employee Possessor)
- Storm Water Pollution Protection Plan Specialist (SWPPP Specialist)
- Traffic Control Supervisor, DOT Qualified

| | | | | | | | | | |
|--------------|------------------------|-------|------|-------|------|--|----------------|------------|-------|
| S2206 | Group IIIB, including: | 45.07 | 6.24 | 20.66 | 1.30 | | L&M | LEG | 73.67 |
|--------------|------------------------|-------|------|-------|------|--|----------------|------------|-------|

- Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours)
- Federal Powderman (Responsible Person in Charge)
- Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones)
- Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours)

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| Class Code | Classification of Laborers & Mechanics | BHR | H&W | PEN | TRN | Other | Benefits | THR |
|------------|--|-----|-----|-----|-----|-------|----------|-----|
|------------|--|-----|-----|-----|-----|-------|----------|-----|

Tunnel Workers, Laborers (The area that is south of N63 latitude and west of W138 longitude)
 *See per diem note on last page

| | | | | | | | | | |
|--------------|------------------------|-------|------|-------|------|--|----------------|------------|-------|
| S2206 | Group IIIB, including: | 45.07 | 6.24 | 20.66 | 1.30 | | L&M | LEG | |
| | Stake Hopper | | | | | | 0.20 | 0.20 | 73.67 |

Tunnel Workers, Power Equipment Operators
 *See per diem note on last page

| | | | | | | | | | |
|--------------|-----------|-------|-------|-------|------|--|----------------|------|-------|
| A2207 | Group I | 46.78 | 10.70 | 13.50 | 1.00 | | L&M | | |
| | | | | | | | 0.10 | 0.05 | 72.13 |
| A2208 | Group IA | 48.72 | 10.70 | 13.50 | 1.00 | | L&M | | |
| | | | | | | | 0.10 | 0.05 | 74.07 |
| A2209 | Group II | 45.94 | 10.70 | 13.50 | 1.00 | | L&M | | |
| | | | | | | | 0.10 | 0.05 | 71.29 |
| A2210 | Group III | 45.14 | 10.70 | 13.50 | 1.00 | | L&M | | |
| | | | | | | | 0.10 | 0.05 | 70.49 |
| A2211 | Group IV | 38.31 | 10.70 | 13.50 | 1.00 | | L&M | | |
| | | | | | | | 0.10 | 0.05 | 63.66 |

* Per diem is an established practice for this classification. This means that per diem is an allowable alternative to board and lodging if all criteria are met. See 8 AAC 30.051-08 AAC 30.056, and the per diem information on page vii of this Pamphlet.

** Work in combination of classifications: Employees working in any combination of classifications within the diving crew (working diver, standby diver, and tender) in a shift are paid in the classification with the highest rate for a minimum of 8 hours per shift.

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pens fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

BID FORM

CITY OF PALMER, ALASKA — WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT—PHASE II

TABLE OF CONTENTS

| | Page |
|--|-------------|
| ARTICLE 1 – Bid Recipient | 1 |
| ARTICLE 2 – Bidder’s Acknowledgements..... | 1 |
| ARTICLE 3 – Bidder’s Representations | 1 |
| ARTICLE 4 – Bidder’s Certification..... | 2 |
| ARTICLE 5 – Basis of Bid | 3 |
| ARTICLE 6 – Time of Completion..... | 5 |
| ARTICLE 7 – Attachments to this Bid..... | 6 |
| ARTICLE 8 – Defined Terms..... | 6 |
| ARTICLE 9 – Bid Submittal | 6 |

ARTICLE 1 – BID RECIPIENT

- 1.01 This Bid is submitted to: City of Palmer, Alaska; herein after referred to as Owner.
- 1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

- 2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.
- 2.02 BIDDER will sign and deliver the required number of counterparts of the AGREEMENT with the Bonds and other documents required by the Bidding Requirements within 15 days after the date of OWNER's Notice of Award.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

- 3.01 In submitting this Bid, Bidder represents that:
 - A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

| <u>Addendum No.</u> | <u>Addendum, Date</u> |
|---------------------|-----------------------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

- B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work and including all American Iron and Steel requirements.
- D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
- E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and

drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

- F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.
- J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;
 - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
 - 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 This section, in general, describes the bid items included in the bid schedule. The description of Bid Items is provided for clarity purposes only. It is not intended to replace, supersede or preclude any information in the plans and specifications. Unless specified otherwise, all lump sum bid items will be paid as a percentage of actual work complete. Percent complete will be based on the schedule of values submitted by the Contractor and approved by the engineer. The schedule of values will break down the lump sum bid items into discrete work activities beyond the breakdown shown on the Bid Form. The schedule of values must be submitted and approved by the Engineer before the Contractor can request a payment for work under this Contract.

Descriptions of the project Bid Items are provided below:

BID ITEM NO. 1: BASE CONSTRUCTION. This lump sum Bid Item includes all other work not specifically designated in all other Bid Items. Provide all labor, equipment, materials and services to construct and commence operation of the Palmer WWTF Improvements. The Bid Item includes work shown and/or specified for the MBBR channel modifications, new standby engine generator, Lagoon 2 modifications, new Manhole #15, yard piping, site work, electrical, instrumentation, equipment, civil related work, mechanical related work and all state and local permits, complete. Excludes secondary clarifiers associated with Bid Item No. 2, Waste Activated Sludge (WAS) Vault associated with Bid Item No. 3, Scum Pump Station associated with Bid Item No. 4, and Lagoon 2 Overflow Structure associated with Bid Item No. 5.

BID ITEM NO. 2: SECONDARY CLARIFIERS. This lump sum Bid Item includes construction of the new Secondary Clarifier Split Structure, new Secondary Clarifier No. 1 and Secondary Clarifier No. 2, new Manhole #16, and associated equipment, site work, concrete tankage, piping, mechanical, electrical, instrumentation and coatings as described in the Contract Documents. The Bid Item includes, but is not limited to, all associated facilities defined in Section 46 43 24 – Sludge Collection: Circular Spiral Scraper-Type and Section 46 73 18 – Aluminum Flat Panel Covers. This Bid Item also includes facilities defined in the 400 Series Drawings and associated state and local permits, complete.

BID ITEM NO. 3: WASTE ACTIVATED SLUDGE (WAS) VAULT. This lump sum Bid Item includes construction of the new WAS Vault, and associated equipment, site work, concrete tankage, piping, mechanical, electrical, instrumentation and coatings as described in the Contract Documents. The Bid Item includes, but is not limited to, all associated facilities defined in Section 43 23 17 – Pumping Equipment: Vortex (Torque-Flow) and Section 43 24 16 – Pumping Equipment: Sump. This Bid Item also includes facilities defined in the 300 Series Drawings and associated state and local permits, complete.

BID ITEM NO. 4: SCUM PUMP STATION. This lump sum Bid Item includes construction of the new Scum Pump Station, and associated equipment, site work, concrete tankage, piping, mechanical, electrical, instrumentation and coatings as described in the Contract Documents. The Bid Item includes, but is not limited to, all associated facilities defined in Section 43 21 23 – WET PIT PREROTATION SCREW CENTRIFUGAL IMMERSIBLE NON-CLOG PUMPING SYSTEM. This Bid Item also includes facilities defined on Drawing 000C009 and associated state and local permits, complete.

BID ITEM NO. 5: LAGOON 2 OVERFLOW STRUCTURE. This lump sum Bid Item includes construction of the new Lagoon 2 Overflow Structure, and associated site work, concrete structure, and piping, as described in the Contract Documents. The Bid Item includes, but is not limited to, all associated facilities defined on Drawing 000C007 and associated state and local permits, complete.

- b. Bidder will complete the Work in accordance with the contract Documents and the provisions below for the following price(s) as summarized in the Bid Sheet Schedule(s) hereinafter.
- c. Bidder agrees that all sales and use taxes are included in the stated bid price for the work.
- d. The Owner reserves the right to reject any or all bids.
- e. Contractor Take Note: It is the intent of the Owner to award a contract to the lowest responsive, responsible bidder on the basis of the combined total of Bid Items No. 1, No. 2, No. 3, No. 4, and No. 5. Bidders must include lump sum bid prices for **all** Bid Items No. 1 through 5. Bids received that do not include pricing for Bid Items 1 through 5 will be considered non-responsive. The purpose and intent of using such a basis of award is to allow the Owner to construct the greatest possible number of Bid Items based upon the responsible bids received and the funding available. The Owner reserves the right to authorize construction of any combination of, or all of, the bid additive alternates defined at the bid amounts presented in the Contractor's Bid Proposal.

BIDDER will complete the Work in accordance with the Contract Documents for the following prices(s):

WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT – Phase II

Bid Schedule A

The Bid for the following items shall be a lump sum bid for all construction work described in the Contract Documents. The bid price shall include all temporary or permanent equipment, materials, supplies, and labor necessary to construct the item in accordance with the Contract Documents. The total lump sum price shall be broken down into the following items for the purpose of progress payments and for the information of the OWNER.

1. BID SCHEDULES: All specific cash allowances are included in the prices set forth below and have been computed in accordance with the General Conditions.

| Bid Item No. | Description | Total Bid Item Price (Use Figures) |
|---|------------------------------------|---------------------------------------|
| 1 | Base Construction | \$ _____ (Use Figures) |
| 2 | Secondary Clarifiers | \$ _____ (Use Figures) |
| 3 | Waste Activated Sludge (WAS) Vault | \$ _____ (Use Figures) |
| 4 | Scum Pump Station | \$ _____ (Use Figures) |
| 5 | Lagoon 2 Overflow Structure | \$ _____ (Use Figures) |
| Total Contract Bid Price (Items No. 1 through No. 5) | | \$ _____ (Use Figures) |
| Total Contract Bid Price, (Bid Items No. 1 through No. 5) _____ (Use Words) | | |

ARTICLE 6 – TIME OF COMPLETION

- 6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:

- A. Required Bid security;
- B. List of Proposed Subcontractors;
- C. List of Proposed Suppliers;
- D. List of Project References;
- E. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;
- F. Contractor’s License No.: _____
- G. Required Bidder Qualification Statement with supporting data
- H. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in the Supplemental General Conditions
- I. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048)
- J. If Bid amount exceeds \$100,000, signed RD Instruction 1940-Q, Exhibit A-1, Certification for Contracts, Grants, and Loans.
- K. Manufacturers’ Certification letter of compliance with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference for all equals or substitutes approved by Addenda for American Iron and Steel products as provided in these Contract Documents.

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

By:
[Signature] _____

[Printed name] _____
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature] _____

[Printed name] _____

Title:

Submittal Date:

Address for giving notices:

Telephone Number:

Fax Number:

Contact Name and e-mail address:

Bidder's License No.:

(where applicable)

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BID BOND (PENAL SUM)
For
City of Palmer Wastewater Treatment Facility Improvements Project – Phase II
City of Palmer, Alaska
BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER (Name and Address):

SURETY (Name, and Address of Principal Place of Business):

OWNER (Name and Address):

BID

Bid Due Date:

Description **City of Palmer Wastewater Treatment Facility Improvements Project – Phase II**

BOND

Bond Number:

Date:

Penal sum _____ \$ _____
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER

SURETY

Bidder's Name and Corporate Seal (Seal) _____
Surety's Name and Corporate Seal (Seal)

By: _____
Signature

By: _____
Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Note: Addresses are to be used for giving any required notice.

Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2 All Bids are rejected by Owner, or
 - 3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at

length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

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EJCDC Form C-451 QUALIFICATIONS STATEMENT

THE INFORMATION SUPPLIED IN THIS DOCUMENT IS CONFIDENTIAL TO THE EXTENT PERMITTED BY LAWS AND REGULATIONS

1. SUBMITTED BY:

Official Name of Firm: _____

Address: _____

2. SUBMITTED TO:

3. SUBMITTED FOR:

Owner: _____

Project Name: _____

TYPE OF WORK:

4. CONTRACTOR'S CONTACT INFORMATION

Contact Person: _____

Title: _____

Phone: _____

Email: _____

5. AFFILIATED COMPANIES:

Name: _____

Address: _____

6. TYPE OF ORGANIZATION:

SOLE PROPRIETORSHIP

Name of Owner: _____

Doing Business As: _____

Date of Organization: _____

PARTNERSHIP

Date of Organization: _____

Type of Partnership: _____

Name of General Partner(s): _____

CORPORATION

State of Organization: _____

Date of Organization: _____

Executive Officers:

- President: _____

- Vice President(s): _____

- Treasurer: _____

- Secretary: _____

LIMITED LIABILITY COMPANY

State of Organization: _____

Date of Organization: _____

Members: _____

JOINT VENTURE

Sate of Organization: _____

Date of Organization: _____

Form of Organization: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

7. LICENSING

Jurisdiction: _____

Type of License: _____

License Number: _____

Jurisdiction: _____

Type of License: _____

License Number: _____

8. CERTIFICATIONS

CERTIFIED BY:

Disadvantage Business Enterprise: _____

Minority Business Enterprise: _____

Woman Owned Enterprise: _____

Small Business Enterprise: _____

Other (_____): _____

9. BONDING INFORMATION

Bonding Company: _____

Address: _____

Bonding Agent: _____

Address: _____

Contact Name: _____

Phone: _____

Aggregate Bonding Capacity: _____

Available Bonding Capacity as of date of this submittal: _____

10. FINANCIAL INFORMATION

Financial Institution: _____

Address: _____

Account Manager: _____

Phone: _____

INCLUDE AS AN ATTACHMENT AN AUDITED BALANCE SHEET FOR EACH OF THE LAST 3 YEARS

11. CONSTRUCTION EXPERIENCE:

Current Experience:

List on **Schedule A** all uncompleted projects currently under contract (If Joint Venture list each participant's projects separately). Note any projects that are subject to American Iron and Steel requirements.

Previous Experience:

List on **Schedule B** all projects completed within the last 5 Years (If Joint Venture list each participant's projects separately). Note any projects that were subject to American Iron and Steel requirements.

Has firm listed in Section 1 ever failed to complete a construction contract awarded to it?

YES NO

If YES, attach as an Attachment details including Project Owner's contact information.

Has any Corporate Officer, Partner, Joint Venture participant or Proprietor ever failed to complete a construction contract awarded to them in their name or when acting as a principal of another entity?

YES NO

If YES, attach as an Attachment details including Project Owner's contact information.

Are there any judgments, claims, disputes or litigation pending or outstanding involving the firm listed in Section 1 or any of its officers (or any of its partners if a partnership or any of the individual entities if a joint venture)?

YES NO

If YES, attach as an Attachment details including Project Owner's contact information.

12. SAFETY PROGRAM:

Name of Contractor's Safety Officer: _____

Include the following as attachments:

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) OSHA No. 500- Log & Summary of Occupational Injuries & Illnesses for the past 5 years.

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) list of all OSHA Citations & Notifications of Penalty (monetary or other) received within the last 5 years (indicate disposition as applicable) - IF NONE SO STATE.

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) list of all safety citations or violations under any state all received within the last 5 years (indicate disposition as applicable) - IF NONE SO STATE.

Provide the following for the firm listed in Section V (and for each proposed Subcontractor furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) the following (attach additional sheets as necessary):

Workers' compensation Experience Modification Rate (EMR) for the last 5 years:

| | | | |
|------|-------|-----|-------|
| YEAR | _____ | EMR | _____ |
| YEAR | _____ | EMR | _____ |
| YEAR | _____ | EMR | _____ |
| YEAR | _____ | EMR | _____ |
| YEAR | _____ | EMR | _____ |

Total Recordable Frequency Rate (TRFR) for the last 5 years:

| | | | |
|------|-------|------|-------|
| YEAR | _____ | TRFR | _____ |
| YEAR | _____ | TRFR | _____ |
| YEAR | _____ | TRFR | _____ |
| YEAR | _____ | TRFR | _____ |
| YEAR | _____ | TRFR | _____ |

Total number of man-hours worked for the last 5 Years:

| | | | |
|------|-------|---------------------------|-------|
| YEAR | _____ | TOTAL NUMBER OF MAN-HOURS | _____ |
| YEAR | _____ | TOTAL NUMBER OF MAN-HOURS | _____ |
| YEAR | _____ | TOTAL NUMBER OF MAN-HOURS | _____ |
| YEAR | _____ | TOTAL NUMBER OF MAN-HOURS | _____ |
| YEAR | _____ | TOTAL NUMBER OF MAN-HOURS | _____ |

Provide Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) Days Away From Work, Days of Restricted Work Activity or Job Transfer (DART) incidence rate for the particular industry or type of Work to be performed by Contractor and each of Contractor's proposed Subcontractors and Suppliers) for the last 5 years:

| | | | |
|------|-------|------|-------|
| YEAR | _____ | DART | _____ |
| YEAR | _____ | DART | _____ |
| YEAR | _____ | DART | _____ |
| YEAR | _____ | DART | _____ |
| YEAR | _____ | DART | _____ |

13. EQUIPMENT:

MAJOR EQUIPMENT:

List on **Schedule C** all pieces of major equipment available for use on Owner's Project.

I HEREBY CERTIFY THAT THE INFORMATION SUBMITTED HEREWITH, INCLUDING ANY ATTACHMENTS, IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

NAME OF ORGANIZATION: _____

BY: _____

TITLE: _____

DATED: _____

NOTARY ATTEST:

SUBSCRIBED AND SWORN TO BEFORE ME

THIS _____ DAY OF _____, 20__

NOTARY PUBLIC - STATE OF _____

MY COMMISSION EXPIRES: _____

REQUIRED ATTACHMENTS

1. Schedule A (Current Experience).
2. Schedule B (Previous Experience).
3. Schedule C (Major Equipment).
4. Audited balance sheet for each of the last 3 years for firm named in Section 1.
5. Evidence of authority for individuals listed in Section 7 to bind organization to an agreement.
6. Resumes of officers and key individuals (including Safety Officer) of firm named in Section 1.
7. Required safety program submittals listed in Section 13.
8. Additional items as pertinent.

SCHEDULE A

CURRENT EXPERIENCE

| Project Name | Owner's Contact Person | Design Engineer | Contract Date | Type of Work | Status | Cost of Work |
|--------------|---------------------------------|---------------------------------|---------------|--------------|--------|--------------|
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |

SCHEDULE B

PREVIOUS EXPERIENCE (Include ALL Projects Completed within last 5 years)

| Project Name | Owner's Contact Person | Design Engineer | Contract Date | Type of Work | Status | Cost of Work |
|--------------|---------------------------------|---------------------------------|---------------|--------------|--------|--------------|
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |

SCHEDULE B

PREVIOUS EXPERIENCE (Include ALL Projects Completed within last 5 years)

| Project Name | Owner's Contact Person | Design Engineer | Contract Date | Type of Work | Status | Cost of Work |
|--------------|---------------------------------|---------------------------------|---------------|--------------|--------|--------------|
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |
| | Name: Address: Telephone: | Name: Company: Telephone: | | | | |

SCHEDULE C - LIST OF MAJOR EQUIPMENT AVAILABLE

| ITEM | PURCHASE DATE | CONDITION | ACQUIRED VALUE |
|------|---------------|-----------|----------------|
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NOTICE OF AWARD

- Bonds are required to be purchased and maintained in accordance with the Contract Documents.

Date of Issuance:

Owner:

Owner's Contract No. All applicable licenses required by the contract documents.

Engineer:

Engineer's Project No.:

Project:

Contract Name: Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Bidder:

Bidder's Address:

TO BIDDER:

You are notified that Owner has accepted your Bid dated [] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: _____

Authorized Signature

The Contract Price of the awarded Contract is: \$ _____

By: _____

unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

Title: Engineer

a set of the Drawings will be delivered separately from the other Contract Documents.

Copy:

You must comply with the following conditions precedent within 15 days of the date of this Notice of Award:

1. Deliver to Owner all required counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security [e.g., performance and payment bonds] and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):
 - Certificates of insurance are required to be purchased and maintained in accordance with the Contract Documents.
 - Signed Copy of the Agreement Between Owner and Contractor.

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**AGREEMENT
BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)**

THIS AGREEMENT is by and between _____ (“Owner”) and
_____ (“Contractor”).

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows:

2.02 City of Palmer Wastewater Treatment Facility Improvements

- A. Furnish and install all labor, materials, and equipment for the construction of new secondary clarification equipment; new secondary split box; installation of new waste activated sludge and scum pumping equipment; piping, valves , and appurtenances; together with related subsidiary and incidental work in accordance with the plans and specifications.

ARTICLE 3 – ENGINEER

3.01 The part of the Project that pertains to the Work has been designed by The Contract Documents for the Goods and Special Services have been prepared by HDR Engineering, Inc., who is hereinafter called Engineer and who is to assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the furnishing of Goods and Special Services.

3.02 The Owner has retained HDR Engineering, Inc (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

- A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 Contract Times: Dates

A. The Work will be substantially completed on or before July 1, 2022, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before November 30, 2022.

B. Parts of the Work shall be substantially completed on or before the following Milestone(s):

a.

1. Milestone 1: BID ITEMS indicated below shall meet the requirements for Substantial Completion on or before July 1, 2022. This work includes the following work items;

a. SECONDARY CLARIFIERS: This lump sum Bid Item includes construction of the new Secondary Clarifier Split Structure, new Secondary Clarifier No. 1 and Secondary Clarifier No. 2, new Manhole #16, and associated equipment, site work, concrete tankage, piping, mechanical, electrical, instrumentation and coatings as described in the Contract Documents. The Bid Item includes, but is not limited to, all associated facilities defined in Section 46 43 24 – Sludge Collection: Circular Spiral Scraper-Type and Section 46 73 18 – Aluminum Flat Panel Covers. This Bid Item also includes facilities defined in the 400 Series Drawings and associated state and local permits, complete.

b. WASTE ACTIVATED SLUDGE (WAS) VAULT: This lump sum Bid Item includes construction of the new WAS Vault, and associated equipment, site work, concrete tankage, piping, mechanical, electrical, instrumentation and coatings as described in the Contract Documents. The Bid Item includes, but is not limited to, all associated facilities defined in Section 43 23 17 – Pumping Equipment: Vortex (Torque-Flow) and Section 43 24 16 – Pumping Equipment: Sump. This Bid Item also includes facilities defined in the 300 Series Drawings and associated state and local permits, complete.

c. SCUM PUMP STATION; This lump sum Bid Item includes construction of the new Scum Pump Station, and associated equipment, site work, concrete tankage, piping, mechanical, electrical, instrumentation and coatings as described in the Contract Documents. The Bid Item includes, but is not limited to, all associated facilities defined in Section 43 21 23 – WET PIT PREROTATION SCREW CENTRIFUGAL IMMERSIBLE NON-CLOG PUMPING SYSTEM. This Bid Item also includes facilities defined on Drawing 000C009 and associated state and local permits, complete.

2. Milestone 2: BID ITEMS indicated below shall meet the requirements for Substantial Completion on or before October 1, 2022: This work includes the following work items;

Milestone 2 includes all other work not specifically designated in all other Bid Items. The Bid Item includes work shown and/or specified for the MBBR channel modifications, new standby engine generator, Lagoon 2 modifications, new Manhole #15, yard piping, site work, electrical, instrumentation, equipment, civil related work, mechanical related work and all state and local permits, complete. Excludes secondary clarifiers associated with Bid Item No. 2, Waste Activated Sludge (WAS) Vault associated with Bid Item No. 3, Scum Pump Station associated with Bid Item No. 4, and Lagoon 2 Overflow Structure associated with Bid Item No. 5

- a. LAGOON 2 OVERFLOW STRUCTURE; This lump sum Bid Item includes construction of the new Lagoon 2 Overflow Structure, and associated site work, concrete structure, and piping, as described in the Contract Documents. The Bid Item includes, but is not limited to, all associated facilities defined on Drawing 000C007 and associated state and local permits, complete.

4.03 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
 1. Substantial Completion: Contractor shall pay Owner \$5,000 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete.
 2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner \$5,000 for each day that expires after such time until the Work is completed and ready for final payment.
 3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.
 4. Milestones: Contractor shall pay Owner \$5,000 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved.

4.04 *Special Damages (deleted)*

ARTICLE 5 – CONTRACT PRICE

- 5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts that follow, subject to adjustment under the Contract:
 - A. For a lump sum of: \$_____.
All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.
 - B. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 25th day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.
1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract
 - a. 95 percent of Work completed (with the balance being retainage); and
 - b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
- B. Upon Substantial Completion of the entire construction to be provided under the Contract Documents, Owner shall pay an amount sufficient to increase total payments to Contractor to 95 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, reflecting the Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 – INTEREST

- 7.01 All amounts not paid when due shall bear interest at the maximum statutory rate allowed by law at the place of OWNER'S project in accordance with the GENERAL CONDITIONS, or eighteen (18) percent per annum, whichever is lowest.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

- 8.01 In order to induce Owner to enter into this Contract, Contractor makes the following representations:
- A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.
 - B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 - C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
 - D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to

existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

- E. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.
- F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
- G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- J. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 Contents

- A. The Contract Documents consist of the following:**
 - 1. This Agreement**
 - 2. Performance Bond**
 - 3. Payment bond**
 - 4. Such other bonds might include maintenance or warranty bonds intended to manage risk after completion of the Work.**
 - 5. Other bonds.**
 - 6. General Conditions**
 - 7. Supplementary Conditions**
 - 8. Volumes 1 and 2: Specifications as listed in the table of contents of the Project Manual.**
 - 9. Volume 4: Drawings listed on the attached sheet index.**

10. **Volume 5: Standard Details**
 11. **Volume 3: Geotechnical Report**
 12. **Addenda (numbers ___ to ___, inclusive).**
 13. **Exhibits to this Agreement (enumerated as follows):**
 - a. **Contractor's Bid (pages ___ to ___, inclusive).**
 - b. **Exhibit A-1: Consent Decree for Reference**
 14. **The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:**
 - a. **Notice to Proceed.**
 - b. **Work Change Directives.**
 - c. **Change Orders.**
 - d. **Field Orders.**
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

9.02 ***Precedence Order of the Contract Documents***

- A. **The Engineer, or designee, shall resolve any discrepancies between these documents. The following order of precedence (highest precedence to lowest precedence) shall apply:**
1. **Authorized Change Orders**
 2. **This Agreement, including exhibits and addenda**
 3. **Supplementary Conditions**
 4. **Standard General Conditions of the Construction Contract, EJCDC.**
 5. **Specifications**
 6. **Detailed Drawings: Figure dimensions, and dimensions that can be computed, on plans shall take precedence over scaled drawings.**
 7. **General Drawings**

9.03 *Contractor acknowledges that it has or has access to all of the Contract Documents referred to in this Section and agrees to comply with all of the Contract Documents.*

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

- A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto

without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 *Contractor's Certifications*

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
 - 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.06 *Other Provisions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

ARTICLE 11 – GOVERNING LAW

- 11.01 This contract shall be governed by the laws of the State of Alaska.
- 11.02 The CONTRACTOR shall give such notices, file information, and pay taxes, deductions, and premiums as may be required by law and comply with all laws, ordinances, permit requirements, rules, and regulations pertaining to the conduct of the Work. The CONTRACTOR shall be liable for violations of same in connection with any portion of the Work provided by the CONTRACTOR and shall cooperate with all governmental entities regarding inspection of the Work in compliance with such requirements. If the CONTRACTOR observes that the Drawings, Specifications, or other portions of the Contract Documents are in conflict with any such laws, ordinances, permit requirements, rules, or regulations, CONTRACTOR shall promptly notify the ENGINEER in writing of such conflict. The OWNER will promptly review the matter and, if necessary, issue a Change Order or take any other action necessary to bring about compliance with the law, ordinance, rule, or regulation in question if it is the responsibility of the OWNER; otherwise, the CONTRACTOR shall ensure such compliance. The CONTRACTOR shall not perform Work known to be contrary to any laws, ordinances, permits, rules, or regulations.
- 11.03 Unless otherwise specified herein, permits and licenses from governmental agencies that are necessary only for ensuring the prosecution of the Work and the subsequent guarantee period shall be secured and paid for by the CONTRACTOR. Permits and licenses of governmental agencies that are necessary to be maintained after expiration of the guarantee period will be secured and paid for by the OWNER.

EXHIBIT A-1 Consent Decree for Reference

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

OWNER:

CONTRACTOR:

By: _____

By: _____

Title: _____

Title: _____

(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____

Attest: _____

Title: _____

Title: _____

Address for giving notices:

Address for giving notices:

License No.: _____

(where applicable)

(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

NOTE TO USER: Use in those states or other jurisdictions where applicable or required.

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ELIZABETH LOEB
Senior Attorney
Environment & Natural Resources Division
Environmental Enforcement Section
U.S. Department of Justice
P.O. Box 7166
Washington, D.C. 20044
(202) 616-8916 (t)
Elizabeth.Loeb@usdoj.gov

STEVEN E. SKROCKI
Office of the U.S. Attorney
Federal Building & U.S. Courthouse
222 West Seventh Avenue, #9, Room 253
Anchorage, Alaska 99513-7567
Tel: (907) 271-5071

JENNIFER CURRIE
Senior Assistant Attorney General
Alaska Department of Law
1031 W. 4th Avenue, Suite 200
Anchorage, AK 99501
907-269-5280(t)
Jennifer.Currie@alaska.gov

Attorneys for Plaintiffs

UNITED STATES COURT FOR THE
DISTRICT OF ALASKA

UNITED STATES OF AMERICA, and
STATE OF ALASKA

Plaintiffs,

v.

CITY OF PALMER, ALASKA

Defendant.

Civil Action No: 3:16-cv-00204-TMB

FIRST MATERIAL MODIFICATION TO CONSENT DECREE

BACKGROUND

A. On December 22, 2016, the United States District Court for the District of Alaska entered a Consent Decree in the above-captioned action between the United States, State of Alaska, and the City of Palmer, Alaska. *See* E.C.F. No. 7. The Consent Decree settled Plaintiffs' claims for violations of the Clean Water Act (CWA) at the City's wastewater treatment plant (WWTP).

B. The Consent Decree contains provisions requiring the City to take various measures to comply with its National Pollutant Discharge Elimination System (NPDES) permit issued by the Alaska Department of Environmental Conservation (ADEC) that authorizes the discharge of pollutants under various conditions and subjects the discharges to limitations, including effluent limits, sampling, and reporting requirements. *See* 33 U.S.C. § 1342(a). Among these measures, the Consent Decree requires that by August 31, 2020, the City shall install and thereafter continuously operate secondary clarifiers which are basins specifically designed to provide effective gravity separation of settleable and suspended solids in biologically treated wastewater. *See* Consent Decree ¶ 11.d.

C. The City has requested an extension of the deadline for installation and operation of the secondary clarifiers because it believes that with other measures the clarifiers are not necessary to comply with its NPDES permit.

D. The Parties have agreed to modify the Consent Decree to extend the deadline for installation and operation of the secondary clarifiers until July 1, 2022, and to require certain measures to mitigate the potential for NPDES permit violations and determine if permit compliance can be achieved without the secondary clarifiers.

E. Paragraph 70 of the Consent Decree provides that:

The terms of this Consent Decree, including any attached appendices, may be modified only by a subsequent written agreement signed by all the Parties. Where the modification constitutes a material change to this Consent Decree, it shall be effective only upon approval by the Court. Extension of any deadlines set forth herein that are less than 120 Days shall not be considered to be a material modification.

F. The changes in this proposed modification are material because they extend a Consent Decree deadline by more than 120 days.

G. This First Material Modification to the Consent Decree does not affect, alter, modify, or amend any obligations or requirements pertaining to the wastewater treatment plant other than as expressly stated herein;

H. The Parties agree, and this Court by entering this First Material Modification to the Consent Decree finds, that this First Material Modification to the Consent Decree has been negotiated in good faith and at arm's length; that this settlement is fair, reasonable, and in the public interest; and that entry of this First Material Modification to the Consent Decree without further litigation is appropriate;

I. The Parties agree and acknowledge that final approval of the United States and entry of this First Material Modification to the Consent Decree is subject to the procedures set forth in 28 C.F.R. § 50.7, which provides for notice of this First Material Modification to the Consent Decree in the *Federal Register*, an opportunity for public comment, and the right of the United States to withdraw or withhold consent if the comments disclose facts or considerations which indicate that this First Material Modification to the Consent Decree is inappropriate, improper, or inadequate. No action by the Court is thus required at this time. Following the expiration of the comment period, the United States will evaluate any comments received and, if it continues to believe this modification is appropriate, will then request that the Court enter the Modification.

J. The City of Palmer consents to entry of this First Material Modification of the Consent Decree without further notice and agrees not to withdraw from or oppose entry of this First Material Modification to the Consent Decree by this Court or challenge any provision of this First Material Modification to the Consent Decree, unless the United States has notified it in writing, that the United States no longer supports entry of the First Material Modification to the Consent Decree;

K. The Parties hereby agree that this Agreement shall be effective as of the date that it is entered by the Court.

L. The undersigned representatives are fully authorized to enter into the terms and conditions of this First Material Modification to the Consent Decree. This First Material Modification to the Consent Decree may be executed in several parts, each of which will be considered an original.

NOW THEREFORE, the Parties hereby agree that, upon approval of this First Material Modification to the Consent Decree, the 2016 Consent Decree shall be modified as follows:

1. On the Title Page above the caption Richard Pomeroy and his contact information shall be replaced with the following:

“STEVEN E. SKROCKI
Office of the U.S. Attorney
Federal Building & U.S. Courthouse
222 West Seventh Avenue, #9, Room 253
Anchorage, Alaska 99513-7567
Tel: (907) 271-5071
Steven.skrocki@usdoj.gov”

and Steven Ross and his contact information shall be replaced with the following:

“JENNIFER CURRIE
Assistant Attorney General
Alaska Department of Law
1031 W. 4th Avenue, Suite 200

Anchorage, AK 99501
907-269-5280(t)
Jennifer.Currie@alaska.gov”

2. In Paragraph 9.b of the Consent Decree, the name Mike Solter and his contact information shall be deleted and replaced with the following:

“ADEC Division of Water
Attn: Tiffany Larson, Compliance Program Manager
610 University Ave
Fairbanks, AK 99709
Tiffany.Larson@alaska.gov”

3. In Paragraph 11.d.i the date August 31, 2020 shall be deleted and replaced with “July 1, 2022.”

4. In Paragraph 11, the following subsection “e” shall be added in double spacing:

“e. Additional Requirements Prior to Installation of Secondary

Clarifiers. Until the installation and continuous operation of Secondary

Clarifiers, the City shall implement the following measures:

i. No later than September 30, 2020, the City shall implement the Solids Management Plan attached as Appendix B to this Consent Decree.

ii. No later than September 30, 2020, the City shall implement the Lagoon Dredging and Ammonia Management Plan attached as Appendix C to this Consent Decree.

iii. No later than August 30, 2020 the City shall complete dredging of Lagoon 2 in accordance with the approved Lagoon Dredging and Ammonia Management Plan attached as Appendix C to this Consent Decree.

iv. As early as possible, but no later than May 31 of each calendar year after 2020, the City shall complete dredging of Lagoon 2 in accordance with the approved Lagoon Dredging and Ammonia Management Plan attached as Appendix C to this Consent Decree.

v. The City shall use best efforts to secure funding for Secondary Clarifiers; the City acknowledges that its failure to secure funding is not a defense to non-compliance with the deadline for installing secondary clarifiers set forth in Paragraph 11.d.i above.

vi. No later than December 31, 2020, the City shall carry out jar testing and full-scale testing, in accordance with the Polymer Testing Plan attached as Appendix D to this Consent Decree and the schedule contained therein, to evaluate whether the addition of polymer would facilitate more efficient solids capture and management, and shall report the results to EPA and DEC for comment and approval within 30 Days of completion of testing, in accordance with the schedule established in Appendix D to this Consent Decree and in accordance with the requirements of Section VII of this Consent Decree.”

5. Paragraph 17 of the Consent Decree shall be deleted and replaced with the following new Paragraph 17:

“17. Submissions Subject to EPA and/or ADEC Comment or Approval.
Where any provision of this Consent Decree specifically requires that a Submission by the City is subject to EPA and/or ADEC approval or

subject to EPA and/or ADEC comment, or where any provision of this Consent Decree specifically references this Section VII, the Submission shall be subject to the provisions of this Section.

a. Unless otherwise provided herein, for Submissions under any provision of this Consent Decree that are subject to EPA and/or ADEC review and opportunity to comment, EPA and/or the State may provide written comments on the Submission, in whole or in part, or may decline to comment. If EPA and/or the State provide written comments within thirty (30) Days of receiving a Submission, the City shall within fifteen (15) Days of receiving such comments either: (i) alter and implement the Submission consistent with such written comments; or (ii) submit the matter for dispute resolution under Section XI (Dispute Resolution) of this Consent Decree.

b. Unless otherwise provided herein, after thirty (30) Days from the date of such Submission, EPA and/or ADEC may nonetheless thereafter provide written comments requiring changes to the Submission which the City shall implement unless implementation of the written comments would be unduly burdensome given the degree to which the City has proceeded with implementing the deliverable, or implementation would otherwise be unreasonable. If the City determines that implementation of the written comments is unduly burdensome or otherwise unreasonable, it shall invoke dispute resolution within sixty (60)

c. For Submissions subject to EPA and/or ADEC approval, EPA and/or ADEC may approve the Submission or decline to approve it, in whole or in part, and may provide written comments.

i. If EPA and/or ADEC disapproves a Submission, in whole or in part, it shall state in writing the basis for such disapproval.

ii. Unless otherwise provided herein, upon receiving EPA's and/or ADEC's written comments or written notice that EPA and/or ADEC disapproves a Submission, in whole or in part, the City shall have forty-five (45) Days to: (1) alter the Submission consistent with EPA's and/or ADEC's written comments or notice of disapproval and provide the Submission to EPA and/or ADEC for final approval, or (2) to invoke Dispute Resolution under Section XI of this Consent Decree."

6. The following changes shall be made to Paragraph 18:

a. the heading shall be deleted and replaced with the following heading:

"Implementation of Plans or Other Measures Pursuant to Submissions Subject to EPA or ADEC Comment or Approval."

b. Paragraph 18.b shall be deleted and replaced with the following:

"b. Where EPA and/or ADEC have approved a Submission or submitted comments on a Submission, fifteen (15) Days after receiving EPA/ADEC approval or comments."

7. In Paragraph 19.a, the following changes shall be made:
- a. The word “and” at the end of 19.a (iv) shall be deleted;
 - b. The period at the end of 19.a (v) shall be replaced with a semi-colon; and
 - c. The following subsections 19.a (vi)-(ix) shall be added after 19.a (v):
“(vi) the status on ammonia and TSS discharges, (vii) NPDES permit compliance, (viii) overall system performance, and (ix) planning and funding for secondary clarifiers.”
8. The following subparagraph c shall be added to Paragraph 29:
- c. The word requirements shall be changed to “requirement.”
9. The following subparagraph d shall be added to Paragraph 29:
- “d. Violation of Additional Requirements Prior to Installation of Secondary Clarifiers. The following stipulated penalties shall accrue per violation per Day for each violation of the additional requirements prior to installation of secondary clarifiers set forth in Paragraph 11.e.

| Period of Delay or Non-Compliance | Stipulated Penalty Per Violation Per Day |
|--|---|
| Days 1-30 | \$500 |
| Days 31-60 | \$1,000 |
| 61 st Day and Beyond | \$2,000 |

10. The following shall be added to the end of Paragraph 37:
- “Except as provided by Paragraph 56, upon the Effective Date of this Consent Decree and any modifications thereto, the stipulated penalty provisions of this Decree shall be retroactively enforceable with regard to any and all violations of Paragraphs 11.e and 19 of this Consent Decree that occurred prior to the Effective Date of this Consent Decree or any subsequent modifications thereto provided that such stipulated penalties may not be

collected unless and until this Consent Decree or any modifications thereto have been entered by the Court.”

11. The following changes shall be made to Paragraph 66:

a. Delete the contact information for the Environmental Protection Agency

and replace with:

“Director, Enforcement and Compliance Assurance Division
U.S. Environmental Protection Agency
1200 Sixth Avenue, Suite 155, 20-C04
Seattle, WA 98101”

b. Delete Mike Solter as the contact for ADEC and replace with:

“Attn: Tiffany Larson, Compliance Program Manager
610 University Ave
Fairbanks, AK 99709
Tiffany.Larson@alaska.gov”

c. Replace Steven G. Ross with “Jennifer Currie” for the Alaska Department of Law with the email address of “Jennifer.Currie@alaska.gov.”

d. Replace Nathan Wallace as the contact for the City of Palmer with:

“John Moosey
City Manager
231 W. Evergreen Avenue
Palmer, AK 99645
jmoosey@palmerak.org”

12. In last sentence of Paragraph 70, “120 Days” shall be replaced with “12 months”.

13. The following appendices shall be added to Paragraph 82:

“Appendix B: Solids Management Plan

Appendix C: Lagoon Dredging and Ammonia Management Plan

Appendix D: Polymer Testing Plan”

14. A redline showing the changes to the Consent Decree by the First Material Modification is attached as Exhibit 1.

ORDER

Before the taking of any testimony, without adjudication of any issue of fact or law, and upon consent and agreement of the United States, Alaska Department of Environmental Conservation, and City of Palmer, it is:

ORDERED, ADJUDGED, AND DECREED that the foregoing First Material Modification to the Consent Decree is hereby approved and entered as a final order of this Court.

Dated and entered this _____ day of _____, 2021.

Timothy Mark Burgess
United States District Judge
District of Alaska

THE UNITED STATES HEREBY CONSENTS TO ENTRY OF THE FIRST MATERIAL MODIFICATION TO THE CONSENT DECREE IN UNITED STATES ET AL. v. CITY OF PALMER, SUBJECT TO THE PUBLIC NOTICE REQUIREMENTS OF 28 C.F.R. § 50.7.

FOR THE UNITED STATES OF AMERICA:

THE UNITED STATES DEPARTMENT OF JUSTICE

JONATHAN BRIGHTBILL
Principal Deputy Assistant Attorney General
Environment and Natural Resources Division

January 19, 2021

DATE

/s/ Elizabeth L. Loeb
ELIZABETH L. LOEB
Senior Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
P.O. Box 7611
Washington, D.C. 20044
Elizabeth.Loeb@usdoj.gov
(202) 616-8916

BEVERLY LI Digitally signed by BEVERLY LI
Date: 2021.01.05 13:22:09
-08'00'

DATE

BEVERLY LI
Regional Counsel
U.S. Environmental Protection Agency, Region 10

Digitally signed by Granatt,
Danielle
Date: 2021.01.05 16:00:24 -08'00'

DANIELLE GRANATT
Assistant Regional Counsel
U.S. Environmental Protection Agency, Region 10
Office of Regional Counsel
1200 Sixth Avenue, Suite 155
Seattle, WA 98101
206-553-2108

FOR THE STATE OF ALASKA:

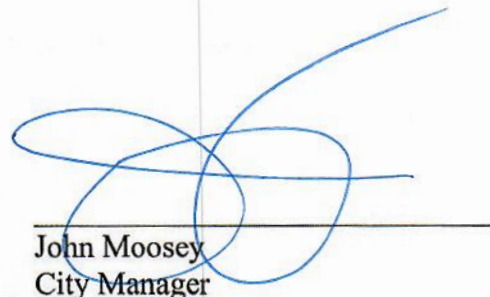
CLYDE "ED" SNIFFEN, JR.
ACTING ATTORNEY GENERAL

December 18, 2020
DATE

By: /s/ Jennifer A. Currie
Jennifer A. Currie
Assistant Attorney General
Alaska Bar No. 0609056
Alaska Department of Law
1031 W. 4th Avenue, Suite 200
Anchorage, AK 99501-1994
jennifer.currie@alaska.gov

FOR THE CITY OF PALMER:

12.23.2020
DATE



John Moosey
City Manager
231 W. Evergreen Avenue
Palmer, AK 99645
jmoosey@palmerak.org

EXHIBIT 1

ELIZABETH LOEB
Senior ~~Counsel~~Attorney
Environment & Natural Resources Division
Environmental Enforcement Section
U.S. Department of Justice
P.O. Box 7166
Washington, D.C. 20044
(202) 616-8916 (t)
Elizabeth.Loeb@usdoj.gov

~~RICHARD POMEROY~~
~~Civil Chief~~
~~U.S. Attorney's~~ STEVEN E. SKROCKI
Office of the U.S. Attorney
Federal Building & U.S. Courthouse
222 West Seventh Avenue, #9, Room 253
Anchorage, Alaska 99513-7567
Tel: (907) 271-5071
Richard.Pomeroy@usdoj.gov

~~STEVEN G. ROSS~~
Steven.Skrocki@usdoj.gov

JENNIFER CURRIE
Assistant Attorney General
Alaska Department of Law
1031 W. 4th Avenue, Suite 200
Anchorage, AK 99501
(~~907~~)-~~269-5274-5280~~(t)
Steven.Ross@alaska.gov
Jennifer.Currie@alaska.gov

Attorneys for Plaintiffs

UNITED STATES COURT FOR THE
DISTRICT OF ALASKA

UNITED STATES OF AMERICA, and
STATE OF ALASKA

Plaintiffs,

v.
CITY OF PALMER, ALASKA

Defendant.

Civil Action No: 3:16-cv-00204-TMB

CONSENT DECREE

TABLE OF CONTENTS

I. JURISDICTION AND VENUE.....4

[II. APPLICABILITY..... 6](#)

[III. OBJECTIVES..... 7](#)

[IV. DEFINITIONS..... 8](#)

[V. CIVIL PENALTY..... 11](#)

[VI. COMPLIANCE MEASURES 12](#)

[VII. REVIEW OF CITY SUBMISSIONS 19](#)

[VIII. REPORTING REQUIREMENTS 22](#)

[IX. STIPULATED PENALTIES 24](#)

[X. FORCE MAJEURE 30](#)

[XI. DISPUTE RESOLUTION 33](#)

[XII. INFORMATION COLLECTION AND RETENTION 35](#)

[XIII. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS..... 37](#)

[XIV. COSTS 39](#)

[XV. NOTICES..... 40](#)

| | |
|--|---------------|
| <u>XVI. RETENTION OF JURISDICTION</u> | <u>42</u> |
| <u>XVII. MODIFICATION</u> | <u>42</u> |
| <u>XVIII. TERMINATION</u> | <u>42</u> |
| <u>XIX. PUBLIC PARTICIPATION</u> | <u>43</u> |
| <u>XX. SIGNATORIES/SERVICE.....</u> | <u>44</u> |
| <u>XXI. INTEGRATION</u> | <u>44</u> |
| <u>XXII. APPENDICES</u> | <u>45</u> |
| <u>XXIII. FINAL JUDGMENT.....</u> | <u>45</u> |
| II. APPLICABILITY..... | 4 |
| III. OBJECTIVES | 5 |
| IV. DEFINITIONS..... | 6 |
| V. CIVIL PENALTY..... | 9 |
| VI. COMPLIANCE MEASURES | 10 |
| VII. REVIEW OF CITY SUBMISSIONS | 16 |
| VIII. REPORTING REQUIREMENTS | 18 |
| IX. STIPULATED PENALTIES | 20 |
| X. FORCE MAJEURE | 26 |
| XI. DISPUTE RESOLUTION..... | 28 |
| XII. INFORMATION COLLECTION AND RETENTION | 31 |
| XIII. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS..... | 33 |
| XIV. COSTS | 35 |
| XV. NOTICES..... | 35 |
| XVI. RETENTION OF JURISDICTION..... | 37 |
| XVII. MODIFICATION | 37 |
| XVIII. TERMINATION..... | 38 |
| XIX. PUBLIC PARTICIPATION | 39 |
| XX. SIGNATORIES/SERVICE..... | 39 |
| XXI. INTEGRATION | 40 |

| | |
|--|-----------|
| XXII. APPENDICES | 40 |
| XXIII. FINAL JUDGMENT | 40 |
| <u>H. APPLICABILITY</u> | <u>5</u> |
| <u>III. OBJECTIVES</u> | <u>6</u> |
| <u>IV. DEFINITIONS.....</u> | <u>7</u> |
| <u>V. CIVIL PENALTY.....</u> | <u>10</u> |
| <u>VI. COMPLIANCE MEASURES</u> | <u>11</u> |
| <u>VII. REVIEW OF CITY SUBMISSIONS</u> | <u>18</u> |
| <u>VIII. REPORTING REQUIREMENTS</u> | <u>21</u> |
| <u>IX. STIPULATED PENALTIES</u> | <u>23</u> |
| <u>X. FORCE MAJEURE</u> | <u>29</u> |
| <u>XI. DISPUTE RESOLUTION</u> | <u>31</u> |
| <u>XII. INFORMATION COLLECTION AND RETENTION</u> | <u>34</u> |
| <u>XIII. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS.....</u> | <u>36</u> |
| <u>XIV. COSTS</u> | <u>38</u> |
| <u>XV. NOTICES.....</u> | <u>39</u> |
| <u>XVI. RETENTION OF JURISDICTION.....</u> | <u>41</u> |
| <u>XVII. MODIFICATION</u> | <u>41</u> |
| <u>XVIII. TERMINATION</u> | <u>41</u> |
| <u>XIX. PUBLIC PARTICIPATION.....</u> | <u>42</u> |
| <u>XX. SIGNATORIES/SERVICE.....</u> | <u>43</u> |
| <u>XXI. INTEGRATION</u> | <u>43</u> |
| <u>XXII. APPENDICES</u> | <u>44</u> |
| <u>XXIII. FINAL JUDGMENT.....</u> | <u>44</u> |

WHEREAS Defendant, the City of Palmer, Alaska (the City), owns and operates a publicly owned treatment works (Facility) currently located at 1802 S. Brooks Road in Palmer, Alaska 99645, that collects, pumps, treats, and disposes of domestic wastewater into the Matanuska River approximately 5 miles northeast of the tidewater at the head of Knik Arm.

WHEREAS Pursuant to Section 402 of the Clean Water Act, 33 U.S.C. § 1342, on December 5, 2006, the United States Environmental Protection Agency (EPA) issued the City a National Pollution Discharge Elimination System (NPDES) permit (Permit) for the Facility, Permit Number AK002249-7. The Permit authorizes the City to discharge specified concentrations and amounts of certain pollutants from the Facility and imposes various monitoring and reporting requirements on the City. The Permit expired on December 31, 2011, however the City timely applied for a new Permit thereby administratively extending the Permit in accordance with federal regulations, 40 C.F.R. § 122.6, and state regulations, 18 AAC 83.155(c).

WHEREAS Plaintiff, the United States of America, on behalf of EPA, and the State of Alaska (State), on behalf of the Alaska Department of Environmental Conservation (ADEC), have filed a Complaint in this action alleging that the City violated the terms and conditions of the Permit and is thereby is liable for civil penalties and injunctive relief pursuant to Section 309(b) and (d) of the Federal Water Pollution Control Act of 1972, as amended (Clean Water Act or CWA), 33 U.S.C. § 1319(b)&(d) and AS 46.03.760(e) and AS 46.03.765.

WHEREAS the City does not admit any liability for the violations alleged in the Complaint.

WHEREAS the Parties recognize, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith and will avoid litigation among the Parties, and that this Consent Decree is fair, reasonable, and in the public interest.

NOW, THEREFORE, with the consent of the Parties and without adjudication of any issue of fact or law except as expressly provided herein, IT IS HEREBY ADJUDGED, ORDERED, AND DECREED as follows:

I. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §§ 1331, 1345, and 1355, Section 309(b) of the CWA, 33 U.S.C. § 1319(b), and over the Parties. Venue lies in this District pursuant to Section 309(b) of the CWA, 33 U.S.C. § 1319(b), and 28 U.S.C. §§ 1391 and 1395(a), because the City is located in this judicial district. For purposes of this Decree, or any action to enforce this Decree, the City consents to the Court's jurisdiction over this Decree and any such action, and over the City, and the City consents to venue in this judicial district.

2. For purposes of this Consent Decree, the City agrees that the Complaint states claims upon which relief may be granted pursuant to Section 309(b) of the CWA, 33 U.S.C. § 1319(b), and 28 U.S.C. §§ 1331, 1345, and 1355, and Title 18, Alaska Administrative Code (AAC) Chapter 83.

II. APPLICABILITY

3. The obligations of this Consent Decree apply to and are binding upon the United States, the State, the City, and any successors, assigns, or other entities or persons otherwise bound by law.

4. No transfer of ownership or operation of the Facility, whether in compliance with the procedures of this Paragraph or otherwise, shall relieve the City of its obligation to ensure that the terms of the Consent Decree are implemented. At least thirty (30) Days prior to any transfer of ownership or operation of the Facility, the City shall provide a copy of this Consent Decree to the proposed transferee and shall simultaneously provide written notice of the prospective transfer, together with a copy of the proposed transfer agreement, to the United States and State, in accordance with Section XV (Notices). Any attempt to transfer ownership or operation of the Facility without complying with this Paragraph constitutes a violation of this Consent Decree.

5. The City shall provide a copy of this Consent Decree to all officers, employees, and agents whose duties might reasonably include compliance with any provision of this Decree, as well as to any contractor retained to perform work required under this Consent Decree. The City shall condition any such contract upon performance of the work in conformity with the terms of this Consent Decree.

6. In any action to enforce this Consent Decree, the City shall not raise as a defense the failure by any of its officers, directors, employees, agents, or contractors to take any actions necessary to comply with the provisions of this Consent Decree.

III. OBJECTIVES

7. It is the goal of the Parties and this Consent Decree for the City to construct and operate various wastewater treatment-related projects that will enable the Facility to comply with its NPDES Permit.

IV. DEFINITIONS

8. Terms used in this Consent Decree that are defined in the CWA or in regulations promulgated pursuant to the CWA shall have the meanings assigned to them in the CWA or such regulations, unless otherwise provided in this Consent Decree. Whenever the terms set forth below are used in this Consent Decree, the following definitions shall apply:

- a. “ADEC” shall mean the Alaska Department of Environmental Conservation and any components thereof or successor agencies and departments.
- b. “APDES Permit” shall mean an Alaska Pollutant Discharge Elimination System Permit issued or administered by ADEC for the Facility under 18 AAC 83, including any amendments and modifications thereto.
- c. “Clean Water Act” or “CWA” shall mean the Federal Water Pollution Control Act of 1972, as amended, 33 U.S.C. §§ 1251-1387.
- d. “Complaint” shall mean the complaint filed by the United States and State in this action.
- e. “Compliance Measures” shall mean all of the requirements set forth in Section VI of this Consent Decree.
- f. “Consent Decree” or “Decree” shall mean this Consent Decree and all appendices attached hereto.
- g. “Date of Lodging” shall mean the day that the Consent Decree is lodged with the Court for public comment as provided by Section XIX (Public Participation) of this Consent Decree.
- h. “Day” shall mean a calendar day unless expressly stated to be a business day. In computing any period of time under this Consent Decree, where the last day

would fall on a Saturday, Sunday, or federal holiday, the period shall run until the close of business of the next business day.

i. “The City” shall mean the City of Palmer, Alaska.

j. “EPA” shall mean the United States Environmental Protection Agency and any of its successor departments or agencies.

k. “Effective Date” shall mean the date upon which this Consent Decree is entered by the Court or a motion to enter the Consent Decree is granted, whichever occurs first, as recorded on the Court’s docket.

l. “Facility” shall mean the City’s publicly owned treatment works, currently located at 1802 South Brooks Road in Palmer, Alaska 99645, all associated collection, holding, transporting and treatment and discharge systems, and all appurtenances, additions, improvements or replacements thereto. As of the Date of Lodging, the Facility includes three lagoons, referred to as Lagoon No.1, Lagoon No. 2, and Lagoon No. 3, as is indicated on the diagram attached hereto as Appendix A.

m. “Interest” shall mean the interest rate specified at 28 U.S.C. § 1961 as of the date that Interest begins to accrue.

n. “Moving Bed Biofilm Reactor” or “MBBR” shall mean a biological wastewater treatment system that utilizes small plastic biofilm carriers (media) suspended in an aeration basin to provide a high biomass density.

o. “NPDES Permit” or “Permit” shall mean the National Pollutant Discharge Elimination System Permit issued by EPA for the Facility, Permit Number AK002249-7, on December 5, 2006, including any amendments and modifications thereto.

p. “Paragraph” shall mean a portion of this Consent Decree identified by an Arabic numeral.

q. “Parties” shall mean the United States, the State, and the City.

r. “Performance Period” shall apply to the MBBR installation and operation and is specified in Paragraph 11.b. below to give the City a period of time to ensure that the MBBR system is running properly before liability for stipulated penalties begins.

s. “Plaintiffs” shall mean the United States and the State of Alaska.

t. “Secondary Clarifiers” shall mean basins specifically designed to provide effective gravity separation of settleable and suspended solids in wastewater treated in a biological treatment process such as MBBR.

u. “Section” shall mean a portion of this Consent Decree identified by a Roman numeral.

v. “State” shall mean the State of Alaska.

w. “Submission” shall mean any plan, notification, report, procedure, protocol, or other deliverable submitted or required to be submitted under this Consent Decree by the City to EPA and/or the State for approval or comment.

x. “Substantial Completion” of a Compliance Measure shall mean that (i) all equipment necessary for successful operation of the Compliance Measure has been constructed or installed, and satisfactorily tested under the range of normal conditions; (ii) personnel have been trained in proper operation of the Compliance Measure; (iii) functional testing is complete and the Compliance Measure is functionally operational; (iv) a complete operations and maintenance manual is available on site; and (v) the City has put the Compliance

Measure into service. With respect to MBBR, putting it into service shall mean that the city has begun active and continuous processing of wastewater through the MBBR system.

y. “United States” shall mean the United States of America, acting on behalf of EPA.

V. CIVIL PENALTY

9. Within thirty (30) Days after the Effective Date of this Consent Decree, the City shall pay the sum of \$192,162.00 as a civil penalty, together with Interest accruing from July 22, 2016.

a. The City shall pay \$96,081.00 of the civil penalty plus Interest thereon accruing from July 22, 2016, to the United States at <https://www.pay.gov> by FedWire Electronic Funds Transfer (EFT) to the U.S. Department of Justice in accordance with written instructions to be provided to the City, following lodging of the Consent Decree, by the Financial Litigation Unit of the U.S. Attorney’s Office for the District of Alaska, Office of the United States Attorney, District of Alaska, 222 West 7th Ave, Rm 253, Anchorage, Alaska 99513. At the time of payment, the City shall send a copy of the EFT authorization form and the EFT transaction record, together with a transmittal letter, which shall state that the payment is for the civil penalty owed pursuant to the Consent Decree in United States v. City of Palmer, and shall reference the civil action number and DOJ case number 90-5-1-1-11214, to the United States in accordance with Section XV (Notices) of this Decree by email to cinwd_acctsreceivable@epa.gov; and by mail to:

EPA Cincinnati Finance Office
26 Martin Luther King Drive
Cincinnati, Ohio 45268

b. The City shall pay \$96,081.00 of the civil penalty plus Interest thereon accruing from July 22, 2016, to the State of Alaska by check made payable to the State of Alaska and delivered to:

ADEC Division of Water
Attn: ~~Mike Solter~~ [Tiffany Larson](#), Compliance Program Manager
~~555 Cordova St~~
~~Anchorage~~ [610 University Ave](#)
[Fairbanks](#), AK ~~99501~~ [99709](#)
Tiffany.Larson@alaska.gov

The same address shall be used for the payment of any stipulated penalties due under this Consent Decree. The State may, by written notice to the other Parties, change its designated recipient or address provided above for payment of any civil penalties or stipulated penalties due hereunder.

VI. COMPLIANCE MEASURES

10. Interim Compliance Measures. The City shall implement the following interim compliance measures:

a. Lagoon Re-circulation System. After January 1, 2016, the City shall maintain and continuously operate a re-circulation system that utilizes two pumps to cause flow to be re-circulated around Lagoon No. 1 and separately around Lagoon No. 2, so as to increase the retention of biomass in each lagoon and thus improve biological ammonia removal. One pump shall be used to recirculate flow around Lagoon No. 1 and the second pump used to recirculate flow around Lagoon No. 2. The pumps used shall be an existing 200 gallons per minute (gpm) capacity pump and a new pump of at least 380 gpm capacity. The City shall continuously operate this re-circulation system until the City installs the MBBR as required by Paragraph 11.b. below.

b. DO Probes and Concentrations.

i. No later than January 1, 2016, the City shall install, calibrate and maintain according to the probe manufacturer's recommendations at least one appropriately located dissolved oxygen (DO) probe in each lagoon. The City shall use these probes to improve and document its maintenance of DO concentrations in Lagoons Nos. 1 and 2 as described below by continuously monitoring and recording DO concentrations at these locations. The City shall use the collected data to determine the range of DO concentrations maintained in each lagoon during each calendar month and shall report that information for each month in its quarterly reports to EPA and ADEC pursuant to Section VIII (Reporting Requirements).

ii. Beginning January 1, 2016, and continuing until installation of the MBBR system as required by Paragraph 11.b below, the City shall maintain a minimum DO concentration of at least 1.0 mg/l in Lagoon No. 1 and of 2.0 mg/l in Lagoon No. 2.

c. Lagoon Dredging.

i. No later than June 1, 2016, the City shall commence dredging of accumulated solids from Lagoon Nos. 1 and 2, and shall complete dredging by September 30, 2016. Solids dredged shall be pumped to the existing sludge storage area in the southwest quarter of the Facility site for drying, lime stabilization, mixing with soil and onsite placement.

ii. Periodic Dredging. During the term of this Consent Decree, the City shall periodically dredge the Facility's lagoons as necessary to maintain sufficient depth for effective settling and compliance with the Permit's Total Suspended Solids (TSS) requirements and any TSS requirements in any subsequent NPDES/APDES permit issued by EPA or ADEC.

d. Alkalinity Feed. No later than July 15, 2016, the City shall monitor pH and alkalinity in Lagoon Nos. 2 and 3 on a weekly basis. If the alkalinity in the Lagoon No. 2

effluent drops below 50 mg/l, the City shall begin manual feeding of alkalinity in Lagoon No. 2 within 24 hours in an attempt to limit its further drop. The manual feeding shall be carried out to prevent exceedance of pH limits in the Permit or subsequent NPDES/APDES permit issued to the City by EPA or ADEC and shall continue until installation and operation of the alkalinity feed system required by Paragraph 11.a below. The City's quarterly reports to EPA and ADEC, submitted pursuant to Section VIII (Reporting Requirements) shall include the results of this pH monitoring; a description of any manual alkalinity feeding undertaken; and the results of manual feeding on alkalinity in Lagoon Nos. 2 and 3.

11. Final Compliance Measures.

a. Alkalinity Feed. No later than June 30, 2018, the City shall install and thereafter continuously operate an alkalinity feed system so as to maintain sufficient alkalinity for nitrification, while maintaining compliance with pH limits in the City's NPDES Permit or subsequent NPDES/APDES permit issued by EPA or ADEC. The City shall conduct continuous pH monitoring and report the range of pH maintained during each calendar month in its quarterly reports to EPA and ADEC pursuant to Section VIII (Reporting Requirements).

b. Moving Bed Biofilm Reactor System (MBBR).

i. MBBR Design and Installation Deadlines. The City shall design, install and operate an MBBR system at the Facility as follows.

(a) By December 5, 2016, the City shall complete the design of an MBBR system for the Facility and submit to EPA and ADEC (pursuant to 18 AAC 72) an engineering plan for the Facility that includes all the Final Compliance Measures under this paragraph (i.e., MBBR system, Solids Handling, and Secondary Clarifiers) for an opportunity to comment pursuant to Section VII below (Review of City Submissions).

(b) By March 1, 2017, the City shall select a contractor to build the MBBR system at the Facility and shall submit the name and credentials of the proposed contractor to EPA.

(c) By July 31, 2018, the City shall achieve Substantial Completion of the MBBR system at the Facility and commence operation of the MBBR system. The Performance Period shall run from July 31, 2018 through April 30, 2019.

ii. MBBR Capacity. The MBBR system at the Facility shall be constructed according to the following requirements:

(a) The MBBR system shall be initially constructed with two MBBR basins sized to support treatment of an average maximum monthly flow of 1.2 million gallons per day (MGD). Initially, the City shall install sufficient media to allow treatment of a maximum monthly flow of 0.65 MGD. The MBBR system shall be configured to allow the future addition of a third basin to support treatment of a future maximum monthly flow of 1.5 MGD.

(b) The MBBR system shall be designed and constructed in accordance with current good industry practice.

(c) After initial MBBR construction, the City shall add additional media as needed to match the City's population growth and wastewater flow up to an average maximum monthly flow of 1.2 MGD. If addition of a third basin is necessary to accommodate further increases in population growth and wastewater flow, as contemplated in Paragraph 11.b.ii(a), the City shall add additional media as needed up to an average maximum monthly flow of 1.5 MGD.

iii. Continuous Operation of MBBR. After July 31, 2018, the City shall continuously operate the MBBR system at the Facility.

c. Solids Removal. The City shall comply with the following solids removal requirements so as to maintain adequate solids removal following startup of the MBBR:

i. The City shall construct the MBBR system to discharge its effluent to Lagoons Nos. 2 and 3 for suspended solids removal until secondary clarifiers are installed in accordance with Paragraph 11.d. below.

ii. No later than July 31, 2018, the City shall construct and achieve Substantial Completion of a post-MBBR polymer feed system with equipment and capability to provide for the addition of at least 3ppm polymer on a flow paced basis prior to Lagoon No. 3. Such equipment shall be designed and constructed in accordance with current good industry practice, and shall include polymer storage, feed equipment, piping, mixing, controls and enclosures as necessary to allow effective use of polymer upon start-up of the MBBR system.

iii. If, after installation and operation of the MBBR system, the City fails to meet any TSS requirement or limit in the Permit, or any TSS requirements in any subsequent NPDES/APDES permit issued by EPA or ADEC, as soon as the City becomes aware of any violation of the TSS requirements, the City shall:

(a) Add polymer as needed at dosage rates determined by jar testing per ASTM Standard D2035-13 (Standard Practice for Coagulation-Flocculation Jar Test of Water) and operational performance to meet then-applicable TSS Permit limits and requirements in the Permit or in any subsequent NPDES/APDES permit issued by EPA or ADEC.

(b) If the addition of polymer under Paragraph 11.c.iii(a) above does not enable the City to meet TSS limits and requirements in the Permit or any subsequent NPDES/APDES permit issued by EPA or ADEC, the City shall, within sixty (60) Days of the first polymer addition, install additional temporary solids removal measures, which may include a lagoon rock filter, a disk filter, or additional chemical feed to meet applicable TSS permit limits and requirements until the Secondary Clarifiers required by Paragraph 11.d below are installed and operational.

d. Secondary Clarifiers.

i. No later than ~~August 31, 2020~~July 1, 2022, the City shall install and thereafter continuously operate two Secondary Clarifiers at the Facility of sufficient treatment and settling capacity to enable the Facility to meet all effluent limits in the Permit or in any subsequent NPDES/APDES permit issued by EPA or ADEC. The Secondary Clarifier system shall be configured to allow the future addition of a third clarifier, if necessary, to support treatment of a future maximum monthly flow of 1.5 MGD. The clarifiers shall be designed and constructed in accordance with current good industry practice.

ii. At least ninety (90) Days prior to constructing the Secondary Clarifiers, the City shall submit to EPA and ADEC (pursuant to 18 AAC 72) any necessary modifications of the engineering plan for the Facility previously submitted under Paragraph 11.b.i(a) above relating to the installation of the Secondary Clarifiers.

e. Additional Requirements Prior to Installation of Secondary Clarifiers.

Until the installation and continuous operation of Secondary Clarifiers, the City shall implement the following measures:

i. No later than September 30, 2020, the City shall implement the Solids Management Plan attached as Appendix B to this Consent Decree.

ii. No later than September 30, 2020, the City shall implement the Lagoon Dredging and Ammonia Management Plan attached as Appendix C to this Consent Decree.

iii. No later than August 30, 2020 the City shall complete dredging of Lagoon 2 in accordance with the approved Lagoon Dredging and Ammonia Management Plan attached as Appendix C to this Consent Decree.

iv. As early as possible, but no later than May 31 of each calendar year after 2020, the City shall complete dredging of Lagoon 2 in accordance with the approved Lagoon Dredging and Ammonia Management Plan attached as Appendix C to this Consent Decree.

v. The City shall use best efforts to secure funding for Secondary Clarifiers; the City acknowledges that its failure to secure funding is not a defense to non-compliance with the deadline for installing secondary clarifiers set forth in Paragraph 10.d.i above.

vi. No later than December 31, 2020, the City shall carry out jar testing and full-scale testing, in accordance with the Polymer Testing Plan attached as Appendix D to this Consent Decree and the schedule contained therein, to evaluate whether the addition of polymer would facilitate more efficient solids capture and management, and shall report the results to EPA and DEC for comment and approval within 30 Days of completion of testing, in accordance with the schedule established in Appendix D to this Consent Decree and in accordance with the requirements of Section VII of this Consent Decree.

12. Permit Compliance. The City shall comply with all terms of the Permit and with all terms of any subsequent NPDES/APDES permit issued by EPA or ADEC.

13. Permits. Where any compliance obligation under this Section requires the City to obtain a federal, state, or local permit or approval, the City shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals. Such approvals and permits include those that may be required under 18 AAC 72.200 and 18 AAC 72.235-240.

14. Pre-Entry Obligations. Obligations of the City under this Consent Decree to undertake Compliance Measures by dates that occur prior to the Effective Date of this Consent Decree, shall be legally enforceable only on and after the Effective Date of this Consent Decree. Liability for stipulated penalties, if applicable, shall accrue for violation of such obligations and payment of such stipulated penalties may be demanded by the United States or the State as provided in this Consent Decree, provided that the stipulated penalties that may have accrued from the Day compliance is due through the Effective Date of this Consent Decree may not be collected unless and until this Consent Decree is entered by the Court.

VII. REVIEW OF CITY SUBMISSIONS

15. Except for Submissions under Sections X and XI (Force Majeure and Dispute Resolution respectively) or required by Paragraph 20 below, where any provision of this Consent Decree requires that the City submit any plan, notification, report, procedure, protocol, or other deliverable (Submission) to EPA and/or ADEC for review and the opportunity to comment, or where any provision of this Consent Decree specifically references this Section VII, the Submission shall be subject to the provisions of this Section.

16. The City shall submit one copy of each Submission to EPA and one copy to the State by the means and to the addressee listed in Section XV (Notices) along with all underlying data or supporting documents.

17. Submissions Subject to EPA and/or ADEC Comment or Approval. Where any provision of this Consent Decree specifically requires that a Submission by the City is subject to EPA and/or ADEC approval or subject to EPA and/or ADEC comment, or where any provision of this Consent Decree specifically references this Section VII, the Submission shall be subject to the provisions of this Section.

a. Unless otherwise provided herein, for Submissions under any provision of this Consent Decree that are subject to EPA and/or ADEC review and opportunity to comment, EPA and/or the State may provide written comments on the Submission, in whole or in part, or may decline to comment. If EPA and/or the State provide written comments within thirty (30) Days of receiving a Submission, the City shall within fifteen (15) Days of receiving such comments either: (i) alter and implement the Submission consistent with such written comments; or (ii) submit the matter for dispute resolution under Section XI (Dispute Resolution) of this Consent Decree.

b. Unless otherwise provided herein, after thirty (30) Days from the date of such Submission, EPA and/or ADEC may nonetheless thereafter provide written comments requiring changes to the Submission which the City shall implement unless implementation of the written comments would be unduly burdensome given the degree to which the City has proceeded with implementing the deliverable, or implementation would otherwise be unreasonable. If the City determines that implementation of the written comments is unduly

burdensome or otherwise unreasonable, it shall invoke dispute resolution within sixty (60) Days of receiving EPA and/or the ADEC's comments.

c. For Submissions subject to EPA and/or ADEC approval, EPA and/or ADEC may approve the Submission or decline to approve it, in whole or in part, and may provide written comments.

i. If EPA and/or ADEC disapproves a Submission, in whole or in part, it shall state in writing the basis for such disapproval.

ii. Unless otherwise provided herein, upon receiving EPA's and/or ADEC's written comments or written notice that EPA and/or ADEC disapproves a Submission, in whole or in part, the City shall have forty-five (45) Days to: (1) alter the Submission consistent with EPA's and/or ADEC's written comments or notice of disapproval and provide the Submission to EPA and/or ADEC for final approval, or (2) to invoke Dispute Resolution under Section [XI](#) of this Consent Decree.

18. Implementation of Plans or Other Measures Pursuant to Submissions Subject to EPA or ADEC Comment or Approval. Unless otherwise provided for herein, the City shall implement each Submission in accordance with the requirements and schedule in the Submission by the following deadlines.

a. Where EPA and/or ADEC have not submitted comments on a Submission, thirty (30) Days after the City provided the Submission to EPA and ADEC for comments.

b. Where EPA and/or ADEC have [approved a Submission or](#) submitted comments on a Submission, -fifteen (15) Days after receiving EPA/ADEC [approval or](#) comments.

c. Where Defendant has invoked dispute resolution regarding any Submission under Section XI (Dispute Resolution), upon completion of any dispute resolution process.

VIII. REPORTING REQUIREMENTS

19. The City shall submit the following reports to EPA and the State by the means and to the addresses specified in Section XV (Notices):

a. Within thirty (30) Days after the end of each calendar quarter (i.e., by April 30, July 30, October 30, and January 30) after the Effective Date of this Consent Decree, until Termination of this Decree pursuant to Section XVIII, the City shall submit a written report for the preceding calendar quarter that shall describe the following: (i) the status of installation of any Compliance Measures required by Section VI of this Consent Decree (Compliance Measures); (ii) any problems encountered or anticipated, together with the required Compliance Measures; (iii) the status of permit applications or plan submissions; (iv) a summary of operation and maintenance activities related to the Facility; **and** (v) a copy of all discharge monitoring reports submitted to ADEC during the applicable calendar quarter; [\(vi\) the status on ammonia and TSS discharges, \(vii\) NPDES permit compliance, \(viii\) overall system performance, and \(ix\) planning and funding for secondary clarifiers.](#)

b. If the City violates or has reason to believe that it may violate, any requirement of this Consent Decree, the City shall report such violation and its likely duration to EPA and the State, in writing, within fifteen (15) Days of the Day the City becomes aware of the violation or likely violation. The report also shall describe any violation of the requirements of this Consent Decree and explain the violation's likely cause and the remedial steps taken, or to be taken, to prevent or minimize such violation. If the cause of a violation cannot be fully

explained at the time the report is due, the City shall so state in the report. The City shall investigate the cause of the violation and shall then submit an amendment to the report, including a full explanation of the cause of the violation, within forty-five (45) Days of the Day the City becomes aware of the cause of the violation. Nothing in this or the following Paragraph relieves the City of its obligation to provide the notice required by Section X (Force Majeure).

20. Whenever any violation of this Consent Decree or any other event affecting the City's performance under this Decree, may pose an immediate threat to public health, welfare, or the environment, the City shall notify EPA and the State orally or by electronic or facsimile transmission as soon as possible, but no later than 24 hours after the City first became aware of the violation or event. This procedure is in addition to the requirements set forth in the preceding Paragraph.

21. All required notifications and reports shall be submitted to the persons designated in Section XV (Notices).

22. Each report or notification submitted by the City under this Section shall be signed by an official of the submitting party and include the following certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

This certification requirement does not apply to emergency or similar notifications where compliance would be impractical.

23. The reporting requirements of this Consent Decree do not relieve the City of any reporting obligation in the CWA or its implementing regulations, or in any other federal, state, or local law, regulation, permit, or other requirement.

24. Any information provided pursuant to this Consent Decree may be used by the United States or State in any proceeding to enforce the provisions of this Consent Decree and as otherwise permitted by law.

IX. STIPULATED PENALTIES

25. The City shall be liable to the United States and State for stipulated penalties for violations of this Consent Decree as specified below, unless excused under Section X (Force Majeure), as a result of Dispute Resolution conducted in accordance with Section XI, or otherwise reduced or waived pursuant to Paragraph 33 herein. A violation includes failing to perform any obligation required by this Consent Decree according to all applicable requirements and within the specified time schedules established by or approved under this Decree.

26. Stipulated penalties under this Section shall begin to accrue on the Day after performance is due or on the Day a violation occurs, whichever is applicable, and shall continue to accrue until performance is completed or until the violation ceases. Stipulated penalties shall accrue simultaneously for separate violations of this Consent Decree.

27. Failure to Timely Pay a Civil Penalty. If the City fails to pay a civil penalty required to be paid under Section V (Civil Penalty) of this Decree when due, the City shall pay a stipulated penalty of \$1000 per day for each day that a payment is late. This Stipulated Penalty is in addition to the Interest due on the Civil Penalty as required by Paragraph 9.

28. Violations of Requirements Relating to Interim Compliance Measures. The following stipulated penalties shall accrue per violation per Day for each violation of a requirement and/or deadline relating to interim compliance measures set forth in Paragraph 10:

| Period of Delay or Non-Compliance | Stipulated Penalty Per Violation Per Day |
|--|---|
| Days 1-30 | \$500 |
| Days 31-60 | \$750 |
| 61 st Day and Beyond | \$1000 |

29. Violations of Requirements Relating to Final Compliance Measures.

a. MBBR Requirements.

i. **Violation of MBBR Design and Contractor Selection**

Requirements. The following stipulated penalties shall accrue per violation per Day for each of the following violations of any requirement and/or deadline set forth in Paragraphs 11.b.i(a) and 11.b.i(b):

| Period of Delay or Non-Compliance | Penalty Per Violation Per Day |
|--|--------------------------------------|
| Days 1-30 | \$300 |
| Days 31-60 | \$600 |
| 61 st Day and Beyond | \$1000 |

ii. **Violation of Alkalinity Feed, Substantial Completion,**

Commencement of Operation, Initial and Continuing Capacity, and MBBR Operation

Requirements. The following stipulated penalties shall accrue per violation per Day for violation of Paragraphs 11.a., 11.b.i(c), 11.b.ii, and 11.b.iii:

| Period of Delay or Non-Compliance | Penalty Per Violation Per Day |
|--|--------------------------------------|
| Days 1-30 | \$1000 |
| Days 31-60 | \$1500 |
| 61 st Day and Beyond | \$2000 |

b. Violations of Solids Removal Requirements. The following stipulated penalties shall accrue per violation per Day for each violation of a requirement and/or deadline related to solids handling set forth in Paragraph 11.c:

| Period of Delay or Non-Compliance | Stipulated Penalty Per Violation Per Day |
|--|---|
| Days 1-30 | \$500 |
| Days 31-60 | \$100 |
| 61 st Day and Beyond | \$1500 |

c. Violations of Requirements Relating to Secondary Clarifiers Installation and Operation. The following stipulated penalties shall accrue per violation per Day for each violation of a ~~requirements~~requirement and/or deadline related to the installation and operation of secondary clarifiers set forth in Paragraph 11.d:

| Period of Delay or Non-Compliance | Stipulated Penalty Per Violation Per Day |
|--|---|
| Days 1-30 | \$750 |
| Days 31-60 | \$1500 |
| 61 st Day and Beyond | \$2000 |

d. Violation of Additional Requirements Prior to Installation of Secondary Clarifiers. The following stipulated penalties shall accrue per violation per Day for each violation of the additional requirements prior to installation of secondary clarifiers set forth in Paragraph 11.e

| <u>Period of Delay or Non-Compliance</u> | <u>Stipulated Penalty Per Violation Per Day</u> |
|---|--|
| <u>Days 1-30</u> | <u>\$500</u> |
| <u>Days 31-60</u> | <u>\$1,000</u> |
| <u>61st Day and Beyond</u> | <u>\$2,000</u> |

30. Permit Violations. The following stipulated penalties shall accrue per violation per Day for each of the following violations of the Permit or of any subsequent NPDES/APDES permit issued by EPA or ADEC.

a. Unauthorized Discharges or Violation of ~~-~~Permit Effluent Limits.

i. Discharge of a pollutant not disclosed in the NPDES permit application submitted by the City to EPA on October 9, 2001 for the current NPDES Permit, or in the application for any subsequent NPDES/APDES permit issued by EPA or ADEC:

| Number of Days in Violation | Stipulated Penalty Per Violation Per Day |
|------------------------------------|---|
| Days 1-30 | \$750 |
| Days 31-60 | \$1500 |
| 61 st Day and Beyond | \$2000 |

ii. Exceedance of any daily maximum ammonia or TSS limit after conclusion of the Performance Period:

| Violations | Number of Days in Violation | Stipulated Penalty Per Violation Per Day |
|--|------------------------------------|---|
| Exceedance of daily maximum limit on ammonia and/or TSS mass (pounds/day); | Days 1-30 | \$1000 |
| | Days 31-60 | \$2000 |
| | 61 st Day and Beyond | \$3000 |
| Exceedance of daily maximum limit for ammonia and/or TSS concentration (mg/l); | | |

iii. Exceedance of any monthly average limit on ammonia and/or TSS mass (pounds/day) and/or exceedance of any monthly average limit on ammonia and/or TSS concentration (milligrams/liter) after conclusion of the Performance Period: \$2000 per violation per month.

iv. Failure to meet the TSS percentage removal requirements after conclusion of the Performance Period: \$2500 per month.

v. Violation of a daily limit for pollutant other than TSS or ammonia:

| Period of Delay or Non-compliance | Stipulated Penalty Per Violation Per Day |
|--|---|
| Days 1-30 | \$750 |
| Days 31-60 | \$1500 |
| 61 st Day and Beyond | \$2000 |

vi. Violation of a monthly average limit for any pollutant listed in the applicable permit other than TSS or ammonia: \$2000 per month.

vii. Violation of a weekly average limit for any pollutant listed in the permit other than TSS or ammonia: \$500 per week.

b. Violation of Sampling Requirements. Violation of any permit sampling requirement:

| Period of Delay or Non-compliance | Stipulated Penalty Per Violation Per Day |
|--|---|
| Days 1-30 | \$750 |
| Days 31-60 | \$1500 |
| 61 st Day and Beyond | \$2000 |

c. Violation of Other Permit Requirements. The following stipulated penalties shall accrue per violation per Day for each violation of any requirement in the Permit other than those listed in Paragraphs ~~30~~30.a and b above:

| Period of Delay or Non-compliance | Stipulated Penalty Per Violation Per Day |
|--|---|
| Days 1-30 | \$350 |
| Days 31-60 | \$800 |
| 61 st Day and Beyond | \$1250 |

31. Other Requirements. The following stipulated penalties shall accrue per violation per Day for each violation of any other requirement of this Consent Decree not specified in Paragraphs 27-~~30~~29.~~d~~30.~~d~~ above.

| Period of Delay or Non-compliance | Stipulated Penalty Per Violation Per Day |
|--|---|
| Days 1-14 | \$350 |
| Days 15-30 | \$800 |
| 31 st Day and Beyond | \$1250 |

32. The City shall pay any stipulated penalty within thirty (30) Days of receiving the United States' or the State's written demand for stipulated penalties. Where both Plaintiffs demand the stipulated penalty, the City shall pay the United States and the State 50% of the total

stipulated penalty demanded unless Plaintiffs agree to a different percentage split.

33. The United States or State may, in the unreviewable exercise of their discretion, reduce or waive stipulated penalties otherwise due the United States or State of Alaska respectively under this Consent Decree.

34. Stipulated penalties shall continue to accrue during any period of Dispute Resolution, but need not be paid until the following:

a. If the dispute is resolved by agreement or by an EPA decision that is not appealed to the Court, the City shall pay accrued penalties determined to be owing, together with interest, within forty-five (45) Days of the effective date of the agreement or the receipt of EPA's decision.

b. If the dispute is appealed to the Court and the United States prevails in whole or in part, the City shall pay all accrued penalties determined by the Court to be owing, together with Interest, within sixty (60) Days of receiving the Court's decision or order, except as provided in subparagraph c, below.

c. If any Party appeals the District Court's decision, the City shall pay all accrued penalties determined to be owing, together with Interest, within fifteen (15) Days of receiving the final appellate court decision.

35. The City shall pay stipulated penalties owing to the United States and the State by the methods set forth in Paragraph 9 above with confirmation notices to the persons specified in Section XV (Notices) stating that the payment is for stipulated penalties and shall state for which violation(s) the penalties are being paid.

36. If the City fails to pay stipulated penalties according to the terms of this Consent Decree, the City shall be liable for Interest on such penalties accruing as of the date payment

became due. Nothing in this Paragraph shall be construed to limit the United States or State from seeking any remedy otherwise provided by law for the City's failure to pay any stipulated penalties.

37. The payment of stipulated penalties as set forth above shall not alter in any way the City's obligation to complete the performance of all activities required under this Consent Decree. The stipulated penalties provided for in this Consent Decree shall be in addition to any other rights, remedies, or sanctions available to the United States or State for the City's violation of this Consent Decree or applicable law. Where a violation of this Consent Decree is also a violation of the CWA, the City shall be allowed a credit for any stipulated penalties paid against any statutory penalties imposed for such violation. Except as provided by Paragraph 56, upon the Effective Date of this Consent Decree and any modifications thereto, the stipulated penalty provisions of this Decree shall be retroactively enforceable with regard to any and all violations of Paragraphs 11.e and 19 of this Consent Decree that occurred prior to the Effective Date of this Consent Decree or any subsequent modifications thereto provided that such stipulated penalties may not be collected unless and until this Consent Decree or any modifications thereto have been entered by the Court.

X. FORCE MAJEURE

38. "Force Majeure," for purposes of this Consent Decree, is defined as any event arising from causes beyond the control of the City, any entity controlled by the City, or the City's contractors that delays or prevents the timely performance of any obligation under this Consent Decree despite the City's best efforts to fulfill the obligation. The requirement that the City exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential Force Majeure event and best efforts to address the effects of any such event: i) as it is

occurring, and ii) after it has occurred to prevent or minimize any resulting delay to the greatest extent possible. "Force Majeure" does not include the City's financial inability to perform any obligation under this Consent Decree or any delay in performance due to the City's failure to obtain, or delay in obtaining, any state or local permits. However, Force Majeure shall include any delay in the performance of any obligation resulting from the City's failure to obtain, or a delay in obtaining, any federal or State permit or approval required to fulfill such obligation, if the City has submitted timely and complete applications and has taken all other actions necessary to obtain all such permits or approvals.

39. If any event occurs or has occurred that may delay or prevent the performance of any obligation under this Consent Decree, whether or not caused by a Force Majeure event, the City shall provide notice orally or by electronic or facsimile transmission to EPA and the State within 72 hours of when the City first became aware that the event might cause a delay or non-compliance, with a copy sent by overnight mail or by certified or registered mail, return receipt requested. Within seven (7) days thereafter, the City shall provide in writing to EPA and the State: an explanation and description of the reasons for the delay or non-compliance; the anticipated duration of the delay or non-compliance; all actions taken or to be taken to prevent or minimize the delay or non-compliance; a schedule for implementing any measures to be taken to prevent or mitigate the delay or the effect of the delay or non-compliance; the City's rationale for attributing such delay or non-compliance to a Force Majeure event if it intends to assert such a claim; and a statement as to whether, in the opinion of the City, such event may cause or contribute to an endangerment to public health, welfare, or the environment. The City shall include with any notice all available documentation supporting the claim that the delay or non-compliance was attributable to a Force Majeure event. Failure to comply with the above

requirements shall preclude the City from asserting a Force Majeure claim for that particular event. The City shall be deemed to have knowledge of any circumstances that the City, any entity controlled by the City, or the City's contractors knew or should have anticipated.

40. If EPA, after consultation with the State, agrees that the delay or non-compliance or anticipated delay or non-compliance is attributable to a Force Majeure event, the time for performing the affected Consent Decree obligations will be extended by EPA for such time as is necessary to complete those obligations and no stipulated penalties shall be due for the extension period. Such an extension shall not, of itself, extend the time for performing any other obligation. EPA will notify the City in writing of the length of the extension, if any.

41. If EPA, after consultation with the State, does not agree that the delay or anticipated delay has been or will be caused by a Force Majeure event, EPA will notify the City in writing of its decision.

42. If the City elects to invoke the dispute resolution procedures set forth in Section XI (Dispute Resolution), it shall do so by sending the United States and the State a written Notice of Dispute no later than fifteen (15) days after receipt of EPA's notice sent pursuant to Paragraphs 40-41 above. In any such proceeding, the City shall have the burden of demonstrating by a preponderance of the evidence that the non-compliance, delay or anticipated delay or non-compliance has been or will be caused by a Force Majeure event, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were exercised to avoid and mitigate the effects of the delay, and that the City complied with the requirements of Paragraphs 38-39 above. If the City carries this burden, the delay at issue shall be deemed not to be a violation by the City of the affected obligation(s) of this Consent Decree.

XI. DISPUTE RESOLUTION

43. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism for the City to resolve disputes arising under or with respect to this Consent Decree. The City's failure to seek dispute resolution under this Section shall preclude the City from raising any disputed issue as a defense to an action by the United States or State to enforce this Consent Decree.

44. Informal Dispute Resolution. Any dispute subject to dispute resolution under this Consent Decree shall first be the subject of informal negotiations. The dispute shall be considered to have arisen when the City sends the United States and the State a written Notice of Dispute. Such Notice of Dispute shall state clearly the matter in dispute. The period of informal negotiations shall not exceed twenty (20) Days from the date the dispute arises, unless that period is modified by written agreement of the City and United States. If the City and the United States cannot resolve a dispute by informal negotiations, then the position advanced by the United States (or the State if the United States is not a party to the dispute) shall be considered binding unless, within twenty (20) Days after the conclusion of the informal negotiation period, the City invokes the formal dispute resolution procedures set forth below.

45. Formal Dispute Resolution. The City shall invoke formal dispute resolution procedures within the time period provided in the preceding Paragraph by serving on the United States and the State a written Statement of Position regarding the matter in dispute. The Statement of Position shall include, but need not be limited to, any supporting factual data, analysis, opinion, or documentation relied upon by the City.

46. The United States shall serve its Statement of Position within forty-five (45) Days of receipt of the City's Statement of Position. The United States' (or, if applicable State's)

Statement of Position shall include, but need not be limited to, any supporting factual data, analysis, opinion, or documentation relied upon by the United States. The United States' (or, if applicable State's) Statement of Position shall be binding on the City, unless the City files a motion for judicial review of the dispute in accordance with the following Paragraph.

47. The City may seek judicial review of the dispute by filing with the Court and serving on the United States and State, a motion requesting judicial resolution of the dispute. The motion must be filed within ten (10) Days of receipt of the United States' Statement of Position pursuant to the preceding Paragraph. The motion shall include a written statement of the City's position on the matter in dispute, including any supporting factual data, analysis, opinion, or documentation, and shall set forth the relief requested and any schedule within which the dispute must be resolved for orderly implementation of the Consent Decree.

48. The United States shall respond to the City's motion within the time period allowed by the Local Rules of this Court. The City may file a reply memorandum, to the extent permitted by the Local Rules.

49. Standard of Review.

a. Disputes Concerning Matters Accorded Record Review. Except as otherwise provided in this Consent Decree, in any dispute brought under this Section XI that pertains to: (i) the adequacy or appropriateness of Submissions, plans, procedures to implement plans, schedules, or any other items requiring approval or comment by EPA or the State under this Consent Decree; (ii) the adequacy of the City's compliance with the requirements set forth in Section VI of this Consent Decree (Compliance Measures), and all other disputes that are accorded review on the administrative record under applicable principles of administrative law, the City shall have the burden of demonstrating, based on the administrative record, that the

position of the United States (or, if applicable State) is arbitrary and capricious or otherwise not in accordance with law.

b. Other Disputes. Except as otherwise provided in this Consent Decree, in any other dispute brought under this Section XI (Dispute Resolution), the City shall bear the burden of demonstrating that its position complies with this Consent Decree and better furthers the objective of the Consent Decree.

50. The invocation of dispute resolution procedures under this Section XI shall not, by itself, extend, postpone, or affect in any way any obligation of the City under this Consent Decree, unless and until final resolution of the dispute so provides. Stipulated penalties with respect to the disputed matter shall continue to accrue from the first Day of non-compliance, but payment shall be stayed pending resolution of the dispute as provided in Paragraph 34. If the City does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section IX (Stipulated Penalties).

XII. INFORMATION COLLECTION AND RETENTION

51. The United States, the State and their representatives, including attorneys, contractors, and consultants, shall have the right of entry into the Facility at all reasonable times, upon presentation of credentials, to:

- a. monitor the progress of obligations required under this Consent Decree;
- b. verify any data or information submitted to the United States or the State in accordance with the terms of this Consent Decree or Permit or any subsequent NPDES or APDES permit issued by EPA or ADEC;
- c. obtain samples and, upon request, splits of any samples taken by the City or its representatives, contractors, or consultants;

- d. obtain documentary evidence, including photographs and similar data; and
- e. assess the City's compliance with this Consent Decree and Permit or any

subsequent NPDES/APDES permit issued by EPA or ADEC.

52. Upon request, the City shall provide EPA, the State or their authorized representatives splits of any samples taken by the City provided such samples are available at the time of the request.

53. Until three (3) years after Termination of this Consent Decree, the City shall retain, and shall instruct its contractors and agents to preserve, all non-identical copies of all documents, records, or other information (including documents, records, or other information in electronic form) in its or its contractors' or agents' possession or control, or that come into its or its contractors' or agents' possession or control, that relate in any manner to the City's performance of its obligations under this Consent Decree. This information-retention requirement shall apply regardless of any contrary corporate or institutional policies or procedures. At any time during this information-retention period, upon request by the United States or the State, the City shall provide copies of any documents, records, or other information required to be maintained under this Paragraph. At the conclusion of the information-retention period provided in this Paragraph, the City shall notify EPA and the State at least ninety (90) Days prior to the destruction of any documents, records, or other information subject to the requirements of this Paragraph and, upon request by EPA or State, the City shall deliver any such documents, records, or other information to EPA or the State. The City may assert that certain documents, records, or other information is privileged under the attorney-client privilege or any other privilege recognized by federal or state law, as applicable. If the City asserts such a privilege, it shall provide the following: i) the title of the document, record, or information; ii)

the date of the document, record, or information; iii) the name and title of each author of the document, record, or information; iv) the name and title of each addressee and recipient of the document, record, or information; v) a description of the subject of the document, record, or information; and vi) the privilege asserted by the City. However, no documents, records, or other information created or generated pursuant to the requirements of this Consent Decree shall be withheld on grounds of privilege.

54. The City may also assert that information required to be provided under this Section is protected as Confidential Business Information (“CBI”) under 40 C.F.R. Part 2. As to any information that the City seeks to protect as CBI, the City shall follow the procedures set forth in 40 C.F.R. Part 2.

55. This Consent Decree in no way limits or affects any right of entry and inspection, or any right to obtain information, held by the United States or the State pursuant to applicable federal or state laws, regulations, or permits, nor does it limit or affect any duty or obligation of the City to maintain documents, records, or other information imposed by applicable federal or state laws, regulations, or permits.

XIII. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS

56. This Consent Decree resolves the civil claims of the United States and State for the violations alleged in the Complaint filed in this action through the Date of Lodging.

57. The United States and State reserve all legal and equitable remedies available to enforce the provisions of this Consent Decree, except as expressly stated in Paragraph 56. This Consent Decree shall not be construed to limit the rights of the United States or State to obtain penalties or injunctive relief under the Act or implementing regulations, or under other federal or state laws, regulations, or permit conditions, except as expressly stated in Paragraph 56. The

United States and State further reserve all legal and equitable remedies to address any imminent and substantial endangerment to the public health or welfare or the environment arising at, or posed by the Facility, whether related to the violations addressed in this Consent Decree or otherwise.

58. This Consent Decree does not limit or affect the rights of the City or of the United States or the State against any third parties not party to this Consent Decree, nor does it limit the rights of third parties not party to this Consent Decree against the City, except as otherwise provided by law and Paragraph 56 herein.

59. In any subsequent administrative or judicial proceeding initiated by the United States or the State for injunctive relief, civil penalties, or other appropriate relief relating to the Facility, the City shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim preclusion, claim-splitting, or other defenses based upon any contention that the claims raised by the United States or the State in the subsequent proceeding were or should have been brought in the instant case, except with respect to claims that have been specifically resolved pursuant to Paragraph 56 of this Section.

60. This Consent Decree is not a permit, or a modification of any permit, under any federal, state, or local laws or regulations. The City is responsible for achieving and maintaining complete compliance with all applicable federal, state, and local laws, regulations, and permits, and the City's compliance with this Consent Decree shall be no defense to any action commenced pursuant to any such laws, regulations, or permits, except as set forth herein. The United States and the State do not, by consent to the entry of this Consent Decree, warrant or aver in any manner that the City's compliance with any aspect of this Consent Decree will result

in compliance with provisions of the CWA, 33 U.S.C. §1251, et seq., or with any other provisions of federal, state, or local laws, regulations, or permits.

61. The City hereby acknowledges that a future NPDES or APDES permit issued for the Facility may impose requirements and limits with which the Facility cannot comply even after installation and operation of the Compliance Measures required herein. If this occurs, the City may be required by applicable federal and state law to dismantle, replace some or all of the Compliance Measures implemented under this Consent Decree. This Consent Decree provides no basis, evidence, or defense regarding the determination of the appropriate treatment methods and effluent limitations that may be imposed by future NPDES or APDES permits.

62. This Consent Decree is not a waiver or limitation of any right of the City to contest any provision of any future NPDES or APDES permit issued for the Facility. The City reserves all rights under applicable state and federal law to contest or appeal any provision of any future NPDES or APDES permit for the Facility.

63. This Consent Decree shall not be construed to create rights in, or grant any cause of action to, any third party not party to this Consent Decree.

64. The Complaint and this Consent Decree shall constitute and establish diligent prosecution by the United States as set forth in Section 505(b)(1)(B) of the CWA, 33 U.S.C. § 1365(b)(1)(B), and any other applicable federal or state law, of all matters alleged in the Complaint.

XIV. COSTS

65. The Parties shall bear their own costs of this action, including attorneys' fees, except that the United States and the State shall be entitled to collect the costs (including

attorneys' fees) incurred in any action necessary to collect any portion of the civil penalty or any stipulated penalties due but not paid by the City.

XV. NOTICES

66. Notifications, communications and Submissions shall be sent to the addressees listed below by electronic, by U.S. Mail, postage pre-paid, or private courier service, except for notices under Section X (Force Majeure) and Section XI (Dispute Resolution), which shall be sent both electronically and by overnight mail or by certified or registered mail, return receipt requested. If the date on which a notification or other communication is due falls on a Saturday, Sunday or federal holiday, the deadline for such Submission shall be the next business day. Where this Consent Decree requires that notices and Submissions be sent to the United States, they shall be sent to the United States Department of Justice and EPA offices designated below. Where this Consent Decree requires that notices and Submissions be sent to EPA, they need only be sent to the EPA offices designated below. Where this Consent Decree requires that notices and Submissions shall be sent to ADEC or the State, they shall be sent to the following persons set forth below.

To the United States:

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
Box 7611 Ben Franklin Station
Washington, DC 20044-7611
Re: DOJ No. 90-5-1-1-09888

Director, ~~Office of Enforcement and Compliance~~ and ~~Enforcement Assurance Division~~
U.S. Environmental Protection Agency
1200 Sixth Avenue, Suite ~~900, OCE-164~~ 155, 20-C04
Seattle, WA 98101

U.S. EPA Alaska Field Office
Attn: Tara Martich

222 W. 7th Ave #19,
Anchorage, AK 99513
martich.tara@epa.gov

To the State:

Alaska Department of Environmental Conservation, Division of Water
Attn: ~~Mike Solter~~ [Tiffany Larson](#), Compliance Program Manager
~~555 Cordova St~~
~~Anchorage~~ [610 University Ave](#)
[Fairbanks](#), AK ~~99501~~ [99709](#)
~~Mike.solter~~ [Tiffany.Larson@alaska.gov](#)

With a copy to:

Alaska Department of Law – Environmental Section
Attn: ~~Steven G. Ross~~ [Jennifer Currie](#), Assistant Attorney General
1031 W. 4th Avenue, Suite 200
Anchorage, AK 99501-1994
~~steven.ross~~ [Jennifer.Currie@alaska.gov](#)

To the City:

~~Nathan E. Wallace~~
[John Moosey](#)
City Manager
231 W. Evergreen Avenue
Palmer, AK 99645
~~Nwallace~~ [jmoosey@palmerak.org](#)

With a copy to:

Michael Gatti
Jermain, Dunnagan & Owens, P.C.
3000 A Street, Suite 300
Anchorage, AK 99508
[mgatti@jdolaw.com](#)

J. Ryan ~~Moyer~~ [Moyers](#)
HDR, Inc.
2525 C Street, Suite 500
Anchorage, AK 99503
[Ryan.Moyers@hdrinc.com](#)

67. Any Party may, by written notice to the other Parties, change its designated notice recipient or notice address provided above.

68. Notices submitted pursuant to this Section shall be deemed submitted upon the day they are postmarked and sent by first class mail, overnight mail or courier, or certified mail return receipt requested, unless otherwise provided in this Consent Decree or by mutual agreement of the Parties in writing.

XVI. RETENTION OF JURISDICTION

69. The Court shall retain jurisdiction over this case until termination of this Consent Decree for the purpose of resolving disputes arising under this Decree or entering orders modifying this Decree, pursuant to Sections XI and XVII, or effectuating or enforcing compliance with the terms of this Decree.

XVII. MODIFICATION

70. The terms of this Consent Decree, including any attached appendices, may be modified only by a subsequent written agreement signed by all the Parties. Where the modification constitutes a material change to this Consent Decree, it shall be effective only upon approval by the Court. Extension of any deadlines set forth herein that are less than ~~120 Days~~ 12 months shall not be considered to be a material modification.

71. Any disputes concerning modification of this Consent Decree shall be resolved pursuant to Section XI (Dispute Resolution); provided, however, that instead of the burden of proof provided by Paragraph 49, the Party seeking the modification bears the burden of demonstrating that it is entitled to the requested modification in accordance with the grounds for relief specified in Federal Rule of Civil Procedure 60(b).

XVIII. TERMINATION

72. This Consent Decree may be terminated after the City has:

- a. Paid the civil penalties and Interest required by Section V;
- b. Substantially complied with all provisions of this Consent Decree and the NPDES Permit, or any subsequent NPDES/APDES permit issued by EPA or ADEC for five (5) years from the Substantial Completion of MBBR as required by Paragraph 11.b; and
- c. Has paid any stipulated penalties and Interest owed pursuant to Section IX (Stipulated Penalties).

73. After the City has satisfied the conditions for termination set forth in Paragraph 72 above, it may serve a Request for Termination upon the United States and State. The Request for Termination shall include all necessary supporting documentation, stating that the City has satisfied the requirements set forth in Paragraph 72 above.

74. Following receipt by the United States and the State of the City's Request for Termination, the Parties shall confer informally concerning the Request and any disagreement that the Parties may have as to whether the City has complied with the requirements for termination of this Consent Decree set forth in Paragraph 72 above. If the United States, after consultation with the State, agrees that the Consent Decree may be terminated, the Parties shall submit, for the Court's approval, a joint stipulation terminating the Decree.

75. If the United States, after consultation with the State, does not agree that the Consent Decree may be terminated, the City may invoke Dispute Resolution under Section XI. However, the City shall not seek Dispute Resolution of any dispute regarding termination until sixty (60) days after service of its Request for Termination.

XIX. PUBLIC PARTICIPATION

76. This Consent Decree shall be lodged with the Court for a period of not less than thirty (30) Days for public notice and comment in accordance with 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if the comments regarding the Consent Decree disclose facts or considerations indicating that the Consent Decree is inappropriate, improper, or inadequate. The City consents to entry of this Consent Decree without further notice and agrees not to withdraw from or oppose entry of this Consent Decree by the Court or to challenge any provision of the Decree, unless the United States has notified the City in writing that it no longer supports entry of the Decree.

XX. SIGNATORIES/SERVICE

77. Each undersigned representative of the City, the State, and the United States certifies that he or she is fully authorized to enter into the terms and conditions of this Consent Decree and legally bind the Party he or she represents to this document.

78. This Consent Decree may be signed in counterparts, and its validity shall not be challenged on that basis.

79. The City agrees to accept service of process by mail with respect to all matters arising under or relating to this Consent Decree and to waive the formal service requirements set forth in Rules 4 and 5 of the Federal Rules of Civil Procedure and any applicable Local Rules of this Court including, but not limited to, service of a summons.

80. The Parties agree that the City need not file an answer or otherwise respond to the Complaint in this action unless or until the Court expressly declines to enter this Consent Decree.

XXI. INTEGRATION

81. This Consent Decree constitutes the final, complete, and exclusive agreement and understanding among the Parties with respect to the settlement embodied in the Decree and

supercedes all prior agreements and understandings, whether oral or written, concerning the settlement embodied herein. Other than deliverables that are subsequently submitted and approved pursuant to this Consent Decree, no other document, nor any representation, inducement, agreement, understanding, or promise, constitutes any part of this Decree or the settlement it represents, nor shall it be used in construing the terms of this Decree.

XXII. APPENDICES

82. The following appendices are attached to and are part of this Consent Decree:

Appendix A: Diagram of Palmer Wastewater Treatment Facility.

[Appendix B: Solids Management Plan](#)

[Appendix C: Lagoon Dredging and Ammonia Management Plan](#)

[Appendix D: Polymer Testing Plan](#)

XXIII. FINAL JUDGMENT

83. Upon approval and entry of this Consent Decree by the Court, this Consent Decree shall constitute a final judgment of the Court as to the United States, the State, and the City.

Dated and entered this _____ day of _____, 2016.

UNITED STATES DISTRICT JUDGE

District of Alaska

APPENDIX B



Solids Management Plan Palmer Wastewater Treatment Facility

Palmer, Alaska

October 12, 2020 (Revised December 2, 2020)



Contents

| | | |
|-------|--|----|
| 1 | Introduction | 1 |
| 1.1 | Regulatory Background | 1 |
| 2 | Solids Management Plan..... | 3 |
| 2.1 | Current On-Site Disposal Practices | 3 |
| 2.2 | Existing Equipment..... | 5 |
| 2.2.1 | Dredging Equipment..... | 5 |
| 2.2.2 | Sludge Depth Measurement..... | 5 |
| 2.2.3 | Dredged Solids Line | 6 |
| 2.2.4 | Sludge Drying Area | 7 |
| 2.3 | Capacity Analysis | 8 |
| 2.3.1 | Estimated 2020 Dredged Solids | 8 |
| 2.3.2 | Estimated Future Annual Dredged Solids | 9 |
| 2.3.3 | Current Drying Bed Capacity Analysis..... | 9 |
| 2.3.4 | Future Drying Bed Capacity Analysis | 9 |
| 2.4 | Biosolids Monitoring | 10 |
| 2.4.1 | Dried Sludge Decant | 10 |
| 2.5 | Solids Disposal Alternative - Landfill Disposal | 10 |
| 2.5.1 | Regulatory Considerations for Disposal of Solids at Landfill | 10 |
| 2.5.2 | Landfill Disposal Cost..... | 11 |
| 3 | Summary and Recommended Plan | 12 |

Acronyms and Abbreviations

| | |
|------------------|--|
| BOD ₅ | 5-day Biochemical Oxygen Demand |
| DO | Dissolved Oxygen |
| gpm | Gallons Per Minute |
| HMI | Human Machine Interface |
| mg/L | Milligrams per Liter |
| mgd | Million Gallons per Day |
| mL | Milliliters |
| NH ₄ | Ammonia (aqueous) |
| NPW | Non-Potable Plant Water |
| PDPS | Plant Drain Pump Station |
| PICS | Process Instrumentation and Control System |
| PLC | Programmable Logic Controller |
| PPD | Pounds Per Day |
| PWWTF | Palmer Wastewater Treatment Facility |
| SCADA | Supervisory Control and Data Acquisition |
| TSS | Total Suspended Solids |
| UV | Ultraviolet Light |

1 Introduction

This document establishes the Solids Management Plan (SMP) for the Palmer Wastewater Treatment Facility (PWWTF). This document will establish the basis for future development of formal Standard Operating Procedures (SOPs) to be completed by January 31, 2021. HDR has reviewed and analyzed performance data, engineering drawings, and recent test results in the development of this plan.

The City of Palmer (City) currently manages solids on site at the facility. Dredged solids from Lagoons 2 and 3 are transferred to an on-site sludge drying area west of Lagoon 3. Sludge dries (through evaporation) typically for one year before it is further stabilized through lime addition. Dried, limed sludge is removed, mixed with topsoil, and used as fill on the WWTP site. This Plan outlines the roadmap for continued operation of the existing solids management process and outlines a landfill disposal contingency plan.

1.1 Regulatory Background

The PWWTF does not currently have a solids management permit and operates its solids management activities under NPDES Permit No. AK-002249-7. The NPDES permit specifies that EPA Region 10 separates wastewater and sludge permitting, but that no separate sludge-only permit has been issued to date. The permit notes:

“Until future issuance of a sludge-only permit, sludge management and disposal activities at the Palmer WWTP continue to be subject to the national sewage sludge standards at 40 CFR Part 503 and any requirements of the State’s biosolids program. The Part 503 regulations are self-implementing, which means that facilities must comply with them whether or not a permit has been issued.” – PWWTF NPDES Permit.

The Clean Water Act Amendments of 1987 required the EPA to develop new regulations pertaining to sewage sludge and solids. In February, 1993, EPA published 40 CFR Part 503 (i.e., Part 503). The Part 503 Rule is a complex, risk-based assessment of potential environmental impacts of pollutants that may be present in solids (USEPA, 1995). These guidelines regulate pollutant and pathogen concentrations as well as vector attraction reduction (VAR).

The Part 503 Rule applies to various dried solids usage and disposal routes, including placement in or on surface disposal sites. Surface disposal sites such as that used at PWWTF are subject to Subpart C (§§ 503.20 - 503.28) of the Part 503 rules. The general provisions of the rules provide basic requirements for solids applied to land including pollutant limits, management practices, operational standards, and monitoring, record keeping and reporting standards.

Based on correspondence with ADEC in June of 2020, the City of Palmer is under the understanding that a State-issued solids handling permit is not required for on-site treatment and disposal at this time and will not be required until solids are removed/disposed of off-site.

October 12, 2020 (Revised December 2, 2020) | 1

As part of this Solids Management Plan, the City has established a Biosolids Management and Testing plan to characterize sludge prior to land application in compliance with CFR Part 503 regulations.

October 12, 2020 (Revised December 2, 2020) | 2

2 Solids Management Plan

2.1 Current On-Site Disposal Practices

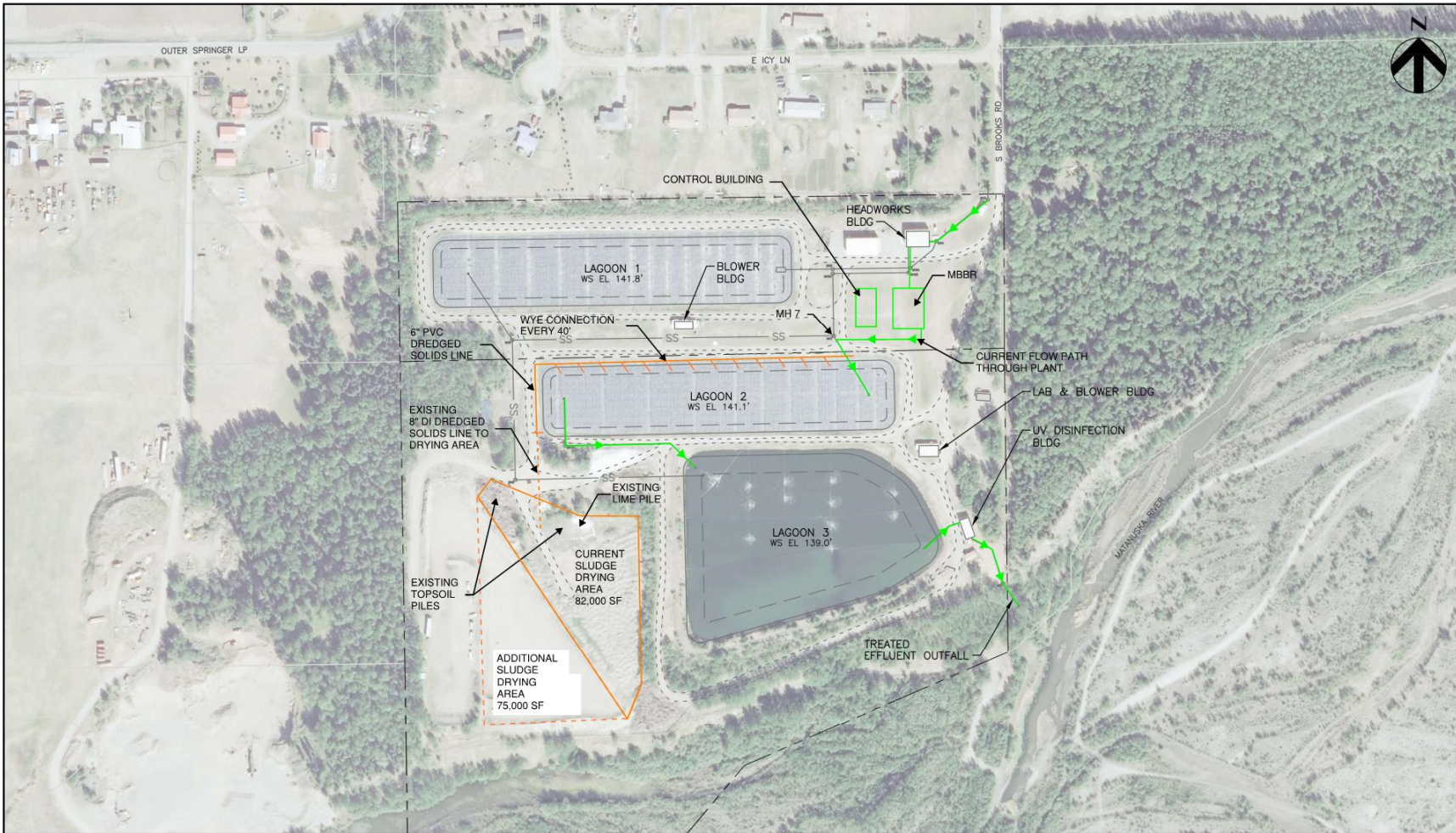
The City purchased a floating dredge in 2003 for the purposes of periodically removing the sludge and settled solids from the lagoons. Sludge is pumped to a sludge drying area located to the west of Lagoon 3. The current sludge drying area is approximately 82,000 square feet in size with a usable area of around 50,000 square feet. The drying area is surrounded with 8-10 foot high berms to provide containment of the drying area. Sludge is typically allowed to dry (through evaporation) for one year before it is further stabilized through lime addition in compliance with Part 503 Subpart C regulations. Lime is metered out by hand shoveling and then mixed using heavy equipment. Dried, limed sludge is removed, mixed with topsoil, and used as fill on the WWTP site. The facility layout and solids management process is presented in Figure 1.

As depicted in Figure 1, the dredge pumps solids through a 6" PVC line that runs along the north and west side of Lagoon 2. The PVC dredged solids line features wye attachment points every 40 feet to facilitate dredging operations. Pumped solids from this line are transferred via an 8 inch ductile iron line to the sludge drying area. Existing supplies of lime and topsoil are stored at the sludge drying area as specified in Figure 1.

Previously, settled sludge was dredged and pumped from the lagoons approximately once every five years. Dredging was a challenging task due to the presence of insulated cover panels on the lagoon. Infrequent dredging efforts resulted in low usage of the sludge drying area. The insulated covers were removed in fall of 2019 to facilitate regular dredging. Prior to removal of the insulated covers, the last known dredging of Lagoon 2 was in 2015/2016.

The PWWTF Lagoon Dredging and Ammonia Management Plan has identified excess solids accumulation in Lagoon 2 as a key contributor to ammonia exceedances in effluent during summer months. The plan specifies annual dredging of Lagoon 2 in addition to dredging of Lagoon 3 as needed based on measured sludge depths. Regular lagoon dredging will increase the capacity demands on the dredging equipment, piping, and on the sludge drying and fill areas.

Figure 1: Palmer WWTF Site Layout and Solids Management Plan



**CITY OF PALMER
WASTEWATER TREATMENT FACILITY
SOLIDS MANAGEMENT PLAN**

EXISTING SITE LAYOUT
NOT TO SCALE

| | |
|--------|-----------|
| DATE | JUNE 2020 |
| FIGURE | 1 |

October 12, 2020 (Revised December 2, 2020) | 4

2.2 Existing Equipment

2.2.1 Dredging Equipment

The City of Palmer purchased the current dredge in 2003 to aid in periodic solids removal from the lagoons. The dredge is stored in a dedicated storage building north of Lagoon 2. The dredge has been well maintained, and the City is proactively addressing maintenance needs of the unit. The City intends to maintain an inventory of readily available wear parts for the dredge. Dredge specifications are provided in Table 1 and the dredge is pictured in Figure 2.

Table 1: Palmer WWTF Dredge Specifications

| Item | Specification |
|--------------------|------------------------------------|
| Dredge Model | LWT Pit Hog RUNT Dredge |
| Weight | 5,800 lbs |
| Dimensions (LxWxH) | 18' x 8'10" x 6' |
| Pump Model | LWT Pit Hog 950 Chopper Pump |
| Pump Type | Centrifugal, Chopper Impeller Pump |
| Pump Design Point | 700 GPM, 40 FT Head |
| Pump Power | 50 HP |

Figure 2: LWT Pit Hog RUNT Dredge



2.2.2 Sludge Depth Measurement

The City currently uses a 'Sludge Judge' for measurement of sludge depth in the lagoons. Measurements are taken from a boat to develop a grid across the lagoon(s). Sludge depth testing will be performed annually as specified in the Lagoon Dredging and Ammonia Management Plan.

2.2.3 Dredged Solids Line

Dredging is facilitated by the dredged solids line running along the north side of Lagoon 2. Specifications for the dredged solids line are provided in Table 2.

Table 2: Palmer WWTF Dredged Solids Line

| Item | Specification |
|---------------|---|
| Line Length | 850 FT PVC |
| Line Material | 6" PVC |
| Attachments | Wye Connections, every 50 FT |
| Connection | Connects to 200 FT of 8" DI line routed to sludge drying area |

Figure 3 (Clockwise from top left): 6" PVC Dredged Solids Line along the bank of Lagoon 2; Wye connection detail (typical); Lime deposit adjacent to sludge drying area; and connection from 6" PVC Dredged Solids Line to 8" DI Dredged Solids Line (buried).



October 12, 2020 (Revised December 2, 2020) | 6

2.2.4 Sludge Drying Area

The current sludge drying area is located to the west of Lagoon 3. The current drying area is roughly 82,000 SF and provides 50,000 SF of useable drying space. The drying area is surrounded with berms roughly 8-10 feet in height that provide containment and an additional physical barrier between the drying area and the nearby Matanuska River. The southern end of the current drying area is located approximately 200 linear feet from the unnamed tributary below or approximately 1,000 linear feet from the main channel of the Matanuska River. The sludge drying area is pictured in Figure 4.

Table 3: Palmer WWTF Sludge Drying Area

| Item | Specification |
|------------------------|---|
| Current Drying Area | 82,000 SF (50,000 SF Useable) |
| Additional Drying Area | 75,000 SF firing range, adjacent to current drying area |
| 2020 Solids Loading | 230 Dry Tons (8,300 cubic feet) |
| Drying Time | 1 Year |
| Treatment | Lime, stored and mixed on-site |
| Disposal | Mixed with topsoil, scraped, and used for on-site fill and grading. |
| Projected Bed Capacity | 50 years (25 years at current bed + 25 years at additional bed) |

Figure 4: Current Sludge Drying Area with Berms Providing Containment



There is an additional potential expansion area in the vicinity of the current drying area that could be used for a future expansion if more drying area is required. This expansion area is on facility property, but is currently used as a firing range for the Palmer Police Department and Federal Bureau of Investigation (FBI). The presence of bullets in the soil matrix may

indicate lead contamination. If levels exceeded allowable limits, RCRA requirements would be triggered and soil would need to be removed from the ground in the area. If the City wishes to pursue expansion of the drying area into the firing range, a firing range characterization study is recommended to be completed in order to determine the level of contamination in the area and estimate the costs to close/cleanup the range. The first step for characterization of the range would be to develop a history (length of usage, calibers used, training exercises conducted, configuration changes, etc) to help guide the characterization.

Figure 5: Potential Future On-Site Expansion Area for Sludge Drying (Current Firing Range)



2.3 Capacity Analysis

The current sludge drying area has been used successfully and has not presented capacity issues for the sporadic dredging operations to date. With the establishment of the PWWTF Lagoon Dredging and Ammonia Management Plan, regular annual dredging operations will increase solids loading on the drying area. Estimates of current dredged solids loading, future dredged solids loading, and a capacity analysis are presented in this section.

2.3.1 Estimated 2020 Dredged Solids

The estimated quantity of dredged solids expected in 2020 as result of current and ongoing dredging operations to address the multiyear accumulations of sludge in Lagoon 2 is provided in Table 4.

Table 4: 2020 Dried Sludge Quantity Estimates

| Description | Specification |
|--------------------|------------------|
| Dry lbs. of sludge | 468,000 lbs/year |
| Dry tons of sludge | 234 tons/year |

October 12, 2020 (Revised December 2, 2020) | 8

| | |
|---------------------|-----------------|
| Volume (@2% solids) | 280 cubic yards |
|---------------------|-----------------|

These 2020 estimates are based on the following assumptions:

- Estimated average of 3 FT of solids depth in Lagoon 2 (as measured by COP staff)
- Approximate area of 125,000 SF on bottom of Lagoon 2
- Approximate 2% solids concentration for the dredged material

2.3.2 Estimated Future Annual Dredged Solids

The estimated quantity of future dredged solids as result of annual dredging operations specified in the PWWTF Lagoon Dredging and Ammonia Management Plan is provided in Table 5.

Table 5: Future Dried Sludge Quantity Estimates

| Description | Specification |
|---------------------|------------------|
| Dry lbs. of sludge | 380,000 lbs/year |
| Dry tons of sludge | 190 tons/year |
| Volume (@2% solids) | 225 cubic yards |

These future estimates are based on the following assumptions:

- Approximate solids concentration of MBBR effluent is 200-300 mg/l
- Annual average flow through WWTF of 0.5 MGD

2.3.3 Current Drying Bed Capacity Analysis

Based on the estimated 2020 dredged solids quantity of 234 tons and 50,000 SF of usable space for the drying beds, the expected depth of solids to be added to the drying bed in 2020 is approximately two inches, not including lime. With annual application of lime and scraping of the beds, the existing beds provide sufficient capacity to handle these demands.

Table 6: Estimated 2020 Drying Bed Depth

| Description | Specification |
|-----------------------|-----------------------|
| 2020 Drying Bed Depth | <6" solids depth/year |

2.3.4 Future Drying Bed Capacity Analysis

Based on the estimated solids production rate of 190 tons/year after 2020 the expected depth of solids to be added to the drying bed as result of annual dredging operations is less than two inches per year.

The long term plan for the Palmer WWTF includes the installation of secondary clarifiers. The solids production rate from secondary clarifiers is projected to approximately match that of the

October 12, 2020 (Revised December 2, 2020) | 9

planned annual lagoon dredging (the secondary clarifiers will replace Lagoon 2 to provide solids settling). With installation of the secondary clarifiers, the expected depth of solids added annually will remain less than two inches per year. There are no anticipated capacity issues for on-site disposal with either regular annual dredging or future use of secondary clarifiers.

Table 7: Estimated Future Drying Bed Depth

| Description | Specification |
|-------------------------|-----------------------|
| Future Drying Bed Depth | <6" solids depth/year |

2.4 Biosolids Monitoring

2.4.1 Dried Sludge Decant

An extensive review of record drawings does not indicate the existence of a lining in the current sludge drying area. On the basis of increased dredging beginning in the summer of 2020, the City will conduct a screening evaluation in the fall of 2020 and summer of 2021 along the riverbank to determine if there is an issue with decant infiltration from the sludge drying area. As the City continues to use the current sludge area for annual sludge drying, screening evaluation will continue along the riverbank while newly dredged solids are drying to determine if there is an issue. More extensive investigation will be performed if screening evaluations determine there is a potential issue.

2.5 Solids Disposal Alternative - Landfill Disposal

The PWWTF is not projected to run out of solids disposal space on-site within the planning horizon (25 years for the current disposal area). However, if future capacity issues do arise, or if other unforeseen considerations preclude disposal on-site, the backup plan is for solids disposal at the Matanuska Susitna Borough Central Landfill. Landfill disposal of solids generated at the Palmer WWTF would likely trigger the requirement for a DEC Permit.

2.5.1 Regulatory Considerations for Disposal of Solids at Landfill

Biosolids that are land filled or used as a cover material at a landfill are subject to federal requirements in 40 CFR Part 258. In addition, in order to co-dispose sewage solids with municipal solid waste at the CPL the following requirements described in 18 AAC 60.365 must be met:

1. The sewage solids must be free of hazardous wastes and polychlorinated biphenyls (PCBs) defined in 40 CFR 761.3.
2. The sewage solids must not contain "free liquids" as defined by EPA Method 9095 (Paint Filter Test).
3. The sewage solids must meet the vector reduction requirement in accordance with 40 CFR 503.33(b)(11); OR must be treated and stabilized to meet Class A or Class B pathogen reduction requirements in accordance with 40 CFR 503.32, AND vector

October 12, 2020 (Revised December 2, 2020) | 10

attraction reduction requirements of 40 CFR 503.33 (b)(1)-(10), as adopted by reference in 18 AAC 60.505.

Correspondence with ADEC in June of 2020 indicates that off-site disposal of solid would also trigger the requirement for a DEC Permit.

2.5.2 Landfill Disposal Cost

It is anticipated that the cost of disposal of solids at the landfill would be substantially greater than the cost of the current solids disposal on-site at the PWWTF. Additionally, it is anticipated that landfill disposal would be more operationally intensive than on-site disposal. For these reasons no specific cost analysis was developed for the landfill disposal alternative.

3 Summary and Recommended Plan

This document provides the Solids Management Plan for the Palmer WWTF. The analysis indicates that the current on-site solids drying area and disposal areas provide adequate capacity to meet Palmer's current and future needs. In the near term, it is recommended that the City continue to use the existing on-site sludge drying area west of Lagoon 3 to dry sludge. If desired, the sludge drying area can be subdivided, but sludge should be applied at depths no greater than six inches annually to promote optimal drying. Sludge should be dried for a one year period before applying lime, mixing with topsoil, and using as on-site fill. In the long term, it is recommended the City repurpose one of the existing lagoons to provide a fully lined location for on-site sludge dewatering and disposal.

This document additionally establishes a Biosolids Monitoring and Testing Plan that will be implemented in the summer of 2021.

This study lastly evaluates the alternative of sludge disposal at the Matanuska Susitna Borough Central Landfill. It was determined that this alternative would be more operationally intensive, more costly, and would trigger additional permitting requirements.

APPENDIX C



Lagoon Dredging and Ammonia Management Plan

Palmer Wastewater Treatment Facility

Palmer, Alaska

October 12, 2020



Contents

| | | |
|-------|---|----|
| 1 | Introduction | 1 |
| 1.1 | Background | 1 |
| 2 | Lagoon Dredging and Ammonia Management Plan | 4 |
| 2.1 | Additional Plan Details and Specifications | 10 |
| 2.1.1 | Dredging Operations | 10 |
| 2.1.2 | Dredging Contingency Plan | 10 |
| 2.1.3 | Summer Operation of Lagoons..... | 10 |
| 2.1.4 | Monitoring and Sampling Protocol..... | 12 |
| 3 | Summary and Conclusions..... | 14 |

Appendices

Appendix A. 2020 Solids Management Plan

Appendix B. APDES Permit No. AK-002249

Acronyms and Abbreviations

| | |
|------------------|--|
| BOD ₅ | 5-day Biochemical Oxygen Demand |
| DO | Dissolved Oxygen |
| gpm | Gallons Per Minute |
| HMI | Human Machine Interface |
| mg/L | Milligrams per Liter |
| mgd | Million Gallons per Day |
| mL | Milliliters |
| NH ₄ | Ammonia (aqueous) |
| NPW | Non-Potable Plant Water |
| PDPS | Plant Drain Pump Station |
| PICS | Process Instrumentation and Control System |
| PLC | Programmable Logic Controller |
| PPD | Pounds Per Day |
| PWWTF | Palmer Wastewater Treatment Facility |
| SCADA | Supervisory Control and Data Acquisition |
| TSS | Total Suspended Solids |
| UV | Ultraviolet Light |

1 Introduction

This document provides the Lagoon Dredging and Ammonia Management Plan (LDAMP) for the Palmer Wastewater Treatment Facility (PWWTF). The City of Palmer (COP) has developed this plan for managing the release of ammonia from the accumulated sludge in Lagoons 2 and 3. The plan includes a detailed schedule for dredging and disposing of the solids from Lagoons 2 and 3, recommendations for operational targets and conditions to optimize nitrification in the lagoons during the summer months, and a sampling protocol to monitor ammonia and related parameters throughout the Palmer WWTF process. This plan is being developed in conjunction with a Solids Management Plan (SMP) for the facility. The SMP, included in Appendix A, details the current practices for solids handling and disposal, the available land (capacity) and equipment that the COP has on-site for solids removal, and the general mechanics of the COP's dredging operation. This information is referenced in the LDAMP but has not been duplicated in this plan.

1.1 Background

The upgraded Palmer Wastewater Treatment Facility (WWTF) was brought on-line in late July 2018 in accordance with a Department of Justice (DOJ) consent decree requiring the COP to meet the current Alaska Pollutant Discharge Elimination (APDES) permit limits. The PWWTF Improvements project generally includes the addition of a Moving Bed Bioreactor (MBBR), lagoon improvements, a new control/blower building, new plant water pump station, flow monitoring flume, and significant yard piping and hydraulic improvements.

As outlined in the Palmer WWTF Performance Testing Report (HDR, April 13, 2020), the PWWTF is achieving a high level of treatment in the MBBR system with consistent MBBR effluent sBOD₅ below 5.0 mg/L and near-complete nitrification with MBBR effluent ammonia consistently below 1.0 mg/L. Phase I improvements did not include the construction of secondary clarifiers for solids removal following the MBBR. Solids removal and polishing is accomplished in the aerobic lagoons (Lagoons 2 and 3). As part of the consent decree for the facility, a polymer system was included in Phase I improvements in order to add polymer to the wastewater stream after the MBBR if solids settling needed to be improved with chemical addition. The polymer system has been installed but has not been required over the first year of operation. Solids removal through the lagoons has been consistent and the effluent TSS levels have averaged 7.8 mg/L over the period (permit requirement is 30 mg/L monthly average).

While the BOD₅ and ammonia levels are extremely low coming out of the MBBR, an increase in effluent ammonia has been occurring across the lagoons. The ammonia increase across the lagoons is believed to be due to aerobic and/or anaerobic digestion of the influent and accumulated solids. Ammonia is released when the solids are digested. If nitrification activity in the lagoons is sufficient (along with sufficient alkalinity and dissolved oxygen to support nitrification), the lagoons may effectively nitrify and keep ammonia concentrations low. If the

rate of $\text{NH}_3\text{-N}$ release from digestion is faster than the rate of nitrification, ammonia will accumulate and increase across the lagoons, as has been observed over the period from August 2018 through October 2019, prior to dredging in fall of 2019.

The upgraded Palmer WWTF has been effective in removing BOD_5 , TSS, and $\text{NH}_3\text{-N}$ to below the required limits on a consistent basis and has met all APDES effluent limits, except for ammonia during the months of July and August in 2019 when the effluent ammonia exceeded the 1.7 mg/L average monthly limit. The average effluent concentrations of BOD_5 , TSS, and $\text{NH}_3\text{-N}$ since the upgraded facility was brought on-line have been 10.7 mg/L, 7.8 mg/l, and 6.3 mg/L, respectively. These average discharge levels are consistently well below the limits required in the APDES permit for September to July. However, July and August 2019 ammonia exceeded permit limits.

After completion of the PWWTF Improvements project, the City of Palmer has taken the following actions to overcome the ammonia release from the digesting sludge in the lagoons:

- PWWTF staff conducted a sludge depth analysis of Lagoon 2 and Lagoon 3 in June/July 2019. The sludge depths recorded in Lagoon 2 show a significant accumulation of solids in the lagoon (over 3-4 feet in some areas). This large amount of accumulated solids was likely digesting and causing the ammonia increase observed in 2018-2019.
- The City began gathering additional operational data across the lagoons to help diagnose and address the ammonia release issue during the summer of 2019.
- The City made several operational changes to try to optimize conditions for nitrification in Lagoons 2 and 3. Optimized conditions include sufficient temperatures, alkalinity (>150 mg/L), and dissolved oxygen (>2-4 mg/L) to promote nitrification. Plant staff began feeding caustic at the MBBR effluent channel to raise the alkalinity going into Lagoon 2. They increased the blower operation in Lagoon 2 to try to consistently operate over 2 mg/L DO.
- The City hired a contractor (and also self-performed) to permanently remove the cover from Lagoon 2. The cover was removed in mid-September 2019 and Lagoon 2 was dredged in September-October 2019 to remove a portion of the accumulated solids from the bottom of the lagoon. The cover will remain off which will facilitate more frequent dredging of the lagoon allowing for additional solids removal.
- In April-May 2020, the City installed permanent PVC piping along the edge of Lagoon 2 to allow for dredged solids to be pumped to the sludge drying beds located on-site. Also in April 2020, the City conducted a sludge depth analysis of Lagoon 2 and determined that while the dredging accomplished in September-October 2019 had removed a portion of the accumulated solids, a significant amount of solids remained (average of approximately 3-4' sludge depth across the lagoon).

This document establishes a dredging plan to:

- Continue dredging to remove as much of the existing solids in the bottom of Lagoon 2 as possible, complete sampling and testing through the WWTF process, and complete minor upgrades of the lagoons in 2020 to prepare for successful ongoing dredging and ammonia management at the facility.
- Outline a dredging and ammonia management plan to maintain annual operation, manage incoming sludge accumulation, and maintain permit compliance after the existing sludge accumulation has been mitigated. In general, annual dredging operation will commence as soon as practicable in the spring at the breakup of surface ice, and will conclude by May 31 each year. Ongoing performance testing will guide annual dredging and ammonia management efforts.

2 Lagoon Dredging and Ammonia Management Plan

The Lagoon Dredging and Ammonia Management Plan will proceed in two phases. Phase A of the plan outlines the steps required in 2020 to remove the multiyear sludge accumulation in the lagoons in order to reach the equilibrium conditions required for successful future operation. Phase B of the plan lays out annual operations once equilibrium conditions have been reached to maintain steady-state operation, manage incoming sludge accumulation, optimize operating conditions for nitrification in the lagoons during the summer months, monitor and adjust plant performance and maintain permit compliance.

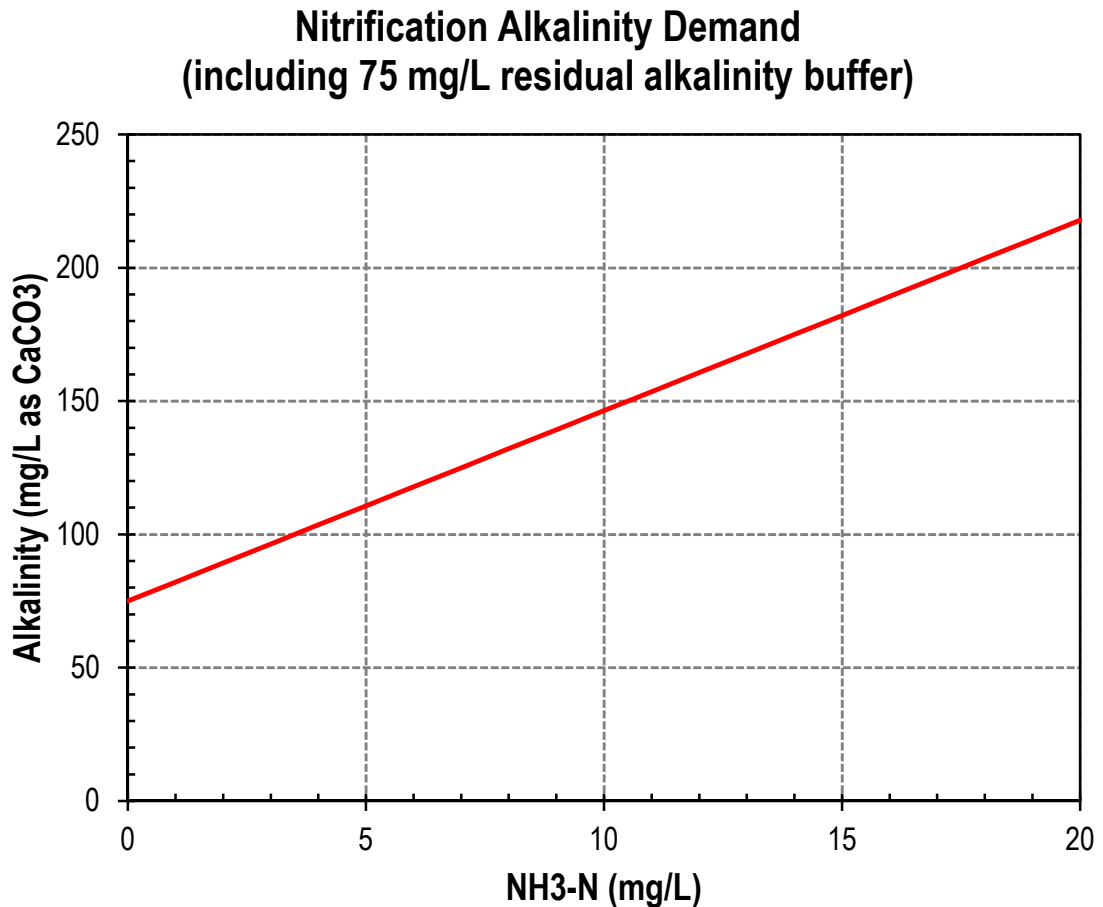
In order to maximize success in future years, the City should target a sludge depth of less than one foot at the conclusion of 2020 dredging efforts. As discussed, the large amount of solids built up on the bottom of Lagoon 2 are digesting and producing ammonia at a greater rate than the lagoon is nitrifying; which results in a net increase of ammonia across the lagoons. The amount of solids on the bottom of the lagoon not only impact the level of digestion and ammonia release, but create additional issues that make it more difficult to achieve nitrification in the lagoons. The Biolac aeration system used in the lagoons utilizes diffusers that currently sit near the bottom of Lagoon 2. The diffusers are located within the build-up of solids which limits their ability to freely 'swing' and aerate the lagoon. This makes it difficult to maintain dissolved oxygen at a level that facilitates nitrification. As the City is dredging Lagoon 2 in June/July 2020, they are raising the elevation of the diffusers in Lagoon 2 to ensure they are out of the accumulated solids on the bottom. This will improve dissolved oxygen management in the lagoon as well as keep the solids from settling on top of the diffusers in the future.

In addition to physically covering the diffusers on the bottom of the lagoon, the large build-up of solids significantly reduces the detention time in Lagoon 2. Lagoon 2 has a volume of approximately 0.63 MG/ft of liquid. Based on the new weir height at the Lagoon 2 effluent (in MH 10) and after the 2020 dredging operation is completed, the liquid depth in Lagoon 2 shall be approximately 8'. At this depth, the lagoon has a volume of approximately 5 MG and a detention time of approximately 10 days (based on an average flow of 0.5 MGD). The accumulated 3' of sludge at the bottom of the lagoon reduces the detention time through the basin to approximately 6 days. This does not allow enough time for complete nitrification. Maintaining a sludge depth of approximately 1'-1.5' will be critical not only to minimize the release of ammonia from digestion, but also to provide enough detention time in Lagoon 2 for nitrification to occur.

Lagoon 3 has a volume of approximately 9.8 MG and provides an additional 19 days of detention time. Conditions for nitrification should be maintained in Lagoon 3 as well as Lagoon 2 to take advantage of the additional polishing. A portion of the lagoon is aerated and baffled. If DO levels greater than 2.0 mg/L can be maintained, and alkalinity is sufficient than some additional ammonia removal/nitrification may be realized in Lagoon 3. Sampling and

monitoring is recommended in Lagoon 3 as discussed in the following sections. Maintaining sufficient alkalinity in Lagoon 3 will be required to nitrify. Figure 1 below provides a Nitrification Alkalinity Demand curve for Lagoon 3 (including 75 mg/L residual alkalinity buffer). Chemical feed for caustic at the MBBR effluent weir will be monitored and maintained to achieve alkalinity levels in Lagoon 3 per the demand curve based on measured ammonia concentrations at the end of Lagoon 2/influent of Lagoon 3.

Figure 1: Lagoon 3 Nitrification Alkalinity Demand



As detailed in the Solids Management Plan, solids will be dredged from Lagoon 2 annually from April through May. The sludge depth in Lagoon 3 will be measured/monitored each spring as well and dredged as needed to maintain approximately less than 1 foot of depth. Solids from the MBBR average approximately 200-300 mg/L and with an annual average flowrate of 0.5 MGD through the WWTF, the anticipated annual amount of solids to be removed from Lagoon 2 is approximately 230 dry tons/year. Reference the SMP for more detailed information on the mechanics of the dredging operation. Dredging each spring will be completed by May 31, to allow the lagoon to settle for at least a month and begin nitrifying before the lower permit limits take effect in July and August.

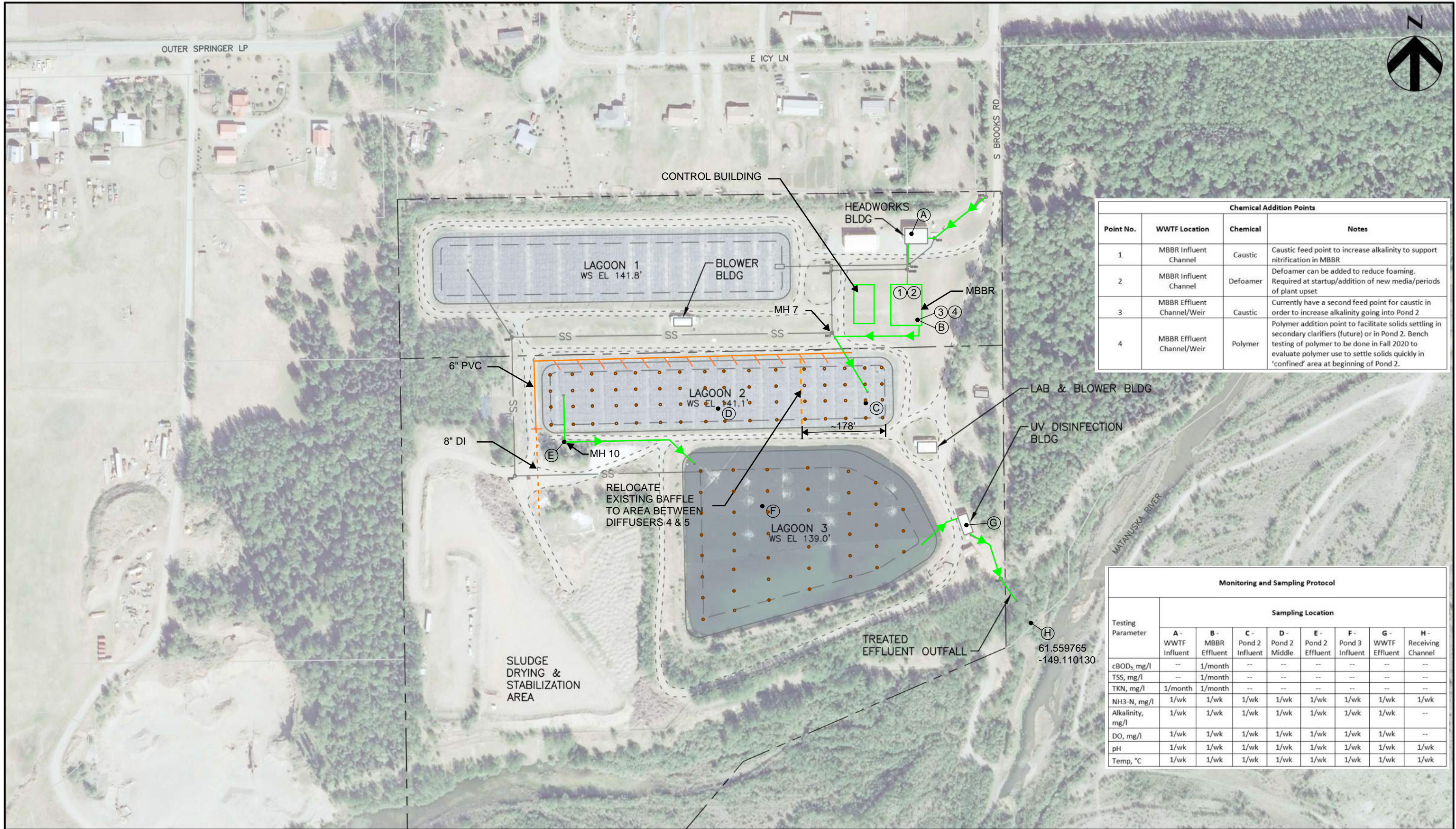
Table 1 provides Phase A of the Lagoon Dredging and Ammonia Management Plan, or proposed steps to be taken in 2020 to best position the City for handling solids accumulation, dredging, and accomplishing nitrification over the summer months in the future. Table 2 provides Phase B of the Lagoon Dredging and Ammonia Management Plan, or proposed annual steps to be taken following 2020, and Figure 2 provides a map specifying sampling locations and other site details.

Table 1: Phase A Lagoon Dredging and Ammonia Management Plan

| Step No. | Recommended Improvement | Completion Status | Estimated Completion Date | Notes |
|--|---|---|--|--|
| Phase A – Remove Legacy Sludge Accumulation | | | | |
| A1 | Dredging of Lagoon 2 | Summer 2020 (started in June 2020) | August 2020 | The current dredging effort will continue to remove as much as possible of the accumulated sludge in Lagoon 2. The increase of ammonia across the lagoons is believed to be due to aerobic and/or anaerobic digestion of the accumulated solids. Minimizing the volume of solids accumulation is critical to reducing ammonia. The dredging effort is to continue through end of August 2020. |
| A2 | Sludge depth testing of Lagoon 2 and Lagoon 3 | | Early September 2020 | Sludge depth testing in Lagoons 2 and 3 will commence in Early September 2020. Sludge depth testing will begin at Lagoon 2 and then continue in Lagoon 3. Sludge depth testing locations are specified in Figure 2. |
| A3 | Additional dredging of Lagoon 2 and/or Lagoon 3 | Not completed, Trigger condition: Sludge depth from Step A2 greater than 1 foot | Sept-Oct 2020 | The sludge depth testing in Step 2 may trigger additional dredging to further address legacy sludge accumulation in Lagoons 2 and 3. Average sludge depths in excess of 1 foot will trigger re-dredging of Lagoon 2 and/or dredging of Lagoon 3. If required, this dredging effort will begin in early September 2020. |
| A4 | Relocation of Lagoon 2 Baffle | | Aug-Oct 2020 | The baffle in the middle of Lagoon 2 will be relocated nearer to the MBBR influent to better contain incoming solids, as specified in Figure 2. This baffle will be placed between Diffuser 4 and Diffuser 5, and will be designed to concentrate solids accumulation to a more limited area to facilitate future dredging efforts. Aeration in this area will be minimized to provide a quiescent zone for solids to settle |
| A5 | Evaluation of polymer addition to MBBR effluent | | Sept-Oct 2020 jar testing and bench testing, Implementation 2021 | Jar testing will be conducted to evaluate the potential addition of polymer at the MBBR effluent to aid in settling. Bench testing will subsequently be conducted to validate jar testing. If found effective, the polymer feed will be implemented in 2021. The polymer system could further aid in limiting solids accumulation to the east (upstream) end of Lagoon 2. |

Table 2: Phase B Lagoon Dredging and Ammonia Management Plan

| Step No. | Recommended Improvement | Completion Status | Estimated Completion Date | Notes |
|--|---|-------------------|--|---|
| Phase B – Ongoing Dredging and Ammonia Management | | | | |
| B1 | Annual Dredging of Lagoon 2 (and Lagoon 3, if required) | | Annually, starting April 2021, and concluding May 31 each year | Lagoon 2 will be dredged annually as early as practicable in spring, and will conclude by May 31 each year to minimize the amount of sludge in the lagoons during July-August when the permit limits for ammonia are lowest for the facility and the bioactivity (digestion) is the highest in the lagoons. Lagoon 3 will be dredged when needed as required by annual sludge depth testing. Dredging will be triggered by average sludge depths greater than 1 foot. |
| B2 | DO Management | | Annually, starting in May | The DO levels in Lagoon 2 will be increased to 4-6 mg/L in May/June to facilitate nitrification in the lagoon. Additionally, DO levels greater than 2.0 mg/L will be maintained in Lagoon 3 over the summer months to facilitate additional nitrification in the polishing Lagoon. |
| B3 | Alkalinity Management | | Annually, starting in May | Caustic will be monitored and fed at the MBBR effluent channel to ensure a sufficient alkalinity going in to Lagoon 2 (>150 mg/L). Sampling points are specified in Figure 2. |
| B4 | Sludge Depth Testing | | Biannually Prior to spring dredging, again in fall. | Sludge depth testing will be performed annually before and after spring dredging in Lagoons 2. Sludge depth monitoring will be performed periodically in Lagoon 2 throughout the summer to provide improved data regarding sludge accumulation. Sludge depth testing will be performed again each fall, and include testing of Lagoon 2 and Lagoon 3. If average sludge accumulation in excess of 1 foot is detected in fall, a second fall dredging event will be triggered. |



| Chemical Addition Points | | | |
|--------------------------|----------------------------|----------|--|
| Point No. | WWTF Location | Chemical | Notes |
| 1 | MBBR Influent Channel | Caustic | Caustic feed point to increase alkalinity to support nitrification in MBBR |
| 2 | MBBR Influent Channel | Defoamer | Defoamer can be added to reduce foaming. Required at startup/addition of new media/periods of plant upset |
| 3 | MBBR Effluent Channel/Weir | Caustic | Currently have a second feed point for caustic in order to increase alkalinity going into Pond 2 |
| 4 | MBBR Effluent Channel/Weir | Polymer | Polymer addition point to facilitate solids settling in secondary clarifiers (future) or in Pond 2. Bench testing of polymer to be done in Fall 2020 to evaluate polymer use to settle solids quickly in 'confined' area at beginning of Pond 2. |

| Monitoring and Sampling Protocol | | | | | | | | |
|----------------------------------|-------------------|-------------------|---------------------|-------------------|---------------------|---------------------|-------------------|-----------------------|
| Testing Parameter | Sampling Location | | | | | | | |
| | A - WWTF Influent | B - MBBR Effluent | C - Pond 2 Influent | D - Pond 2 Middle | E - Pond 2 Effluent | F - Pond 3 Influent | G - WWTF Effluent | H - Receiving Channel |
| cBOD ₅ , mg/l | -- | 1/month | -- | -- | -- | -- | -- | -- |
| TSS, mg/l | -- | 1/month | -- | -- | -- | -- | -- | -- |
| TKN, mg/l | 1/month | 1/month | -- | -- | -- | -- | -- | -- |
| NH ₃ -N, mg/l | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk |
| Alkalinity, mg/l | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | -- |
| DO, mg/l | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | -- |
| pH | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk |
| Temp, °C | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk |

Map Legend

- Primary Process Flow Path
- Dredged Solids Line
- Sludge Depth Testing Point



**CITY OF PALMER
WASTEWATER TREATMENT FACILITY
DREDGING & AMMONIA MANAGEMENT PLAN**

EXISTING SITE LAYOUT
NOT TO SCALE

DATE
JUNE 2020

FIGURE
2

2.1 Additional Plan Details and Specifications

2.1.1 Dredging Operations

Dredging shall be accomplished in April-May and concluded no later than May 31 every year as specified in Tables 1 and 2 and described in more detail in the Solids Management Plan (Appendix A) for the facility. Sludge depth will be measured, as described in the SMP, in both lagoons before and after dredging each year to determine the effectiveness of the dredging operation.

2.1.2 Dredging Contingency Plan

The city's existing dredge is in good condition. The dredge has been well maintained, and the City is proactively addressing maintenance needs of the unit. The City intends to purchase wear parts for the dredge to have them available on the shelf in Palmer both for proactive maintenance and for repairs as needed. The City of Palmer will purchase an inventory of wear parts for the dredge in the winter of 2020/2021 to maintain on-hand at the facility. These parts will be available on-site for spring 2021 dredging operations. In the event of a mechanical failure, a backup dredge can be brought in to continue dredging operations while the primary dredge is repaired. This will reduce the turn-around time required to address mechanical issues and reduce dredge downtime.

In the event of failure of both the primary dredge and a backup dredge, the City can hire a dredging contractor to provide dredging services. The City has established contact with Merrell Bros. Inc. based in Indiana and has obtained price quotes for dredging services. Merrell Bros. has experience working in Alaska including water and sewer projects in Seward, North Pole, Dillingham, and Bethel. Merrell Bros is familiar with the logistics required to mobilize equipment to work in Alaska. This will ensure dredging operations specified in this plan proceed on schedule each year in April and May.

2.1.3 Summer Operation of Lagoons

In addition to annual dredging of Lagoon 2 to minimize the amount of solids in the bottom of the lagoon, it will be important to operate the lagoons in a manner that creates the most favorable conditions to achieve nitrification. Limiting the amount of solids in the lagoon is important as ammonia is released when the solids are digested. If nitrification activity in the lagoons is sufficient (along with sufficient alkalinity and dissolved oxygen to support nitrification), the lagoons may effectively nitrify and keep ammonia concentrations low. If the rate of ammonia release from digestion is faster than the rate of nitrification, ammonia will accumulate and increase across the lagoons. The following sections detail operational targets to maintain especially over the summer months when the permit limits for ammonia are lowest for the facility and the bioactivity (digestion) is the highest in the lagoons. Also, each year around May-June the DO levels in Lagoon 2 will be increased to 4-6 mg/L to facilitate nitrification in the lagoon. Additionally, alkalinity (caustic) will be introduced at the MBBR influent channel and monitored at the MBBR effluent to ensure a sufficient alkalinity going in

to Lagoon 2. A target alkalinity of 150 mg/L at the beginning of Lagoon 2 will be maintained to facilitate nitrification in Lagoon 2. Additionally, ammonia and alkalinity levels will be monitored in Lagoon 3 and alkalinity (caustic) added as needed at the MBBR effluent to facilitate additional nitrification in Lagoon 3.

2.1.3.1 Operational Set Points and Guidelines

The following operational targets will be maintained to facilitate nitrification in Lagoons 2 and 3 from May 1 to October 31 annually:

Table 3: Operational Set Points

| Operational Set Points | | |
|-------------------------|----------|---|
| Parameter | Target | Notes |
| Temperature | >8°C | While not in operators' control, should be monitored with other set points to gauge ability of lagoon to nitrify. |
| Alkalinity | 150 mg/l | Target alkalinity at the beginning of each lagoon to ensure alkalinity is not limiting nitrification. |
| Dissolved Oxygen | 4-6 mg/l | Target DO throughout Lagoons 2 and 3 to create aerobic conditions for nitrification. |
| Detention time Lagoon 2 | 10 days | Assumes dredging completed |
| Detention time Lagoon 3 | 19 days | Assumes dredging completed |

2.1.3.2 Chemical Feed Systems

The PWWTF has chemical feed systems for caustic, polymer, and defoamer.

Table 4: Available Chemical Addition Points

| Chemical Addition Points | | | |
|--------------------------|----------------------------|----------|---|
| Point No. | WWTF Location | Chemical | Notes |
| 1 | MBBR Influent Channel | Caustic | Caustic feed point to increase alkalinity to support nitrification in MBBR |
| 2 | MBBR Influent Channel | Defoamer | Defoamer can be added to reduce foaming. Required at startup/addition of new media/periods of plant upset |
| 3 | MBBR Effluent Channel/Weir | Caustic | Currently have a second feed point for caustic in order to increase alkalinity going into Lagoon 2. Should feed caustic just prior MBBR effluent weir to meet alkalinity setpoint at the beginning of Lagoon 2. |

| | | | |
|---|----------------------------|---------|---|
| 4 | MBBR Effluent Channel/Weir | Polymer | Polymer addition point to facilitate solids settling in secondary clarifiers (future) or in Lagoon 2. Bench testing of polymer to be done in Fall 2020 to evaluate polymer use to settle solids in the baffled area at beginning of Lagoon 2. |
|---|----------------------------|---------|---|

2.1.4 Monitoring and Sampling Protocol

Regular performance testing shall monitor performance of the facility annually, and specifically the lagoons through the summer months from May 1 to October 31. Samples shall be taken be at the locations indicated on Figure 2. The follow chart shows the testing parameters and frequency for each location.

Table 5: Lagoon Sampling Parameters

| Monitoring and Sampling Protocol | | | | | | | | |
|----------------------------------|-------------------------|-------------------------|-----------------------------|---------------------------|-----------------------------|-----------------------------|-------------------------|-----------------------------|
| Testing Parameter | Sampling Location | | | | | | | |
| | A - WWTF Influent | B - MBBR Effluent | C - Lagoon 2 Influent | D - Lagoon 2 Middle | E - Lagoon 2 Effluent | F - Lagoon 3 Influent | G - WWTF Effluent | H - Receiving Channel |
| cBOD ₅ , mg/l | -- | 1/month | -- | -- | -- | -- | -- | -- |
| TSS, mg/l | -- | 1/month | -- | -- | -- | -- | -- | -- |
| TKN, mg/l | 1/month | 1/month | -- | -- | -- | 1/month | -- | -- |
| NH ₃ -N, mg/l | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk |
| Alkalinity, mg/l | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | -- |
| DO, mg/l | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | -- |
| pH | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk |
| Temp, °C | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk | 1/wk |

Additional Notes on Sampling Location and Frequency

All sampling indicated in Table 5 above shall be completed in addition to the regular sampling completed by the COP for permit compliance.

- All samples within lagoons should be taken by boat, near the center of the lagoons.
- Sample location H is located in the small receiving channel at a point downstream of the outfall but prior to the confluence with the Matanuska River. The sample location point is located at 61.559765, -149.110130.
- Gather and review the operational data and monitoring monthly to verify performance of the system.

- At the end of each year of operation in the current configuration, the City will incorporate the results of the lagoon dredging, along with the performance data collected by COP WWTF staff over the year and present the findings in an updated Performance Testing Report.

3 Summary and Conclusions

The City intends to remove/dredge solids from Lagoons 2 and 3 on an annual basis to minimize the accumulation of solids and the potential for sludge digestion/ammonia release to ammonia levels greater than the permit effluent limits. Both Lagoons 2 and 3 will be dredged annually between April-May to minimize the amount of sludge in the lagoons during July-August when the permit limits for ammonia are lowest for the facility and the bioactivity (digestion) is the highest in the lagoons. Also, each year around May-June the DO levels in Lagoon 2 will be increased to 4-6 mg/L to facilitate nitrification in the lagoon. Additionally, caustic will be fed at the MBBR influent channel and monitored at the MBBR effluent to ensure a sufficient alkalinity going in to Lagoon 2. A target alkalinity of 150 mg/L at the beginning of Lagoon 2 will be maintained to facilitate nitrification in Lagoon 2.



Solids Management Plan Palmer Wastewater Treatment Facility

Palmer, Alaska

October 12, 2020 (Revised December 2, 2020)



Contents

| | | |
|-------|--|----|
| 1 | Introduction | 1 |
| 1.1 | Regulatory Background | 1 |
| 2 | Solids Management Plan..... | 3 |
| 2.1 | Current On-Site Disposal Practices | 3 |
| 2.2 | Existing Equipment..... | 5 |
| 2.2.1 | Dredging Equipment..... | 5 |
| 2.2.2 | Sludge Depth Measurement..... | 5 |
| 2.2.3 | Dredged Solids Line | 6 |
| 2.2.4 | Sludge Drying Area | 7 |
| 2.3 | Capacity Analysis | 8 |
| 2.3.1 | Estimated 2020 Dredged Solids | 8 |
| 2.3.2 | Estimated Future Annual Dredged Solids | 9 |
| 2.3.3 | Current Drying Bed Capacity Analysis..... | 9 |
| 2.3.4 | Future Drying Bed Capacity Analysis | 9 |
| 2.4 | Biosolids Monitoring | 10 |
| 2.4.1 | Dried Sludge Decant | 10 |
| 2.5 | Solids Disposal Alternative - Landfill Disposal | 10 |
| 2.5.1 | Regulatory Considerations for Disposal of Solids at Landfill | 10 |
| 2.5.2 | Landfill Disposal Cost..... | 11 |
| 3 | Summary and Recommended Plan | 12 |

Acronyms and Abbreviations

| | |
|------------------|--|
| BOD ₅ | 5-day Biochemical Oxygen Demand |
| DO | Dissolved Oxygen |
| gpm | Gallons Per Minute |
| HMI | Human Machine Interface |
| mg/L | Milligrams per Liter |
| mgd | Million Gallons per Day |
| mL | Milliliters |
| NH ₄ | Ammonia (aqueous) |
| NPW | Non-Potable Plant Water |
| PDPS | Plant Drain Pump Station |
| PICS | Process Instrumentation and Control System |
| PLC | Programmable Logic Controller |
| PPD | Pounds Per Day |
| PWWTF | Palmer Wastewater Treatment Facility |
| SCADA | Supervisory Control and Data Acquisition |
| TSS | Total Suspended Solids |
| UV | Ultraviolet Light |

1 Introduction

This document establishes the Solids Management Plan (SMP) for the Palmer Wastewater Treatment Facility (PWWTF). This document will establish the basis for future development of formal Standard Operating Procedures (SOPs) to be completed by January 31, 2021. HDR has reviewed and analyzed performance data, engineering drawings, and recent test results in the development of this plan.

The City of Palmer (City) currently manages solids on site at the facility. Dredged solids from Lagoons 2 and 3 are transferred to an on-site sludge drying area west of Lagoon 3. Sludge dries (through evaporation) typically for one year before it is further stabilized through lime addition. Dried, limed sludge is removed, mixed with topsoil, and used as fill on the WWTP site. This Plan outlines the roadmap for continued operation of the existing solids management process and outlines a landfill disposal contingency plan.

1.1 Regulatory Background

The PWWTF does not currently have a solids management permit and operates its solids management activities under NPDES Permit No. AK-002249-7. The NPDES permit specifies that EPA Region 10 separates wastewater and sludge permitting, but that no separate sludge-only permit has been issued to date. The permit notes:

“Until future issuance of a sludge-only permit, sludge management and disposal activities at the Palmer WWTP continue to be subject to the national sewage sludge standards at 40 CFR Part 503 and any requirements of the State’s biosolids program. The Part 503 regulations are self-implementing, which means that facilities must comply with them whether or not a permit has been issued.” – PWWTF NPDES Permit.

The Clean Water Act Amendments of 1987 required the EPA to develop new regulations pertaining to sewage sludge and solids. In February, 1993, EPA published 40 CFR Part 503 (i.e., Part 503). The Part 503 Rule is a complex, risk-based assessment of potential environmental impacts of pollutants that may be present in solids (USEPA, 1995). These guidelines regulate pollutant and pathogen concentrations as well as vector attraction reduction (VAR).

The Part 503 Rule applies to various dried solids usage and disposal routes, including placement in or on surface disposal sites. Surface disposal sites such as that used at PWWTF are subject to Subpart C (§§ 503.20 - 503.28) of the Part 503 rules. The general provisions of the rules provide basic requirements for solids applied to land including pollutant limits, management practices, operational standards, and monitoring, record keeping and reporting standards.

Based on correspondence with ADEC in June of 2020, the City of Palmer is under the understanding that a State-issued solids handling permit is not required for on-site treatment and disposal at this time and will not be required until solids are removed/disposed of off-site.

October 12, 2020 (Revised December 2, 2020) | 1

As part of this Solids Management Plan, the City has established a Biosolids Management and Testing plan to characterize sludge prior to land application in compliance with CFR Part 503 regulations.

October 12, 2020 (Revised December 2, 2020) | 2

2 Solids Management Plan

2.1 Current On-Site Disposal Practices

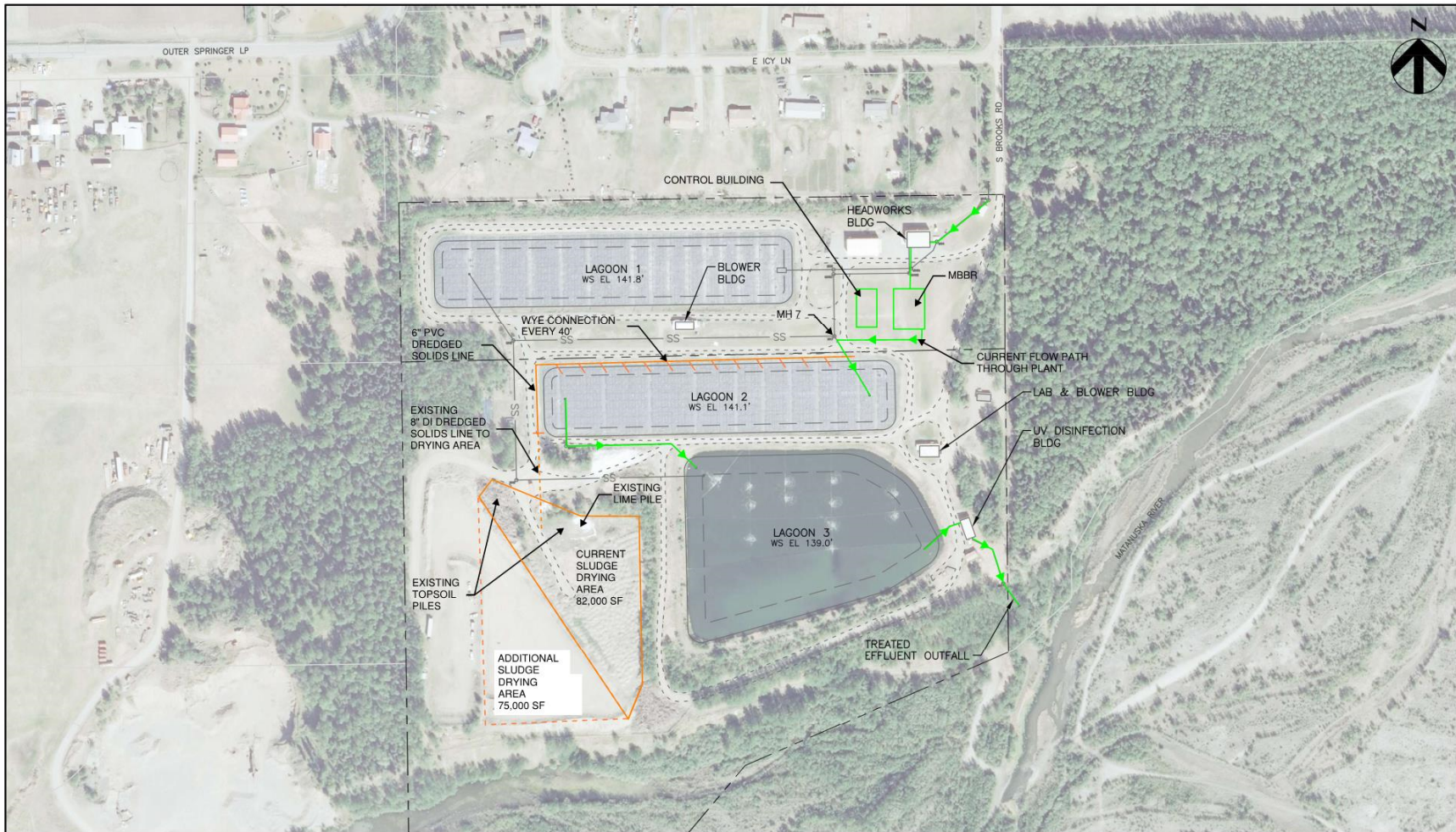
The City purchased a floating dredge in 2003 for the purposes of periodically removing the sludge and settled solids from the lagoons. Sludge is pumped to a sludge drying area located to the west of Lagoon 3. The current sludge drying area is approximately 82,000 square feet in size with a usable area of around 50,000 square feet. The drying area is surrounded with 8-10 foot high berms to provide containment of the drying area. Sludge is typically allowed to dry (through evaporation) for one year before it is further stabilized through lime addition in compliance with Part 503 Subpart C regulations. Lime is metered out by hand shoveling and then mixed using heavy equipment. Dried, limed sludge is removed, mixed with topsoil, and used as fill on the WWTP site. The facility layout and solids management process is presented in Figure 1.

As depicted in Figure 1, the dredge pumps solids through a 6" PVC line that runs along the north and west side of Lagoon 2. The PVC dredged solids line features wye attachment points every 40 feet to facilitate dredging operations. Pumped solids from this line are transferred via an 8 inch ductile iron line to the sludge drying area. Existing supplies of lime and topsoil are stored at the sludge drying area as specified in Figure 1.

Previously, settled sludge was dredged and pumped from the lagoons approximately once every five years. Dredging was a challenging task due to the presence of insulated cover panels on the lagoon. Infrequent dredging efforts resulted in low usage of the sludge drying area. The insulated covers were removed in fall of 2019 to facilitate regular dredging. Prior to removal of the insulated covers, the last known dredging of Lagoon 2 was in 2015/2016.

The PWWTF Lagoon Dredging and Ammonia Management Plan has identified excess solids accumulation in Lagoon 2 as a key contributor to ammonia exceedances in effluent during summer months. The plan specifies annual dredging of Lagoon 2 in addition to dredging of Lagoon 3 as needed based on measured sludge depths. Regular lagoon dredging will increase the capacity demands on the dredging equipment, piping, and on the sludge drying and fill areas.

Figure 1: Palmer WWTF Site Layout and Solids Management Plan



**CITY OF PALMER
WASTEWATER TREATMENT FACILITY
SOLIDS MANAGEMENT PLAN**

EXISTING SITE LAYOUT
NOT TO SCALE

DATE
JUNE 2020

FIGURE
1

October 12, 2020 (Revised December 2, 2020) | 4

2.2 Existing Equipment

2.2.1 Dredging Equipment

The City of Palmer purchased the current dredge in 2003 to aid in periodic solids removal from the lagoons. The dredge is stored in a dedicated storage building north of Lagoon 2. The dredge has been well maintained, and the City is proactively addressing maintenance needs of the unit. The City intends to maintain an inventory of readily available wear parts for the dredge. Dredge specifications are provided in Table 1 and the dredge is pictured in Figure 2.

Table 1: Palmer WWTF Dredge Specifications

| Item | Specification |
|--------------------|------------------------------------|
| Dredge Model | LWT Pit Hog RUNT Dredge |
| Weight | 5,800 lbs |
| Dimensions (LxWxH) | 18' x 8'10" x 6' |
| Pump Model | LWT Pit Hog 950 Chopper Pump |
| Pump Type | Centrifugal, Chopper Impeller Pump |
| Pump Design Point | 700 GPM, 40 FT Head |
| Pump Power | 50 HP |

Figure 2: LWT Pit Hog RUNT Dredge



2.2.2 Sludge Depth Measurement

The City currently uses a 'Sludge Judge' for measurement of sludge depth in the lagoons. Measurements are taken from a boat to develop a grid across the lagoon(s). Sludge depth testing will be performed annually as specified in the Lagoon Dredging and Ammonia Management Plan.

October 12, 2020 (Revised December 2, 2020) | 5

2.2.3 Dredged Solids Line

Dredging is facilitated by the dredged solids line running along the north side of Lagoon 2. Specifications for the dredged solids line are provided in Table 2.

Table 2: Palmer WWTF Dredged Solids Line

| Item | Specification |
|---------------|---|
| Line Length | 850 FT PVC |
| Line Material | 6" PVC |
| Attachments | Wye Connections, every 50 FT |
| Connection | Connects to 200 FT of 8" DI line routed to sludge drying area |

Figure 3 (Clockwise from top left): 6" PVC Dredged Solids Line along the bank of Lagoon 2; Wye connection detail (typical); Lime deposit adjacent to sludge drying area; and connection from 6" PVC Dredged Solids Line to 8" DI Dredged Solids Line (buried).



October 12, 2020 (Revised December 2, 2020) | 6

2.2.4 Sludge Drying Area

The current sludge drying area is located to the west of Lagoon 3. The current drying area is roughly 82,000 SF and provides 50,000 SF of useable drying space. The drying area is surrounded with berms roughly 8-10 feet in height that provide containment and an additional physical barrier between the drying area and the nearby Matanuska River. The southern end of the current drying area is located approximately 200 linear feet from the unnamed tributary below or approximately 1,000 linear feet from the main channel of the Matanuska River. The sludge drying area is pictured in Figure 4.

Table 3: Palmer WWTF Sludge Drying Area

| Item | Specification |
|------------------------|---|
| Current Drying Area | 82,000 SF (50,000 SF Useable) |
| Additional Drying Area | 75,000 SF firing range, adjacent to current drying area |
| 2020 Solids Loading | 230 Dry Tons (8,300 cubic feet) |
| Drying Time | 1 Year |
| Treatment | Lime, stored and mixed on-site |
| Disposal | Mixed with topsoil, scraped, and used for on-site fill and grading. |
| Projected Bed Capacity | 50 years (25 years at current bed + 25 years at additional bed) |

Figure 4: Current Sludge Drying Area with Berms Providing Containment



There is an additional potential expansion area in the vicinity of the current drying area that could be used for a future expansion if more drying area is required. This expansion area is on facility property, but is currently used as a firing range for the Palmer Police Department and Federal Bureau of Investigation (FBI). The presence of bullets in the soil matrix may

October 12, 2020 (Revised December 2, 2020) | 7

indicate lead contamination. If levels exceeded allowable limits, RCRA requirements would be triggered and soil would need to be removed from the ground in the area. If the City wishes to pursue expansion of the drying area into the firing range, a firing range characterization study is recommended to be completed in order to determine the level of contamination in the area and estimate the costs to close/cleanup the range. The first step for characterization of the range would be to develop a history (length of usage, calibers used, training exercises conducted, configuration changes, etc) to help guide the characterization.

Figure 5: Potential Future On-Site Expansion Area for Sludge Drying (Current Firing Range)



2.3 Capacity Analysis

The current sludge drying area has been used successfully and has not presented capacity issues for the sporadic dredging operations to date. With the establishment of the PWWTF Lagoon Dredging and Ammonia Management Plan, regular annual dredging operations will increase solids loading on the drying area. Estimates of current dredged solids loading, future dredged solids loading, and a capacity analysis are presented in this section.

2.3.1 Estimated 2020 Dredged Solids

The estimated quantity of dredged solids expected in 2020 as result of current and ongoing dredging operations to address the multiyear accumulations of sludge in Lagoon 2 is provided in Table 4.

Table 4: 2020 Dried Sludge Quantity Estimates

| Description | Specification |
|--------------------|------------------|
| Dry lbs. of sludge | 468,000 lbs/year |
| Dry tons of sludge | 234 tons/year |

October 12, 2020 (Revised December 2, 2020) | 8

| | |
|---------------------|-----------------|
| Volume (@2% solids) | 280 cubic yards |
|---------------------|-----------------|

These 2020 estimates are based on the following assumptions:

- Estimated average of 3 FT of solids depth in Lagoon 2 (as measured by COP staff)
- Approximate area of 125,000 SF on bottom of Lagoon 2
- Approximate 2% solids concentration for the dredged material

2.3.2 Estimated Future Annual Dredged Solids

The estimated quantity of future dredged solids as result of annual dredging operations specified in the PWWTF Lagoon Dredging and Ammonia Management Plan is provided in Table 5.

Table 5: Future Dried Sludge Quantity Estimates

| Description | Specification |
|---------------------|------------------|
| Dry lbs. of sludge | 380,000 lbs/year |
| Dry tons of sludge | 190 tons/year |
| Volume (@2% solids) | 225 cubic yards |

These future estimates are based on the following assumptions:

- Approximate solids concentration of MBBR effluent is 200-300 mg/l
- Annual average flow through WWTF of 0.5 MGD

2.3.3 Current Drying Bed Capacity Analysis

Based on the estimated 2020 dredged solids quantity of 234 tons and 50,000 SF of usable space for the drying beds, the expected depth of solids to be added to the drying bed in 2020 is approximately two inches, not including lime. With annual application of lime and scraping of the beds, the existing beds provide sufficient capacity to handle these demands.

Table 6: Estimated 2020 Drying Bed Depth

| Description | Specification |
|-----------------------|-----------------------|
| 2020 Drying Bed Depth | <6" solids depth/year |

2.3.4 Future Drying Bed Capacity Analysis

Based on the estimated solids production rate of 190 tons/year after 2020 the expected depth of solids to be added to the drying bed as result of annual dredging operations is less than two inches per year.

The long term plan for the Palmer WWTF includes the installation of secondary clarifiers. The solids production rate from secondary clarifiers is projected to approximately match that of the

October 12, 2020 (Revised December 2, 2020) | 9

planned annual lagoon dredging (the secondary clarifiers will replace Lagoon 2 to provide solids settling). With installation of the secondary clarifiers, the expected depth of solids added annually will remain less than two inches per year. There are no anticipated capacity issues for on-site disposal with either regular annual dredging or future use of secondary clarifiers.

Table 7: Estimated Future Drying Bed Depth

| Description | Specification |
|-------------------------|-----------------------|
| Future Drying Bed Depth | <6" solids depth/year |

2.4 Biosolids Monitoring

2.4.1 Dried Sludge Decant

An extensive review of record drawings does not indicate the existence of a lining in the current sludge drying area. On the basis of increased dredging beginning in the summer of 2020, the City will conduct a screening evaluation in the fall of 2020 and summer of 2021 along the riverbank to determine if there is an issue with decant infiltration from the sludge drying area. As the City continues to use the current sludge area for annual sludge drying, screening evaluation will continue along the riverbank while newly dredged solids are drying to determine if there is an issue. More extensive investigation will be performed if screening evaluations determine there is a potential issue.

2.5 Solids Disposal Alternative - Landfill Disposal

The PWWTF is not projected to run out of solids disposal space on-site within the planning horizon (25 years for the current disposal area). However, if future capacity issues do arise, or if other unforeseen considerations preclude disposal on-site, the backup plan is for solids disposal at the Matanuska Susitna Borough Central Landfill. Landfill disposal of solids generated at the Palmer WWTF would likely trigger the requirement for a DEC Permit.

2.5.1 Regulatory Considerations for Disposal of Solids at Landfill

Biosolids that are land filled or used as a cover material at a landfill are subject to federal requirements in 40 CFR Part 258. In addition, in order to co-dispose sewage solids with municipal solid waste at the CPL the following requirements described in 18 AAC 60.365 must be met:

1. The sewage solids must be free of hazardous wastes and polychlorinated biphenyls (PCBs) defined in 40 CFR 761.3.
2. The sewage solids must not contain "free liquids" as defined by EPA Method 9095 (Paint Filter Test).
3. The sewage solids must meet the vector reduction requirement in accordance with 40 CFR 503.33(b)(11); OR must be treated and stabilized to meet Class A or Class B pathogen reduction requirements in accordance with 40 CFR 503.32, AND vector

October 12, 2020 (Revised December 2, 2020) | 10

attraction reduction requirements of 40 CFR 503.33 (b)(1)-(10), as adopted by reference in 18 AAC 60.505.

Correspondence with ADEC in June of 2020 indicates that off-site disposal of solid would also trigger the requirement for a DEC Permit.

2.5.2 Landfill Disposal Cost

It is anticipated that the cost of disposal of solids at the landfill would be substantially greater than the cost of the current solids disposal on-site at the PWWTF. Additionally, it is anticipated that landfill disposal would be more operationally intensive than on-site disposal. For these reasons no specific cost analysis was developed for the landfill disposal alternative.

3 Summary and Recommended Plan

This document provides the Solids Management Plan for the Palmer WWTF. The analysis indicates that the current on-site solids drying area and disposal areas provide adequate capacity to meet Palmer's current and future needs. In the near term, it is recommended that the City continue to use the existing on-site sludge drying area west of Lagoon 3 to dry sludge. If desired, the sludge drying area can be subdivided, but sludge should be applied at depths no greater than six inches annually to promote optimal drying. Sludge should be dried for a one year period before applying lime, mixing with topsoil, and using as on-site fill. In the long term, it is recommended the City repurpose one of the existing lagoons to provide a fully lined location for on-site sludge dewatering and disposal.

This document additionally establishes a Biosolids Monitoring and Testing Plan that will be implemented in the summer of 2021.

This study lastly evaluates the alternative of sludge disposal at the Matanuska Susitna Borough Central Landfill. It was determined that this alternative would be more operationally intensive, more costly, and would trigger additional permitting requirements.

Appendix B. APDES Permit No. AK-002249

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

**Authorization to Discharge Under The
National Pollution Discharge Elimination System**

In compliance with the provisions of the Clean Water Act, 33 U.S.C. §1251 *et seq.*, as amended by the Water Quality Act of 1987, P.L. 100-4, the “Act”, the

**City of Palmer
Wastewater Treatment Plant**

is authorized to discharge from a facility located in Palmer, Alaska, at the following location:

| Outfall | Receiving Water | Latitude | Longitude |
|----------------|------------------------|-----------------|------------------|
| 001 | Matanuska River | 61° 33’ 30”N | 149° 06’ 20”W |

in accordance with the discharge point, effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective January 1, 2007

This permit and the authorization to discharge shall expire at midnight, December 31, 2011

The permittee shall reapply for a permit reissuance on or before May 4, 2011, 180 days before the expiration of this permit if the permittee intends to continue operations and discharges at the facility beyond the term of this permit.

Signed this 5th day of December, 2006,

 /s/ Michael F. Gearheard
Michael F. Gearheard, Director
Office of Water and Watersheds

TABLE OF CONTENTS

| | |
|---|-----------|
| Cover Sheet: Issuance and Expiration Dates | |
| Schedule of Submittals | 4 |
| I. Limitations and Monitoring Requirements..... | 4 |
| A. Discharge Authorization | 5 |
| B. Effluent Limitations and Monitoring | 5 |
| C. Schedule of Compliance | 8 |
| D. Whole Effluent Toxicity Testing Requirements | 8 |
| E. Surface Water Monitoring | 9 |
| II. Special Conditions..... | 11 |
| A. Operation and Maintenance | 11 |
| B. Quality Assurance Plan (QAP) | 12 |
| D. Pretreatment Requirements | 13 |
| E. Sludge Management Requirements | 14 |
| F. Signage..... | 14 |
| III. General Monitoring, Recording and Reporting Requirements..... | 15 |
| A. Representative Sampling (Routine and Non-Routine Discharges)..... | 15 |
| B. Reporting of Monitoring Results | 15 |
| C. Monitoring Procedures..... | 16 |
| D. Additional Monitoring by Permittee | 16 |
| E. Records Contents | 16 |
| F. Retention of Records..... | 17 |
| G. Twenty-four Hour Notice of Noncompliance Reporting..... | 17 |
| H. Other Noncompliance Reporting | 18 |
| I. Notice of New Introduction of Toxic Pollutants..... | 18 |
| J. Schedule of Compliance | 19 |

| | |
|--|-----------|
| IV. Compliance Responsibilities | 19 |
| A. Duty to Comply..... | 19 |
| B. Penalties for Violations of Permit Conditions | 19 |
| C. Need to Halt or Reduce Activity not a Defense..... | 21 |
| D. Duty to Mitigate..... | 21 |
| E. Proper Operation and Maintenance | 21 |
| F. Bypass of Treatment Facilities..... | 22 |
| G. Upset Conditions..... | 23 |
| H. Toxic Pollutants | 23 |
| I. Removed Substances | 23 |
| J. Planned Changes..... | 24 |
| K. Anticipated Noncompliance..... | 24 |
| V. General Provisions..... | 24 |
| A. Permit Actions | 24 |
| B. Duty to Reapply | 24 |
| C. Duty to Provide Information..... | 25 |
| D. Other Information | 25 |
| E. Signatory Requirements..... | 25 |
| F. Availability of Reports..... | 26 |
| G. Inspection and Entry | 26 |
| H. Property Rights | 27 |
| I. Transfers | 27 |
| J. State Laws..... | 27 |
| VI. Definitions..... | 28 |

The following table summarizes some of the action items the permittee must complete and/or submit to EPA/ADEC during the term of the permit:

| <u>Action Item</u> | <u>Due Date</u> |
|---|--|
| 1. Discharge Monitoring Reports (DMRs) | DMRs are due monthly and must be postmarked by the 15 th day of the month following the monitoring month (see Part III.B.). |
| 2. Operation and Maintenance (O&M) Plan | The Plan must be developed and implemented by March 30, 2007 (see Part II.A.). The Plan must be kept on site. |
| 3. Quality Assurance Plan (QAP) | The Plan must be developed and implemented by March 30, 2007(see Part II.B.). The Plan must be kept on site. |
| 4. Report of Progress | The Reports must be submitted by January 1, 2008, 2009, 2010 and 2011 (see Part I.C.). |
| 5. Ammonia Effluent Limits | Compliance with ammonia effluent limits must be achieved by November 31, 2011 (see Part I.C.). |
| 6. NPDES Application Renewal | The application must be submitted no later than May 4, 2011, or at least 180 days before expiration (see Part V.B.). |
| 7. Expanded Effluent Testing, Whole Effluent Toxicity (WET) Testing & Surface Water Monitoring Report | Reports must be submitted with the NPDES renewal application by July 4, 2011 (see Part I.B., C. & E). |
| 8. Update Industrial Waste Survey | Complete by July 3, 2007 (see Part II.C.) |

I. Limitations and Monitoring Requirements

A. Discharge Authorization

During the effective period of this permit, the permittee is authorized to discharge from outfall 001 to the Matanuska River, within the limits and subject to the conditions set forth herein. This permit authorizes the discharge of only those pollutants resulting from facility processes, waste streams, and operations that have been clearly identified in the permit application process.

B. Effluent Limitations and Monitoring

1. The permittee must limit and monitor discharges from outfall 001 as specified in Table 1 below. All figures represent maximum effluent limits unless otherwise indicated. The permittee must comply with the effluent limits at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.
2. The permittee must not discharge any floating solids, visible foam in other than trace amounts, oily wastes or petroleum hydrocarbons that produce a sheen, film or discoloration on the surface of the receiving water or adjoining shorelines.
3. Removal Requirements for BOD₅ and TSS: The monthly average effluent concentration for BOD₅ and TSS must not exceed 15 percent of the monthly average influent concentration. Percent removal of BOD₅ and TSS must be reported on the Discharge Monitoring Reports (DMRs). For each parameter, the monthly average percent removal must be calculated from the arithmetic mean of the influent concentration values and the arithmetic mean of the effluent concentration values measured during that month.
4. The permittee must collect influent samples from the influent stream prior to any treatment system and influent monitoring is required to be performed within same 24-hour period as effluent monitoring.
5. The permittee must collect effluent samples from the effluent stream after the last treatment unit prior to discharge into the receiving water.
6. Minimum Levels. For all effluent monitoring, the permittee must use methods that can achieve a minimum level (ML) less than the effluent limitation, to the extent practicable.
7. The permittee must report on the monthly DMR whether chlorine was added to the effluent for total or partial disinfection during the calendar month. If chlorine is added, the permittee must comply with the applicable conditional

residual chlorine effluent limits and monitoring requirements in Table 1.

8. The permittee must perform the expanded effluent testing required by Part D of NPDES application Form 2A (EPA Form 3510-2A, revised 1/99). The permittee must submit the results of this testing with its application for renewal of this NPDES permit. To the extent that effluent monitoring required by other conditions of this permit satisfies this requirement, these samples may be used to satisfy the requirements of this paragraph.

Table 1. Effluent and Influent Limits and Monitoring Requirements

| Parameter | Units | Effluent and Influent Limits | | | Monitoring Requirements | | |
|---|-----------------|------------------------------|----------------------|---------------------|--------------------------|-------------------------|----------------------------|
| | | Average Monthly Limit | Average Weekly Limit | Maximum Daily Limit | Monitoring Location | Monitoring Frequency | Sample Type |
| Ammonia (as N) ¹ | mg/L | 8.7 | --- | 18.5 | effluent | 1/week | grab |
| | lbs/day | 68.9 | --- | 146.6 | | | |
| Ammonia (as N) ¹ (July & August) | mg/L | 1.7 | --- | 3.6 | effluent | 1/week | grab |
| | lbs/day | 13.5 | --- | 28.5 | | | |
| BOD ₅ | mg/L | 30 | 45 | 60 | effluent and influent | 1/week | 24-hour timed composite |
| | lbs/day | 258 | 357 | 475 | | | |
| | % Removal | See I.B.3. | | | | | |
| DO | mg/L | ≥2 at all times | | | effluent | 1/month | grab |
| Fecal Coliform Bacteria ¹ | FC/100 mL | 100 ² | --- | 200 | effluent | 1/week | grab |
| Fecal Coliform Bacteria ¹ (July & August) | FC/100 mL | 20 ² | --- | 40 | effluent | 1/week | grab |
| Flow | mgd | --- | --- | 0.95 | effluent or influent | continuous | recording |
| pH | s.u. | 6.5-8.5 at all times | | | effluent | 5/week | grab |
| TSS | mg/L | 30 | 45 | 60 | effluent and influent | 1/week | 24-hour timed composite |
| | lbs/day | 258 | 357 | 475 | | | |
| | % Removal | See Part I.B.3. | | | | | |
| Residue ⁵ | --- | See Part I.B.2. | | | effluent | 1/week | visual |
| Petroleum Hydrocarbons ⁵ | --- | See Part I.B.2. | | | effluent | 1/week | visual |
| Total Residual Chlorine ^{1,3} | µg/L | 1.7 | --- | 3.4 | effluent | 2/week | grab |
| | lbs/day | 0.013 | --- | 0.027 | | | |
| Temperature | C° | --- | --- | --- | effluent | 5/week | grab |
| Whole Effluent Toxicity | TU _C | --- | --- | --- | effluent | 3x/5 years ⁴ | grab |

Table 1. Effluent and Influent Limits and Monitoring Requirements

| Parameter | Units | Effluent and Influent Limits | | | Monitoring Requirements | | |
|---------------------------|-------|------------------------------|----------------------|---------------------|-------------------------|-------------------------|-------------|
| | | Average Monthly Limit | Average Weekly Limit | Maximum Daily Limit | Monitoring Location | Monitoring Frequency | Sample Type |
| Expanded Effluent Testing | --- | --- | --- | --- | effluent | 3x/5 years ⁴ | grab |

Footnotes:

1. Reporting is required within 24-hours if the maximum daily limit is violated.
2. Based on the geometric mean of all samples taken in that month.
3. The effluent limits for chlorine is not quantifiable using EPA approved analytical methods. The permittee will be in compliance with the effluent limits provided the total chlorine residual is at or below the compliance evaluation or minimum level of 0.100 mg/L (100µg/L). Limit and monitoring requirements only apply when chlorine disinfection is being used.
4. To be performed in August 2007, May 2008 and January 2009. Expanded effluent testing and WET testing must occur on the same day, and results reported with the application for renewal.
5. Residue and petroleum hydrocarbon monitoring (see Part I.B.2.) must occur at Outfall 001.

C. Schedule of Compliance

1. The permittee must achieve compliance with ammonia limitations (September through June) of Part 1.B. (Table 1) by November 31, 2011. In the interim, the following ammonia effluent limitations must be met:

Average Monthly Limit: 34 mg/L (269 lbs/day)
Maximum Daily Limit: 71 mg/L (562 lbs/day)

2. Until compliance with the ammonia effluent limits are achieved, the permittee must submit annual Report of Progress which outlines the progress made towards reaching the compliance dates. A 1-year, 2-year, 3-year, and 4-year Report of Progress must be submitted by January 1, 2008, 2009, 2010 and 2011. At a minimum, the Reports of Progress must include:
 - a) An assessment of the previous 1 year of ammonia data, and a comparison to effluent limitations.
 - b) A discussion of progress made towards meeting the effluent limitations.
 - c) Further actions and milestones targeted for the upcoming year.

D. Whole Effluent Toxicity Testing Requirements

The permittee must conduct chronic toxicity tests on effluent samples from outfall 001. Testing must be conducted in accordance with subsections 1 through 4, below.

1. Toxicity testing must be conducted as grab sampling, and must be performed on the same day as expanded effluent testing.
2. Chronic Test Species and Methods
 - a) A total of three chronic tests must be conducted: in January 2008, May 2009 and August 2010.
 - b) The permittee must conduct short-term tests with the water flea, *Ceriodaphnia dubia* (survival and reproduction test), and the fathead minnow, *Pimephales promelas* (larval survival and growth test).
 - c) The presence of chronic toxicity must be determined as specified in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition, EPA/821-R-02-013, October 2002.
 - d) The permittee shall identify and report the following endpoints:
 - a. The no observable effect concentration (NOEC)
 - b. Chronic toxicity units (TU_C)
 - c. The IC₂₅
 - d. The LC₅₀
3. Quality Assurance
 - a) The toxicity testing on each organism must include a series of five test dilutions and a control. Dilution series must be selected in accordance with *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition, EPA/821-R-02-013, October 2002.
 - b) All quality assurance criteria and statistical analyses used for chronic tests and reference toxicant tests must be in accordance with *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition, EPA/821-R-02-013, October 2002, and individual test protocols.
 - c) In addition to those quality assurance measures specified in the

methodology, the following quality assurance procedures must be followed:

- (i) If organisms are not cultured in-house, concurrent testing with reference toxicants must be conducted. If organisms are cultured in-house, monthly reference toxicant testing is sufficient. Reference toxicant tests must be conducted using the same test conditions as the effluent toxicity tests.
- (ii) If either of the reference toxicant tests or the effluent tests do not meet all test acceptability criteria as specified in the test methods manual, the permittee must re-sample and re-test within 14 days of receipt of the test results.
- (iii) Control and dilution water must be receiving water or lab water, as appropriate, as described in the manual. If the dilution water used is different from the culture water, a second control, using culture water must also be used. Receiving water may be used as control and dilution water upon notification of EPA and ADEC. In no case shall water that has not met test acceptability criteria be used for either dilution or control.

4. Reporting

- a) The permittee must submit the results of the toxicity tests with the application for permit renewal, no later than July 4, 2011
- b) The report of toxicity test results must include all relevant information outlined in Section 10, Report Preparation, of *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition, EPA/821-R-02-013, October 2002. In addition to toxicity test results, the permittee must report: dates of sample collection and initiation of each test, flow rate at the time of sample collection, and the results of expanded effluent testing as required in Part I. B.

E. Surface Water Monitoring

The permittee must conduct surface water monitoring in accordance with the following requirements. Surface water monitoring must begin within 30 days after the effect date of the permit and continue until the next permit issuance becomes effective. The program must meet the following requirements:

1. Monitoring stations must be established in the Matanuska River at the following locations:

- a) one location upstream of Outfall 001 in the actual discharge channel.
 - b) two locations downstream of the discharge at the edge of the mixing zone (or as close to the edge of the mixing zone as is practical due to site and access limitations).
2. Monitoring stations must be approved in writing by ADEC.
 3. To the extent practicable, surface water sample collection must occur on the same day as effluent sample collection.
 4. The flow rate must be measured as near as practicable to the time that other ambient parameters are sampled.
 5. Samples must be analyzed for the parameters listed in Table 2, and must achieve MLs that are equivalent to or less than those listed in Table 2. The permittee may request different MLs. The request must be in writing and must be approved by EPA. Once approved, these MLs supersede the maximum MLs in Table 2.
 6. Quality assurance/quality control plans for all the monitoring must be documented in the Quality Assurance Plan required under Part II. B., "Quality Assurance Plan".
 7. All surface water monitoring results must be submitted to EPA and ADEC with the application for permit renewal no later than July 4, 2011. This data shall be submitted in both hard copy and electronic (i.e., spreadsheet) format. At a minimum, the report must include the following:
 - a) Date of sample collection and analyses.
 - b) Results of sample analysis.
 - c) Relevant quality assurance/quality control (QA/QC) information.

Table 2. Receiving Water Monitoring Requirements

| Parameter | Units | Sample Frequency | Sample Location | Sample Type | Maximum ML |
|---|-----------|---|---------------------------------------|-------------|------------|
| Ammonia, total (as N) | mg/L | 3/year ¹ | downstream ⁴ | grab | 0.05 |
| Ammonia, total (as N) | mg/L | 1/month for 2 years 1/3 month thereafter | upstream | grab | 0.05 |
| DO | mg/L | 3/year | downstream ⁴ | grab | --- |
| Fecal Coliform Bacteria (May 1 - September 31) | FC/100 mL | 1/month ^{6,7} | upstream & downstream ⁴ | grab | 1.0 |
| Fecal Coliform Bacteria (October 1 - April 30) | FC/100 mL | 3/6 months ^{2,7} | upstream & downstream ⁴ | grab | 1.0 |

Table 2. Receiving Water Monitoring Requirements

| Parameter | Units | Sample Frequency | Sample Location | Sample Type | Maximum ML |
|----------------------------------|------------------------|------------------------|------------------------------------|-------------|------------|
| Flow | mgd or cfs and ft/sec. | 1/month | upstream | grab | --- |
| Hardness (as CaCO ₃) | mg/L | 3/week ⁵ | downstream | grab | 10 |
| pH | s.u. | 3/year ³ | upstream & downstream ⁴ | grab | --- |
| Residue | --- | 1/quarter ⁸ | downstream ⁴ | visual | --- |
| Temperature | °C | 3/year ³ | upstream & downstream ⁴ | grab | --- |

Footnote:

- 1 This monitoring shall occur during the months of February, May, and August.
- 2 During the 6-month period from October 1 – April 30, a total of 3 samples shall be collected. Each sampling event shall be approximately every other month.
- 3 This monitoring must occur on the same day as ammonia ambient monitoring.
- 4 See Part I.E.1.b. and I.E.2.
- 5 Sampling shall be conducted for one week during the months of February 2007 and August 2007.
- 6 During the 6-month period from May 1 – September 31, a total of 3 samples shall be collected, one in each of the following months: May, June, and September.
- 7 Sampling may be discontinued after two years if the results indicate that Alaska Water Quality Standards have not been exceeded. Sampling must resume if the method of disinfection is changed, and may also be discontinued after two years if water quality standards have not been exceeded on the outside edge of the mixing zone.
- 8 Quarterly sampling shall occur during the months of February, May, August, and November.

II. Special Conditions

A. Operation and Maintenance

1. In addition to the requirements specified in Section III.E. of this permit (Proper Operation and Maintenance), by March 30, 2007, the permittee shall review its operation and maintenance (O&M) plan and ensure that it includes appropriate best management practices (BMPs); the plan must be reviewed annually thereafter. BMPs include measures which prevent or minimize the potential for the release of pollutants to the Matanuska River. The O&M Plan shall be retained on site and made available to EPA and ADEC upon request.
2. The permittee shall develop or update a description of pollution prevention measures and controls appropriate for the facility, and implement such controls. The appropriateness and priorities of controls in the O&M Plan shall reflect identified potential sources of pollutants at the facility. The description of BMPs shall address, to the extent practicable, the following minimum

components:

- a) Spill prevention and control;
- b) Optimization of chemical usage;
- c) Preventive maintenance program;
- d) Minimization of pollutant inputs from industrial users;
- e) Research, develop and implement a public information and education program to control the introduction of household hazardous materials to the sewer system; and
- f) Water conservation.

B. Quality Assurance Plan (QAP)

The permittee must develop a Quality Assurance Plan (QAP) for all monitoring required by this permit by March 30, 2007. Any existing QAP may be modified for use under this section. The QAP may be incorporated as part of the facilities O&M manual.

1. The QAP must be designed to assist in planning for the collection and analysis of effluent and receiving water samples in support of this permit and in explaining data anomalies when they occur.
2. Throughout all sample collection and data analysis activities, the permittee must use the EPA-approved QA/QC and chain-of-custody procedures described in *Requirements for Quality Assurance Project Plans* (EPA/QA/R-5) and *Guidance for Quality Assurance Project Plans* (EPA/QA/G-5). The QAP must be prepared in the format that is specified in these documents.
3. At a minimum, the QAP must include the following:
 - a) Details on the number of samples, type of sample containers, preservation of samples, holding times, analytical methods, analytical detection and quantitation limits for each target compound, type and number of quality assurance field samples, precision and accuracy requirements, sample preparation requirements, sample shipping methods, and laboratory data delivery requirements.
 - b) Map(s) indicating the location of each sampling point.
 - c) Qualification and training of personnel.
 - d) Names(s), address(es) and telephone number(s) of the laboratories used by or proposed to be used by the permittee.
4. The permittee is responsible for reviewing and updating the QAP to ensure all

material is still current and applicable.

5. The permittee must amend the QAP whenever there is a modification in sample collection, sample analysis, or other procedure addressed by the QAP.
6. Copies of the QAP shall be kept on site and shall be made available to EPA and/or ADEC upon request.

C. Pretreatment Requirements

1. The permittee must update the Sewer Use Ordinance to comply with current federal pretreatment regulations and guidance. A copy of the revised ordinance shall be kept on site and made available to EPA and/or ADEC upon request.
2. The permittee shall update the Industrial Waste Survey to ensure proper identification of non-domestic users subject to pretreatment standards. Such a survey shall be completed by July 3, 2007.
3. The permittee shall perform annual inspections, surveillance, and monitoring of non-domestic users to determine compliance with applicable pretreatment standards and requirements.
4. Under no circumstances shall the permittee allow introduction of the following wastes into the waste treatment system:
 - a) Wastes which will create a fire or explosion hazard in the treatment works;
 - b) Wastes which will cause corrosive structural damage to the treatment works, but in no case, wastes with a pH lower than 5.0, unless the works is designed to accommodate such wastes;
 - c) Solid or viscous substances in amounts which cause obstructions to the flow in sewers, or interference with the proper operation of the treatment works;
 - d) Wastewaters at a flow rate and/or pollutant discharge rate which is excessive over relatively short time periods so that there is a treatment process upset and subsequent loss of treatment efficiency;
 - e) Any pollutant, including oxygen demanding pollutants (e.g., BOD₅) released in a discharge of such volume or strength as to cause interference in the treatment works;

- f) Heat in amounts which inhibit biological activity in the treatment works resulting in interference, but in no case heat in such quantities that the temperature at the POTW exceeds 40 °C (104 °F) unless EPA Region 10, upon request of the POTW, approves alternate temperature limits;
 - g) Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through;
 - h) Wastes which result in the presences of toxic gases, vapors, or fumes within the treatment works in quantities that may cause acute worker health and safety problems; and
 - i) Any trucked or hauled pollutants, except at discharge points designated by the treatment works.
5. The permittee must require any industrial user of its treatment works to comply with any applicable requirements of Sections 204(b), 307, and 308 of the CWA, including any requirements established under 40 CFR § 403.
6. The permittee must require any industrial user of its treatment works to comply with applicable requirements in 40 CFR § 405 through 471.

D. Sludge Management Requirements

The permittee shall ensure that an updated biosolids permit application (Form 2S) is on file with the EPA.

E. Signage

1. **Outfall Location Signs.** The permittee must maintain a sign, or signs on the shoreline near the mixing zone and outfall line. The sign, or signs, shall:
- a) state that treated domestic wastewater is being discharged, the name and owner of the facility, and the approximate location and size of the mixing zone;
 - b) inform the public that certain activities, such as the harvesting of shellfish for raw consumption and contact recreation should not take place in the mixing zone; and
 - c) give a contact telephone number for additional information.

III. Monitoring, Recording and Reporting Requirements

A. Representative Sampling (Routine and Non-Routine Discharges)

Samples and measurements must be representative of the volume and nature of the monitored discharge.

In order to ensure that the effluent limits set forth in this permit are not violated at times other than when routine samples are taken, the permittee must collect additional samples at the appropriate outfall whenever any discharge occurs that may reasonably be expected to cause or contribute to a violation that is unlikely to be detected by a routine sample. The permittee must analyze the additional samples for those parameters limited in Part I.B. of this permit that are likely to be affected by the discharge.

The permittee must collect such additional samples as soon as the spill, discharge, or bypassed effluent reaches the outfall. The samples must be analyzed in accordance with paragraph III.C. (“Monitoring Procedures”). The permittee must report all additional monitoring in accordance with paragraph III.D. (“Additional Monitoring by Permittee”).

B. Reporting of Monitoring Results

1. Effluent Monitoring Results: The permittee must summarize effluent monitoring results from Part I.B (Table 1) each month on the Discharge Monitoring Report (DMR) from (EPA No. 3320-1) or equivalent. Monitoring results greater than the minimum detection level (MDL) shall be reported as the actual value measured and monitoring results less than the MDL shall be reported as “[MDL value]”. The permittee must submit reports monthly, postmarked by the 15th day of the following month. The permittee must sign and certify all DMRs, and all other reports, in accordance with the requirements of Part V.E. of this permit (“Signatory Requirements”). The permittee must submit the legible originals of these documents to the Director, Office of Compliance and Enforcement, with copies to ADEC at the following addresses:

U.S. EPA Region 10
Attn: PCS Data Entry Team
1200 Sixth Avenue, OCE-133
Seattle, Washington 98101

Alaska Department of Environmental Conservation
Division of Air and Water Quality
555 Cordova Street
Anchorage, Alaska 99503

- a) **Surface Water Monitoring Results:** The permittee must summarize the results of all surface water monitoring as outlined in Part I.E. (Table 2) in a report to be submitted along with the application for permit renewal no later than May 4, 2011. This information shall be provide in both hard copy and electronic spreadsheet form, and submitted to EPA at the following address:

U.S. EPA Region 10
Attn: NPDES Permits Unit Manager
1200 Sixth Avenue, OWW-133
Seattle, Washington 98101

A copy of the surface water monitoring results must also be provided to ADEC.

C. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR 136, unless other test procedures have been specified in this permit or approved by EPA as an alternate test procedure under 40 CFR 136.5.

D. Additional Monitoring by Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the permittee must include the results of this monitoring in the calculation and reporting of the data submitted on the DMR. Such increased frequency shall also be indicated.

Upon request by EPA, the permittee must submit results of any other sampling, regardless of the test method used.

E. Records Contents

Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;
2. The individual(s) who performed the sampling or measurements;
3. The date(s) analyses were performed;

4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

F. Retention of Records

1. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least five years from the date of the sample, measurement, report, or application. This period may be extended by request of the Director at any time. Data collected on-site, copies of DMRs, and a copy of this NPDES permit must be maintained on-site during the duration of activity at the permitted location.
2. The permittee is required under 40 CFR §503 to retain sludge records for a period of five years.

G. Twenty-four Hour Notice of Noncompliance Reporting

1. The permittee must report the following occurrences of noncompliance by telephone within 24 hours from the time the permittee becomes aware of the circumstances:
 - a) any noncompliance that may endanger health or the environment;
 - b) any unanticipated bypass that exceeds any effluent limitation in the permit (See Part IV.F., “Bypass of Treatment Facilities”);
 - c) any upset that exceeds any effluent limitation in the permit (See Part IV.G., “Upset Conditions”); or
 - d) any violation of a maximum daily discharge limitation for those toxic or hazardous pollutants identified within Table 1 of Part I.B.
 - e) any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limitation in the permit.
2. The permittee must also provide a written submission within five days of the time that the permittee becomes aware of any event required to be reported

under subpart 1 above. The written submission must contain:

- a) a description of the noncompliance and its cause;
 - b) the period of noncompliance, including exact dates and times;
 - c) the estimated time noncompliance is expected to continue if it has not been corrected; and
 - d) steps taken or planned to reduce, eliminate, and prevent re-occurrence of the noncompliance.
3. The Director of the Office of Compliance and Enforcement may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the NPDES Compliance Unit in Seattle, Washington, by phone, (206) 553-1846.
 4. Reports shall be submitted to the addresses in Part III.B (“Reporting of Monitoring Results”).

H. Other Noncompliance Reporting

The permittee must report all instances of noncompliance, not required to be reported within 24 hours, at the time that monitoring reports for Part III.B (“Reporting of Monitoring Results”) are submitted. The reports shall contain the information listed in Part III.G.2 of this permit (“Twenty-four Hour Notice of Noncompliance Reporting”).

I. Notice of New Introduction of Toxic Pollutants

The permittee must notify the Director of the Office of Water and Watersheds and ADEC of:

1. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to Sections 301 or 306 of the Act if it were directly discharging those pollutants; and
2. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.
3. For the purposes of this section, adequate notice must include information on:

- a) the quality and quantity of effluent to be introduced into the POTW, and
 - b) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.
4. The permittee must notify the Director of the Office of Water and Watersheds at the following address:

U.S. EPA Region 10
Attn: NPDES Permits Unit Manager
1200 6th Avenue, OWW-130
Seattle, WA 98101

J. Compliance Schedule

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit must be submitted no later than 14 days following each schedule date.

IV. Compliance Responsibilities

A. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action, for permit termination, revocation and reissuance, or modification, or for denial of a permit renewal application

B. Penalties for Violations of Permit Conditions

1. Civil and Administrative Penalties. Pursuant to 40 CFR Part 19 and the Act, any person who violates section 301, 302, 306, 307, 308, 318 or 405 of the Act, or any permit condition or limitation implementing any such sections in a permit issued under section 402, or any requirement imposed in a pretreatment program approved under sections 402(a)(3) or 402(b)(8) of the Act, is subject to a civil penalty not to exceed the maximum amounts authorized by Section 309(d) of the Act and the Federal Civil Penalties Inflation Adjustment Act (28 U.S.C. § 2461 note) as amended by the Debt Collection Improvement Act (31 U.S.C. § 3701 note) (currently \$32,500 per day for each violation).
2. Administrative Penalties. Any person may be assessed an administrative penalty by the Administrator for violating section 301, 302, 306, 307, 308, 318 or 405 of this Act, or any permit condition or limitation implementing any

of such sections in a permit issued under section 402 of this Act. Pursuant to 40 CFR 19 and the Act, administrative penalties for Class I violations are not to exceed the maximum amounts authorized by Section 309(g)(2)(A) of the Act and the Federal Civil Penalties Inflation Adjustment Act (28 U.S.C. § 2461 note) as amended by the Debt Collection Improvement Act (31 U.S.C. § 3701 note) (currently \$11,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed \$32,500). Pursuant to 40 CFR 19 and the Act, penalties for Class II violations are not to exceed the maximum amounts authorized by Section 309(g)(2)(B) of the Act and the Federal Civil Penalties Inflation Adjustment Act (28 U.S.C. § 2461 note) as amended by the Debt Collection Improvement Act (31 U.S.C. § 3701 note) (currently \$11,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed \$157,500).

3. Criminal Penalties.

- (a) Negligent Violations. The Act provides that any person who negligently violates sections 301, 302, 306, 307, 308, 318, or 405 of the Act, or any condition or limitation implementing any of such sections in a permit issued under section 402 of the Act, or any requirement imposed in a pretreatment program approved under section 402(a)(3) or 402(b)(8) of the Act, is subject to criminal penalties of \$2,500 to \$25,000 per day of violation, or imprisonment of not more than 1 year, or both. In the case of a second or subsequent conviction for a negligent violation, a person shall be subject to criminal penalties of not more than \$50,000 per day of violation, or by imprisonment of not more than 2 years, or both.
- (b) Knowing Violations. Any person who knowingly violates such sections, or such conditions or limitations is subject to criminal penalties of \$5,000 to \$50,000 per day of violation, or imprisonment for not more than 3 years, or both. In the case of a second or subsequent conviction for a knowing violation, a person shall be subject to criminal penalties of not more than \$100,000 per day of violation, or imprisonment of not more than 6 years, or both.
- (c) Knowing Endangerment. Any person who knowingly violates section 301, 302, 303, 306, 307, 308, 318 or 405 of the Act, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than \$250,000 or imprisonment of not more than 15 years, or both. In the case

of a second or subsequent conviction for a knowing endangerment violation, a person shall be subject to a fine of not more than \$500,000 or by imprisonment of not more than 30 years, or both. An organization, as defined in section 309(c)(3)(B)(iii) of the Act, shall, upon conviction of violating the imminent danger provision, be subject to a fine of not more than \$1,000,000 and can be fined up to \$2,000,000 for second or subsequent convictions.

(d) False Statements. The Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than \$10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than \$20,000 per day of violation, or by imprisonment of not more than 4 years, or both. The Act further provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

C. Need to Halt or Reduce Activity not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with this permit.

D. Duty to Mitigate

The permittee must take all reasonable steps to minimize, or prevent, any discharge, or sludge use or disposal, in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Proper Operation and Maintenance

The permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed, or used, by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or

auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

F. Bypass of Treatment Facilities

1. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 2 and 3 of this Part.
2. Notice.
 - a) Anticipated Bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Director, if possible, at least 10 days before the date of the bypass.
 - b) Unanticipated Bypass. The permittee shall submit notice of an unanticipated bypass as required under Part III.G (“Twenty-four Hour Notice of Noncompliance Reporting”).
3. Prohibition of bypass.
 - a) Bypass is prohibited and the Director of the Office of Compliance and Enforcement may take enforcement action against a permittee for a bypass, unless:
 - (i) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
 - (ii) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
 - (iii) The permittee submitted notices as required under paragraph 2 of this Part.
 - b) The Director of the Office of Compliance and Enforcement may approve an anticipated bypass, after considering its adverse effects, if the Director determined that it will meet the three conditions listed

above in paragraph 3.a. of this Part.

G. Upset Conditions

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of paragraph 2 of this Part are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.
2. Necessary upset demonstration conditions. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
 - a) An upset occurred and that the permittee can identify the cause(s) of the upset;
 - b) The permitted facility was at the time being properly operated;
 - c) The permittee submitted notice of the upset as required under Part III.G, "Twenty-four Hour Notice of Noncompliance Report;" and
 - d) The permittee complied with any remedial measures required under Part IV.D, "Duty to Mitigate."
3. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

H. Toxic Pollutants

The permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

I. Removed Substances

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

J. Planned Changes

The permittee must give notice to the Director of the Office of Water and Watersheds as specified in part III.I.3. and ADEC as soon as possible of any planned physical alterations or additions to the permitted facility whenever:

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source as determined in 40 CFR 122.29(b); or
2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are not subject to effluent limitations in this permit.
3. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application site.

K. Anticipated Noncompliance

The permittee shall give advance notice to the Director of the Office of Compliance and Enforcement and ADEC of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

V. General Provisions

A. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause as specified in 40 CFR 122.62, 122.64, or 124.5. The filing of a request by the permittee for a permit modification, revocation and reissuance, termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

B. Duty to Reapply

If the permittee intends to continue an activity regulated by this permit after the

expiration date of this permit, the permittee must apply for and obtain a new permit. In accordance with 40 CFR 122.21(d), and unless permission for the application to be submitted at a later date has been granted by the Regional Administrator, the permittee must submit a new application at least 180 days before the expiration date of this permit.

C. Duty to Provide Information

The permittee must furnish to EPA and ADEC, within the time specified in the request, any information that EPA or ADEC may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee must also furnish to EPA or ADEC, upon request, copies of records required to be kept by this permit.

D. Other Information

When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or that it submitted incorrect information in a permit application or any report to EPA or ADEC, it must promptly submit the omitted facts or corrected information.

E. Signatory Requirements

All applications, reports, or information submitted to EPA and ADEC must be signed and certified as follows.

1. All permit applications must be signed as follows:
 - c) For a corporation: by a responsible corporate officer.
 - d) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.
 - e) For a municipality, state, federal, Indian tribe, or other public agency: by either a principal executive officer or ranking elected official.
2. All reports required by the permit and other information requested by EPA or ADEC must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
 - a) The authorization is made in writing by a person described above;
 - b) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or

position having overall responsibility for environmental matters for the company; and,

c) The written authorization is submitted to the Director of the Office of Compliance and Enforcement and ADEC.

2. Changes to authorization. If an authorization under Part V.E.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part V.E.2. must be submitted to the Director of the Office of Compliance and Enforcement and ADEC prior to or together with any reports, information, or applications to be signed by an authorized representative.
3. Certification. Any person signing a document under this Part must make the following certification:

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations”.

F. Availability of Reports

In accordance with 40 CFR 2, information submitted to EPA pursuant to this permit may be claimed as confidential by the permittee. In accordance with the Act, permit applications, permits and effluent data are not considered confidential. Any confidentiality claim must be asserted at the time of submission by stamping the words “confidential business information” on each page containing such information. If no claim is made at the time of submission, EPA may take the information available to the public without further notice to the permittee. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR 2, Subpart B (Public Information) and 41 Fed. Reg. 36902 through 36924 (September 1, 1976), as amended.

G. Inspection and Entry

The permittee must allow the Director of the Office of Compliance and Enforcement, EPA Region 10; ADEC; or an authorized representative (including

an authorized contractor acting as a representative of the Administrator), upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

H. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to persons or property or invasion of other private rights, nor any infringement of federal, tribal, state or local laws or regulations.

I. Transfers

This permit is not transferable to any person except after notice to the Director of the Office of Water and Watersheds as specified in part III.I.3. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Act. (See 40 CFR 122.61; in some cases, modification or revocation and reissuance is mandatory).

J. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by section 510 of the Act.

VI. Definitions

1. “Act” means the Clean Water Act or the Federal Water Pollution Control Act, as Amended (33 U.S.C. 466 et seq.).
2. “ADEC” means the Alaska Department of Environmental Conservation.
3. “Average monthly discharge limitation” means the highest allowable average of “daily discharges” over a calendar month, calculated as the sum of all “daily discharges” measured during a calendar month divided by the number of “daily discharges” measured during that month.
4. “Average weekly discharge limitation” means the highest allowable average of “daily discharges” over a calendar week, calculated as the sum of all “daily discharges” measured during a calendar week divided by the number of “daily discharges” measured during that week.
5. “Best Management Practices” (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage areas.
6. “Bypass” means the intentional diversion of waste streams from any portion of a treatment facility.
7. “Chronic toxic unit” (“TUc”) is a measure of chronic toxicity. TUc is the reciprocal of the effluent concentration that causes no observable effect on the test organisms by the end of the chronic exposure period (i.e., $100/\text{“NOEC”}$ or $100/\text{“IC}_{25}$ ”).
8. “Categorical Industrial User (CIU)” is a discharger to a POTW which carries out specific categories of industrial activity identified in 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N.
9. “Daily discharge” means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the “daily discharge” is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in

other units of measurement, the “daily discharge” is calculated as the average measurement of the pollutant over the day.

10. “Director of the Office of Compliance and Enforcement” means the Director of the Office of Compliance and Enforcement, EPA Region 10, or an authorized representative.
11. “Director of the Office of Water and Watersheds” means the Director of the Office of Water and Watersheds, EPA Region 10, or an authorized representative.
12. “DMR” means discharge monitoring report
13. “Geometric mean” means the “n”th root of the product of “n” samples collected during the month, where n refers to the number of samples collected in the month.
14. “Grab” is a single sample or measurement taken at a specific time or over as short a period of time as is feasible.
15. “Inhibition concentration” (IC_p) is a point estimate of the toxicant concentration that causes a given percent reduction (p) in a non-quantal biological measurement (e.g., reproduction or growth) calculated from a continuous model (e.g., Interpolation Method).
16. “Maximum daily discharge limitation” means the highest allowable “daily discharge”.
17. “Method detection limit (MDL)” is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero as determined by a specific laboratory method (40 CFR 136).
18. “Minimum level (ML)” is the concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes and processing steps have been followed.
19. “NOEC means no observed effect concentration. The NOEC is the highest concentration of toxicant (e.g., effluent) to which organisms are exposed in a

chronic toxicity test [full life-cycle or partial life-cycle (short term) test], that causes no observable adverse effects on the test organisms (i.e., the highest concentration of effluent in which the values for the observed responses are not statistically significantly different from the controls).

20. "NPDES " means National Pollutant Discharge Elimination System, the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits . . . under sections 307, 402, 318, and 405 of the CWA.
21. "Pollutant", for the purposes of this permit, is an organic substance, an inorganic substance, a combination of organic and inorganic substances, or pathogenic organisms that, after discharge and upon exposure, ingestion, inhalation, or assimilation into an organism either directly from the environment or indirectly by ingestion through the food-chain, could, on the basis of information available to the Administrator of EPA, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunction in reproduction), or physical deformations in either organisms or offspring of the organisms.
22. "POTW means Publicly Owned Treatment Works, as defined at 40 CFR 403.3(o).
23. "Sewage sludge" means solid, semi-solid, or liquid residue generated during the treatment of domestic sewage and/or a combination of domestic sewage and industrial waste of a liquid nature in a Treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the incineration of sewage sludge or grit and screenings generated during preliminary treatment of domestic sewage in a Treatment Works. These must be disposed of in accordance with 40 CFR 258.
24. A "Significant Industrial User (SIU)" means a categorical industrial user that discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater), contributes a process wastestream that make up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW, or is designated as such by the Control Authority (the City of Palmer) as defined in 40 CFR 403.12(a) on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement. The Control Authority

has the option to determine an industrial user meeting the above criteria as a non-significant industrial user if the industrial user's discharge does not have reasonable potential to adversely affect the POTW's operation or violate any pretreatment standard or requirement.

25. A "24-hour composite" sample shall mean a flow-proportioned mixture of not less than eight discrete aliquots. Each aliquot shall be a grab sample of not less than 100 mL and shall be collected and stored in accordance with procedures prescribed in the most recent edition of *Standard Methods for the Examination of Water and Wastewater*.
26. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

APPENDIX D

Appendix D

Palmer Polymer Addition Study

Introduction

1. Palmer shall carry out both benchtop and full-scale studies to characterize the benefits of polymer addition to the MBBR effluent as it relates to the settleability of solids within Lagoon #2.
2. As part of the upgrade to the Palmer wastewater treatment plant, polymer addition equipment was installed; however, Palmer has not utilized this capability to-date.
3. Palmer is evaluating the possibility of (i) not constructing secondary clarification; (ii) relying upon the existing lagoons to effect solids removal, and (iii) relying upon enhanced lagoon solids removal practices to allow continuous compliance with all effluent permit limitations, including ammonia.
4. The intent of this polymer study is to determine if polymer addition to the MBBR effluent would allow for measurably more effective lagoon solids removal practices, by causing solids settling to occur in a smaller localized area of Lagoon #2. This may facilitate more efficient and frequent removal by dredging of solids from Lagoon # 2, and thus reduce the organic nitrogen available for digestion and potentially improve facility ammonia control.

Testing

Jar Testing

1. Palmer shall first utilize the process known as “jar testing.” Jar testing is a benchtop evaluation of polymer addition on MBBR effluent solids settling rates. Palmer shall complete this jar testing by September 30, 2020.
2. In general, for the jar testing, Palmer shall:
 - a. Utilize standard 6-cell/ gang mixer jar testing apparatus;
 - b. Carry out testing in general accordance with ASTM-2035;
 - c. Test at least four polymers, each across its manufacturer’s recommended dosage range;
 - d. Utilize visual observation, turbidity and TSS samples to quantify the relative performance of the various polymer-dosage combinations.
 - e. Employ a “blank” cell in each test, to allow assessment of the improvement in MBBR effluent settling rates.
3. Document the results of the benchtop jar test study in a report, to be submitted to EPA and DEC by October 30, 2020 for review and approval.

Full-scale Testing

4. Based upon the results of the benchtop study, carry out full-scale testing of the most promising polymer/dosage combination(s). This full-scale testing shall utilize (i) laboratory settleometer/settled sludge volume testing; and (ii) monthly sludge depth measurements to characterize the impact of the polymer on the solids accumulation pattern in Lagoon #2. Based on the schedule for implementation of the full-scale testing, Palmer will likely only be able to conduct sludge depth measurements in Lagoon #2 for 1-2 months before the end of 2020. Testing will not be performed when ice is on the lagoons due to safety concerns. Sludge depth measurement in Lagoon #2 will continue as is safe from December 2020 through March 2021 based on the ice conditions on the lagoon and will continue measurement in April 2021.
5. Establish a baseline for solids settling prior to starting full-scale testing.
6. Conduct settleometer testing at a single point at the Lagoon #2 influent, after the polymer has been added during full-scale testing on a frequency of 1 sample per week during the time period when there is ice build-up in the lagoon.
7. In general, for the settleometer testing, Palmer shall:
 - a. Utilize standard settleometer and paddle stirring device;
 - b. Carry out testing in general accordance with Standard Methods for Wastewater;
8. Document the results of the full-scale study in a report, to be provided to EPA and DEC by February 1, 2021 for review and approval. This report shall include the results of the study, sludge depth profiles, and settleometer readings as well as recommendations regarding use of polymer.
9. Incorporate approved recommendation into facility operations by February 28, 2021.

NOTICE TO PROCEED

Owner: _____ Owner's Contract No.: _____
Contractor: _____ Contractor's Project No.: _____
Engineer: _____ Engineer's Project No.: _____
Project: _____ Contract Name: _____
Effective Date of Contract: _____

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on _____, 20__.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, the date of Substantial Completion is _____, and the date of readiness for final payment is _____.

Before starting any Work at the Site, Contractor must comply with the following: (1) Provide the Owner and Engineer with copies of the Contractor's Safety Plan (2) Provide Owner and Engineer with the Contractor's Preliminary Schedule, Preliminary Schedule of Submittals.

Owner:

Authorized Signature

By:

Title:

Date Issued:

Copy: Engineer

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PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER; City of Palmer, Alaska 231 W Evergreen Avenue. Palmer, Alaska 99645:

CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description *(name and location)*:

BOND

Bond Number:

Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:

Amount:

Modifications to this Bond Form: None See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal *(seal)*

Surety's Name and Corporate Seal *(seal)*

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed

by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Definitions

14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims

for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:

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PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER : City of Palmer, Alaska, 231 W Evergreen Avenue. Palmer, Alaska 99645

CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description *(name and location)*:

BOND

Bond Number:

Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:

Amount:

Modifications to this Bond Form: None See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

(seal)
Contractor's Name and Corporate Seal

(seal)
Surety's Name and Corporate Seal

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond shall arise after the following:
 - 5.1 Claimants who do not have a direct contract with the Contractor,
 - 5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
 - 5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).
 - 5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
 - 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
 - 7.2 Pay or arrange for payment of any undisputed amounts.
 - 7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.
8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.
16. **Definitions**
 - 16.1 **Claim:** A written statement by the Claimant including at a minimum:
 1. The name of the Claimant;
 2. The name of the person for whom the labor was done, or materials or equipment furnished;
 3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
 4. A brief description of the labor, materials, or equipment furnished;
 5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
 6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
 7. The total amount of previous payments received by the Claimant; and
 - 16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
 - 16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
 - 16.4 **Owner Default:** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
 - 16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.
17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.
18. Modifications to this Bond are as follows:
 8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

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Contractor's Application for Payment No.

| | | |
|-----------------------|---------------------------|-------------------------|
| | Application Period: | Application Date: |
| To (Owner): | From (Contractor): | Via (Engineer): |
| Project: | Contract: | |
| Owner's Contract No.: | Contractor's Project No.: | Engineer's Project No.: |

**Application For Payment
Change Order Summary**

| Approved Change Orders | Number | Additions | Deductions | | |
|--------------------------------|--------|-----------|------------|--|----------|
| | | | | 1. ORIGINAL CONTRACT PRICE..... | \$ _____ |
| | | | | 2. Net change by Change Orders..... | \$ _____ |
| | | | | 3. Current Contract Price (Line 1 ± 2)..... | \$ _____ |
| | | | | 4. TOTAL COMPLETED AND STORED TO DATE (Column F total on Progress Estimates)..... | \$ _____ |
| | | | | 5. RETAINAGE: | |
| | | | | a. X Work Completed..... | \$ _____ |
| | | | | b. X Stored Material..... | \$ _____ |
| | | | | c. Total Retainage (Line 5.a + Line 5.b)..... | \$ _____ |
| | | | | 6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5.c)..... | \$ _____ |
| | | | | 7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)..... | \$ _____ |
| | | | | 8. AMOUNT DUE THIS APPLICATION..... | \$ _____ |
| | | | | 9. BALANCE TO FINISH, PLUS RETAINAGE (Column G total on Progress Estimates + Line 5.c above)..... | \$ _____ |
| TOTALS | | | | | |
| NET CHANGE BY CHANGE ORDERS | | | | | |

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;

(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all Liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such Liens, security interest, or encumbrances); and

(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor Signature

By: _____ Date: _____

Payment of: \$ _____
(Line 8 or other - attach explanation of the other amount)

is recommended by: _____ (Date) _____
(Engineer)

Payment of: \$ _____
(Line 8 or other - attach explanation of the other amount)

is approved by: _____ (Date) _____
(Owner)

Approved by: _____ (Date) _____
Funding or Financing Entity (if applicable)

Progress Estimate - Unit Price Work

Contractor's Application

| For (Contract): | | | | | | | | Application Number: | | | |
|---------------------|-------------|----------------------|-------|------------|--------------------------|------------------------------|---------------------------------|---------------------------------------|--|-----------|---------------------------|
| Application Period: | | | | | | | | Application Date: | | | |
| A | | | | | | B | C | D | E | F | |
| Item | | Contract Information | | | | Estimated Quantity Installed | Value of Work Installed to Date | Materials Presently Stored (not in C) | Total Completed and Stored to Date (D + E) | % (F / B) | Balance to Finish (B - F) |
| Bid Item No. | Description | Item Quantity | Units | Unit Price | Total Value of Item (\$) | | | | | | |
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CERTIFICATE OF SUBSTANTIAL COMPLETION

| | |
|-------------|---------------------------|
| Owner: | Owner's Contract No.: |
| Contractor: | Contractor's Project No.: |
| Engineer: | Engineer's Project No.: |
| Project: | Contract Name: |

This [preliminary] [final] Certificate of Substantial Completion applies to:

- All Work The following specified portions of the Work:

Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

Amendments to Owner's responsibilities: None
 As follows

Amendments to Contractor's responsibilities: None
 As follows:

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract.

| | | | | | |
|------------------------|------------------------------|------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| EXECUTED BY ENGINEER: | | RECEIVED: | | RECEIVED: | |
| By: _____ | By: _____ | By: _____ | By: _____ | By: _____ | By: _____ |
| (Authorized signature) | Owner (Authorized Signature) | Owner (Authorized Signature) | Contractor (Authorized Signature) | Contractor (Authorized Signature) | Contractor (Authorized Signature) |
| Title: _____ | Title: _____ | Title: _____ | Title: _____ | Title: _____ | Title: _____ |
| Date: _____ | Date: _____ | Date: _____ | Date: _____ | Date: _____ | Date: _____ |

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by



Issued and Published Jointly by



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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

| | Page |
|--|-------------|
| Article 1 – Definitions and Terminology | 1 |
| 1.01 Defined Terms | 1 |
| 1.02 Terminology | 5 |
| Article 2 – Preliminary Matters..... | 6 |
| 2.01 Delivery of Bonds and Evidence of Insurance | 6 |
| 2.02 Copies of Documents | 6 |
| 2.03 Before Starting Construction | 6 |
| 2.04 Preconstruction Conference; Designation of Authorized Representatives | 7 |
| 2.05 Initial Acceptance of Schedules | 7 |
| 2.06 Electronic Transmittals..... | 7 |
| Article 3 – Documents: Intent, Requirements, Reuse | 8 |
| 3.01 Intent..... | 8 |
| 3.02 Reference Standards | 8 |
| 3.03 Reporting and Resolving Discrepancies | 8 |
| 3.04 Requirements of the Contract Documents | 9 |
| 3.05 Reuse of Documents | 10 |
| Article 4 – Commencement and Progress of the Work | 10 |
| 4.01 Commencement of Contract Times; Notice to Proceed | 10 |
| 4.02 Starting the Work..... | 10 |
| 4.03 Reference Points | 10 |
| 4.04 Progress Schedule | 10 |
| 4.05 Delays in Contractor’s Progress | 11 |
| Article 5 – Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions | 12 |
| 5.01 Availability of Lands | 12 |
| 5.02 Use of Site and Other Areas | 12 |
| 5.03 Subsurface and Physical Conditions..... | 13 |
| 5.04 Differing Subsurface or Physical Conditions | 14 |
| 5.05 Underground Facilities | 15 |

| | | |
|---|--|----|
| 5.06 | Hazardous Environmental Conditions at Site..... | 17 |
| Article 6 – Bonds and Insurance | | 19 |
| 6.01 | Performance, Payment, and Other Bonds | 19 |
| 6.02 | Insurance—General Provisions | 19 |
| 6.03 | Contractor’s Insurance | 20 |
| 6.04 | Owner’s Liability Insurance | 23 |
| 6.05 | Property Insurance..... | 23 |
| 6.06 | Waiver of Rights | 25 |
| 6.07 | Receipt and Application of Property Insurance Proceeds | 25 |
| Article 7 – Contractor’s Responsibilities | | 26 |
| 7.01 | Supervision and Superintendence | 26 |
| 7.02 | Labor; Working Hours | 26 |
| 7.03 | Services, Materials, and Equipment..... | 26 |
| 7.04 | “Or Equals” | 27 |
| 7.05 | Substitutes | 28 |
| 7.06 | Concerning Subcontractors, Suppliers, and Others | 29 |
| 7.07 | Patent Fees and Royalties | 31 |
| 7.08 | Permits | 31 |
| 7.09 | Taxes | 32 |
| 7.10 | Laws and Regulations..... | 32 |
| 7.11 | Record Documents..... | 32 |
| 7.12 | Safety and Protection..... | 32 |
| 7.13 | Safety Representative | 33 |
| 7.14 | Hazard Communication Programs | 33 |
| 7.15 | Emergencies | 34 |
| 7.16 | Shop Drawings, Samples, and Other Submittals..... | 34 |
| 7.17 | Contractor’s General Warranty and Guarantee..... | 36 |
| 7.18 | Indemnification | 37 |
| 7.19 | Delegation of Professional Design Services | 37 |
| Article 8 – Other Work at the Site | | 38 |
| 8.01 | Other Work | 38 |
| 8.02 | Coordination | 39 |
| 8.03 | Legal Relationships..... | 39 |

| | |
|---|----|
| Article 9 – Owner’s Responsibilities..... | 40 |
| 9.01 Communications to Contractor..... | 40 |
| 9.02 Replacement of Engineer | 40 |
| 9.03 Furnish Data | 40 |
| 9.04 Pay When Due..... | 40 |
| 9.05 Lands and Easements; Reports, Tests, and Drawings | 40 |
| 9.06 Insurance..... | 40 |
| 9.07 Change Orders..... | 40 |
| 9.08 Inspections, Tests, and Approvals..... | 41 |
| 9.09 Limitations on Owner’s Responsibilities | 41 |
| 9.10 Undisclosed Hazardous Environmental Condition..... | 41 |
| 9.11 Evidence of Financial Arrangements..... | 41 |
| 9.12 Safety Programs | 41 |
| Article 10 – Engineer’s Status During Construction..... | 41 |
| 10.01 Owner’s Representative..... | 41 |
| 10.02 Visits to Site..... | 41 |
| 10.03 Project Representative..... | 42 |
| 10.04 Rejecting Defective Work..... | 42 |
| 10.05 Shop Drawings, Change Orders and Payments..... | 42 |
| 10.06 Determinations for Unit Price Work | 42 |
| 10.07 Decisions on Requirements of Contract Documents and Acceptability of Work | 42 |
| 10.08 Limitations on Engineer’s Authority and Responsibilities..... | 42 |
| 10.09 Compliance with Safety Program..... | 43 |
| Article 11 – Amending the Contract Documents; Changes in the Work | 43 |
| 11.01 Amending and Supplementing Contract Documents | 43 |
| 11.02 Owner-Authorized Changes in the Work | 44 |
| 11.03 Unauthorized Changes in the Work | 44 |
| 11.04 Change of Contract Price | 44 |
| 11.05 Change of Contract Times | 45 |
| 11.06 Change Proposals | 45 |
| 11.07 Execution of Change Orders..... | 46 |
| 11.08 Notification to Surety..... | 47 |
| Article 12 – Claims..... | 47 |

| | | |
|--------------|---|----|
| 12.01 | Claims | 47 |
| Article 13 – | Cost of the Work; Allowances; Unit Price Work..... | 48 |
| 13.01 | Cost of the Work | 48 |
| 13.02 | Allowances | 50 |
| 13.03 | Unit Price Work | 51 |
| Article 14 – | Tests and Inspections; Correction, Removal or Acceptance of Defective Work..... | 52 |
| 14.01 | Access to Work..... | 52 |
| 14.02 | Tests, Inspections, and Approvals | 52 |
| 14.03 | Defective Work..... | 53 |
| 14.04 | Acceptance of Defective Work..... | 53 |
| 14.05 | Uncovering Work | 53 |
| 14.06 | Owner May Stop the Work | 54 |
| 14.07 | Owner May Correct Defective Work..... | 54 |
| Article 15 – | Payments to Contractor; Set-Offs; Completion; Correction Period | 55 |
| 15.01 | Progress Payments | 55 |
| 15.02 | Contractor’s Warranty of Title | 58 |
| 15.03 | Substantial Completion | 58 |
| 15.04 | Partial Use or Occupancy | 59 |
| 15.05 | Final Inspection | 59 |
| 15.06 | Final Payment..... | 59 |
| 15.07 | Waiver of Claims | 61 |
| 15.08 | Correction Period | 61 |
| Article 16 – | Suspension of Work and Termination | 62 |
| 16.01 | Owner May Suspend Work | 62 |
| 16.02 | Owner May Terminate for Cause | 62 |
| 16.03 | Owner May Terminate For Convenience | 63 |
| 16.04 | Contractor May Stop Work or Terminate | 63 |
| Article 17 – | Final Resolution of Disputes | 64 |
| 17.01 | Methods and Procedures | 64 |
| Article 18 – | Miscellaneous | 64 |
| 18.01 | Giving Notice | 64 |
| 18.02 | Computation of Times..... | 64 |
| 18.03 | Cumulative Remedies | 64 |

| | | |
|-------|-------------------------------|----|
| 18.04 | Limitation of Damages | 65 |
| 18.05 | No Waiver | 65 |
| 18.06 | Survival of Obligations | 65 |
| 18.07 | Controlling Law | 65 |
| 18.08 | Headings..... | 65 |

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
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 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer

has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.
27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.
38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:*
 1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. *Day:*
 1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:*
 1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).
- E. *Furnish, Install, Perform, Provide:*
 1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:
 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or

computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

- A. Standards Specifications, Codes, Laws and Regulations
 - 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 - 2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

- A. *Reporting Discrepancies:*
 - 1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict,

error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 2. abnormal weather conditions;
 3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.

- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

- 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
- 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part

by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading of Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
 - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 - 3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:
1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or
 2. is of such a nature as to require a change in the Drawings or Specifications; or
 3. differs materially from that shown or indicated in the Contract Documents; or
 4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

- c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
 1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
 2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after

becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Possible Price and Times Adjustments:*
 - 1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
 - d. Contractor gave the notice required in Paragraph 5.05.B.
 - 2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 - 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

- A. *Reports and Drawings*: The Supplementary Conditions identify:
1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
 2. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.
- H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.
- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.
- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is

maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

- A. *Workers' Compensation:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
 - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
 - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

4. Foreign voluntary worker compensation (if applicable).
- B. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
 2. claims for damages insured by reasonably available personal injury liability coverage.
 3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- C. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage:
 - a. Such insurance shall be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Broad form property damage coverage.
 4. Severability of interest.
 5. Underground, explosion, and collapse coverage.
 6. Personal injury coverage.
 7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
 8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- D. *Automobile liability:* Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.
- E. *Umbrella or excess liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. *Contractor's pollution liability insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result

of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.
- I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:
 - 1. include at least the specific coverages provided in this Article.
 - 2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
 - 3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
 - 4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
 - 5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

- A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
 - 1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
 - 2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
 - 3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
 - 4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.
 11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.
- C. *Deductibles:* The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance:* If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:
 - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the

policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and

guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 "Or Equals"

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) it has a proven record of performance and availability of responsive service; and
 - 4) it is not objectionable to Owner.
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor's Expense:* Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

- D. *Effect of Engineer's Determination:* Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
 - 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
 - 2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 - 3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - a. shall certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design,
 - 2) be similar in substance to that specified, and
 - 3) be suited to the same use as that specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from that specified, and

- 2) available engineering, sales, maintenance, repair, and replacement services.
- d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- E. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination:* If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

- O. Nothing in the Contract Documents:
1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - 1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
 - C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
 - D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
 - E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
 - F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
 - G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or

exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements:*

1. Before submitting a Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.
3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

- a. Contractor shall submit the number of copies required in the Specifications.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples:*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.
3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- D. *Engineer's Review:*
 1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
 4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.
 5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
 6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
 7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal;
 6. the issuance of a notice of acceptability by Engineer;
 7. any inspection, test, or approval by others; or
 8. any correction of defective Work by Owner.

- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. an itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. the extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.
- C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

- D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during

or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 - 1. *Change Orders:*
 - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
 - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
 - 2. *Work Change Directives:* A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an

adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
 3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on

the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

- C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
 2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 Execution of Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and
 4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 *Claims*

- A. *Claims Process:* The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
 - 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 - 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
 - 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. *Submittal of Claim:* The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation:*
 - 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
 - 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim

submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:
 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable

thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes

other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
- 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
- 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee:* When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

- B. *Cash Allowances*: Contractor agrees that:
 - 1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:
 - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 Access to Work

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 Tests, Inspections, and Approvals

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 - 3. by manufacturers of equipment furnished under the Contract Documents;
 - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will

include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments:*
1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
 2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.
- C. *Review of Applications:*
1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
 2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

- a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
- a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
- a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
- a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

- e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due:*

- 1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner:*

- 1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. the Contract Price has been reduced by Change Orders;
 - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
 - j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - l. there are other items entitling Owner to a set off against the amount recommended.
- 2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount

remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.
 - 2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

- A. *Application for Payment:*
 - 1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of

inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation,

including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such other adjacent areas;
 - 2. correct such defective Work;
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
 - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses,

and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for

expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this Article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
 - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this Article, Owner or Contractor may:
 - 1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or
 - 2. agree with the other party to submit the dispute to another dispute resolution process; or
 - 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

SUPPLEMENTARY CONDITIONS

Prepared by



Issued and Published Jointly by



This **Supplementary Conditions** has been prepared for use with the Standard General Conditions of the Construction Contract (EJCDC® C-700, 2013 Edition). Their provisions are interrelated and a change in one may necessitate a change in the other. The suggested language contained in the **Guide to the Preparation of Instructions to Bidders** (EJCDC® C-200, 2013 Edition) is also carefully integrated with the suggested language of this document. The full EJCDC Construction series of documents is discussed in the **Commentary on the 2013 EJCDC Construction Documents** (EJCDC® C-001, 2013 Edition).

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National Society of Professional Engineers
1420 King Street, Alexandria, VA 22314-2794
(703) 684-2882
www.nspe.org

American Council of Engineering Companies
1015 15th Street N.W., Washington, DC 20005
(202) 347-7474
www.acec.org

American Society of Civil Engineers
1801 Alexander Bell Drive, Reston, VA 20191-4400
(800) 548-2723
www.asce.org

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TABLE OF CONTENTS

| | Page |
|--|-------------|
| ARTICLE 1 – DEFINITIONS AND TERMINOLOGY | 1 |
| SC- 1.01 Defined Terms..... | 1 |
| ARTICLE 2 – PRELIMINARY MATTERS | 2 |
| SC- 2.02 Copies of Documents | 2 |
| ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE..... | 3 |
| SC- 3.01 Intent..... | 3 |
| ARTICLE 4-COMMENCEMENT AND PROGRESS OF THE WORK..... | 3 |
| SC-4.01 Commencement of Times: Notice to Proceed..... | 3 |
| ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS..... | 4 |
| SC- 5.03 Subsurface and Physical Conditions..... | 4 |
| SC- 5.06 Hazardous Environmental Conditions | 5 |
| ARTICLE 6 – BONDS AND INSURANCE..... | 5 |
| SC- 6.02 Insurance—General Provisions | 5 |
| SC- 6.03 Contractor’s Insurance..... | 5 |
| SC- 6.05 Property Insurance..... | 7 |
| ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES..... | 8 |
| SC- 7.01 Supervision and Superintendence | 8 |
| SC- 7.02 Labor; Working Hours | 8 |
| SC- 7.03 Services, Materials, and Equipment..... | 9 |
| SC- 7.04 “Or Equals” | 9 |
| SC- 7.05 Substitutes | 9 |
| SC- 7.06 Concerning Subcontractors, Suppliers and Others | 10 |
| SC- 7.08 Permits | 10 |
| SC- 7.09 Taxes | 10 |
| SC- 7.19 Delegation of Professional Services..... | 11 |
| SC- 7.20 Quality Control..... | 11 |
| ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION..... | 12 |
| SC- 10.03 Project Representative..... | 12 |
| ARTICLE 11 – Amending the COntract Documents; Changes in the Work | 16 |
| SC- 11.04 Change of Contract Price | 16 |
| SC- 11.07 Execution of Change Orders | 16 |
| ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK..... | 17 |
| SC- 13.01 Cost of the Work | 17 |
| SC- 13.02 Allowances | 17 |
| SC- 13.03 Unit Price Work..... | 18 |
| ARTICLE 14 – TESTS AND INSPECTIONS: CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK..... | 18 |
| SC- 14.02 Tests, Inspections and Approvals..... | 18 |
| ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD | 19 |
| SC- 15.01.B Progress Payments..... | 19 |
| SC- 15.02 Contractor’s Warranty of Title | 20 |
| SC- 15.03 Substantial Completion..... | 20 |
| SC- 15.07 Waiver of Claims | 20 |

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES 21

 SC- 17.02 Arbitration..... 21

 SC- 17.03 Attorneys’ Fees 22

ARTICLE 19 – federal requirements 22

 SC- 19.01 Agency Not a Party..... 22

 SC- 19.02 Contract Approval..... 22

 SC- 19.03 Conflict of Interest 22

 SC- 19.04 Gratuities..... 23

 SC- 19.05 Audit and Access to Records..... **Error! Bookmark not defined.**

 SC- 19.06 Small, Minority, and Women's Businesses 23

 SC- 19.07 Anti-Kickback..... 23

 SC- 19.08 Clean Air and Pollution Control Acts..... 24

 SC- 19.09 State Energy Policy..... **Error! Bookmark not defined.**

 SC- 19.10 Equal Opportunity Requirements 24

 SC- 19.11 Restrictions on Lobbying 24

 SC- 19.12 Environmental Requirements 24

I. SUPPLEMENTARY CONDITIONS

A. *Caption and Introductory Statements*

Supplementary Conditions

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC® C-700 (2013 Edition). All provisions that are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC-1.01 Defined Terms

SC-1.01. Add to the list of definitions in Paragraph 1.01.A by inserting the following as numbered items in their proper alphabetical positions:

Geotechnical Baseline Report (GBR) — The interpretive report prepared by or for Owner regarding subsurface conditions at the Site, and containing specific baseline geotechnical conditions that may be anticipated or relied upon for bidding and contract administration purposes, subject to the controlling provisions of the Contract, including the GBR's own terms. The GBR is a Contract Document.

Geotechnical Data Report (GDR) — The factual report that collects and presents data regarding actual subsurface conditions at or adjacent to the Site, including Technical Data and other geotechnical data, prepared by or for Owner in support of the Geotechnical Baseline Report. The GDR's content may include logs of borings, trenches, and other site investigations, recorded measurements of subsurface water levels, the results of field and laboratory testing, and descriptions of the investigative and testing programs. The GDR does not include an interpretation of the data. If opinions, or interpretive or speculative non-factual comments or statements appear in a document that is labeled a GDR, such opinions, comments, or statements are not operative parts of the GDR and do not have contractual standing. Subject to that exception, the GDR is a Contract Document.

SC-1.01.A.8 Add the following language at the end of the last sentence of Paragraph 1.01.A.8:

The Change Order Form to be used on this Project is EJCDC C-941. Agency approval is required before Change Orders are Effective.

SC-1.01.A.48 Add the following language at the end of the last sentence of Paragraph 1.01.A.48:

A Work Change Directive cannot change Contract Price or Contract Times without a subsequent Change Order.

- SC-1.01.A.49** Add the following new Paragraph after Paragraph 1.01.A.49:
- Abnormal Weather Conditions-** Conditions of extreme or unusual weather for a given region, elevation, or season as determined by the Engineer. Extreme or unusual weather that is typical for a given region, elevation or season shall not be considered Abnormal Weather Conditions.
- SC-1.01.A.50** Add the following new Paragraph at the end of the last sentence of Paragraph 1.01.A.49:
- Agency-** the Project is financed in whole or in part by USDA Rural Utilities Service pursuant to the Consolidated Farm and Rural Development Act (7 USC Section 1921 et seq.) The Rural Utilities Service programs are administered through the USDA Rural Development Offices; therefore, the Agency for these documents is USDA Rural Development.
- SC-1.01.A.51** Add the following new Paragraph at the end of the last sentence of Paragraph 1.01.A.50:
- Manufacturer’s Certification** letter is documentation provided by the manufacturer, supplier, distributor, vendor, fabricator, etc. to various entities stating that the American Iron and Steel products to be used in the project are produced in the United States in accordance with American Iron and Steel requirements. Refer to Manufacturer’s Certification Letter provided in these Contract Documents.
- SC-1.01.A.52** Add the following new Paragraph at the end of the last sentence of Paragraph 1.01.A.51:
- AIS** - refers to requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. The term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

ARTICLE 2 – PRELIMINARY MATTERS

SC-2.02 Copies of Documents

- SC-2.02.A.** Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor five copies of the Contract Documents (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF).

- SC-2.02** Add the following new paragraph immediately after Paragraph 2.02.B:

Conformed documents incorporate and integrate Addenda and amendments negotiated prior to the Effective Date of the Contract. The conformed documents are produced for the convenience of the user and are not binding on the Owner nor do conformed documents take the place of the Contract Documents.

- SC-2.05.A. Before Starting Construction:** Add the following language to the end of 2.05.A:

2.05.A.4 A preliminary schedule of payments showing projected cash flow over the duration of the Project.

ARTICLE SC-2.06.B. DELETE PARAGRAPH 2.06.B AND REPLACE IT WITH THE TERM (DELETED).3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

SC-3.01 Intent

SC-3.01 Add the following language at the end of Paragraph 3.01.A:

The Order of Precedence of the Contract Documents shall be a stated in the Agreement.

SC-3.01 Add the following new paragraphs immediately after Paragraph 3.01.E:

- F. The Specifications may vary in form, format and style. Some specification sections are written in varying degrees of streamlined or declarative style and some sections may be relatively narrative by comparison. Omissions of such words and phrases as "the Contractor shall," "in conformity with," "as shown," or "as specified" are intentional in streamlined sections. Omitted words and phrases shall be supplied by inference. Similar types of provisions may appear in various parts of a section or articles within a part depending on the format of the section. The Contractor shall not take advantage of any variation of form, format or style in making claims for extra Work.**
- G. The cross referencing of specification sections under the subparagraph heading "Related Sections include but are not necessarily limited to:" and elsewhere within each specification section is provided as an aid and convenience to the Contractor. The Contractor shall not rely on the cross referencing provided and shall be responsible to coordinate the entire Work under the Contract Documents and provide a complete Project whether or not the cross referencing is provided in each section or whether or not the cross referencing is complete.**

ARTICLE 4-COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.01 Commencement of Times: Notice to Proceed

SC-4.01.A Amend the last sentence of Paragraph 4.01.A by striking out the following words:

In no event will Contract Times commence to run later than the sixtieth day after the Bid opening or the thirtieth day after the Effective Date of the Contract, whoever date is earlier.

SC-4.05.C.2 Amend Paragraph 4.05.C.2 by striking out the following text: “abnormal weather conditions;” and inserting the following text:

Abnormal Weather Conditions;

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

SC-5.03 Subsurface and Physical Conditions

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.B:

- C. The following reports of explorations and tests of subsurface conditions at or adjacent to the Site are known to Owner:**
- 1. Report dated *October 2016, prepared by Shannon & Wilson, Consulting Engineers, Consulting Engineers, AK., entitled: “Palmer WWTP Improvements Report”, consisting of 33 pages.* The Technical Data contained in such report upon whose accuracy Contractor may rely are those indicated in the definition of Technical Data in the General Conditions.**
 - 2. Report dated *April 6, 2009, prepared by HDL, Engineering Consultants, Inc., Anchorage, AK., entitled: “Geotechnical Report, WWTP Subsurface Discharge System”, consisting of 39 pages.* The Technical Data contained in such report upon whose accuracy Contractor may rely are as indicated in the definition of Technical Data in the General Conditions.**
- D. The following drawings of physical conditions relating to existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities) are known to Owner:**
- 1. Drawings dated *April, 1984, prepared by Datum Engineering & Surveying, PO Box 500, Palmer, AK, entitled: “City of Palmer Sewage Lagoon Expansion”, consisting of 7 sheets numbered 1 to 7, inclusive.***
 - 2. Drawings dated *April, 1988, prepared by NHawthorne Engineering, 7127 Old Seward Highway, Anchorage, Alaska, entitled: “City of Palmer Sewage Treatment Plant 1988 Improvements”, consisting of 6 sheets numbered 1 to 6, inclusive.***
 - 3. Drawings dated *November, 1988, prepared by Datum Engineering and Surveying, PO Box 500 Anchorage, Alaska, entitled: “City of Palmer Sewage Outfall Line”, consisting of 14 sheets numbered 1 to 14, inclusive.***
 - 4. Drawings dated *February 2002, prepared by LCMF, Anchorage, Alaska, entitled: “City of Palmer Wastewater Treatment Plant Improvements”, consisting of 52 sheets numbered 1 to 52, inclusive.***
 - 5. Drawings dated *June 2017, prepared by HDR, Anchorage, Alaska, entitled: “City of Palmer Wastewater Treatment Facility Improvements Project – 2017 – Conformed Documents”, consisting of 119 sheets numbered 1 to 119, inclusive.***
- E. Upon request, given a minimum of 3 days advance notice, Contractor may examine copies of reports and drawings identified in SC 5.03.C and SC 5.03.D**

that were not included with the Bidding Documents at City of Palmer City Hall, Palmer, Alaska during regular business hours, or may request copies from Engineer.

SC-5.06 Hazardous Environmental Conditions

SC 5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:

- A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.**
- B. The Contractor's Scope of Work:**
 - 1. The Contractor's scope of Work shall include implementation of all necessary safety, public health and environmental procedures and requirements relating to sanitary sewage encountered during the work.**
 - 2. The Contractor's Scope of Work shall include necessary environmental requirements for handling and disposal of Asbestos Pipe removed from service or excavated during the course of the Work.**

ARTICLE 6 – BONDS AND INSURANCE

SC-6.02 Insurance—General Provisions

SC-6.02 Add the following language at the end of Paragraph 6.02.A:

“Surety and Insurance companies from which the bonds and insurance for this Project are purchased shall possess a financial strength rating of at least A- and a financial size category of VII or higher from A.M. or an equivalent rating service, in addition to the other requirements specified herein.

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

- 1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.**

SC-6.03 Contractor's Insurance

SC 6.03 Add the following new paragraph immediately after Paragraph 6.03.I.5:

6. Ensure Contractor provides the Owner with the valid Certificate of Insurance and amendatory endorsements or copies of the applicable policy language affecting coverage, in advance of the performance of any work and as soon as possible, prior to or upon renewal, exhibiting coverage as required by the Contract and the Supplementary Conditions.

SC 6.03 Add the following new paragraph immediately after Paragraph 6.03.J:

- K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:**

1. **Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:**

| | |
|--|---------------------|
| State: | <u>Statutory</u> |
| Federal, if applicable (e.g., Longshoreman's): | <u>Statutory</u> |
| Jones Act coverage, if applicable: | |
| Bodily injury by accident, each accident | \$ <u>Statutory</u> |
| Bodily injury by disease, aggregate | \$ <u>Statutory</u> |
| Employer's Liability: | |
| Bodily injury, each accident | \$ <u>1,000,000</u> |
| Bodily injury by disease, each employee | \$ <u>1,000,000</u> |
| Bodily injury/disease aggregate | \$ <u>1,000,000</u> |
| For work performed in monopolistic states, stop-gap liability coverage shall be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of: | \$ <u>1,000,000</u> |
| Foreign voluntary worker compensation | <u>Statutory</u> |

2. **Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:**

| | |
|---|---------------------|
| General Aggregate | \$ <u>5,000,000</u> |
| Products - Completed Operations Aggregate | \$ <u>5,000,000</u> |
| Personal and Advertising Injury | \$ <u>1,000,000</u> |
| Each Occurrence (Bodily Injury and Property Damage) | \$ <u>5,000,000</u> |

3. **Automobile Liability under Paragraph 6.03.D. of the General Conditions:**

| | |
|--------------------------|---------------------|
| Combined Single Limit of | \$ <u>2,000,000</u> |
|--------------------------|---------------------|

4. **Excess or Umbrella Liability:**

| | |
|-------------------|---------------------|
| Per Occurrence | \$ <u>2,000,000</u> |
| General Aggregate | \$ <u>2,000,000</u> |

5. Contractor's Pollution Liability:

| | |
|-------------------|---------------------|
| Each Occurrence | \$ <u>2,000,000</u> |
| General Aggregate | \$ <u>2,000,000</u> |

If box is checked, Contractor is not required to provide Contractor's Pollution Liability insurance under this Contract

6. Additional Insureds: In addition to Owner and Engineer, include as additional insureds the following:

- a) City of Palmer, Alaska, 231 W Evergreen Ave, Palmer, Alaska 99645
- b) HDR, Inc, 2525 C Street, Suite 500, Anchorage, Alaska, 99503-2632
- c) CRW Engineering, Inc3940 Arctic Blvd #300, Anchorage, AK 99503
- d) Shannon & Wilson, Inc, 5430 Fairbanks St #3, Anchorage, Alaska
- e) Materials Testing Firm hired by the Owner

7. Contractor's Professional Liability:

| | |
|------------------|---------------------|
| Each Claim | \$ <u>2,000,000</u> |
| Annual Aggregate | \$ <u>2,000,000</u> |

SC-6.05 Property Insurance

SC-6.05.A. Delete Paragraph 6.05.A of the General Conditions and substitute the following in its place:

Contractor shall provide and maintain installation floater insurance for property under the care, custody, or control of Contractor. The installation floater insurance shall be a broad form or "all risk" policy providing coverage for all materials, supplies, machinery, fixtures, and equipment that will be incorporated into the Work. Coverage under the Contractor's installation floater will include:

1. any loss to property while in transit,
2. any loss at the Site, and
3. any loss while in storage, both on-site and off-site.

Coverage cannot be contingent on an external cause or risk, or limited to property for which the Contractor is legally liable. The Contractor will be solely responsible for any deductible carried under this coverage and claims on materials, supplies, machinery, fixture, and equipment that will be incorporated into the Work while in transit or in storage. This policy will include a waiver of subrogation applicable to Owner, Contractor, Engineer, all Subcontractors, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them.

ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES

SC-7.01 *Supervision and Superintendence*

SC-7.01.B. Amend Paragraph 7.01.B to add the following sentences: “The Contractor shall identify their representative at the Site that shall have authority to act on behalf of Contractor. All communications given to or received from this representative shall be binding on Contractor. Any replacement proposed by the Contractor for the Contractor’s superintendent shall be a competent superintendent and shall be subject to the approval of the Owner. The Contractor’s superintendent shall be present at the site at all times while Work is in progress and shall be available by phone for emergencies 24 hours a day, 7 days per week. If at any time the superintendent leaves the Project Site while Work is in progress, the Engineer and Owner shall be notified and provided with the name and contact information for the Contractor’s representative having responsible charge.”

SC-7.01.C. Add the following new paragraph immediately after Paragraph 7.01.B:

Any superintendent or other personnel, who repeatedly fails to follow the Engineer’s or Owner’s written or oral orders, directions, instructions, or determinations, shall be subject to removal from the project. Upon the written request of the Engineer, the Contractor shall immediately remove such superintendent or other personnel and name a replacement in writing. Noncompliance with the Engineer’s request to remove and replace personnel at any level shall be grounds for terminating the Contract.

SC-7.02 *Labor; Working Hours*

SC-7.02.B. Add the following new subparagraphs immediately after Paragraph 7.02.B:

1. Regular working hours will be between 7:00 a.m. and 5:00 p.m., excluding Saturdays and Sundays and legal holidays
2. Owner's legal holidays are:
 - New Year’s Day
 - Washington’s Birthday (3rd Monday in February)
 - Memorial Day (Last Monday in May)
 - Veteran’s Day
 - Thanksgiving (4th Thursday in November)
 - Christmas Day

SC-7.02.C. Add the following new paragraph immediately after Paragraph 7.02.B:

Contractor shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer’s services (including those of the Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-7.02.C. Add the following new subparagraph immediately after Paragraph 7.02.C:

1. For purposes of administering the foregoing requirement, Engineer's labor costs shall be estimated average of \$150 per hour, additional overtime costs shall include expenses for materials, equipment, supplies, transportation and subsistence as actual cost plus a 10 percent markup.

SC-7.03 Services, Materials, and Equipment

SC-7.03.B. Add the following new subparagraphs immediately after Paragraph 7.03.B:

1. Where the Work requires equipment be furnished, due to the lack of standardization of equipment as produced by the various manufacturers, it may become necessary to make minor modifications in the structures, buildings, piping, mechanical work, electrical work, accessories, controls, or other work, to accommodate the particular equipment offered. Contractor's bid price for any equipment offered shall include the cost of making any necessary changes subject to the approval of Engineer.

SC-7.03.d. Add the following new sentence as 7.03.d:

1. All iron and steel products must meet American Iron and Steel requirements.

SC-7.04 "Or Equals"

SC-7.04.A Amend the third sentence of Paragraph 7.04.A by striking out the following words:

Unless the specification or description contains or is followed by words reading that no like, equivalent, 'or equal' item is permitted.

SC-7.04.A.1 Amend the last sentence of Paragraph a.3 by striking out "and" and adding a period at the end of Paragraph a.3.

SC-7.04.A.1 Delete Paragraph 7.06.A.1.a.4 in it's entirety and insert the following in its place:

"(Deleted)"

SC-7.04.B.1 Add 7.04.B.1:

Contractor shall include a Manufacturer's Certification letter for compliance with American Iron and Steel requirements in support data, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents. In addition, for the Deminimis Waiver, Contractor shall maintain an itemized list of incidental components and ensure that the cost is less than 5% of total materials cost for project; for the Minor Components Waiver, the Contractor shall maintain a list of products to which the minor components waiver applies and the cost of the non-domestically produced component is less than 5% of total materials cost of that product.

SC-7.05 Substitutes

SC- 7.05.A.3.a.4 Add 7.05.A.3.a.4:

4) comply with American Iron and Steel by providing Manufacturer's Certification letter of American Iron and Steel compliance, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

SC-7.05.D Add the following paragraph after Paragraph 7.05.D: Reimbursement rates for the Engineer or their officers, directors, members, partners, employees, agents, and other consultants and subcontractors for evaluation of proposed substitutes shall be on the basis established in Paragraph 15.01.E.4 of these Supplementary Conditions.

SC-7.06 Concerning Subcontractors, Suppliers and Others

SC-7.06.A Amend Paragraph 7.06.A by adding the following text to the end of the Paragraph:

The Contractor shall not award work valued at more than 50 percent of the Contract Price to Subcontractor (s), without written approval of the Owner.

SC-7.06.B Delete Paragraph 7.06.B in its entirety and insert the following in its place:

“(Deleted)”

SC-7.06.E Amend the second sentence of Paragraph 7.06.E by striking out “Owner may also require the Contractor to retain specific replacements; provided, however, that”

SC-7.08 Permits

SC-7.08 Add the following paragraph and subparagraphs after Paragraph 7.8.A:

This Facility is located outside of the Palmer, Alaska City Limits and permitting is administered by the Matanuska-Susitna Borough. Contractor shall obtain and be responsible for all permits including the Building Permit, Mechanical Permit, Plumbing Permit and Electrical Permit for the Work. The Owner shall pay the costs for the Building Permit, Mechanical Permit, Plumbing Permit and Electrical Permit, and associated plan check fees for the Work

SC-7.08. Add a new paragraph immediately after Paragraph GC-7.08A. which is to read as follows:

"B. In those instances where a certificate of occupancy must be obtained before the Work under this Contract can be occupied and placed into service by Owner, it shall be the responsibility of Contractor to arrange, coordinate, and pay any costs of obtaining said certificate."

SC-7.09 Taxes

SC 7.09 Add a new paragraph immediately after Paragraph 7.09.A:

B. Owner is exempt from payment of sales and compensating use taxes of the State of Alaska and of cities and counties thereof on all materials to be incorporated into the Work.

1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.

2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

SC-7.11 Record Documents

SC 7.11.A Modify 7.11.A by inserting the following after "written interpretations and clarifications,":

Manufacturers' Certification letter is documentation provided by the manufacturer, supplier, distributor, vendor, fabricator, etc. to various entities stating that the iron and steel products to be used in the project are produced in the United States in accordance with American Iron and Steel Requirements. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

SC-7.16 Shop Drawings, Samples, and Other Submittals

SC 7.16.A.1.e Add 7.16.A.1.e:

e. obtained Manufacturer's Certification letter for any item in the submittal subject to American Iron and Steel requirements and include the Certificate in the submittal. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

SC 7.16.D.9 Add 7.16.D.9:

Engineer's review and approval of Shop Drawing or Sample shall include review of compliance with American Iron and Steel requirements, as applicable.

SC-7.17 Contractor's General Warranty and Guarantee

SC 7.17.E Add 7.17.E:

Contractor shall certify upon Substantial Completion that all Work and Materials has complied with American Iron and Steel requirements as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. Contractor shall provide said Certification to Owner. Refer to General Contractor's Certification Letter provided in these Contract Documents.

SC-7.19 Delegation of Professional Services

SC 7.19 Add a new Article immediately after Article 7.19.:

SC-7.20 Quality Control

SC 7.20 A. Contractor shall provide quality control, which shall include the initial and subsequent inspections of the Contractor's Work to ensure that the Work conforms to the Contract Documents.

B. Contractor shall designate the person responsible for the Contractor's Quality Control while Work is in Progress, and shall notify the Engineer, in writing, prior to any change in quality control representative assignment.

SC-7.12 *Safety and Protection*

SC-7.12 Insert the following after the second sentence of Paragraph 7.12.C:

The following Owner safety programs are applicable to the Work: *[here expressly identify by title and/or date, any such Owner safety programs].*

ARTICLE 8 – OTHER WORK AT THE SITE

SC-8.02 *Coordination*

SC-8.02 Delete Paragraph 8.02.A in its entirety and replace with the following:

- A. Owner intends to contract with others for the performance of other work at or adjacent to the Site.**
- 1. City of Palmer shall have authority and responsibility for coordination of the various contractors and work forces at the Site;**
 - 2. The following specific matters are to be covered by such authority and responsibility:** *Installation of a second blower within the existing Control Building scheduled to be completed June 2021-September 2021*
 - 3. The extent of such authority and responsibilities is:** *Installation of blower equipment including electrical, instrumentation, process piping and associated work in the area within in and immediately outside the existing Control Building.*

ARTICLE 9 – OWNER’S RESPONSIBILITIES

SC-9.13 *Owner’s Site Representative*

SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

SC-9.13 Owner will furnish an “Owner’s Site Representative” to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Owner’s Site Representative is not Engineer’s consultant, agent, or employee. Owner’s Site Representative will be *[Here identify individual or entirety]*. The authority and responsibilities of Owner’s Site Representative follow: *[Here describe the duties and activities of the Owner’s Site Representative]*

ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION

SC-10.03 *Project Representative*

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.A:

- B. The Resident Project Representative (RPR) will be Engineer's representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.**
- 1. General: RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall**

generally communicate with Owner only with the knowledge of and under the direction of Engineer.

2. **Schedules:** Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.
3. **Conferences and Meetings:** Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.
4. **Liaison:**
 - a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
 - b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
 - c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.
5. **Interpretation of Contract Documents:** Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.
6. **Shop Drawings and Samples:**
 - a. Record date of receipt of Samples and Contractor-approved Shop Drawings.
 - b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.
 - c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.
7. **Modifications:** Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.
8. **Review of Work and Rejection of Defective Work:**
 - a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed

Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

9. Inspections, Tests, and System Start-ups:

- a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.
- b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.

10. Records:

- a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.
- b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.
- c. Maintain records for use in preparing Project documentation.

11. Reports:

- a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.
- b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.
- c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

13. **Certificates, Operation and Maintenance Manuals:** During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.
14. **Completion:**
 - a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.
 - b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.
 - c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.

C. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

SC-10.10 American Iron and Steel

SC 10.10.A Add 10.10.A American Iron and Steel:

- A. "Services required to determine and certify that to the best of the Engineer's knowledge and belief all iron and steel products referenced in engineering analysis, the Plans, Specifications, Bidding Documents, and associated Bid

Addenda requiring design revisions are either produced in the United States or are the subject of an approved waiver and services required to determine to the best of the engineer's knowledge and belief that approved substitutes, equals, and all iron and steel products proposed in the shop drawings, Change Orders and Partial Payment Estimates are either produced in the United States or are the subject of an approved waiver under Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017).

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

SC-11.04 Change of Contract Price

SC 11.04 Add the following new paragraph after Paragraph 11.04.C:

D. In the event the Contractor submits a request for additional compensation as a result of a Change or Differing Site Condition, or as a result of delays, acceleration, or loss of productivity, the Owner reserves the right, upon written request, to audit and inspect the Contractor's books and records relating to the Project. Upon written request for an audit, the Contractor shall make its books and records available with in 14 days of request. Owner shall specifically designate identity of the auditor. As part of the audit, Contractor shall make available its books and records relating to the Project, including but not limited too the Bidding Documents, cost reports, payroll records, material invoices, subcontracts, purchase orders, daily timesheets, and daily diaries. The Audit shall be limited to those cost items which are sought by the Contractor in a Change Order or Claim submission to the Owner.

SC-11.06 Change Proposals

SC 11.06 Modify 11.06.A.1 by inserting the following sentence after “within 15 days after the submittal of the Change Proposal.”:

Include supporting data (name of manufacturer, city and state where the product was manufactured, description of product, signature of authorized manufacturer's representative) in the Manufacturer's Certification Letter, as applicable.

SC-11.07 Execution of Change Orders

SC 11.07.C Add the following new paragraph after Paragraph 11.07.B:

All Contract Change Orders must be concurred in by the Agency before they are effective.

ARTICLE 12 – CLAIMS

12.01 Claims

SC-12.01.B Delete Paragraph 12.01.B in its entirety and replace with the following:

B. SUBMITTAL OF A CLAIM: WRITTEN NOTICE STATING THE GENERAL NATURE OF EACH CLAIM SHALL BE DELIVERED BY THE CLAIMANT TO ENGINEER AND THE OTHER PARTY TO THE CONTRACT PROMPTLY (BUT NO EVENT LATER THAN 10 DAYS) AFTER THE START OF THE EVENT GIVING RISE THERETO. THE RESPONSIBILITY TO SUBSTANTIATE A CLAIM SHALL REST WITH THE PARTY MAKING THE CLAIM. NOTICE OF THE AMOUNT OR EXTENT OF THE CLAIM, WITH SUPPORTING DATA SHALL BE DELIVERED TO THE ENGINEER AND THE OTHER PARTY TO THE CONTRACT WITHIN 20 DAYS AFTER THE START OF SUCH EVENT (UNLESS ENGINEER ALLOWS ADDITIONAL TIME FOR CLAIMANT TO SUBMIT ADDITIONAL OR MORE ACCURATE DATA IN SUPPORT OF SUCH CLAIM). A CLAIM FOR AN ADJUSTMENT IN CONTRACT TIMES SHALL BE PREPARED IN ACCORDANCE WITH THE PROVISION OF PARAGRAPH 11.01.B. EACH CLAIM SHALL BE ACCOMPANIED BY CLAIMANT'S WRITTEN STATEMENT THAT THE ADJUSTMENT CLAIMED IS THE ENTIRE ADJUSTMENT TO WHICH THE CLAIMANT BELIEVES IT IS ENTITLED AS A RESULT OF SAID EVENT. THE OPPOSING PARTY SHALL SUBMIT ANY RESPONSE TO ENGINEER AND THE CLAIMANT

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC-13.01 Cost of the Work

SC 13.01.B.5.c Delete Paragraph 13.01.B.5.c in its entirety and insert the following in its place:

c. Construction Equipment and Machinery:

- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.**
- 2) Costs for equipment and machinery owned by Contractor will be paid at a rate shown for such equipment in the Rental Rate Blue Book. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than \$1,000 will be considered small tools.**

SC-13.02 Allowances

SC 13.02.C Delete Paragraph 13.02.C in its entirety and insert the following in its place:

“(Deleted)”

SC-13.03 Unit Price Work

SC-13.03.B. Amend Paragraph 13.03.B to add the following sentences: “Progress estimates serve only as basis for partial payments. The Engineer may revise progress estimates and/or quantities any time before final acceptance. If the Engineer deems it proper to do so, changes may be made in progress estimates and in the final estimate.”

SC-13.03.C. Amend Paragraph 13.03.C to add the following sentences: “Work described in the Contract Documents, or reasonably inferred as required for a functionally complete installation, but not identified in the listing of unit price items, shall be considered incidental to unit price work listed and the cost of incidental work included as a part of the unit price.”

SC 13.03.E Delete Paragraph 13.03.E in its entirety and insert the following in its place:

- E. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:**
- 1. if the extended price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 15 percent from the estimated quantity of such item indicated in the Agreement; and**
 - 2. if there is no corresponding adjustment with respect to any other item of Work; and**
 - 3. if Contractor believes that Contractor has incurred additional expense as a result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, Owner may make a Claim, seeking an adjustment in the Contract Price.**

ARTICLE 14 – TESTS AND INSPECTIONS: CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

SC-14.02 Tests, Inspections and Approvals

SC 14.02 Add the following language at the end of Paragraph 14.02.A

“Contractor shall establish an inspection program and a testing plan acceptable to the Engineer and shall maintain complete inspection and testing records and make these available to the Engineer upon Written request”

SC 14.02.B Delete Paragraph 14.02.B and its subparagraphs in their entirety and replace with the following:

B. The Owner shall employ and pay for the services of an independent testing laboratory or the Engineer to perform all inspections, tests, or approvals required by the Contract Documents to satisfy the Special Inspections requirements of the International Building Code (IBC) adopted by the City.

Contractor shall pay for all other inspections, tests, or approvals required by the Contract Documents, including:

1. Inspections, Tests or approvals covered by Paragraph 14.02.C and 14.02. D.
2. Costs incurred with connections of tests or inspections conducted pursuant to Paragraph 14.05 and
3. As otherwise specifically noted in the Contract Documents.

SC - 14.03 Defective Work

14.03.D. Add the following language and subparagraphs at the end of Paragraph 14.03.D:

Tests required by Contract Documents to be performed by Contractor and that require test certificates be submitted to Owner or Engineer for acceptance shall be made by an independent testing laboratory or agency licensed or certified in accordance with Laws and Regulations and applicable state and local statutes. In the event state license or certification is not required, testing laboratories or agencies shall meet following applicable requirements:

1. Basic requirements of ASTM E329, Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials as Used in Construction and ASTM D3666, Standard Specification for Minimum Requirements for Agency Testing and Inspecting Bituminous Paving Materials, as applicable.
2. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

14.03.G. Add Paragraph 14.03.G:

G. Installation of Materials that are non-compliant with American Iron and Steel requirements shall be considered defective work.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

SC-15.01 Progress Payments

SC-15.01.B Amend the second Paragraph 15.01.B.1 by striking out the following text: “a bill of sale, invoice, or other.”

SC 15.01.B.3 Add the following at the end of Paragraph 15.01.B.3:

Not payments shall be made that would deplete the retainage, place in escrow any funds that are required for retainage, or invest the retainage for the Benefit of the Contractor.

SC 15.01.B.4 Add the following after Paragraph 15.01.B.3:

4. By submitting Materials for payment, Contractor is certifying that the submitted Materials are compliant with American Iron and Steel requirements. Manufacturer’s Certification letter for Materials satisfy this certification. Refer to Manufacturer’s Certification Letter provided in these Contract Documents. The Application for Payment Form to be used on this

Project is EJCDC C0620. The Agency must approve all Applications for Payment before Payment is made.

SC 15.01.C.2.d Add Paragraph 15.01.C.2.d:

d. the Materials presented for payment comply with American Iron and Steel.

SC 15.01.D.1 Delete Paragraph 15.01.D.1 in its entirety and insert the following in its place:

The Application for Payment with the Engineer's recommendations will be presented to the Owner and Agency for consideration. If both the Owner and Agency find the application for Payment acceptable, the recommended amount less any reduction under provisions of Paragraph 15.01.E shall become due twenty (20) days after the receipt of the Application for Payment is presented to the Owner, the Owner shall make payment to the Contractor.

SC-15.02 Contractor's Warranty of Title

SC 15.02.A Amend Paragraph 15.02.A by striking out the following text: " no later than seven days after the time of payment by the Owner and insert "no later than the time of payment by the Owner"

SC-15.03 Substantial Completion

SC 15.03.A Modify 15.03.A by adding the following after the last sentence:

Services required to determine and certify that to the best of the Contractor's knowledge and belief all substitutes, equals, and all iron and steel products proposed in the shop drawings, Change Orders and Partial Payment Estimates, and those installed for the project are either produced in the United States or are the subject of an approved waiver under Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference.

SC 15.03.B Add the following new subparagraph to Paragraph 15.03.B:

- 1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.**

SC-15.07 Waiver of Claims

SC-15.07.B. Amend Paragraph 15.07.B to state "The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner and/or Engineer other than those pending matters that have been duly submitted or appealed under the provisions of Article 17."

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

SC-17.02 Arbitration

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

SC-17.02 Arbitration

- A. All matters subject to final resolution under this Article will be decided by arbitration in accordance with the rules of Construction Industry Arbitration Rules of the American Arbitration Association, subject to the conditions and limitations of this paragraph. This agreement to arbitrate and any other agreement or consent to arbitrate entered into will be specifically enforceable under the prevailing law of any court having jurisdiction.**
- B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitrator or arbitration provider, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in this Article, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event shall any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations. The demand for arbitration should include specific reference to Paragraph SC-17.02.D below.**
- C. No arbitration arising out of or relating to the Contract shall include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:
 - 1. the inclusion of such other individual or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration; and**
 - 2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration and which will arise in such proceedings.****
- D. The award rendered by the arbitrator(s) shall be consistent with the agreement of the parties, in writing, and include a concise breakdown of the award, and a written explanation of the award specifically citing the Contract provisions deemed applicable and relied on in making the award.**
- E. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.**
- F. The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor.**

SC-17.03 *Attorneys' Fees*

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

SC-17.02 Attorneys' Fees: For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

Add Article 19 titled "Federal Requirements"

ARTICLE 19 – FEDERAL REQUIREMENTS

SC-19.01 *Agency Not a Party*

SC- 19.01 Add the following language as Paragraph 19.01 with the title "Agency Not a Party"

A. This Contract is expected to be funded in part with the funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees is a party to this Contract.

SC-19.02 *Contract Approval*

SC - 19.02 Add the following sections after Article 19.02 with the title "Contract Approval":

- A.** Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the following "Certificate of Owners' Attorney" (Attachment C-A) before Owner submits the executed Contract Documents to Agency for approval.
- B.** Concurrence by Agency in the award of the Contract is required before the Contract is effective.

SC-19.03 *Conflict of Interest*

SC-19.03 Add the following language after Article 19.02.B with the title "Conflict of Interest".

- A.** Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has financial interest in Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or Subcontractors.

SC-19.04 *Gratuities*

SC-19.04 Add the following language after Article 19.03.A with the title “Gratuities”.

- A. If the Owner finds after a notice and hearing that Contractor, or any of Contractor’s agents or representatives, offered or gave gratuities (in terms of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which the Owner bases such findings shall be an issue and may be reviewed in proceedings under dispute resolution provisions of this Contract.**
- B. In the event this Contract is terminated as provided in Paragraph 19.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by the Owner) which shall not be less than three nor more than ten times the costs Contractor incurs providing any such gratuities to any such officer or employee.**

SC-19.05 *Small, Minority, and Women's Businesses*

SC-19.05 Add the following language after Article 19.04.B with the title “Small, Minority, and Women’s Businesses”.

- A. If Contractor intends to let any subcontracts for a portion of the work, Contractor shall take affirmative steps to assure that small, minority and women’s businesses are used when possible as sources of supplies, equipment, construction, and services. Affirmative steps shall consist of: (1) including qualified small, minority and women’s businesses on solicitation lists; (2) assuring that small, minority and women’s businesses are solicited whenever they are potential sources; (3) dividing total requirements when economically feasible, into small tasks or quantities to permit maximum participation of small, minority and women’s businesses; (5) using the services and assistance of the small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce; (6) requiring each party to a subcontract to take the affirmative steps of this section; and (7) Contractor is encouraged to procure goods and services from labor surplus area firms.**

SC-19.06 *Anti-Kickback*

SC-19.06 Add the following after Article 19.05.A(5) with the title “Anti-Kickback”.

- A. Contractor shall comply with the Copeland Anti-Kickback Act (18 USC 874 and 40 USC 276c) as supplemented by Department of Labor regulations (29 CFR Part 3, “Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or Part by Loans or Grants of the United States of America”). The Act provides that Contractor or Subcontractor shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of**

the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to the Agency.

SC-19.07 Clean Air and Pollution Control Acts

SC-19.07 Add the following after Article 19.06.A with the title “Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended”.

A. Contractor to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

SC-19.08 Equal Opportunity Requirements

SC-19.08 Add the following after Article 19.07.A with the title “Equal Opportunity Requirements”.

The Contract is considered a federally assisted construction contract. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of “federally assisted construction contract” in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, “Equal Employment Opportunity” (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, “Amending Executive Order 11246 Relating to Equal Employment Opportunity,” and implementing regulations at 41 CFR part 60, “Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor.”

B.

SC-19.09 Restrictions on Lobbying

SC-19.09 Add the following after Article 19.08.A with the title “Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)”.

A. Contractors that apply or bid for an award exceeding \$100,000 must file the required certification (RD Instruction 1940-Q, Exhibit A-1). The Contractor certifies to the Owner and every subcontractor certifies to the Contractor that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining the Contract if it is covered by 31 U.S.C. 1352. The Contractor and every subcontractor must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner. .

SC-19.10 Environmental Requirements

SC-19.10 Add the following after Article 19.09.A with the title “Environmental Requirements”.

When constructing a Project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental conditions:

- A. **Wetlands-**When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.
- B. **Floodplains-** When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100-year floodplain areas (Stanford Flood Hazard Area) delineated on the Federal Emergency management Agency Floodplain Amps, or other appropriate maps, e.g., alluvial soils on NRCS Soil Survey Maps.
- C. **Historic Preservation-** Any excavation by Contractor that uncovers an historical or archaeological artifact or human remains shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions by Agency after consultations with the State Historic Preservation Officer (SHPO).
- D. **Endangered Species –** Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.
- E. **Mitigation Measures –** The following environmental mitigation measures are required on this Project:

SC 19.11 Add the following after Article 19.10.E. with the title “Contract Work Hours and Safety

Standards Act (40 U.S.C. 3701-3708)”:

- A. Where applicable, for contracts awarded by the Owner in excess of \$100,000 that involve the employment of mechanics or laborers, the Contractor must comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, the Contractor must compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

SC 19.12 Add the following after Article 19.11.A. with the title “Debarment and Suspension (Executive Orders 12549 and 12689)”:

- A. A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

SC 19.13 Add the following after Article 19.12.A. with the title “Procurement of recovered materials”:

- A. The Contractor must comply with 2 CFR Part 200.322, “Procurement of recovered materials.”

SC 19.14 Add the following:

“Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. The de minimis and minor components waiver {add project specific waivers as applicable} apply to this contract.

SC 19.15 Add SC 19.15 Definitions:

“Assistance recipient” is the entity that receives funding assistance from programs required to comply with Section 746 Division A Title VII of the Consolidated Appropriations Act of 2017 (Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. This term includes owner and/or applicant.

“Certifications” means the following:

- Manufacturers’ certification is documentation provided by the manufacturer or fabricator to various entities stating that the iron and steel products to be used in the project are produced in the United States in accordance with American Iron and Steel (AIS) Requirements. If items are purchased via a supplier, distributor, vendor, etc. vs. from the manufacturer or fabricator directly, then the supplier, distributor, vendor, etc. will be responsible for obtaining and providing these certification letters to the parties purchasing the products.
- Engineers’ certification is documentation that plans, specifications, and bidding documents comply with AIS.
- Contractors’ certification is documentation submitted upon substantial completion of the project that all iron and steel products installed were produced in the United States.

“Coating” means a covering that is applied to the surface of an object. If a coating is applied to the external surface of a domestic iron or steel component, and the application takes place outside of the United States, said product would be considered a compliant product under the AIS requirements. Any coating processes that are applied to the external surface of iron and steel components that would otherwise be AIS compliant would not disqualify the product from meeting the AIS requirements regardless of where the coating processes occur, provided that final assembly of the product occurs in the United States. This exemption only applies to coatings on the external surface of iron and steel components. It does not apply to coatings or linings on internal surfaces of iron and steel products, such as the lining of lined pipes. All manufacturing processes for lined pipes, including the application of pipe lining, must occur in the United States for the product to be compliant with AIS requirements.

“Construction materials” are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. Note: Mechanical and electrical components, equipment and systems are not considered construction materials. See definition of mechanical and electrical equipment.

“Consulting engineer” is an individual or entity with which the owner has contracted to perform engineering/architectural services for water and waste projects funded by the programs subject to AIS requirements).

“De minimis incidental components” are various miscellaneous low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. Examples of incidental components could include small washers, screws, fasteners (such as “off the shelf” nuts and bolts), miscellaneous wire, corner bead, ancillary tube, signage, trash bins, door hardware etc. Costs for such de minimis incidental components cumulatively may comprise no more than a total of five percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed one percent of the total cost of the materials used in and incorporated into a project.

“General contractor” is the individual or entity with which the applicant has contracted (or is expected to) to perform construction services (or for water and waste projects funded by the programs subject to AIS requirements). This includes bidders, contractors that have received an award from the applicant and any party having a direct contractual relationship with the owner/applicant. A general contractor is often referred to as the prime contractor.

“Iron and steel products” are defined as the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. Only items on the above list made primarily of iron or steel, permanently incorporated into the project must be produced in the United States. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

“Manufacturers” meaning a supplier, fabricator, distributor, materialman, or vendor is an entity with which the applicant, general contractor or with any subcontractor has contracted to furnish materials or equipment to be incorporated in the project by the applicant, contractor or a subcontractor.

“Manufacturing processes” are processes such as melting, refining, forming, rolling, drawing, finishing, and fabricating. Further, if a domestic iron and steel product is taken out of the

United States for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-U.S. sources.

“Mechanical equipment” is typically that which has motorized parts and/or is powered by a motor. “Electrical equipment” is typically any machine powered by electricity and includes components that are part of the electrical distribution system. AIS does apply to mechanical equipment.

“Minor components” are components within an iron and/or steel product otherwise compliant with the American Iron and Steel requirements. This is different from the de minimis definition where de minimis pertains to the entire project and the minor component definition pertains to a single product. This waiver, would allow non-domestically produced miscellaneous minor components comprising up to five percent of the total material cost of an otherwise domestically produced iron and steel product to be used. However, unless a separate waiver for a product has been approved, all other iron and steel components in said product must still meet the AIS requirements. This waiver does not exempt the whole product from the AIS requirements only minor components within said product and the iron or steel components of the product must be produced domestically. Valves and hydrants are also subject to the cost ceiling requirements described here. Examples of minor components could include items such pins and springs in valves/hydrants, bands/straps in couplings, and other low cost items such as small fasteners etc.

“Municipal castings” are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and solid waste infrastructure.

“National Office” refers to the office responsible for the oversight and administration of the program nationally. The National Office sets policy, develops program regulations, and provides training and technical assistance to help the state offices administer the program. The National Office is located in Washington, D.C.

“Owner” is the individual or entity with which the general contractor has contracted regarding the work, and which has agreed to pay the general contractor for the performance of the work, pursuant to the terms of the contract for water and waste projects funded by the programs subject to AIS requirements. For the purpose of this Bulletin, this term is synonymous with the term “applicant” as defined in 7 CFR 1780.7 (a) (1), (2) and (3) and is an entity receiving financial assistance from the programs subject to the AIS requirements.

“Pass through Entities” is an entity that provides a subaward to a loan and/or grant recipient to carry out part of a Federal program. Examples are grantees utilizing the Revolving Loan Program and Household Water Well Program and Alaska Native Tribal Health Consortium (ANTHC) or the State of Alaska from the RAVG Program.

“Primarily iron or steel” is defined as a product made of greater than 50 percent iron or steel, measured by cost. The cost should be based on the material costs. An exception to this definition is reinforced precast concrete (see Definitions). All technical specifications and applicable industry standards (e.g. NIST, NSF, AWWA) must be met. If a product is determined to be less than 50 percent iron and steel, the AIS requirements do not apply.

For example, the cost of a fire hydrant includes:

(1) The cost of materials used for the iron portion of a fire hydrant (e.g. bonnet, body and shoe); and (2) The cost to pour and cast to create those components (e.g. labor and energy).

Not included in the cost are:

(1) The additional material costs for the non-iron and steel internal workings of the hydrant (e.g. stem, coupling, valve, seals, etc.); and (2) The cost to assemble the internal workings into the hydrant body.

“Produced in the United States” means that the production in the United States of the iron or steel products used in the project requires that all manufacturing processes must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives.

“Project” is the total undertaking to be accomplished for the applicant by consulting engineers, general contractors, and others, including the planning, study, design, construction, testing, commissioning, and start-up, and of which the work to be performed under the contract is a part. A project includes all activity that an applicant is undertaking to be financed in whole or part by programs subject to AIS requirements. The intentional splitting of projects into separate and smaller contracts or obligations to avoid AIS requirements is prohibited.

“Reinforced Precast Concrete” may not consist of at least 50 percent iron or steel, but the reinforcing bar and wire must be produced in the United States and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the United States. The cement and other raw materials used in concrete production are not required to be of domestic origin. If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the United States.

“Steel” means an alloy that includes at least 50 percent iron, between 0.02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel, and other specialty steels.

“Structural steel” is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees, and zees. Other shapes include but are not limited to, H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

“Ultimate recipient” is a loan or grant recipient receiving funds from a pass-through entity. Examples include: (1) a loan recipient from the Revolving Loan Fund; (2) a loan recipient from the Household Water Well Program; and (3) a grant recipient from ANTHC or the State of Alaska from the RAVG Program.

“United States” means each of the several states, the District of Columbia, and each Federally Recognized Indian Tribe.

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Work Change Directive No.

| | |
|-------------------|---------------------------|
| Date of Issuance: | Effective Date: |
| Owner: | Owner's Contract No.: |
| Contractor: | Contractor's Project No.: |
| Engineer: | Engineer's Project No.: |
| Project: | Contract Name: |

Contractor is directed to proceed promptly with the following change(s):

Description:

Attachments: *[List documents supporting change]*

Purpose for Work Change Directive:

Directive to proceed promptly with the Work described herein, prior to agreeing to changes on Contract Price and Contract Time, is issued due to: *[check one or both of the following]*

- Non-agreement on pricing of proposed change.
- Necessity to proceed for schedule or other Project reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

| | | |
|----------------|------|------------------------|
| Contract Price | \$ | [increase] [decrease]. |
| Contract Time | days | [increase] [decrease]. |

Basis of estimated change in Contract Price:

- | | |
|---|-------------------------------------|
| <input type="checkbox"/> Lump Sum | <input type="checkbox"/> Unit Price |
| <input type="checkbox"/> Cost of the Work | <input type="checkbox"/> Other |

RECOMMENDED:

AUTHORIZED BY:

RECEIVED:

| | | |
|---------------------------------|------------------------------|-----------------------------------|
| By: | By: | By: |
| Engineer (Authorized Signature) | Owner (Authorized Signature) | Contractor (Authorized Signature) |
| Title: | Title: | Title: |
| Date: | Date: | Date: |

Approved by Funding Agency (if applicable)

By: _____ Date: _____
 Title: _____

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Date of Issuance: _____ Effective Date: _____
 Owner: _____ Owner's Contract No.: _____
 Contractor: _____ Contractor's Project No.: _____
 Engineer: _____ Engineer's Project No.: _____
 Project: _____ Contract Name: _____

The Contract is modified as follows upon execution of this Change Order:

Description: _____

Attachments: *[List documents supporting change]*

| CHANGE IN CONTRACT PRICE | CHANGE IN CONTRACT TIMES <i>[note changes in Milestones if applicable]</i> |
|--|---|
| Original Contract Price: \$ _____ | Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ days or dates |
| [Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: \$ _____ | [Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: Substantial Completion: _____ Ready for Final Payment: _____ days |
| Contract Price prior to this Change Order: \$ _____ | Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates |
| [Increase] [Decrease] of this Change Order: \$ _____ | [Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates |
| Contract Price incorporating this Change Order: \$ _____ | Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ days or dates |

| | | |
|--|---|--|
| <p>RECOMMENDED:</p> <p>By: _____ Engineer (if required)</p> <p>Title: _____</p> <p>Date: _____</p> | <p>ACCEPTED:</p> <p>By: _____ Owner (Authorized Signature)</p> <p>Title: _____</p> <p>Date: _____</p> | <p>ACCEPTED:</p> <p>By: _____ Contractor (Authorized Signature)</p> <p>Title: _____</p> <p>Date: _____</p> |
|--|---|--|

Approved by Funding Agency (if applicable)

By: _____ Date: _____
 Title: _____

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Date of Issuance: _____ Effective Date: _____
Owner: _____ Owner's Contract No.: _____
Contractor: _____ Contractor's Project No.: _____
Engineer: _____ Engineer's Project No.: _____
Project: _____ Contract Name: _____

Contractor is hereby directed to promptly execute this Field Order, issued in accordance with General Conditions Paragraph 11.01, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference: _____
Specification(s) _____ Drawing(s) / Detail(s) _____

Description: _____

Attachments: _____

| | |
|--|--|
| ISSUED: | RECEIVED: |
| By: _____ Engineer (Authorized Signature) | By: _____ Contractor (Authorized Signature) |
| Title: _____ | Title: _____ |
| Date: _____ | Date: _____ |

Copy to: Owner

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CERTIFICATE OF OWNER’S ATTORNEY AND AGENCY CONCURRENCE

CERTIFICATE OF OWNER’S ATTORNEY

PROJECT NAME:

CONTRACTOR NAME:

I, the undersigned, _____, the duly authorized and acting legal representative of _____, do hereby certify as follows: I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

Name

Date

AGENCY CONCURRENCE

As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the Agency hereby concurs in the form, content, and execution of this Agreement.

Agency Representative

Date

Name

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CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant or Federal loan, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant or loan.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant or loan, the undersigned shall complete and submit Standard Form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including contracts, subcontracts, and subgrants under grants and loans) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

(name)

(date)

(title)

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United States Department of Agriculture

AD-1048

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion
 Lower Tier Covered Transactions**

The following statement is made in accordance with the Privacy Act of 1974 (5 U.S.C. § 552(a), as amended). This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, and 2 C.F.R. §§ 180.300, 180.355, Participants' responsibilities. The regulations were amended and published on August 31, 2005, in 70 Fed. Reg. 51865-51880. Copies of the regulations may be obtained by contacting the Department of Agriculture agency offering the proposed covered transaction.

According to the Paperwork Reduction Act of 1995 an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0505-0027. The time required to complete this information collection is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. The provisions of appropriate criminal and civil fraud privacy, and other statutes may be applicable to the information provided.

(Read Instructions On Page Two Before Completing Certification)

- A. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency;
- B. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

ORGANIZATION NAME

PR/AWARD NUMBER OR PROJECT NAME

NAME(S) AND TITLE(S) OF AUTHORIZED REPRESENTATIVE(S)

SIGNATURE(S)

DATE

The U.S. Department of Agriculture (USDA) prohibits discrimination in all of its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, political beliefs, genetic information, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs). Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Assistant Secretary for Civil Rights, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, S.W., Stop 9410, Washington, DC 20250-9410, or call toll-free at (866) 632-9992 (English) or (800) 877-8339 (TDD) or (866) 377-8642 (English Federal-relay) or (800) 845-6136 (Spanish Federal-relay). USDA is an equal opportunity provider, employer and lender.

Instructions for Certification

- (1) By signing and submitting this form, the prospective lower tier participant is providing the certification set out on page 1 in accordance with these instructions.
- (2) The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension or debarment.
- (3) The prospective lower tier participant shall provide immediate written notice to the person(s) to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- (4) The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549, at 2 C.F.R. Parts 180 and 417. You may contact the department or agency to which this proposal is being submitted for assistance in obtaining a copy of those regulations.
- (5) The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
- (6) The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
- (7) A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the System for Award Management (SAM) database.
- (8) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- (9) Except for transactions authorized under paragraph (5) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

COMPLIANCE STATEMENT

This statement relates to a proposed contract with _____

(Name of borrower or grantee)

who expects to finance the contract with assistance from either the Rural Housing Service (RHS), Rural Business-Cooperative Service (RBS), or the Rural Utilities Service (RUS) or their successor agencies, United States Department of Agriculture (whether by a loan, grant, loan insurance, guarantee, or other form of financial assistance). I am the undersigned bidder or prospective contractor, I represent that:

1. I have have not, participated in a previous contract or subcontract subject to Executive Order 11246 (regarding equal employment opportunity) or a preceding similar Executive Order.
2. If I have participated in such a contract or subcontract, I have, have not, filed all compliance reports that have been required to file in connection with the contract or subcontract.
 If the proposed contract is for \$50,000 or more: or if the proposed nonconstruction contract is for \$50,000 or more and I have 50 or more employees, I also represent that:
3. I have, have not previously had contracts subject to the written affirmative action programs requirements of the Secretary of Labor.
4. If I have participated in such a contract or subcontract, I have, have not developed and placed on file at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor.

I understand that if I have failed to file any compliance reports that have been required of me, I am not eligible and will not be eligible to have my bid considered or to enter into the proposed contract unless and until I make an arrangement regarding such reports that is satisfactory to either the RHS, RBS or RUS, or to the office where the reports are required to be filed.

I also certify that I do not maintain or provide for my employees any segregated facilities at any of my establishments, and that I do not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I certify further that I will not maintain or provide for my employees any segregated facilities at any of my establishments, and that I will not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I agree that a breach of this certification is a violation of the Equal Opportunity clause in my contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and wash rooms, restaurants and other eating areas time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. I further agree that (except where I have obtained identical certifications for proposed subcontractors for specific time periods) I will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that I will retain such certifications in my files; and that I will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays the valid OMB control number. The valid OMB control number for this information collection is 0575-0018. The time required to complete this information collection is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

**NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR
CERTIFICATIONS OF NON-SEGREGATED FACILITIES**

A certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding \$ 10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

Date _____

(Signature of Bidder or Prospective Contractor)

Address (including Zip Code)

GENERAL (PRIME) CONTRACTOR'S CERTIFICATION OF COMPLIANCE WITH PROVISIONS OF THE AMERICAN IRON AND STEEL REQUIREMENTS OF SECTION 746 OF TITLE VII OF THE CONSOLIDATED APPROPRIATIONS ACT OF 2017 (DIVISION A - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS ACT, 2017) AND SUBSEQUENT STATUTES MANDATING DOMESTIC PREFERENCE

DATE:

RE: PROJECT NAME
APPLICANT
CONTRACT NUMBER

I hereby certify that to the best of my knowledge and belief all iron and steel products installed for this project by my company and by any and all subcontractors and manufacturers my company has contracted with for this project comply with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference or are the subject of a waiver approved by the Secretary of Agriculture or designee.

This certification is to be submitted upon completion of the project to the project engineer.

Name of Construction Company (PRINT)

By Authorized Representative (SIGNATURE)

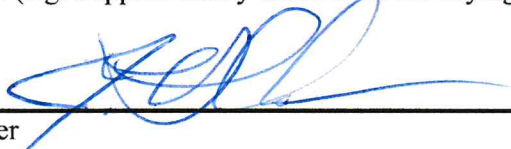
Title

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ENGINEER'S CERTIFICATION OF FINAL PLANS AND SPECIFICATIONSPROJECT NAME: PALMER WWTF IMPROVEMENTS - PHASE II

The final Drawings and Specifications, other assembled Construction Contract Documents, bidding-related documents (or requests for proposals or other construction procurement documents), and any other Final Design Phase deliverables, comply with all requirements of the U.S. Department of Agriculture, Rural Utilities Service, to the best of my knowledge and professional judgment.

If the Engineers Joint Contract Documents Committee (EJCDC) documents have been used, all modifications required by RUS Bulletin 1780-26 have been made in accordance with the terms of the license agreement, which states in part that the Engineer "must plainly show all changes to the Standard EJCDC Text, using 'Track Changes' (redline/strikeout), highlighting, or other means of clearly indicating additions and deletions." Such other means may include attachments indicating changes (e.g. Supplementary Conditions modifying the General Conditions).



Engineer5/25/2021

Date**J. RYAN MOYERS, PE - PROJECT MANAGER**

Name and Title

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EXAMPLE OF A MANUFACTURER'S CERTIFICATION LETTER OF COMPLIANCE WITH PROVISIONS OF THE AMERICAN IRON AND STEEL (AIS) REQUIREMENTS OF SECTION 746 OF TITLE VII OF THE CONSOLIDATED APPROPRIATIONS ACT OF 2017 (DIVISION A - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS ACT, 2017) AND SUBSEQUENT STATUTES MANDATING DOMESTIC PREFERENCE

Date:

Company Name:

Company Address:

Subject: AIS Step Certification for Project (X), Owner's Name, and Contract Number

I, (company representative), certify that the (melting, bending, galvanizing, cutting, etc.) processes for (manufacturing or fabricating) the following products and/or material shipped or provided for the subject project is in full compliance with the AIS requirement as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference.

Item, Products and/or Materials, and location of delivery (City, State):

- 1.
- 2.

Such processes for AIS took place at the following location:

(City, State)

This certification is to be submitted upon request to interested parties (e.g. municipalities, consulting engineers, general contractors, etc.)

If any of the above compliance statements change while providing materials to this project, please immediately notify the person(s) who is requesting to use your product(s).

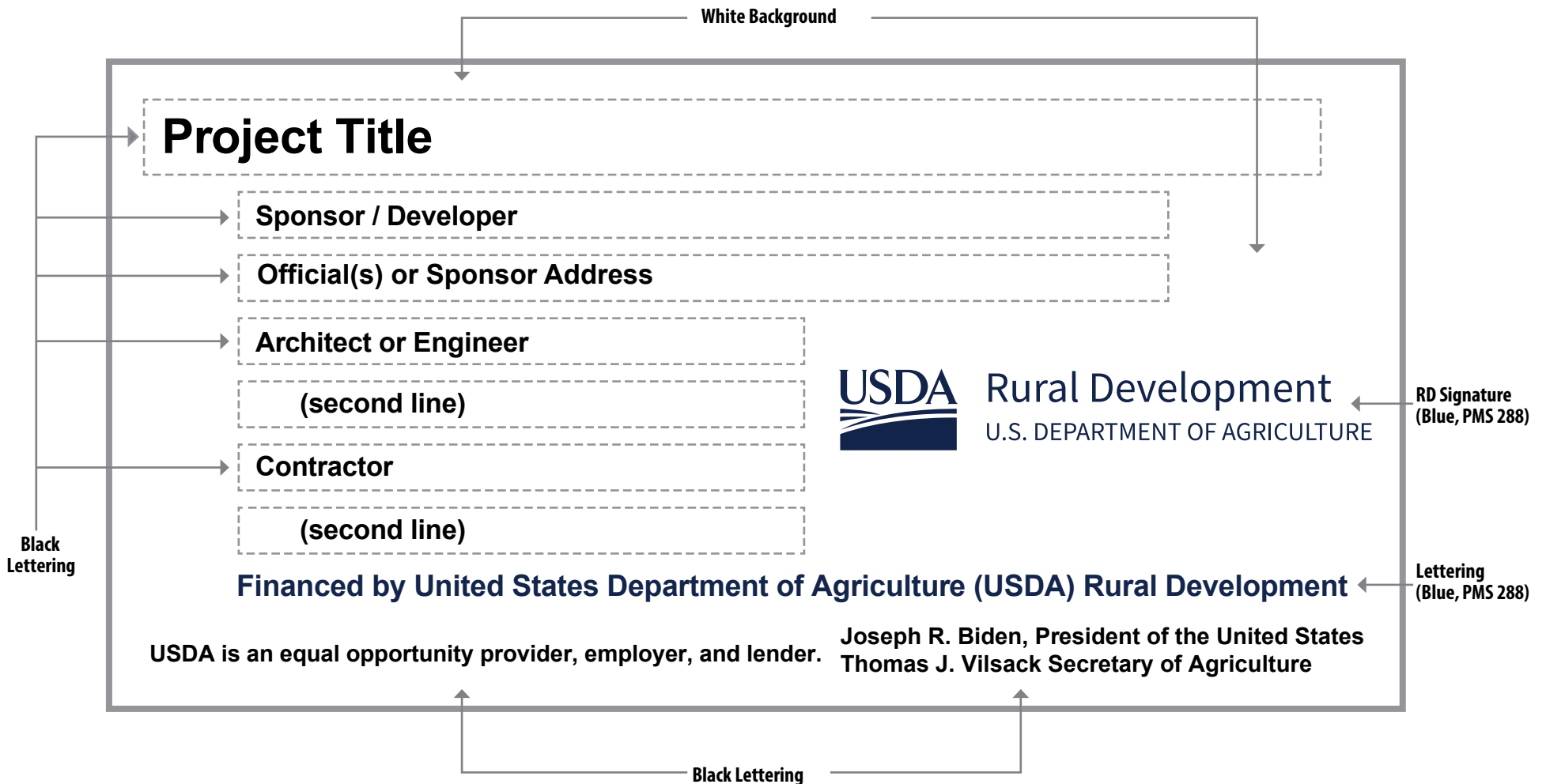
Authorized Company Representative Signature

(Note: *Authorized signature shall be manufacturer's representative not the material distributor or supplier*)

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TEMPORARY CONSTRUCTION SIGN FOR RURAL DEVELOPMENT PROJECTS

Recommended Fonts: Helvetica or Arial



SIGN DIMENSIONS : 1200 mm x 2400 mm x 19 mm (approx. 4' x 8' x 3/4")
PLYWOOD PANEL (APA RATED A-B GRADE-EXTERIOR)

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DIVISION 01

GENERAL REQUIREMENTS



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SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment and services as indicated in accord with provisions of Contract Documents.
2. It is the intent of the Contract Documents to describe a functionally complete project. Furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, complete, and functional installation.

1.2 WORK COVERED BY CONTRACT

A. The Work to be performed includes:

1. Furnish and install all labor, materials, and equipment for the construction of MBBR channel modifications; construction of a new Secondary Clarifier Split Structure; installation of a new standby engine generator; installation of new Manholes #15 and #16; construction of two new Secondary Clarifiers; construction of a new Waste Activated Sludge Vault, construction of a new Scum Pump Station, installation of a new Lagoon 2 Overflow Structure and associated Lagoon 2 modifications, site work; and piping, valves, and appurtenances together with related subsidiary and incidental work in accordance with the plans and specifications.

1.3 CONTRACTOR'S USE OF PREMISES

A. Contractor shall limit his use of the premises for Work and storage and allow for:

1. Owner occupancy.
2. Uninterrupted operation of existing adjacent facilities.

B. Coordinate use of premises under direction of Owner and Engineer.

C. Contractor assumes full responsibility for the protection and safekeeping of products and materials Contractor has stored on or off of the site.

D. Contractor shall move any stored products, or materials, under Contractor's responsibility, which interfere with operations of Owner or separate contractor/subcontractor.

E. Contractor shall obtain and pay for the use of any additional storage or work areas if needed for Contractor operations.

- F. Contractor shall confine all materials storage, equipment storage and employee and subcontractor parking to the areas designated in the Contract Documents. Contractor shall not store materials or equipment, nor shall employees of the Contractor or subcontractors park automobiles in a manner that hinders Owner's access to the facility.
- G. Contractor shall restore any areas used for materials storage, trailers, offices, equipment storage, or employee and subcontractor parking to their original condition or better.

1.4 WORK SEQUENCE

- A. The Contractor shall organize and plan the construction activities to assure the safety and reliability of and to minimize the interruption to the electric system and all other utilities.
- B. The proposed Work sequence shall be submitted to the Engineer in the Schedule of Construction.

1.5 OWNER OCCUPANCY

- A. Owner will occupy the premises during the entire period of construction for the conduct of his normal operations. Contractor shall coordinate with Owner in all construction operations to minimize conflicts and to facilitate Owner usage.

1.6 PARTIAL OWNER OCCUPANCY

- A. Schedule operations so as to complete certain areas of the Work, as designated under Sequence of Work, to enable Owner's occupancy prior to Substantial Completion of the entire Work.
- B. Owner will occupy new facilities for the purpose of conducting normal operations
- C. Execute Certificate of Substantial Completion for each area listed above prior to Owner's occupancy.
 - 1. After Owner occupancy, Contractor shall allow:
 - a. Access for Owner's personnel.
 - b. Access for the public.
 - c. Operation of area HVAC, plumbing and electrical systems.
 - d. Operation of equipment and processes to remain in service during the course of the work
 - 2. After occupancy, Owner will provide:
 - a. Contractor access to finish punch list items.
 - b. Operation of area HVAC, plumbing and electrical systems.

- c. Operation of equipment and processes to remain in service during the course of the work.
- 3. Other conditions of occupancy:
 - a. The correction period for the occupied Work shall commence at the date of occupancy.

1.7 OUTAGES

- A. The Contractor shall submit a REMOVAL FROM SERVICE (RFS) REQUEST at least 14 days prior to the planned outage for approval by the Owner. RFS Forms are attached to the Contract Documents.
- B. The Contractor shall organize and plan the construction activities so that the number and length of any required outages shall be minimized.
- C. An outage to any customer shall require specific approval of the Owner. The Owner reserves the right to reject any request for an outage.
- D. In some cases it may be necessary, at Contractor's expense, to either install temporary facilities for service or schedule the Work during a period when the outage would have minimal impact on the customer.
- E. The Contractor shall provide the Owner at least 48 hours' notice in advance of any requested outage so that the Owner may advise and coordinate the outage with the customers.
- F. Except during periods when an outage cannot occur (i.e., Alaska State Fair), the Contractor shall have a maximum period of 16 hours for a planned outage in accordance with the Contract Documents (Removal from Service Request).

1.8 CONTRACTOR-FURNISHED PRODUCTS

- A. Contractor shall furnish all products, other than Owner-furnished products designated above.
- B. Components required to be supplied in quantity within a specification section shall all be the same and shall be interchangeable.

1.9 UNDERGROUND UTILITIES

- A. Utilities known to the Engineer, who may have underground facilities in the vicinity of the Work, may be contacted as follows:
 - 1. **Electric Service-** Matanuska Electric Association (MEA)
163 E Industrial Way
Palmer, Alaska
Phone: 907-761-9300 or 907- 761-2699
 - 2. **Gas** - ENSTAR GAS Utility Telephone: 907-334-7600

3. **Water Service-** City of Palmer Public Works Department
1316 A S. Bonanza Street
Phone: 907-745-3400
4. **Fiber Optic Cable** - Palmer Wastewater Treatment Facility
Brooks Road, Palmer, Alaska
Chris Nall/Public Works Director Telephone: 907-761-1350

1.10 PERMITS AND LICENSES

- A. Contractor shall obtain, at his expense, all permits and licenses necessary for the construction of the Work in accordance with Paragraph 7.08. of the General Conditions C-700.

1.11 TREE TRIMMING, CLEARING, AND TREE REMOVAL

- A. Contractor shall provide all required labor and equipment for trimming, clearing, and tree removal:

1.12 PHASING

- A. The Contractor shall be responsible for determining phasing of the existing system and insuring that the phasing of the new system is correct.

1.13 FENCES

- A. All fences affected by the Work shall be maintained by the Contractor until completion of the Work. Fences disturbed by the construction shall be restored by the Contractor to their original or better condition and to their original location.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 01 22 00
MEASUREMENT AND PAYMENT

PART 1 - APPLICATIONS FOR PAYMENT

1.1 GENERAL

- A. Submit applications for payment to Engineer in accordance with the schedule established by Conditions of the Contract and Agreement Between Owner and Contractor.
- B. Related sections include but are not necessarily limited to:
 - 1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - a. Agreement. Lump Sum Price:
 - b. General Conditions of the Contract: Progress Payments, Retainage, and Final Payment.
 - 2. Division 1 – General Requirements.
 - a. Schedule of Values: Section 01 29 73.

1.2 ALLOWANCES

- A. Allowance(s) are established to provide the Owner with a method for compensating the Contractor for specific items of Work that are not completely defined in the Contract Documents prior to the award of contract and maybe required to complete the Work.
- B. Allowance(s) for minor changes are for the exclusive use of Owner as a result of changed conditions, design refinements, and unanticipated design issues.
- C. The Owner can compensate the Contractor for the work as defined below without issuing a change order as long as the costs are within the Allowance amount stated in the Contract.
- D. Allowances shall be administered in accordance with Article 13 Cost of the Work; Allowances; Unit Price Work: Paragraph 13.02. The Owner will issue a field order or directive to proceed with the work as defined in the Allowance.
- E. Owner approval is required prior to the start of the work and/or authorization of progress payments for the Allowance(s).
- F. The Owner and Contractor can agree to compensate the Contractor for work covered by the Allowance(s) in one or more of the following methods;
 - 1. Lump sum payment agreed to prior to beginning the work,
 - 2. Agreed on unit prices measured against actual installed quantities, and/or

3. Contractor's actual costs as documented on force account sheets completed daily and approved by the Owner. Overhead and Profit will be compensated through the Contractor's Fee as defined in the Contract Documents.
- G. Submit Allowances with the Application for Payment; include the invoice showing date for with the work was completed or purchase date, date of delivery to the site and the name of the subcontractor or supplier.
- H. Contractor shall consult with the Engineer in the selection of the product or service and obtain approval in writing from the Engineer prior to the start of the Allowance Work.

1.3 FORMAT AND DATA REQUIRED

- A. Submit applications on attached EJCDC Form C-620 as provided in Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
- B. Application and Certificate of Payment with itemized data typed on 8-1/2" x 11" white paper continuation sheets.
- C. Provide itemized data on continuation sheet:
1. Format, schedules, line items, and values: Those of the Schedule of Values.
- D. Provide the Schedule of Values and all application for progress payments to the Owner in electronic Excel Format for the Owner's Use. Supply the Excel Files on suitable electronic media as a formal submittal,

1.4 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

- A. Application form:
1. Fill in required information, including that for Change Orders executed prior to the date of submittal application.
 2. Fill in summary of dollar values to agree with the respective totals indicated on the continuation sheets.
 3. Execute certification with the signature of a responsible officer of the Contractor's firm.
- B. Continuation sheets:
1. Fill in total list of all scheduled component items of Work, with item number and the scheduled dollar value for each item.
 2. Fill in the dollar value in each column for each scheduled line item when work has been performed or products stored, rounding off values to nearest dollar.

3. List each Change Order executed prior to the date of submission at the end of the continuation sheets.
 - a. List by Change Order number and description, as for an original component item of work.

1.5 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

- A. When Owner or Engineer requires substantiating data, Contractor shall submit suitable information, with a cover letter identifying:
 1. Project.
 2. Application number and date.
 3. Detailed list of enclosures.
 4. For stored products:
 - a. Item number and identification as shown on application.
 - b. Description of specific material stored at the site (upon verification of payment from supplier).
- B. Submit one copy of data and cover letter for each copy of application.

1.6 PREPARATION OF APPLICATION FOR FINAL PAYMENT

- A. Fill in application form as specified for progress payments.

1.7 SUBMITTAL PROCEDURE

- A. Applications for payment must be agreed upon by the Contractor and Engineer and submitted to Owner as stated in the AGREEMENT. If statement is not received in final form prior to this date, the application may not be processed until the following payment period.
- B. Number: One copy of each application.
- C. When Engineer finds the application properly completed and correct, he will transmit a Certificate for Payment to Owner, with a copy to Contractor.

1.8 PAYMENTS

- A. As stated in the AGREEMENT.
- B. Failure to submit schedules and plans:
 1. Progress payments will be withheld if updated schedules are not submitted with payment requests.

PART 2 - PRODUCTS (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 01 25 13
PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The procedure for requesting the approval of substitution of a product that is not equivalent to a product which is specified by descriptive or performance criteria or defined by reference to one or more of the following:
 - a. Name of manufacturer.
 - b. Name of vendor.
 - c. Trade name.
 - d. Catalog number.
2. Substitutions are not "or-equals."
3. This Specification Section does not address substitutions for major equipment.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

C. Request for Substitution - General:

1. Base all bids on materials, equipment, and procedures specified.
2. Certain types of equipment and kinds of material are described in specifications by means of references to names of manufacturers and vendors, trade names, or catalog numbers.
 - a. When this method of specifying is used, it is not intended to exclude from consideration other products bearing other manufacturer's or vendor's names, trade names, or catalog numbers, provided said products are "or-equals," as determined by Engineer.
3. Other types of equipment and kinds of material may be acceptable substitutions under the following conditions:
 - a. Or-equals are unavailable due to strike, discontinued production of products meeting specified requirements, or other factors beyond control of Contractor;
or,

- b. Contractor proposes a cost and/or time reduction incentive to the Owner.

1.2 QUALITY ASSURANCE

- A. In making request for substitution or in using an approved product, Contractor represents they:
 - 1. Have investigated proposed product, and have determined that it is adequate or superior in all respects to that specified, and that it will perform function for which it is intended.
 - 2. Will provide same guarantee for substitute item as for product specified.
 - 3. Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
 - 4. Waives all claims for additional costs related to substitution which subsequently arise.

1.3 DEFINITIONS

- A. Product: Manufactured material or equipment.

1.4 PROCEDURE FOR REQUESTING SUBSTITUTION

- A. Substitution shall be considered only:
 - 1. After Award of Contract.
 - 2. Under the conditions stated herein.
- B. Written request through Contractor only.
- C. Transmittal Mechanics:
 - 1. Follow the transmittal mechanics prescribed for Shop Drawings in Specification Section 01 33 00.
 - a. Product substitution will be treated in a manner similar to "deviations," as described in Specification Section 01 33 00.
 - b. List the letter describing the deviation and justifications on the transmittal form in the space provided under the column with the heading DESCRIPTION.
 - 1) Include in the transmittal letter, either directly or as a clearly marked attachment, the items listed in Paragraph D below.
- D. Transmittal Contents:
 - 1. Product identification:
 - a. Manufacturer's name.

- b. Telephone number and representative contact name.
 - c. Specification Section or Drawing reference of originally specified product, including discrete name or tag number assigned to original product in the Contract Documents.
2. Manufacturer's literature clearly marked to show compliance of proposed product with Contract Documents.
3. Itemized comparison of original and proposed product addressing product characteristics including but not necessarily limited to:
 - a. Size.
 - b. Composition or materials of construction.
 - c. Weight.
 - d. Electrical or mechanical requirements.
4. Product experience:
 - a. Location of past projects utilizing product.
 - b. Name and telephone number of persons associated with referenced projects knowledgeable concerning proposed product.
 - c. Available field data and reports associated with proposed product.
5. Data relating to changes in construction schedule.
6. Data relating to changes in cost.
7. Samples:
 - a. At request of Engineer.
 - b. Full size if requested by Engineer.
 - c. Held until substantial completion.
 - d. Engineer not responsible for loss or damage to samples.

1.5 APPROVAL OR REJECTION

- A. Written approval or rejection of substitution given by the Engineer.
- B. Engineer reserves the right to require proposed product to comply with color and pattern of specified product if necessary to secure design intent.
- C. In the event the substitution is approved, the resulting cost and/or time reduction will be documented by Change Order in accordance with the General Conditions.

D. Substitution will be rejected if:

1. Submittal is not through the Contractor with his stamp of approval.
2. Request is not made in accordance with this Specification Section.
3. In the Engineer's opinion, acceptance will require substantial revision of the original design.
4. In the Engineer's opinion, substitution will not perform adequately the function consistent with the design intent.

E. Contractor shall reimburse Owner for the cost of Engineer's evaluation whether or not substitution is approved. Contractor shall reimburse the Owner for Engineer's evaluation at a rate of \$150 per hour.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION



EXHIBIT A Substitution Request Form (One Item per each Form)

| | | |
|---|--|-----------------------------------|
| Project: City of Palmer: Palmer WWTP Facility Plan Update | | Date: |
| Substitution Requestor: | | |
| Contractor: | | |
| Specification Section No: | Paragraph No. (i.e. 2.1.A.1.c): | Specified Item: |
| | | |
| Proposed Substitution: | | |
| Provide Product Data Sheets, Manufacturer's written installation instructions, drawings, diagrams, or any other information as an attached to this Form that will demonstrate the proposed substitution is an Approved Equal. | | |
| In the lines provided state differences between proposed substitutions and specified item. Differences include but are not limited to interrelationship with other items; materials, equipment, function, utility, life cycle costs, applied finished, appearances, and quality. _____ _____ _____ | | |
| In the lines provided demonstrate how the proposed substitution is compatible with or modifies other systems, parts, equipment or components of the Project and Work under the Contract : _____ _____ | | |
| In the lines provided, describe what effect the proposed substitution has on dimensions indicated on the Drawings and previously reviewed Shop Drawings? _____ _____ _____ | | |
| In the lines provided, describe what effect the proposed substitution has on the Construction Schedule and Contract Time. _____ _____ _____ | | |
| In the lines provided, describe what effect the proposed substitution has on the Contract Price. This includes all direct, indirect, impact and delay costs. _____ _____ _____ | | |
| Manufacturer's guarantees of the proposed and specified items are: <input type="checkbox"/> Same <input type="checkbox"/> Different (explain on attachment) | | |
| The undersigned state that the function, utility, life cycle costs, applied finishes, appearance and quality of the proposed substitution are equal or superior to those of the specified item. | | |
| For use by Project Representative: | | |
| <input type="checkbox"/> Accepted | <input type="checkbox"/> Accepted as Noted | _____ (Contractor's Signature) |
| <input type="checkbox"/> Not Accepted | <input type="checkbox"/> Received Too Late | _____ (Contractor's Firm) |
| _____ (Date) | | _____ (Firms Address) |
| _____ (Telephone) | | |

Comments:

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SECTION 01 29 73
SCHEDULE OF VALUES (LUMP SUM PROJECTS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for:
 - a. Schedule of Values.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Building Code:
 - a. International Code Council (ICC):
 - 1) International Building Code and associated standards, on including all amendments, referred to herein as Building Code.

1.3 SUBMITTALS

- A. As required in the General Conditions Part 2.03.A.3 Schedule of Values.

1.4 SCHEDULE OF VALUES

- A. Where a Contract is awarded on a lump sum basis, the Contractor shall file with the Engineer a balanced price segregation of the lump sum bid into items similar to the various subdivisions of the general and detailed specifications, the sum of which shall equal the lump sum bid.

1. The cost of various materials shall be furnished upon request of the Engineer, and such data will then be used as a basis for making progress estimates.
2. Breakdown costs, itemized by Specification Section and trade, and distribute cost to individual applicable units and structures.
3. Where structures, units, equipment or other components are identified by a specific series or, identification number, utilize said designation throughout cost breakdown.

4. Provide detailed breakdown for individual yard piping or conduit runs and identify approximate quantities involved to satisfaction of the Engineer.
 5. Provide separate breakdown for change order items requested.
- B. A reasonable allocation of the Contract Price to the component parts of the Work will be approved if component parts of the Work have values assigned to them that are well-balanced with respect to relative values for similar work established by published estimating guides.
1. Unless otherwise agreed to at the Preconstruction Conference, Means Estimator Guide or other similar nationally recognized estimating guide shall be used for resolving differences between Engineer's and Contractor's opinions of allocation of values.
 2. Consent of Surety: If Contractor and Engineer cannot mutually agree on a Schedule of Values, Engineer will approve a Schedule of Values approved by the Surety providing the Performance Bond.
- C. Contractor's costs shall not govern the allocation of values when application of Contractor's costs to a component part of the Work results in any other component part or combination of component parts being under-valued in relation to conventional estimating guides.
- D. SCHEDULE OF VALUES shall be agreed upon prior to first Application for Payment.

1.5 APPLICATION FOR PAYMENT

- A. Provide a Summary Sheets and cost breakdown sheets equivalent to those specified in Section 01 22 00 Measurement and Payment supplemental information: Contractor's Application for Payment Forms EJCDC C-620 form specified in Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
- B. Provide an additional breakdown sheet, equivalent to the Stored Material Summary as specified Section 01 22 00 Measurement and Payment supplemental information: Contractor's Progress Estimate form., showing the tabulation format for stored materials.
- C. Submit this sheet each month with Contractor's pay request breakdown.
- D. The detail and format of cost breakdown and stored materials tabulation sheet shall be fully approved by Engineer.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 01 30 00
SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for:
 - a. Pre-construction Conference.
 - b. Project signs.
 - c. Contractor's Superintendent's Field Office.
 - d. Drawings and Contract Documents for Contractor use.
 - e. Project photographs.
 - f. Testing and Special Inspections.
 - g. Schedule of Values.
 - h. Project meetings.
 - i. Special considerations related to adjacent properties and facilities.
 - j. Historical and archaeological finds.
 - k. Administrative procedures.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 RELATED WORK AT PROJECT SITE

A. Power:

1. Coordinate Contractor's work with the Matanuska Electric Cooperative (MEA).
2. Coordination and installation of any necessary piping or structures to be located near MEA work.

B. Natural Gas:

1. Coordinate Contractor's work with the Gas Company (ENSTAR).
2. Coordinate demolition, relocation, and installation of gas lines as shown or necessary to complete the work.
3. Coordination and installation of any necessary piping or structures to be located near ENSTAR work.
4. Perform Work on gas facilities in accordance with ENSTAR requirements and codes.

C. PALMER WWTF Buried Fiber Optic

1. Coordinate Contractor's work with the Palmer Wastewater Treatment Facility
2. Coordinate demolition poles and installation of Fiber lines as shown or necessary to complete the work.
3. Coordination and installation of any necessary piping or structures to be located near Palmer Wastewater Treatment Facility
4. Perform Work in accordance with Palmer Wastewater Treatment Facility requirements and codes.

1.3 UTILITY NOTIFICATION AND COORDINATION

A. Coordinate the Work with various utilities within the Project limits. Notify utilities prior to the commencement of the Work, if damage occurs, or if conflicts or emergencies arise during the Work.

1. Palmer Wastewater Treatment Facility
 - a. Chris Nall/Public Works Director
 - b. Telephone: 907-761-1350
2. Matanuska Electric Cooperative
 - a. Telephone: (907) 761-2699
3. ENSTAR GAS Utility
 - a. Telephone: 907-334-7600

1.4 PROJECT MILESTONES

- A. General: Include Milestones specified herein as part of the Progress Schedule.
- B. Project Milestones: Generally described in the Agreement Form. The following is a listing of the Project Milestones.

1. Milestone 1: Substantial Completion of SECONDARY CLARIFIERS; WASTE ACTIVATED SLUDGE (WAS) VAULT; SCUM PUMP STATION; as specified in the Agreement.
2. Milestone 2: Substantial Completion of all other work not specifically designated in all other Bid Items as specified in the Agreement.
3. Final Completion of the Entire Contract as specified in the Agreement.

1.5 GENERAL WORK SEQUENCING

- A. For the purposes of this Article: General Work Sequencing section and the following Article: Facility Work Sequencing and Operations sections, see “Substantial Completion” as defined in the General Conditions.
 1. Site Civil, yard piping and utilities, Utility connections and associated work, preliminary power and gas line relocations and temporary power and gas service connections shall be conducted throughout the project. It is the Contractor’s responsibility to integrate these project elements and coordinate the work with the Owner and Utilities to operate and maintain continuous operation of all facilities.
 2. Software Functional Testing (FT) and Programmable Logic Controller software programming shall be completed by a systems integrator.
 - a. Contractor shall allow for sufficient time to program for FT and PLC testing.
 - 1) Software and PLC integrator shall be provided a minimum of 30 days for software programming and testing.
 - 2) Contractor shall allocate 10 working days in the Project Schedule for testing the software program and PLC for each unit process. Unit processes are defined by the Process and Instrumentation Drawings (P&ID).
- B. Facility Work Sequencing and Operations
 1. Continuous operation of the Owner’s Facilities is of critical importance. Contractor shall schedule Work activities to enable the existing Owner facilities continuous operation and maintenance, unless otherwise allowed. Removal from Service (RFS) requests are described and provided in these Contract Documents for coordination of the Work with the Owner’s facilities in the event of a necessary shutdown or interruption is required.
 2. Do not open or close valves, turn on or off any of the Owner’s equipment or processes, except as required by the Contract Documents and only in coordination and conjunction with the written approval of the Owner.
- C. Sequence of Work
 1. Task headings and descriptions set forth below are descriptive only and not intended to define the scope of work included herein.
 2. The specified sequences are not all-inclusive. They are intended to convey overall constraints and suggested construction sequences. The Contractor shall plan and

schedule Work, relocations of utilities and other Work necessary to complete the Work in an appropriate sequence of operation to perform the Work.

3. Contractor shall make special note of the Alaska State Fair Schedule at which time the Palmer Wastewater Treatment Facility has increased influent flow rates. Dates for this period are available on the State of Alaska State Fair Website. No unit process shall be taken out of service during this period.
4. Constraints and Potential Sequencing:
 - a. Initial Site work:
 - 1) Install all necessary erosion control measures.
 - 2) Construct Contractor's Staging Areas, site preparation, clearing and grubbing.
 - 3) Mobilize Contractor trailer, provide construction site power temporary panel and other utilities, sanitation facilities as specified.
 - 4) Perform initial excavation, provide temporary power and natural gas relocations.
 - 5) Provide construction site power panel and temporary power drop and pole.
 - b. Construct New Secondary Splitter Box
 - c. Construct New Secondary Clarifiers/Scum Pit/WAS Vault
 - d. Construct pipeline from new Clarifiers to (MH #16) to existing UV facility
 - e. Commissioning of the Secondary Clarifiers, WAS vault, and Scum Pit. Route temporary WAS line above ground from WAS vault to Lagoon 3 to continuously operate the secondary clarifiers while Lagoon #2 work is completed.
 - f. Complete Lagoon #2 work.
 - g. Construct new manhole (MH #15) between Lagoon 1 and Manhole #7
 - h. Performance testing and monitor effluent quality.

1.6 QUALITY ASSURANCE

A. Referenced Standards:

1. Building code:
 - a. International Code Council (ICC):
 - 1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.

1.7 PRE-CONSTRUCTION CONFERENCE

- A. A preconstruction conference shall be held at the Project Site after award of Contract.
 - 1. Engineer will notify the Contractor as to the date and time of the conference 2 weeks in advance of the proposed date.
 - 2. Contractor's Project Manager and Project Superintendent and Contractor's Subcontractor Representatives shall attend.

1.8 PROJECT SIGNS

- A. Engineer's Sign:
 - 1. Furnish and install 4 FT x 8 FT plywood backboard with support legs and bracing.
 - 2. Securely mount Engineer-furnished sign to backboard.
- B. Regulatory Agency Sign(s): USRDA TEMPORARY CONSTRUCTION SIGNS FOR RURAL DEVELOPMENT PROJECTS IN Div 00 Contract Forms.
 - 1. Furnish and install 4 FT x 8 FT plywood backboard with support legs and bracing for each sign.
 - 2. Furnish and install commercially produced regulatory agency sign(s) conforming to Exhibit(s).
 - a. Color sample of Exhibit(s) is provided in the USRDA TEMPORARY CONSTRUCTION SIGN FOR RURAL DEVELOPMENT PROJECTS IN Div 00 Contract Forms.
 - b. Sign(s) may be professionally painted on backboard on site.
- C. Contractor's standard company sign.
 - 1. No restrictions.
- D. Coordinate sign locations with Owner.
- E. Signs not listed in this Specification Section permitted only upon approval of Owner.

1.9 CONTRACTOR'S SUPERINTENDENT'S FIELD OFFICE

- A. Establish at site of Project.
- B. Equipment: Telephone, telecopy, and sanitary facilities.
- C. Ensure attendance at this office during the normal working day.
- D. At this office, maintain complete field file of Shop Drawings (including American Iron and Steel certifications), posted Contract Drawings and Specifications, and other files of field operations including provisions for maintaining "As Recorded Drawings."
- E. Remove field office from site upon acceptance of the entire work by the Owner.

1.10 DRAWINGS AND CONTRACT DOCUMENTS FOR CONTRACTOR USE

- A. Refer to General Conditions.
- B. Contractor shall pick up all "no-charge" documents within 10 days from date of Notice to Proceed.
- C. Additional documents after "no-charge" documents will be furnished to Contractor at cost.

1.11 PROJECT PHOTOGRAPHS

- A. At least once each month during construction of the Work, provide progress pictures as directed by Engineer.
 - 1. Pictures shall be digital and provided on disk with thumbnail index as a submittal, see Section 01 33 00.
 - 2. Provide number of photographs as follows:
 - a. Twenty-four ground level color photos per month.
 - 3. Contractor shall schedule and coordinate photographer with Engineer's Field Representative.
 - 4. Photographically impose a site plan key map on each photograph in the upper right hand corner and show by arrow the subject and the direction from which the photograph was taken.
 - a. Date all photographs.

1.12 PROJECT MEETINGS

- A. Construction Meetings:
 - 1. The Engineer will conduct construction meetings involving:
 - a. Contractor's project manager.
 - b. Contractor's project superintendent.
 - c. Owner's designated representative(s).
 - d. Engineer's designated representative(s).
 - e. Contractor's subcontractors as appropriate to the Work in progress.
 - f. Owner's Construction Quality Control Consultant.
 - 2. Meetings will be conducted every 2 weeks.

3. The Engineer will take meeting minutes and submit copies of meeting minutes to participants and designated recipients identified at the Preconstruction Conference.
 - a. Corrections, additions or deletions to the minutes shall be noted and addressed at the following meeting.
4. The Engineer will schedule meetings for most convenient time frame.
5. The Engineer will have available at each meeting full chronological files of all previous meeting minutes.
6. The Contractor shall have available at each meeting up-to-date record drawings.

B. Pre-Installation Conferences:

1. Coordinate and schedule with Resident Project Representative and Engineer for each material, product or system specified.
 - a. Conferences to be held prior to initiating installation, but not more than 2 weeks before scheduled initiation of installation.
 - b. Conferences may be combined if installation schedule of multiple components occurs within the same 2-week interval.
 - c. Review manufacturer's recommendations and Contract Documents Specification Sections.
2. Contractor's Superintendent and individual who will actually act as foreman of the installation crew (installer), if other than the Superintendent, shall attend.

1.13 SPECIAL CONSIDERATIONS RELATED TO ADJACENT PROPERTIES AND FACILITIES

- A. Contractor shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to the site.
- B. Access, Traffic Control, and Parking:
 1. Maintain conditions of access road to site such that access is not hindered as the result of construction related deterioration.
 2. Do not permit driving across or transporting materials or equipment across areas outside the construction limits shown on the Drawings.
 3. Provide traffic control devices and personnel necessary to ensure a safe interface of construction traffic with business traffic to and from adjacent sites.
 4. Provide access routes for emergency vehicles at all times.
 5. Provide daily sweeping of hard-surface roadways to remove soils tracked onto roadway.

6. Provide on site parking for all staff to limit interference with adjacent properties and businesses.

1.14 HISTORICAL AND ARCHAEOLOGICAL

- A. If during the course of construction, evidence of deposits of historical or archeological interest is found, the Contractor shall cease operations affecting the find and shall notify Owner.
 1. No further disturbance of the deposits shall ensue until the Contractor has been notified by Owner that Contractor may proceed.
 2. Owner will issue a notice to proceed after appropriate authorities have surveyed the find and made a determination to Owner.
 3. Compensation to the Contractor, if any, for lost time or changes in construction resulting from the find, shall be determined in accordance with changed or extra work provisions of the Contract Documents.
 4. The site has been previously investigated and has no known history of historical or archaeological finds.

1.15 ADMINISTRATIVE PROCEDURES

- A. Electronic Document Tracking System
 1. The Owner and Contractor shall utilize EADOC (Bentley) system for electronic submittal of all data and documents throughout the duration of the Contract.
 2. EADOC is a web based electronic media site that is hosted by EADOC (Bentley) utilizing their web solution software.
 3. EADDOC shall be made available to all Owner's Project personnel, Contractor's Project personnel, subcontractor personnel, suppliers, consultants and the Designer of Record.
 4. The joint use of this system is to facilitate the electronic exchange of Project Information, automation of process, and overall management of the Contract. EADOC shall be the primary means of Project information submission and management.
 5. When requested in writing by the Owner's project representative or the Owner, paper documents shall also be provided by the Contractor.
 6. In the event of a discrepancy between the EADOC electronic version and the submitted paper version, the paper documents shall govern.
 7. The Owner's Project representative shall control the Contractor's access to EADOC by allowing access and assigning user profiles to accepted Contractor personnel. User profiles define the levels of access into the system, determine assigned function-based authorizations(what items can be seen or accessed). Subcontractors and suppliers shall be given access to EADOC through the Contractor. Entry of information exchanged and transferred between the Contractor

and its subcontractors and suppliers on EADOC shall be the responsibility of the Contractor.

8. Joint ownership of Data: Data entered in a collaborative mode (entered with intent to share as determined by permissions and workflow with in the EADOC system) by the Owner's Project representative and the Contractor shall be jointly owned.
9. Automated System Notification and Audit Log Tracking: Review comments made or lack thereof by the Owner or Owner's Project repetitive on Contractor submitted documentation shall not relieve the Contractor from compliance with the requirements of the Contract Documents. The Contractor is responsible for tracking, managing, and documenting the Work to comply with the requirements of the Contract Documents. Owner's acceptance via automated system EADOC notifications or audit log extends only to the face value of the submitted Project documentation and does not constitute validation or approval of the Contractor's submitted information.
10. Submittals: See Submittal procedures in Section 01 33 00.
11. Computer Requirements: The Contractor shall use computer hardware and software that meets the requirements of EADOC (Bentley) system as recommended by EADOC to access and utilize EADOC. AS recommendations are modified by EADOC, the Contractor shall upgrade their system(s) to meet recommendations or better. Upgrading the Contractor's computer systems as required by EADOC shall not be justification for a cost or time modification to the Contract.
12. The Contractor shall be responsible to ensure that connectivity to the EADOC system (whether at the home office or jobsite) is accomplished through DSL, Cable, T-1 or wireless communication systems. The minimum bandwidth requirements for using the system is 128 kb/s. It is recommended faster connection be used when uploading pictures and files into the system.
13. Contractor Responsibility: The Contractor shall be responsible for the validity of their information placed in EADOC and for the abilities of their personnel. Accepted users shall be knowledgeable in the EADOC system and the use of computers, including internet browsers, email programs, CAD drawing applications and Adobe PDF document distribution system.
14. The Contractor shall use the existing forms attached to this Section as Supplemental information to the maximum extent possible. If a form does not exist in EADOC, the Contractor shall include a form of their own or provided the Owner's Project representative as an attachment to a submittal.
15. The Contractor is responsible for training of their Project Personnel in the use of EADOC (outside what is provided by the Contract Documents by the Owner) and other programs indicated above as needed.
16. User Access Administration: Contractor shall provide tot the Owner, as list of the Contractor's key Project personnel for the Owner's Project representative's acceptance and approval. Contractor is responsible for adding and removing users from the system. The Owners Project representative reserves the right to perform a

security check on all potential users. The Contractor shall be allowed to add or subtract subcontractor or supplier personnel.

17. Connectivity Problems: EADOC is a web-based environment and therefore subject to inherent speed and connectivity problems of the internet. The Contractor is responsible for its own connectivity to the Internet. EADOC response time is dependent upon the Contractor's computer equipment, including processor speed, Internet access speed and the current traffic on the internet. The Owner shall not be liable for delays associated with the usage of EADOC including, but not limited to, slow response time, downtime periods, connectivity problems, or loss of information. The Contractor shall ensure connectivity to the EADOC system is maintained throughout the project duration. Under no circumstances shall the usage, of EADOC, be grounds for a time extension or cost adjustment to the Contract.

18. Training: The Owner shall provide for the following training of Contractor Project Personnel:

a. Up to two training sessions shall be offered to the Contractor and subcontractor personnel to be coordinated at the time arranged by Contractor with the Owner's Project Representative within 21 days of Notice to Proceed. Contractor shall be considered incidental to the work.

B. Unless otherwise specified, or agreed to in the Pre-Construction Conference, use the EJCDC Forms included in Div 00 Contract Forms for Work Change Directives, Change Proposal Request and Field Orders.

1. Change Proposal Request (EJCDC C- 941)

2. Work Change Directive. (EJCDC C- 940)

3. Field Order (EJCDC C- 942)

C. The following attached forms for Request for Information, and Request for Information (RFI), Removal From Service Request:

1. Request For Information (RFI)

2. Removal From Service Request

D. These forms are included as supplements to this section.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SUPPLEMENTAL INFORMATION

1. Request for Information (RFI)
2. Removal from Service Request

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REQUEST FOR INFORMATION (RFI)

Project: City of Palmer Wastewater Treatment Facility Improvements

HDR PROJECT NO.:

RFI NO.:

DATE:

REQUEST:

Signature _____ Owner _____ Contractor _____ HDR Engineering, Inc.

REPLY:

DATE:

Signature _____ Owner _____ Contractor _____ HDR Engineering, Inc.

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REMOVAL FROM SERVICE Request (RFS)

Project: City of Palmer Wastewater Treatment Facility Improvements

Subject:

This form shall be used for requesting and documenting significant operations interruptions or requests from the Contractor to make modifications to existing infrastructure that is in operation typically. This form shall be submitted two weeks and approved before shutdown.

Building/Area Affected:

Systems/Equipment Affected:

Day of Shutdown _____ Time _____ Duration _____

Work to be Accomplished:

Foreman in Charge: _____ Crew size: _____

List Shutdown Activities with Start Time and Special Requirements

Problems that may be encountered and corrective action:

City Operations

Contractor

City Utility Mechanic

Owners Project Representative

City Electrician

Engineer

City I & C

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SECTION 01 33 00
SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mechanics and administration of the submittal process for:
 - a. Shop Drawings.
 - b. Informational submittals.
 - 2. General content requirements for Shop Drawings.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Operations and Maintenance Manual submittal requirements are specified in Specification Section 01 33 04.
 - 4. Specification Sections in Division 02 through Division 44 identifying required submittals.

1.2 DEFINITIONS

- A. Shop Drawings:
 - 1. See STANDARD GENERAL CONDITIONS FOR CONSTRUCTION CONTRACTS.
 - 2. Product data is Shop Drawing information.
- B. Informational Submittals:
 - 1. Submittals other than Shop Drawings and samples required by the Contract Documents that do not require approval.
 - 2. Representative types of informational submittal items include but are not limited to:
 - a. Equipment delivery schedule.
 - b. Installed equipment and systems performance test reports.
 - c. Manufacturer's installation certification letters.

- d. Instrumentation and control commissioning reports.
 - e. Warranties.
3. For-Information-Only submittals upon which the Engineer is not expected to conduct review or take responsive action may be so identified in the Contract Documents.

1.3 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings and Product Data:

1. Transmit paper copy submittals to:

HDR Engineering, Inc.
2525 C Street
Suite # 500
Anchorage, AK 99503-2633
Attn: Ryan Moyers, PE

2. Electronic Transmission of Submittals:

a. Contractor shall use the project electronic document tracking system.

3. Utilize one copy of attached Exhibit "A" to transmit all Shop Drawings and samples.

a. An electronic version (Microsoft Word .doc format) of Exhibit "A" will be given to Contractor upon request.

4. All submittals must be from Contractor and bear his approval stamp.

a. Shop Drawing submittal stamp shall read "(Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval as stipulated under STANDARD GENERAL CONDITIONS FOR CONSTRUCTION CONTRACTS Paragraph 5.06C."

5. Provide submittal information defining specific equipment or materials utilized on the project.

a. Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.

6. Calculations required in individual Specification Sections will be received for information purposes only, as evidence calculations have been performed by individuals meeting specified qualifications, and will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.

7. Submittal schedule:

a. Schedule of Shop Drawings:

- 1) Submitted and approved in accordance with timeframes listed in Contract.
- 2) Account for multiple transmittals under any Specification Section where partial submittals will be transmitted.

B. Informational Submittals:

1. Transmit under Contractor's standard letter of transmittal or letterhead.
2. Submit in triplicate or as specified in individual Specification Section.
3. Transmit paper copy submittals to:

HDR Engineering, Inc.
2525 C Street
Suite 500
Anchorage, AK 99503-2633
Attn: Ryan Moyers, PE

4. Electronic Transmission of Submittals:

- a. Via email: ryan.moyers@hdrinc.com
- b. Contractor may also use Electronic Document Tracking System when approved by Engineer.

1.4 PREPARATION OF SUBMITTALS

A. Legibility:

1. All submittals and all pages of all copies of a submittal shall be completely legible.
2. Submittals which, in the Engineer's sole opinion, are illegible will be returned without review.

B. Shop Drawings:

1. Scope of any submittal and letter of transmittal:
 - a. Limited to one Specification Section.
 - b. Do not submit under any Specification Section entitled (in part) "Basic Requirements" unless the product or material submitted is specified, in total, in a "Basic Requirements" Specification Section.
2. Numbering letter of transmittal:
 - a. Use the Specification Section number followed by a series number ("-xx" and beginning with "01"); increase the series number sequentially with each additional transmittal for that Specification Section.

3. Describing transmittal contents:
 - a. Provide listing of each component or item in submittal capable of receiving an independent review action.
 - b. Identify for each item:
 - 1) Manufacturer and Manufacturer's Drawing or data number.
 - 2) Contract Document tag number(s).
 - 3) Specification Article/Paragraph number if appropriate.
 - 4) Unique page numbers for each page of each separate item.
 - c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.
4. Contractor stamping:
 - a. General:
 - 1) Contractor's review and approval stamp shall be applied either to the letter of transmittal or a separate sheet preceding each independent item in the submittal.
 - a) Contractor's signature and date shall be original ink signature.
 - 2) Letters of transmittal may be stamped only when the scope of the submittal is one (1) item.
 - 3) Submittals containing multiple independent items shall be prepared with an index sheet for each item listing the discrete page numbers for each page of that item, which shall be stamped with the Contractor's review and approval stamp.
 - a) Individual pages or sheets of independent items shall be numbered in a manner that permits Contractor's review and approval stamp to be associated with the entire contents of a particular item and vice-versa.
 - 4) In the event submittals are transmitted as a single item and found to include multiple independent items, the Buyer and Engineer reserve the right to limit review to the single item listed, remove the other items from the submittal and return them not reviewed to the Contractor for coordination, stamping and submittal under a new transmittal number that is not a re-submittal number.
 - a) The items not listed in the transmittal letter will not be logged as received, or in any other manner acknowledged as submitted.
 - b. Electronic stamps:
 - 1) Contractor may electronically embed Contractor's review and approval stamp to either the letter of transmittal or a separate index sheet preceding each independent item in the submittal.

- 2) Contractor's signature and date on electronically applied stamps shall be original ink signature.
5. Resubmittals:
- a. Number with original Specification Section and series number with a suffix letter starting with "A" on a (new) duplicate transmittal form.
 - b. Do not increase the scope of any prior transmittal.
 - c. Account for all components of prior transmittal.
 - 1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
 - a) Do not include submittal information for items listed with prior "A" or "B" Action in resubmittal.
 - 2) Indicate "Outstanding-To Be Resubmitted At a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
 - a) Obtain Engineer's approval to exclude items.
6. Contractor shall not use red color for marks on transmittals.
- a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
 - b. Engineer will use red marks or enclose marks in a cloud.
7. Transmittal contents:
- a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.
 - b. Provide submittal information or marks defining specific equipment or materials utilized on the Project.
 - 1) Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.
 - c. Identify equipment or material project application, tag number, Drawing detail reference, weight, and other Project specific information.
 - d. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
 - e. Do not modify the manufacturer's documentation or data except as specified herein.
 - f. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 IN pages.
 - 1) Indicate exact item or model and all options proposed.

- g. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the Specification Section.
 - 1) Arrange data and performance information in format similar to that provided in Contract Documents.
 - 2) Provide, at minimum, the detail specified in the Contract Documents.
 - h. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.
8. Provide one electronic copy of each submittal until submittal has received either an "A" or "B" action.
- a. Submittal may be transmitted via e-mail, upload to PTCS (when approved by Engineer), or on a CD-ROM disc.
 - b. The Engineer will mark comments directly on the electronic copy of each submittal or provide review comment in an electronic comment sheet attached to the Shop Drawing Transmittal sheet included in Exhibit A.
 - c. Engineer will return the submittals with the review comments via e-mail or uploaded to a File Transfer Protocol (FTP) site where submittals are transmitted to.
9. Upon receipt of either an "A" or "B" action, incorporate any comments and then provide three paper copies and one electronic copy on compact disc (CD-ROM) of each submittal.

C. Informational Submittals:

- 1. Prepare in the format and detail specified in Specification requiring the informational submittal.

D. Paper copy submittals:

- 1. Provide 8-1/2 x 11 IN, 8-1/2 x 14 IN, and 11 x 17 IN size sheets on heavy first quality paper with standard three-hole punching and bound in appropriately sized three-ring (or post) binders with clear overlays front, spine and back.
- 2. Reduce Drawings or diagrams bound in manuals to an 8-1/2 x 11 IN or 11 x 17 IN size.

- a. Where reduction is not practical to ensure readability, fold larger Drawings separately and place in vinyl envelopes which are bound into the binder.
 - b. Identify vinyl envelopes with drawing numbers.
3. Provide a Cover Page for each binders with the following information:
 - a. Contractor's Name.
 - b. Date.
 - c. Buyer's Name.
 - d. Project Name.
 - e. Specification Section.
 - f. Project Equipment Tag Numbers, if applicable.
 - g. Model Numbers, if applicable.
 - h. Engineer.
 4. Provide a Table of Contents or Index for each binder.
 - a. Use plastic-coated dividers to tab each section per the Table of Contents/Index for easy reference.

E. Electronic copy submittals:

1. Electronic copies are to be produced in Adobe Acrobat's Portable Document Format (PDF) Version 5.0 or higher.
2. Do not password protect and/or lock the PDF document.
3. Create one PDF document (PDF file) for each submittal.
4. Drawings shall be provided in AutoCAD 2010 .dwg and PDF formats.
5. Rotate pages that must be viewed in landscape to the appropriate position for easy reading.
6. Images only shall be scanned at a resolution of 300 dpi or greater.
 - a. Perform Optical Character Recognition (OCR) capture on all images.
 - b. Word searches of the PDF document must operate successfully to demonstrate OCR compliance.
7. Create bookmarks in the navigation frame, for each entry in the Table of Contents/Index.
8. File naming conventions:

- a. File names shall use a "ten dot three" convention (XXXXX-YY-Z.PDF) where XXXXX is the Specification Section number, YY is the Shop Drawing Root number and Z is an ID number used to designate the associated volume.
 - 1) Example 1:
 - a) Two pumps submitted as separate Shop Drawings under the same Specification Section:
 - (1) Pump 1 = 11061-01-1.pdf.
 - (2) Pump 2 = 11061-02-1.pdf.
 - 2) Example 2:
 - a) Control system submitted as one Shop Drawing but separated into two O&M volumes:
 - (1) Volume 1 = 13440-01-1.pdf.
 - (2) Volume 2 = 13440-01-2.pdf.
9. Label CD-ROM discs and jewel cases with same information required for Cover Pages.

1.5 ENGINEER'S REVIEW ACTION

A. Shop Drawings and Samples:

- 1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
 - a. A - FURNISH AS SUBMITTED.
 - b. B - FURNISH AS NOTED (BY ENGINEER).
 - c. C - REVISE AND RESUBMIT.
 - d. D - REJECTED.
 - e. E - ENGINEER'S REVIEW NOT REQUIRED.
- 2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
 - a. Drawings not stamped by the Contractor or stamped with a stamp containing language other than that specified in Paragraph 1.3A.4.a., will not be reviewed for technical content and will be returned without any action.
- 3. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.
 - a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.

- b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
 4. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
 - a. The portion of the submittal given "C" or "D" will not be distributed.
 - 1) Correct and resubmit items so marked.
 - b. Items marked "A" or "B" will be fully distributed.
 - c. If a portion of the items or system proposed are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
 - 1) This is at the sole discretion of the Engineer. In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."
 - 2) Distribution to the Buyer and field will not be made (unless previously agreed to otherwise).
 5. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.
 6. Calculations required in individual Specification Sections will be received for information purposes only, as evidence calculations have been performed by individuals meeting specified qualifications, and will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.
 7. All costs, associated with the review of any Shop Drawing resubmitted more than once shall be borne by the Contractor with said costs being deducted from the lump sum amount shown in the Contractor's proposal. Transmittals of submittals which the Engineer considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" Action in a prior submittal, will be returned with Action "E. Engineer's Review Not Required."
- B. Engineer will review two versions, initial submittal and one resubmittal, of each Shop Drawing, Installation Manual, and Operations and Maintenance Manual at no cost to the Contractor.
1. Should additional reviews beyond the root and one resubmittal be required due to no fault of the Buyer or Engineer, Engineer will tack the review hours and expenses associated with these extra reviews.
 2. Buyer will issue a deductive change order to the Contractor for the extra review expenses of the Engineer and/or Buyer.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

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EXHIBIT A

Shop Drawing Transmittal
No. _____ - _____
(Spec Section) (Series)

| Project Name: City of Palmer WWTP Facility Plan Update | | | | | Date Received: | |
|---|------------|-------------|----------------------------|----------------------------|---------------------|--------|
| Project Owner: | | | | | Checked By: | |
| Contractor: | | | HDR Engineering, Inc. | | Log Page: | |
| Address: | | | Address: | | HDR No.: | |
| | | | | | Spec Section: | |
| | | | | | Drawing/Detail No.: | |
| Attn: | | | Attn: | | 1st. Sub | ReSub. |
| Date Transmitted: | | | Previous Transmittal Date: | | | |
| Item No. | No. Copies | Description | Manufacturer | Mfr/Vendor Dwg or Data No. | Action Taken* | |
| | | | | | | |
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| Remarks: | | | | | | |
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| | | | | | | |
| * The Action designated above is in accordance with the following legend: | | | | | | |

- | | |
|--|--|
| <p>A - Furnish as Submitted</p> <p>B - Furnish as Noted</p> <p>C - Revise and Submit</p> <ol style="list-style-type: none"> 1. Not enough information for review. 2. No reproducibles submitted. 3. Copies illegible. 4. Not enough copies submitted. 5. Wrong sequence number. 6. Wrong resubmittal number. 7. Wrong spec. section. 8. Wrong form used. 9. See comments. <p>D - Rejected</p> | <p>E - Engineer's review not required</p> <ol style="list-style-type: none"> 1. Submittal not required. 2. Supplemental Information. Submittal retained for informational purposes only. 3. Information reviewed and approved on prior submittal. 4. See comments. 5. Delegated Design - Submittal received as requested by the Contract Documents. The Engineer did not review the engineering or technical content of the submittal. <p>Engineer's review and approval is limited to determine whether items covered by this submittal will, after installation or incorporation in the Work, conform in general to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole. Any deviation from plans or specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Engineer shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.</p> |
|--|--|

Comments:

| | | |
|----|--|------|
| | | |
| By | | Date |

Distribution: Contractor | | File | | Field | | Owner | | Other | |

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SECTION 01 33 04
OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

- A. Section Includes:
 - 1. Administration of the submittal process for Operation and Maintenance Manuals.
 - 2. Content requirements for Operation and Maintenance Manuals.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. General submittal requirements are specified in Specification Section 01 33 00, Submittals.
 - 4. Sections in Division 02 through Division 44 identifying required Operation and Maintenance Manual submittals.

1.2 DEFINITIONS

- A. Equipment Operation and Maintenance Manuals:
 - 1. Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.
- B. Building Materials and Finishes Operation and Maintenance Manuals:
 - 1. Contain the information required for proper installation and maintenance of building materials and finishes.

1.3 SUBMITTALS

- A. List of all the Operation and Maintenance Manuals required by the Contract as identified in Division 02 through Division 44.
- B. Operation and Maintenance Manuals:
 - 1. Draft and final electronic copies.
 - 2. Final paper copies: One.

1.4 SUBMITTAL SCHEDULE

- A. List of Required Operation and Maintenance Manuals:
 - 1. Submit list with Specification Section number and title within 21 days after Notice to Proceed.

B. Draft Operation and Maintenance Manuals:

1. Submit approvable draft manuals in electronic format (PDF) within 90 days after Notice to Proceed.
 - a. Include placeholders or fly sheet pages where information is not final or is missing from the draft manual.

C. Final Operation and Maintenance Manuals:

1. Final approval of Operation and Maintenance Manuals in electronic format (PDF) must be obtained 45 days prior to equipment start-up.
2. Provide paper copies and CD-ROMs of approved final Operation and Maintenance Manuals in electronic format (PDF), a minimum of 30 days prior to equipment start-up.
3. Issue addenda to Final Approved Operation and Maintenance Manual to include:
 - a. Equipment data that requires collection after start-up, for example but not limited to electrical switchgear, automatic transfer switch, and circuit breaker settings.
 - b. Equipment field testing data.
 - c. Equipment start-up reports.
 - d. Revisions made to the drawings that are included in the manual during the field testing.

1.5 PREPARATION OF SUBMITTALS

A. General:

1. All pages of the Operation and Maintenance Manual submittal shall be legible.
 - a. Submittals which, in the Engineer's sole opinion, are illegible will be rejected without review.
2. Identify each equipment item in a manner consistent with names and identification numbers used in the Contract Documents, not the manufacturer's catalog numbers.
3. Neatly type any data not furnished in printed form.
4. Operation and Maintenance Manuals are provided for Owner's use, to be reproduced and distributed as training and reference materials within Owner's organization.
 - a. This requirement is:
 - 1) Applicable to both paper copy and electronic files.
 - 2) Applicable to materials containing copyright notice as well as those with no copyright notice.

5. Notify supplier and/or manufacturer of the intended use of Operations and Maintenance Manuals provided under the Contract.

B. Operation and Maintenance Manual Format and Delivery:

1. Draft electronic submittals:

- a. Provide manual in Adobe Acrobat Portable Document Format (PDF), latest version.
- b. Create one PDF file for each equipment Operation and Maintenance Manual.
- c. Do not password protect or lock the PDF document.
- d. Drawings or other graphics must be converted to PDF file format from the original drawing file format and made part of the PDF document.
- e. Scanning of drawings is to be used only where actual file conversion is not possible and drawings must be scanned at a resolution of 300 dpi or greater.
- f. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.
- g. Create bookmarks in the bookmarks panel for the Operation and Maintenance Manual cover, the Table of Contents and each major section of the Table of Contents.
- h. Using Adobe Acrobat Standard or Adobe Acrobat Professional, set the PDF document properties, initial view as follows:
 - 1) Select File → Properties → Initial View.
 - 2) Select the Navigation tab: Bookmarks Panel and Page.
 - 3) Select the Page layout: Single Page.
 - 4) Select the Magnification: Fit Page.
 - 5) Select Open to page: 1.
 - 6) Set the file to open to the cover page of the manual with bookmarks to the left, and the first bookmark linked to the cover page.
- i. Set the PDF file "Fast Web View" option to open the first several pages of the document while the rest of the document continues to load.
 - 1) To do this:
 - a) Select Edit → Preferences → Documents → Save Settings.
 - b) Check the Save As optimizes for Fast Web View box.
- j. PDF file naming convention:
 - 1) Use the Specification Section number, the manufacturer's name and the equipment description, separated by underscores.
 - 2) Example: « Specification # »_Sanitaire_Coarse_Bubble_Diffusers.pdf.

- 3) Do not put spaces in the file name.
2. Final electronic submittals:
 - a. Submit two copies in PDF file format on two CD-ROM discs (one copy per CD-ROM), each secured in a jewel case.
 - b. CD-ROM Labeling:
 - 1) Provide the following printed labeling on all CD-ROM discs:
 - a) Project name.
 - b) Specification Section.
 - c) Equipment names and summary of tag(s) covered.
 - d) Manufacturer name.
 - e) Date (month, year).
 - c. CD-ROM Jewel Case Holder:
 - 1) Insert jewel cases containing labeled CD-ROM discs in 3-ring binder holder (C-Line Products, www.c-lineproducts.com stock number CLI-61968 or equivalent) at the front of each final paper copy.
 3. Final paper copy submittals:
 - a. Quantity: Provide two copies.
 - b. Paper: 8.5 x 11 IN or 11 x 17 IN bright white, 20 pound paper with standard three-hole punching.
 - c. 3-Ring Binder:
 - 1) Provide D-ring binder with clear vinyl sleeves (i.e., view binder) on front and spine.
 - 2) Insert binder title sheet with the following information under the front and spine sleeves:
 - a) Project name.
 - b) Specification Section.
 - c) Equipment names and summary of tag(s) covered.
 - d) Manufacturer name.
 - e) Date (month, year).
 - 3) Provide plastic sheet lifters prior to first page and following last page.
 - d. Drawings:
 - 1) Provide all drawings at 11 x 17 IN size, triple folded and three-hole punched for insertion into manual.

- 2) Where reduction is not practical to ensure readability, fold larger drawings separately and place in three-hole punched vinyl envelopes inserted into the binder.
 - 3) Identify vinyl envelopes with drawing numbers.
- e. Use plastic coated dividers to tab each section of each manual in accordance with the Table of Contents.

C. Equipment Operation and Maintenance Manual Content:

1. Provide a cover page as the first page of each manual with the following information:
 - a. Manufacturer(s) Name and Contact Information.
 - b. Vendor's Name and Contact Information.
 - c. Date (month, year).
 - d. Project Owner and Project Name.
 - e. Specification Section.
 - f. Project Equipment Tag Numbers.
 - g. Model Numbers.
 - h. Engineer's Name.
 - i. Contractor's Name.
2. Provide a Table of Contents for each manual.
3. Provide Equipment Record sheets as follows:
 - a. Printed copies of the Equipment Record (Exhibits B1, B2 and B3), as the first tab following the Table of Contents.
 - b. Exhibits B1-B3 are available as Fillable PDF Form documents from the Engineer.
 - c. Each section of the Equipment Record must be completed in detail; simply referencing the related equipment Operation and Maintenance Manual sections for nameplate, maintenance, spare parts or lubricant information is not acceptable.
 - d. For equipment involving separate components (for example, a motor and gearbox), a fully completed Equipment Record is required for each component.
 - e. Submittals that do not include the Equipment Record(s) will be rejected without further content review.

4. Provide a printed copy of the Manufacturer's Field Services report as required by Specification Section 01 65 50 following the Equipment Record sheets.
5. Provide the following detailed information, as applicable:
 - a. Use equipment tag numbers from the Contract Documents to identify equipment and system components.
 - b. Equipment function, normal and limiting operating characteristics.
 - c. Instructions for assembly, disassembly, installation, alignment, adjustment, and inspection.
 - d. Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.
 - e. Lubrication and maintenance instructions.
 - f. Troubleshooting guide.
 - g. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project; delete or cross out information that does not specifically apply to the Project.
 - h. Parts lists:
 - 1) A parts list and identification number of each component part of the equipment.
 - 2) Exploded view or plan and section views of the equipment with a detailed parts callout matching the parts list.
 - 3) A list of recommended spare parts.
 - 4) List of spare parts provided as specified in the associated Specification Section.
 - 5) A list of any special storage precautions which may be required for all spare parts.
 - i. General arrangement, cross-section, and assembly drawings.
 - j. Electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, and interconnection diagrams.
 - k. Test data and performance curves.
 - l. As-constructed fabrication or layout drawings and wiring diagrams.
 - m. Copy of the equipment manufacturer's warranty meeting the requirements of the Contract.
 - n. Copy of any service contracts provided for the specific piece of equipment as part of the Contract.

6. Additional information as required in the associated equipment or system Specification Section.

D. Building Materials and Finishes Operation and Maintenance Manual Content:

1. Building products, applied materials and finishes:
 - a. Include product data, with catalog number, size, composition and color and texture designations.
 - b. Provide information for ordering custom manufactured products.
2. Necessary precautions:
 - a. Include product MSDS for each approved product.
 - b. Include any precautionary application and storage guidelines.
3. Instructions for care and maintenance:
 - a. Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
4. Moisture protection and weather exposed products:
 - a. Include product data listing, applicable reference standards, chemical composition, and details of installation.
 - b. Provide recommendations for inspections, maintenance and repair.
5. Additional requirements as specified in individual product specifications.

1.6 TRANSMITTAL OF SUBMITTALS

A. Operation and Maintenance Manuals.

1. Transmit paper copy submittals to:

HDR Engineering, Inc.
2525 C Street,
Suite # 500
Anchorage, AK 99503-2633
Attn: Ryan Moyers, PE

2. Utilize one copy of attached Exhibit "A" to transmit all Operation and Maintenance Manuals.
 - a. An electronic version (Microsoft Word .doc format) of Exhibit "A" will be given to Contractor upon request.

3. Transmittal numbering:
 - a. Number each submittal with the Specification Section number followed by a series number beginning with “-01” and increasing sequentially with each additional transmittal, followed by “-OM” (for example: 11061-01-OM).
4. Submit draft and final Operation and Maintenance Manual in electronic format (PDF) to Engineer, until manual is approved.
5. All submittals must be from Contractor and bear his approval stamp.
 - a. Operation and Maintenance Manual submittal stamp may be Contractor's standard approval stamp.

B. Expedited Return Delivery:

1. Include prepaid express envelope or air bill in submittal transmittal package for any submittals Contractor expects or requires express return mail.
2. Inclusion of prepaid express envelope or air bill does not obligate Engineer to conduct expedited review of submittal.

1.7 ENGINEER'S REVIEW ACTION

A. Draft Electronic (PDF) Submittals:

1. Engineer will review and indicate one of the following review actions:
 - a. A - ACCEPTABLE
 - b. B - FURNISH AS NOTED
 - c. C - REVISE AND RESUBMIT
 - d. D - REJECTED
2. Submittals marked as Acceptable or Furnish As Noted will be retained; however, the transmittal form will be returned with a request for the final paper and electronic documents to be submitted.
3. Copies of submittals marked as Revise and Resubmit or Rejected will be returned with the transmittal form marked to indicate deficient areas.
4. Resubmit until approved.

B. Final Paper Copy Submittals:

1. Engineer will review and indicate one (1) of the following review actions:
 - a. A - ACCEPTABLE
 - b. D - REJECTED

2. Submittals marked as Acceptable will be retained with the transmittal form returned as noted.
3. Submittals marked as Rejected will be returned with the transmittal form marked to indicate deficient areas.
4. Resubmit until approved.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

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EXHIBIT A

Operation and Maintenance Manual
Transmittal _____ - _____ - OM
(Spec Section) (Series) .

Project Name: City of Palmer — Palmer WWTP Facility Plan Update Date Received:

Project Owner: City of Palmer Checked By:

Contractor: Owner: Log Page:

Address: Address: HDR No.:

Attn: Attn: 1st. Sub. ReSub.

Date Transmitted: Previous Transmittal Date:

| No. Copies | Description of Item | Manufacturer | Dwg. or Data No. | Action Taken* |
|------------|---------------------|--------------|------------------|---------------|
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Remarks:

To: From: HDR Engineering, Inc.

Date:

- * The Action designated above is in accordance with the following legend:
- A - Acceptable
 - B - Furnish as Noted
 - C - Revise and Resubmit
 - D - Rejected

Comments:

By _____ Date _____

Distribution: Contractor | | File | | Field | | Owner | | Other | |

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Equipment Data and Spare Parts Summary

| | |
|---|------------------------|
| Project Name: City of Palmer — Palmer WWTP Facility Plan Update | Specification Section: |
| Equipment Name | Year Installed: |

Project Equipment Tag No(s).

| | |
|------------------------|-------------------|
| Equipment Manufacturer | Project/Order No. |
| Address | Phone |

| | | |
|-----|----------|--------|
| Fax | Web Site | E-mail |
|-----|----------|--------|

Local Vendor/Service Center

| | |
|---------|-------|
| Address | Phone |
|---------|-------|

| | | |
|-----|----------|--------|
| Fax | Web Site | E-mail |
|-----|----------|--------|

MECHANICAL NAMEPLATE DATA

| | | | | | | | |
|--------|-----------|----------|-----|------------|--|--|--|
| Equip. | | | | Serial No. | | | |
| Make | | | | Model No. | | | |
| ID No. | Frame No. | HP | RPM | Cap. | | | |
| Size | TDH | Imp. Sz. | CFM | PSI | | | |
| Other: | | | | | | | |

ELECTRICAL NAMEPLATE DATA

| | | | | | | | | |
|--------|-----------|----------|------|------------|--------|------------|--------|----|
| Equip. | | | | Serial No. | | | | |
| Make | | | | Model No. | | | | |
| ID No. | Frame No. | HP | V. | Amp. | HZ | PH | RPM | SF |
| Duty | Code | Ins. Cl. | Type | NEMA | C Amb. | Temp. Rise | Rating | |
| Other: | | | | | | | | |

SPARE PARTS PROVIDED PER CONTRACT

| Part No. | Part Name | Quantity |
|----------|-----------|----------|
| | | |
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RECOMMENDED SPARE PARTS

| Part No. | Part Name | Quantity |
|----------|-----------|----------|
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(Jun 1990; Revised Oct 2001, Revised Nov 2007)
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Lubrication Summary

| | | | | | | |
|-----------------------|---|---------------------------|---------|--------|-------|-----|
| Equipment Description | | Project Equip. Tag No(s). | | | | |
| Lubricant Point | | | | | | |
| Lubricant Type | | Manufacturer | Product | AGMA # | SAE # | ISO |
| | 1 | | | | | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| Lubricant Point | | | | | | |
| Lubricant Type | | Manufacturer | Product | AGMA # | SAE # | ISO |
| | 1 | | | | | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| Lubricant Point | | | | | | |
| Lubricant Type | | Manufacturer | Product | AGMA # | SAE # | ISO |
| | 1 | | | | | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| Lubricant Point | | | | | | |
| Lubricant Type | | Manufacturer | Product | AGMA # | SAE # | ISO |
| | 1 | | | | | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| Lubricant Point | | | | | | |
| Lubricant Type | | Manufacturer | Product | AGMA # | SAE # | ISO |
| | 1 | | | | | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| Lubricant Point | | | | | | |
| Lubricant Type | | Manufacturer | Product | AGMA # | SAE # | ISO |
| | 1 | | | | | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |

(Feb 1991; Revised Oct 2001, Revised Nov 2007)
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SECTION 01 35 05
ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Minimizing the pollution of air, water, or land; control of noise, the disposal of solid waste materials, and protection of deposits of historical or archaeological interest.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Prior to the start of any construction activities submit:
 - a. A detailed proposal of all methods of control and preventive measures to be utilized for environmental protection.
 - b. A drawing of the work area, haul routes, storage areas, access routes and current land conditions including trees and vegetation.
 - c. A copy of the NPDES permit for storm water discharges from construction activities.
 - d. A copy of the approved pollution prevention plan.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Employ and utilize environmental protection methods, obtain all necessary permits, and fully observe all local, state, and federal regulations.

B. Land Protection:

1. Except for any work or storage area and access routes specifically assigned for the use of the Contractor, the land areas outside the limits of construction shall be preserved in their present condition.
 - a. Contractor shall confine his construction activities to areas defined for work within the Contract Documents.
2. Manage and control all borrow areas, work or storage areas, access routes and embankments to prevent sediment from entering nearby water or land adjacent to the work site.
3. Restore all disturbed areas including borrow and haul areas and establish permanent type of locally adaptable vegetative cover.
4. Unless earthwork is immediately paved or surfaced, protect all side slopes and backslopes immediately upon completion of final grading.
5. Plan and execute earthwork in a manner to minimize duration of exposure of unprotected soils.
6. Except for areas designated by the Contract Documents to be cleared and grubbed, the Contractor shall not deface, injure or destroy trees and vegetation, nor remove, cut, or disturb them without approval of the Engineer.
 - a. Any damage caused by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense.

C. Surface Water Protection:

1. Apply for and obtain a permit from the local environmental agency for storm water discharges.
2. Prepare pollution prevention plan that has been approved by the local environmental agency.
3. Utilize, as necessary, erosion control methods to protect side and backslopes, minimize and the discharge of sediment to the surface water leaving the construction site as soon as rough grading is complete.
 - a. These controls shall be maintained until the site is ready for final grading and landscaping or until they are no longer warranted and concurrence is received from the Engineer.
 - b. Physically retard the rate and volume of run-on and runoff by:
 - 1) Implementing structural practices such as diversion swales, terraces, straw bales, silt fences, berms, storm drain inlet protection, rocked outlet protection, sediment traps and temporary basins.

- 2) Implementing vegetative practices such as temporary seeding, permanent seeding, mulching, sod stabilization, vegetative buffers, hydroseeding, anchored erosion control blankets, sodding, vegetated swales or a combination of these methods.
- 3) Providing Construction sites with graveled or rockered access entrance and exit drives and parking areas to reduce the tracking of sediment onto public or private roads.
4. Discharges from the construction site shall not contain pollutants at concentrations that produce objectionable films, colors, turbidity, deposits or noxious odors in the receiving stream or waterway.

D. Solid Waste Disposal:

1. Collect solid waste on a daily basis.
2. Provide disposal of degradable solid waste to an approved solid waste disposal site.
3. Provide disposal of nondegradable solid waste to an approved solid waste disposal site or in an alternate manner approved by Engineer and regulatory agencies.
4. No building materials wastes or unused building materials shall be buried, dumped, or disposed of on the site.

E. Fuel and Chemical Handling:

1. Store and dispose of chemical wastes in a manner approved by regulatory agencies.
2. Take special measures to prevent chemicals, fuels, oils, greases, herbicides, and insecticides from entering drainage ways.
3. Do not allow water used in onsite material processing, concrete curing, cleanup, and other waste waters to enter a drainage way(s) or stream.
4. The Contractor shall provide containment around fueling and chemical storage areas to ensure that spills in these areas do not reach waters of the state.

F. Control of Dust:

1. The control of dust shall mean that no construction activity shall take place without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction.
 - a. Reasonable measures may include paving, frequent road cleaning, planting vegetative groundcover, application of water or application of chemical dust suppressants.

- b. The use of chemical agents such as calcium chloride must be approved by the State of Alaska DOT.
 2. Utilize methods and practices of construction to eliminate dust in full observance of agency regulations.
 3. The Engineer will determine the effectiveness of the dust control program and may request the Contractor to provide additional measures, at no additional cost to Owner.
- G. Burning:
 1. Do not burn material on the site.
 2. If the Contractor elects to dispose of waste materials by burning, make arrangements for an off-site burning area and conform to all agency regulations.
- H. Control of Noise:
 1. Control noise by fitting equipment with appropriate mufflers.
- I. Completion of Work:
 1. Upon completion of work, leave area in a clean, natural looking condition.
 2. Ensure all signs of temporary construction and activities incidental to construction of required permanent work are removed.
 3. Grade, fill and seed all disturbed areas.
- J. Historical Protection:
 1. If during the course of construction, evidence of deposits of historical or archaeological interests is found, cease work affecting find and notify Engineer.
 - a. Do not disturb deposits until written notice from Engineer is given to proceed.
 2. The Contractor will be compensated for lost time or changes in construction to avoid the find based upon normal change order procedures.

END OF SECTION

SECTION 01 45 03
QUALITY ASSURANCE

PART 1 - SHOP TESTS

1.1 GENERAL

- A. Contractor shall pay all costs associated with specified shop tests of materials and equipment, including retesting of items that fail original tests.
- B. Related requirements specified elsewhere:
 - 1. Inspections and testing required by laws, ordinances, rules, regulations, orders, or approvals of public authorities: Conditions of the Contract.

PART 2 - MANUFACTURER'S FIELD SERVICES

2.1 GENERAL

- A. Contractor shall provide and pay for the services of Manufacturer's factory service technician representative to perform the specified services on Contractor supplied equipment.
- B. Contractor shall schedule manufacturer's field services to avoid conflicting with other field testing.
- C. Manufacturer's Authorized Representative shall complete the requirements of this Section and provide preliminary, interim and final Manufacturer's Field Service Reports and its certification of the equipment's proper installation and operation and commencement of the warranty period.

2.2 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

- A. Authorized representative of the Manufacturer.
- B. Experienced in the application, installation, operation, and training of the subject equipment.
- C. Submit qualifications of manufacturer's representative.

2.3 MANUFACTURER'S SERVICES PROVIDED BY THE REPRESENTATIVE

- A. The Contractor shall provide the following manufacturer's services as listed in individual specification sections for minimum time periods shown therein. All costs shall be at the expense of the Seller to provide the Manufacturer's services. If minimum time not shown provide time as necessary to fulfill service requirements shown below:
 - 1. Installation Check: Manufacturer's representative to perform installation and preoperational check as follows.
 - a. Inspect, check, and adjust equipment as required and approve installation.

- b. Site visits to be between 7:00 a.m. and 3:30 p.m., on Monday through Friday.
 - c. Revisit as often as required to correct all problems and until equipment installation and operation are acceptable to Owner or Owner's duly authorized representative:
 - 1) The cost of additional visits due wholly or in part to deficiencies in Contractor's equipment or documentation shall be at no additional cost to Owner.
2. Startup:
- a. Manufacturer's representative to start-up and check operation of equipment:
 - 1) Be present when equipment is placed in operation.
 - 2) Check for proper operation.
 - 3) Check for motor overloads by measuring amperage and voltage on each phase.
3. Manufacturer's Field Service Report:
- a. Submit two (2) preliminary copies of handwritten, typed or electronically produced manufacturer's field service report (enclosed at end of this section) after services have been performed but prior to Manufacturer's Representative leaving the site:
 - 1) Submit one copy to Engineer.
 - 2) Submit one copy to Owner or Owner's duly authorized representative.
 - b. Submit five (5) copies of final manufacturer's field service report (enclosed at end of this section) and neatly written, typed or electronically produced within forty-eight (48) hours after the Manufacturer's Representative has completed his inspections and services certifying that:
 - 1) Equipment is properly installed and lubricated.
 - 2) Equipment is in accurate alignment.
 - 3) Equipment is free from any undue stress imposed by connecting anchor bolts.
 - 4) Equipment has operated satisfactorily under full load conditions.
 - 5) Signature acknowledgement of Owner or Owner's duly authorized representative's acceptance.
4. Manufacture's Training Service:
- a. Prior to final inspection or acceptance, fully instruct Owner or Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems, for the time period (s) specified in individual specification sections at no cost to the Owner.

- b. Operation and maintenance information shall constitute the basis of instruction. Review contents of information with personnel in full detail to explain all aspects of operations and maintenance.
- c. Training must be scheduled 7 days in advance with the Owner. Prior to scheduling training an outline that lists the topics to be covered and time that will be spent on each topic must be submitted and approved by the Engineer. Trainer shall be available to Owner for a minimum period of 4 consecutive hours, or as required by the individual equipment specifications, between 7:00 AM and 3:30 PM local time. Each session will be held on a different calendar day or different work shift.
- d. Conduct all personnel training after completion of Equipment Startup for the equipment for which training is being conducted:
 - 1) Personnel training on individual equipment or systems will not be considered completed unless:
 - a) All pre-training deliverables are received and approved a minimum of fourteen (14) days before commencement of training on the individual equipment or system.
 - b) No system malfunctions occur during training.
 - c) All provisions of field and classroom training specifications are met.
 - 2) Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to Owner.
- e. Field and classroom training requirements:
 - 1) Hold classroom training on-site.
 - 2) Training instructor: Factory trained and employed, and familiar with giving both classroom and "hands-on" instructions:
 - a) Be at classes on time. Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule. Normal time lengths for class periods can vary, but brief rest breaks should be scheduled and taken. Costs to reschedule session due to late arrival by instructor will be borne by Contractor.
 - 3) Organize training sessions into maintenance verses operation topics and identify on schedule.
 - 4) Plan for minimum class attendance of 10 people at each session and provide sufficient classroom materials, samples, and handouts for those in attendance.
 - 5) Instructors have a typed agenda and well prepared instruction material. The use of visual aids, e.g., films, pictures, and slides are recommended during the classroom training programs. Deliver agendas to the Engineer a minimum of 7 days prior to the classroom training. Provide equipment required for presentation of films, slides, and other visual aids.

- 6) In the on-site operator training sessions, cover the information required in the Operation and Maintenance manuals submitted according to Section 01 33 04 and the following areas as applicable:
 - a) Operation of equipment.
 - b) Theory of operation.
 - c) Start-up procedures.
 - d) Shutdown procedures.
 - e) Selection of proper polymer types and dosages.
 - f) Lubrication of equipment.
 - g) Maintenance and repair of equipment.
 - h) Replacement parts for the equipment
 - i) Troubleshooting of equipment.
 - j) Preventive maintenance procedures.
 - k) Adjustments to equipment.
 - l) Optimizing equipment performance.
 - m) Capabilities.
 - n) Operational safety.
 - o) Emergency situation response.
 - p) Takedown procedures (disassembly and assembly).
 - q) Recordkeeping.
 - r) Instrumentation and controls.
 - s) Others deemed important by Contractor.
- 7) Address above paragraphs, a), b), c), d), e), f), g), h), i), j), r) etc. in the operation sessions.
- 8) Address above paragraphs c), d), e), f), g), h), i), j), k), k) etc. in the maintenance sessions.
- 9) Maintain a log of classroom training including instructors, topics, dates, time, and attendance.
- 10) Submit Post-Training Report including:
 - a) Classroom training log.
 - b) List of individuals trained.
 - c) Summary of training agenda.
 - d) Summary of questions and answers provided.
 - e) Recommendations for follow-up training.

PART 3 - FIELD TESTING

3.1 GENERAL

- A. Contractor shall pay all costs associated with field testing of his equipment as specified in the individual sections with the following exceptions:
 - 1. Owner shall pay for power.

3.2 TESTING

- A. Provide all materials, labor, and equipment required for testing.
- B. Perform all tests in presence of Owner or Owner's duly authorized representative's acceptance.
- C. Prepare and submit to Engineer five (5) copies of written reports detailing the results of the tests and identifying corrective action for materials and equipment which fail to pass field tests.
- D. Repair all materials and equipment which fail during testing with no additional cost to Owner.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Manufacturer's field services as specified in individual specification sections.

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MANUFACTURER FIELD SERVICE REPORT

PROJECT: City of Palmer
Wastewater Treatment Facility Improvements Project

CONTRACT:

I. Description

- A. Specification Section Number: _____
- B. Manufacturer: _____
- C. Representative: _____
- D. Type of Service: Initial___ Interim___ Final ___

II. General Review

- A. The above referenced equipment/material/supplies have been inspected, checked, and adjusted. Yes___ No___

(please explain) _____

- B. The above referenced equipment/material/supplies were placed upon properly prepared or suitable substrate. DNA___ Yes___ No___

(please explain) _____

- C. The above referenced equipment/material/supplies are free from any undue stress imposed by any connected piping, anchor bolts or any other load.
DNA___ Yes___ No___

(please explain) _____

D. The above referenced equipment/material/supplies have operated under design conditions. DNA___ Yes___ No___
 (please explain)_____

E. The above referenced equipment/material/supplies have been installed per the manufacturer's recommendations and the Documents, are approved, and require no corrective work. Yes___ No___
 (please explain)_____

F. The above referenced equipment/material/supplies are acceptable to the manufacturer as installed providing the following corrective action is performed (please list):

1. _____
2. _____
3. _____
4. _____
5. _____

III. Inspection Checklist

| | <u>Item</u> | <u>OK</u> | <u>Readings or Comments</u> |
|----|-----------------------------|-----------|---------------------------------|
| A. | Bearings | _____ | _____ |
| B. | Belts | _____ | _____ |
| C. | Lubrication Levels | _____ | _____ |
| D. | Vibration (Report attached) | _____ | _____ |
| E. | AMPS | _____ | _____ |
| F. | Volts | _____ | _____ |
| G. | Rotation | _____ | _____ |
| H. | Alignment | _____ | _____ |
| I. | Anchor Bolts | _____ | _____ |
| J. | Grout | _____ | _____ |

- K. Substrate Approval _____
- L. Other
 - 1. Motor Megger Test _____
 - 2. _____
 - 3. _____

IV. O&M Manuals

The O&M manual as presented contains all information required for proper operation, maintenance, and instruction of this system. DNA___ Yes___ No___

(please explain)_____

V. Preventive Maintenance

The preventive maintenance summary outlined in the O&M manual is acceptable for operation of the system throughout the warranty period. DNA___ Yes___ No___

(please explain)_____

VI. Spare Parts

All spare parts specified with the system are in new condition and are available on-site for transfer to the Buyer. DNA___ Yes___ No___

(please explain)_____

VII. Operator Training/Classroom Instruction

Operator training and classroom instruction has been performed per the requirements of the Documents. DNA___ Yes___ No___

(please explain)_____

VIII. Remarks:

IX. Certification

I hereby certify that I, _____, am a duly authorized representative of the manufacturer, that I am empowered by the manufacturer to inspect, approve, and operate his equipment. That I am authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as modified herein. I also certify that all information contained herein is true and accurate.

By: _____
Authorized Representative

For: _____

Date: _____

X. Acknowledgements

By: _____

For: _____
(Seller)

Date: _____

By: _____

For: HDR Engineering, Inc.
(Engineer)

Date: _____

END OF SECTION

SECTION 01 45 25
TESTING CONCRETE STRUCTURES FOR WATERTIGHTNESS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Requirements for furnishing all labor, materials, tools, equipment, and services, for all testing of concrete structures for watertightness, in accord with provisions of the Contract Documents.
 2. Completely coordinate with work of all other trades.
 3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete leak test.
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 2. Division 01 - General Requirements.
- C. Payment:
1. Contractor shall pay all costs required for testing, test water, retesting, patching, repair and work required to provide access for repair as required to meet watertightness requirements specified or indicated.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
1. American Concrete Institute (ACI):
 - a. 350.1, Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures and Commentary.
 2. NSF International (NSF).
 3. Underwriters Laboratories, Inc. (UL).
 4. United States Department of Agriculture (USDA).
 5. Water Quality Association (WQA).

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Watertightness testing plan:
 - a. Plan shall include:
 - 1) Scheduling for testing.
 - 2) Description of testing apparatus for measuring water level in structure and evaporation pan.
 - a) Include Drawings (plans, sections and details) as appropriate to fully describe apparatus.
 - b) Location plan showing measurement location and evaporation pan location.
 - 3) Procedures for isolation of tank or compartments to assure a constant volume during testing.
 - 4) Narrative describing testing procedure.
 - 5) Calculations showing:
 - a) Total structure volume at water elevation for commencement of test period.
 - b) Maximum water leakage allowed.
 - c) Test period: See ACI 350.1.
 - 6) Plan shall be in accordance with ACI 350.1, Chapters 1 and 2.
 3. If structure has running water leaks or fails watertightness test, submit repairing and patching plan.
 - a. Include with plan:
 - 1) Location and areas of leaks.
 - 2) Repair material and procedures proposed for repair.
 - 3) Photographs of all visible leaks and damp areas.
 - a) Include distant photos and close-ups to document conditions.

B. Informational Submittals:

1. Results of watertightness testing indicating the following:
 - a. Level of water in structure and in evaporation pan and water temperature at commencement of test period.
 - b. Level of water in structure and in evaporation pan and water temperature at end of test period.

- c. Net leakage in percent of total volume during test period (gross leakage minus that due to evaporation).
- d. Results of retesting required due to leakage exceeding percentages allowed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Water for Testing:
 - 1. See ACI 350.1.
 - 2. Wastewater plant: Raw or treated effluent water.
 - 3. Water treatment: Potable water.
 - 4. Coordinate delivery of water for testing with Owner.
- B. Any patching or repair materials that may come into contact with potable water in tanks shall be approved for drinking water per NSF, UL, USDA, or WQA.

PART 3 - EXECUTION

3.1 PREPARATION BEFORE TESTING

- A. General:
 - 1. Verify the specified 28-day concrete strength has been achieved prior to testing.
 - 2. Testing shall be performed prior to placement of exterior backfill soil.
 - a. Contractor is responsible for phasing construction to minimize the impact of leak testing.
 - 3. Contractor to furnish all necessary materials such as flange cover plates.
 - 4. Testing shall be performed prior to application of specified waterproofing.
 - 5. Test the following tanks prior to backfilling:
 - a. Secondary Clarifier
 - b. Secondary Scum Pump Station
 - c. Splitter Box

B. Source of water for watertightness testing:

1. Coordinate use of water for filling basins with Owner.
2. The source of water will be plant effluent or approved equal at the sole discretion of the Engineer.
3. The cost of providing water will be paid by the Contractor.
 - a. The cost of additional water due to retesting will be paid by the Contractor.

C. Cleaning:

1. Thoroughly clean interior of structure to be tested of all debris and dirt and hose down surfaces of all walls and slabs.
2. See Specification Section 01 74 13.

D. Patching and Finishing:

1. Prepare concrete surfaces in accordance with ACI 350.1 and Specification Section 03 35 00.
 - a. Review tank for areas of potential leakage before filling for testing for leakage.

3.2 TESTING FOR LEAKAGE

A. Provide watertightness testing for the following structures in accordance with the indicated criteria:

1. Where no elevation is given for WATER ELEVATION AT COMMENCEMENT OF TEST PERIOD in the following table, use the normal operating water elevation for the indicated structure.

| STRUCTURE NAME or TYPE | WATER ELEVATION AT COMMENCEMENT OF TEST PERIOD | MAXIMUM WATER LEAKAGE ALLOWED IN TEST PERIOD (PERCENT OF TOTAL VOLUME) |
|-----------------------------|--|--|
| Secondary Clarifier | 150.0 | 0.05% |
| Secondary Scum Pump Station | 148.0 | 0.05% |
| Splitter Box | 150.5 | 0.05% |

B. Perform a watertightness test as required by Engineer on any additional structure when in the opinion of the Engineer the structure contains sufficient concrete defects that could impair the watertightness of the structure.

1. Testing to conform to requirements of this Specification Section with allowable leakage and other criteria as established by Engineer.

- C. Test for leakage in accordance with ACI 350.1, latest edition, Chapters 1 and 2, and this Specification Section.
 - 1. Isolate sections of structures that can be isolated during operation.
 - a. Test section separately.
 - 2. Allow Owner's Representative to witness testing for watertightness and review accompanying results.
- D. Place evaporation pan in an easily accessible location.
- E. Record level of water in structure and evaporation pan and water temperature at commencement of the test period.
- F. During testing period, inspect structure for areas indicating leakage.
 - 1. Any areas evidencing running water shall be repaired and patched.
 - 2. Patching or repair of leaks as defined above shall be completed independent of the watertightness test.
 - a. Passing watertightness test does not relieve Contractor from repairing running water leaks.
- G. Record level of water surface in the structure and evaporation pan and temperature every 24 HRS until end of test period.
 - 1. Test periods defined per ACI 350.1.
- H. If leakage is greater than that allowed, repair and patch areas suspected of causing the leakage.
 - 1. Re-test structure using the same procedure until leakage is equal to or less than that allowed.
 - 2. Provide repair plan to Engineer for approval prior to repair of tank.
 - 3. Cracks suspected to cause leakage shall be filled with epoxy adhesive.
 - a. Patching shall be performed after defective concrete area is cleaned of all loose material to surface of sound concrete.
 - 4. Prior to patching activities, Contractor to submit patching materials and procedures for review and approval by Engineer.
- I. Dispose of water used for testing.
 - 1. Dispose of water used for testing to an area which will not damage new or existing construction and will not interfere with construction operations or plant operations.

2. Provide hoses, temporary connections, temporary fittings and other conduits as necessary to dispose of test water without damage to structure or terrain.
3. Point of disposal shall be approved by Engineer.

END OF SECTION

SECTION 01 45 33
SPECIAL INSPECTIONS AND TESTING PROGRAM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Contractor responsibilities for special inspection and testing.
2. Special Inspection program and reporting requirements.
3. Attachment A to this Specification Section includes the Submittal of Special Inspections.
4. Attachment B to this Specification Section includes Special Inspector qualifications, reporting requirements, and material specific inspections and tests.
 - a. This information is for the Contractor reference only and is not part of the Contract Documents.
 - b. It is included to assist the Contractor in understanding the Owner-provided Services so that those services may be factored into the Contractor's pricing and schedule.
 - c. The Service Provider(s) responsible for the Owner-provided Services will be selected after Contract award.

B. Purpose:

1. This Document was developed to address the requirements of the 2012 International Building Code (IBC), section 1704.1, including:
 - a. One or more special inspectors will be hired by the Owner or the Owner's Agent to provide inspections during constructions on the types of work listed under Section 1704.
2. A Statement of Special Inspections will be submitted to the Building Code Official as a condition for permit issuance. This statement is included as Attachment A to this Specification. Attachment B includes a complete list of materials and work requiring special inspections, the inspections to be performed and a list of the minimum qualifications of the individuals, approved agencies or firms intended to be retained for conducting such inspections.

C. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 DEFINITIONS

- A. Special Inspector: Representative of the Owner approved inspection agency designated for that portion of the work.
- B. Testing Agency: Approved agency, not affiliated or hired by the Contractor, which is responsible for the materials testing requirements of the project including but not limited to concrete cylinder breaks, soils testing, and masonry materials testing.
- C. Statement of Special Inspections: Document provided to the Building Code Official outlining special inspections and tests to be done on the project and frequency of required test.
- D. Soils Engineer or Geotechnical Engineer: For the purposes of Special Inspection "Soils Engineer," "Geotechnical Engineering," and "Special Inspector" shall be interchangeable as pertains to the Division 31 specifications.
- E. NICET: National Institute for Certification in Engineering Technologies.

1.3 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor shall cooperate with testing agency personnel, special inspector, and agents of the Building Code Official and provide access to the work.
 - 1. Providing access to the work shall include all labor and facilities to perform inspections and tests as listed in the specifications for the duration of the inspections or tests involved.
 - 2. Contractor shall provide means to obtain and handle samples taken on site.
- B. Attend a pre-construction meeting to coordinate and clarify inspection and testing procedures, requirements.
- C. Contractor shall notify special inspector and/or testing agency of work to be inspected/tested minimum of 24 HRS prior.
- D. Work for which special inspections are required shall remain accessible and exposed for the purposes of special inspections until completion of required special inspections.
- E. Any portion of work that is not in conformance shall be corrected and re-inspected. Such portions of the work shall not be covered or concealed until authorized by Owner's Representative.
- F. Work to be inspected should be complete at time of inspector's arrival on-site.
- G. Payment for Special Inspection services will be in accordance with the following:
 - 1. Payment described below is for the Testing Agency and Special Inspector costs, and does not include the Contractor's costs listed in Paragraph 1.3 A.

2. After Contractor notification, inspector arrives at site and performs inspection within the timeframe defined in Item 4 below.
 - a. Inspection reveals work is satisfactory.
 - b. Owner pays all costs associated with this inspection.
 3. After Contractor notification, inspector arrives at site and performs inspection within the timeframe defined in Item 4 below.
 - a. Inspection reveals work is deficient.
 - b. Contractor corrects deficiencies within timeframe defined in Item 4) below.
 - c. Work is re-inspected and work is satisfactory.
 - d. Owner pays all costs associated with this inspection.
 4. After Contractor notification, inspector arrives at site and work is not ready for inspection when inspector arrives.
 - a. Inspector will remain on-site for a maximum of 2 HRS awaiting the completion of the work.
 - b. If work is not ready for inspection at the end of this period, inspector will be dismissed until Contractor requests re-inspection.
 - c. All costs associated with this inspection trip will be charged to the Contractor.
 5. After Contractor notification, inspector arrives at site and performs inspection within the timeframe defined above.
 - a. Inspection reveals work is deficient.
 - b. Contractor attempts to correct deficiencies within 2 HR timeframe and calls for re-inspection.
 - c. Work is re-inspected and found to still be deficient.
 - d. Inspector will be dismissed.
 - e. All costs associated with this inspection trip will be charged to the Contractor.
 6. Owner will pay for "passing" soils on the Project. Costs of corrective actions and cost of failed test areas requiring retesting are the sole responsibility of the Contractor. For additional specific payment requirements for soils see the respective Division 31 Section.
- H. Special Inspection is intended to be an independent quality assurance. Special Inspections shall not relieve the Contractor of any quality assurance, quality control, workmanship, or warranty responsibilities. Contractor's own personnel shall review all work to be inspected for conformance with Contract Documents prior to calling for inspection.

1.4 REPORTING DUTIES AND AUTHORITY

- A. A pre-construction meeting to coordinate and clarify inspection, testing, and procedural requirements will be held per Section 01 30 00.
 - 1. The meeting is to be attended by:
 - a. Owner.
 - b. Engineer.
 - c. Building Code Official or designee.
 - d. Testing Agency and Special Inspectors.
 - e. General Contractor.
 - f. Appropriate Sub-contractor(s).
- B. Special Inspector shall report all deficient work to the Contractor as soon as possible.
 - 1. Deficient work that has been covered up or concealed prior to re-inspection shall be reported to the Engineer and the Building Code Official.
- C. Special Inspector does not have authority to stop work or modify the requirements of the Contract Documents.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

Attachment A to Section 01 45 33 Submittal of Special Inspections

Statement Date: {_____}

Project Name: {_____}

Project Address: {_____}

Owner: {_____}

Registered Design Professional in Responsible Charge (DPRC): {_____}

The Statement of Special Inspections (Statement) is submitted as a condition for permit issuance in accordance with the Special Inspection requirements of the Building Code. The Special Inspection program is outlined in Specification Section 01 45 33 and Attachments A and B. A detailed explanation of the requirements for Special Inspections and Testing can be found in specification Section 01 45 33 of the Project Manual in conjunction with the Technical Specifications for each material.

{Bi-weekly} {Monthly} Special Inspection reports will be submitted to the DPRC and the Building Official. Discovered discrepancies will be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies will be brought to the attention of the DPRC and the Building Official. Only documents that are prepared and signed or sealed by the Special Inspectors (SI) are valid.

The SI is responsible for verifying all information on each document prior to signing or sealing and directly forwarding it to the DPRC and Building Official. The SI is responsible for verifying all inspectors under his supervision maintain current certifications during the course of the project. At the conclusion of each individual Special Inspection type, the SI will complete a Final Report.

The Special Inspection program does not relieve the Contractor or any other entity of any contractual duties, including quality control, quality assurance, or safety. The Contractor is solely responsible for construction means, methods, and job site safety. Failure to adhere to the SI program as outlined herein may result in a stop work notice being issued by the Building Official.

Respectfully submitted,
Design Professional in Responsible Charge,

Type or Print Name

{_____} License # {_____}

Expires: {_____}

Signature

Date

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ATTACHMENT B
SPECIAL INSPECTIONS, INSPECTOR QUALIFICATIONS AND REPORTING
REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 2. Division 01 - General Requirements.
 3. Section 03 05 05 - Concrete Testing and Inspection.
 4. Section 05 12 00 - Structural Steel.
 5. Section 05 50 00 - Metal Fabrications.
 6. Section 31 23 00 - Earthwork.

1.2 QUALIFICATIONS

- A. Qualifications stated here are the minimum recommended by the Engineer. If the Building Code Official has more stringent qualifications, the more stringent qualifications will take precedence.
- B. All Special Inspections and Testing to be done under the direction of a Professional Engineer or Registered Architect registered in the State of Alaska herein referred to as Registered Professional for Special Inspections (RPSI).
- C. Soil, concrete, mortar, grout, steel and aluminum-related testing.
1. The Testing Agency shall have a minimum of 10 years' experience in the testing of these materials.
 2. The Testing Agency's technician(s) conducting this testing:
 - a. Shall have a minimum of 5 years' experience in the testing of soil, concrete, mortar, grout, steel and aluminum as appropriate.
 3. Concrete-related work:
 - a. International Code Council certification for Reinforced Concrete and American Concrete Institute Concrete Field Testing Technician – Grade 1.

D. Special Structural Inspections:

1. Professional Engineers or Architects, licensed in the State of Alaska, may perform special inspections in accordance with their license qualifications.
2. Other individuals, working under the direct supervision of a licensed engineer and meeting the following qualifications, may perform special inspections.
3. Soils-related work:
 - a. NICET Level II Certification in geotechnical engineering technology/construction; or
 - b. Registered Geologist; or
 - c. Engineer Intern under the direct supervision of a Licensed Professional Engineer registered in the State of Alaska.
4. Concrete-related work:
 - a. International Code Council certification for Reinforced Concrete Special Inspector or American Concrete Institute Concrete Construction Special Inspector.
 - b. Alternatively, may be an Engineer Intern under the direct supervision of a Licensed Professional Engineer registered in the State of Alaska.
5. Precast concrete erection-related work:
 - a. Engineer Intern under the direct supervision of a Licensed Professional Engineer registered in the State of Alaska.
6. Precast concrete erection welding:
 - 1) American Welding Society as a Certified Welding Inspector; or
 - 2) International Code Council Structural Steel and Welding Certification and American Welding Society Qualified and 1 year of related experience; or
 - 3) NDT Level II or II Certificate (for non-destructive testing only).
7. Fire resistive coating (intumescent paint) related work:
 - a. International Code Council Spray-Applied Fireproofing Certification and (3) years of related experience; or
 - b. International Code Council Fire Inspector 1 Certification and 3 years of related experience.
8. Other equivalent certifications will not be acceptable unless approved by the Engineer.

1.3 REPORTING DUTIES AND AUTHORITY

- A. Reporting requirements for special inspector per IBC 2012 for Building System Related Work.
 - 1. Comply with requirements of IBC Section 1704.
 - 2. Provide written documentation of all inspections and testing.
 - a. Include exact location of work.
 - b. If testing of specimens is included, include detailed information on storage and curing of specimens prior to testing.
 - 3. Furnish inspection and test reports to the Contractor, the Engineer's Project Manager and the Owner's on-site representative.
 - a. Indicate that work inspected was done in conformance with approved construction documents.
 - b. Immediately report any discrepancies to the Contractor for correction.
 - c. If the discrepancies are not corrected in a timely fashion, notify the Engineer's Project Manager and Owner's on-site representative.
 - 4. Issue an electronic report summarizing all inspections, corrective action notifications and resolution of discrepancies and non-conforming work every 2 weeks (14 calendar days).
 - a. Copy will be available to:
 - 1) Engineer's Project Manager.
 - 2) Owner.
 - 3) The Building Code Official.
 - 4) General Contractor.
 - 5. At the end of the Project, the RPSI shall compile all test reports for each inspected material and for each Special Inspector and summarize into a single PDF and submit to the Engineer and Building Code Official.
 - a. Final summary report to be signed and sealed by a Registered Professional for Special Inspections stating:
 - 1) The required Special Inspections have been performed.
 - 2) All discrepancies have been resolved except as specifically stated in the summary report.
- B. Special Inspector shall report all deficient work to the Contractor as soon as possible.
 - 1. Deficient work that has been covered up or concealed prior to re-inspection shall be reported to the Engineer and the Building Code Official.

- C. Special Inspector does not have authority to stop work or modify the requirements of the Contract Documents.

1.4 MATERIAL SPECIFIC SPECIAL INSPECTIONS AND TESTS

- A. Material specific requirements for special inspection and testing are listed in the technical specifications listed below. Special inspection and testing requirements will be located in each appropriate technical specification under "SOURCE QUALITY CONTROL", "FIELD QUALITY CONTROL" and/or "QUALITY ASSURANCE" as appropriate for each material.

1.5 SOILS

- A. Special Inspection/testing will be provided per IBC Section 1705.6 as required to determine that the site has been prepared in accordance with the approved soils report, and to verify the allowable soil bearing pressure, materials, compaction densities, trenching and backfill and conformance to the project Specifications.
- B. Inspection/testing requirements are listed separately in Specification Division 31 and are indicated as the work to be done by the Geotechnical Engineer, Testing Agency, or Special Inspections and Testing Provider.

1.6 CONCRETE

- A. Special Inspection and testing will be provided per IBC Table 1705.3. Inspection is required for material verification, reinforcing steel, embedded bolts, mechanical splices, concrete tests, welding of reinforcing, concrete placement and curing, and waterstop placement.
- B. Inspection and testing requirements are listed separately in Specification Section 03 05 05 and are indicated as the work to be done by the Special Inspector or Testing Agency.

1.7 PRECAST CONCRETE

- A. Special Inspection and testing will be provided per IBC Table 1705.3, Item 10. Inspection and testing is required for connection embed number and placement, connection welding, and proper panel detailing prior to placement.
- B. Inspection requirements are indicated as the work to be done by the Special Inspector.

1.8 STEEL, STAINLESS STEEL, AND ALUMINUM

- A. Special Inspection will be provided for structural steel and aluminum as specified below. Inspection is required for material verification, high-strength bolting, welding and other work noted on the Contract Documents.
 - 1. Comply with AISC 360, Specification for Structural Steel Buildings, Chapter N, for structural steel and steel fabrications.

2. Special inspections of aluminum structures, fabrications and associated welding shall comply with the 2015 edition of ADM 1, The Aluminum Design Manual, Chapter N.
- B. Inspection/testing requirements are listed separately in Section 05 12 00 and Section 05 50 00 and are indicated as the work to be done by the Special Inspector. Inspection requirements listed are applicable to aluminum, stainless steel, and structural steel.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS ATTACHMENT)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS ATTACHMENT)

END OF ATTACHMENT

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SECTION 01 61 03
EQUIPMENT: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements of this Specification Section apply to all equipment provided on the Project including those found in other Divisions even if not specifically referenced in individual "Equipment" Articles of those Specification Sections.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Division 43– Process GAS and Liquid Handling, Purification and Storage Equipment
4. Division 46– Water and Wastewater Equipment

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Bearing Manufacturers Association (ABMA).
2. American Gear Manufacturers Association (AGMA).
3. ASTM International (ASTM):
 - a. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
4. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
5. International Society of Automation (ISA).
6. International Organization for Standardization (ISO):
 - a. 1940, Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance Tolerances.

7. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. ICS 6, Enclosures for Industrial Control and System.
 - c. MG 1, Motors and Generators.
 8. International Electrical Testing Association (NETA):
 - a. ATS, Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems.
 9. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC):
 - 1) Article 430, Motors, Motor Circuits, and Controllers.
 10. National Institute for Certification in Engineering Technologies (NICET).
 11. National Institute of Standards and Technology (NIST).
 12. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
 13. Underwriters Laboratories, Inc. (UL).
 - a. 508, Standard for Safety Industrial Control Equipment.
 - b. 508A, Standard for Safety Industrial Control Panels.
- B. Electrical Equipment and Connections Testing Program:
1. Testing firm:
 - a. An independent firm performing, as the sole or principal part of its business for a minimum of 10 years, the inspection, testing, calibration , and adjusting of systems.
 - b. Must have an established monitoring and testing equipment calibration program with accuracy traceable in an unbroken chain, according to NIST.
 2. Field personnel:
 - a. Minimum of 1 year field experience covering all phases of electrical equipment inspection, testing, and calibration.
 - b. Relay test technician having previous experience with testing and calibration of relays of the same manufacturer and type used on project

and proficient in setting and testing the types of protection elements used.

c. Supervisor certified by NETA or NICET.

3. Analysis personnel:

a. Minimum three (3) years combined field testing and data analysis experience.

b. Supervisor certified by NETA or NICET.

C. Miscellaneous:

1. A single manufacturer of a "product" to be selected and utilized uniformly throughout Project even though:

a. More than one manufacturer is listed for a given "product" in Specifications.

b. No manufacturer is listed.

2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations.

3. Variable speed equipment applications: The driven equipment manufacturer shall have single source responsibility for coordination of the equipment and VFD system and insure their compatibility.

1.3 DEFINITIONS

A. Product: Manufactured materials and equipment.

B. Major Equipment Supports - Supports for Equipment:

1. Located on or suspended from elevated slabs with supported equipment weighing 2000 LBS or greater, or;

2. Located on slab-on-grade or earth with supported equipment weighing 5000 LBS or more.

C. Equipment:

1. One or more assemblies capable of performing a complete function.

2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.

3. Not limited to items specifically referenced in "Equipment" articles within individual Specifications.

D. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:

1. General for all equipment:
 - a. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - b. Data sheets that include manufacturer's name and complete product model number.
 - 1) Clearly identify all optional accessories that are included.
 - c. Acknowledgement that products submitted comply with the requirements of the standards referenced.
 - d. Manufacturer's delivery, storage, handling, and installation instructions.
 - e. Equipment identification utilizing numbering system and name utilized in Drawings.
 - f. Equipment installation details:
 - 1) Location of anchorage.
 - 2) Type, size, and materials of construction of anchorage.
 - 3) Anchorage setting templates.
 - 4) Manufacturer's installation instructions.
 - g. Equipment area classification rating.
 - h. Shipping and operating weight.
 - i. Equipment physical characteristics:
 - 1) Dimensions (both horizontal and vertical).
 - 2) Materials of construction and construction details.
 - j. Equipment factory primer and paint data.
 - k. Manufacturer's recommended spare parts list.
 - l. Equipment lining and coatings.
 - m. Equipment utility requirements include air, natural gas, electricity, and water.

- n. Ladders and platforms provided with equipment:
 - 1) Certification that all components comply fully with OSHA requirements.
 - 2) Full details of construction/fabrication.
 - 3) Scaled plan and sections showing relationship to equipment.
- 2. Mechanical and process equipment:
 - a. Operating characteristics:
 - 1) Technical information including applicable performance curves showing specified equipment capacity, rangeability, and efficiencies.
 - 2) Brake horsepower requirements.
 - 3) Copies of equipment data plates.
 - b. Piping and duct connection size, type and location.
 - c. Equipment bearing life certification.
 - d. Equipment foundation data:
 - 1) Equipment center of gravity.
 - 2) Criteria for designing vibration, special or unbalanced forces resulting from equipment operation.
- 3. Electric motor:
 - a. Motor manufacturer and model number.
 - b. Complete motor nameplate data.
 - c. Weight.
 - d. NEMA design type.
 - e. Enclosure type.
 - f. Frame size.
 - g. Winding insulation class and temperature rise.
 - h. Starts per hour.
 - i. Performance data:
 - 1) Motor speed-torque curve superimposed over driven machine speed-torque curve during start-up acceleration and at rated terminal voltage a minimum permissible or specified terminal voltage for all motors over 100 HP.
 - 2) Time-current plots with acceleration versus current and thermal damage curves at the operating and ambient temperatures and at

- rated terminal voltage and minimum permissible or specified terminal voltage for all motors over 100 HP.
- 3) Guaranteed minimum efficiencies at 100 percent, 75 percent, and 50 percent of full load
 - 4) Guaranteed minimum power factor at 100 percent, 75 percent, and 50 percent of full load.
 - 5) Locked rotor and full load current at rated terminal voltage and minimum permissible or specified terminal voltage.
 - 6) Starting, full load, and breakdown torque at rated terminal voltage and minimum permissible or specified terminal voltage.
- j. Bearing data and lubrication system.
- k. Thermal Protection System including recommended alarm and trip settings for winding and bearing RTD's.
- l. Fabrication and/or layout drawings:
- 1) Dimensioned outlined drawing.
 - 2) Connection diagrams including accessories (strip heaters, thermal protection, etc.).
- m. Certifications:
- 1) When utilized with a variable frequency controller, certify motor is inverter duty and the controller and motor are compatible.
 - a) Include minimum speed at which the motor may be operated for the driven machinery.
- n. Electrical gear:
- 1) Unless specified in a narrow-scope Specification Section, provide the following:
 - a) Equipment ratings: Voltage, continuous current, kVa, watts, short circuit with stand, etc., as applicable.
 - 2) Control panels:
 - a) Panel construction.
 - b) Point-to-point ladder diagrams.
 - c) Scaled panel face and subpanel layout.
 - d) Bill of Materials.
 - e) Technical product data on panel components.
 - f) Panel and subpanel dimensions and weights.
 - g) Panel access openings.
 - h) Nameplate schedule.
 - i) Panel anchorage.

4. Systems schematics and data:
 - a. Provide system schematics where required in system specifications.
 - 1) Acknowledge all system components being supplied as part of the system.
 - 2) Utilize equipment, instrument and valving tag numbers defined in the Contract Documents for all components.
 - 3) Provide technical data for each system component showing compliance with the Contract Document requirements.
 - 4) For piping components, identify all utility connections, vents and drains which will be included as part of the system.

5. Qualifications for:

- a. Vibration testing firm and personnel.
- b. Infrared thermography testing firm and personnel.
- c. Electrical equipment and connections testing firm and personnel.

6. Testing plans, in accordance with PART 3 of this Specification Section:

- a. Vibration testing.
- b. Thermography testing.
- c. Electrical equipment and connection testing.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 33 04 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.

C. Informational Submittals:

1. Sample form letter for equipment field certification.
2. Certification that equipment has been installed properly, has been initially started up, has been calibrated and/or adjusted as required, and is ready for operation.
3. Certification for major equipment supports that equipment foundation design loads shown on the Drawings or specified have been compared to actual loads exhibited by equipment provided for this Project and that said design loadings are equal to or greater than the loads produced by the equipment provided.

4. Field noise testing reports if such testing is specified in narrow-scope Specification Sections.
5. Notification, at least 1 week in advance, that motor testing will be conducted at factory.
6. Certification from equipment manufacturer that all manufacturer-supplied control panels that interface in any way with other controls or panels have been submitted to and coordinated with the supplier/installer of those interfacing systems.
7. Motor test reports.
8. Certification prior to Project closeout that electrical panel drawings for manufacturer-supplied control panels truly represent panel wiring including any field-made modifications.
9. Provide three bound final written reports documenting vibration monitoring and testing for specified equipment.
 - a. Include the acceptance criteria of all equipment tested.
 - b. Provide individual tabbed sections for information associated with each piece of tested equipment.
10. Preliminary field quality control testing format to be used as a basis for final field quality control reporting.
11. Testing and monitoring reports in accordance with PART 3 of this Specification Section.
12. Certification that driven equipment is compatible.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Motors:
 - a. Baldor.
 - b. General Electric.
 - c. Marathon Electric.
 - d. Reliance Electric.
 - e. Siemens.
 - f. Teco-Westinghouse.

- g. U.S. Motors.
- h. WEG.

2.2 MANUFACTURED UNITS

A. General:

1. Furnished equipment manufacturer's field quality control services and testing as specified in the individual equipment Specification Sections.
2. Perform and report on all tests required by the equipment manufacturer's Operation and Maintenance Manual.
3. Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
 - a. Contract Drawings and Specifications.
 - b. Related construction change documentation.
 - c. Approved Shop Drawings.
 - d. Approved Operation and Maintenance Manuals.
 - e. Other pertinent information as required.

B. Equipment Monitoring and Testing Plans:

1. Approved in accordance with Shop Drawing submittal schedule.
2. Included as a minimum:
 - a. Qualifications of firm, field personnel, and analysis personnel doing the Work.
 - b. List and description of testing and analysis equipment to be utilized.
 - c. List of all equipment to be testing, including:
 - 1) Name and tag numbers identified in the Contract Documents.
 - 2) Manufacturer's serial numbers.
 - 3) Other pertinent manufacturer identification,

C. Instruments Used in Equipment and Connections Quality Control Testing:

1. Minimum calibration frequency:
 - a. Field analog instruments: Not more than 6 months.
 - b. Field digital instruments: Not more than 12 months.

- c. Laboratory instruments: Not more than 12 months.
 - d. If instrument manufacturer's calibration requirements are more stringent, those requirements shall govern.
2. Carry current calibration status and labels on all testing instruments.
 3. See individual testing programs for additional instrumentation compliance requirements.
- D. Testing and Monitoring Program Documentation:
1. Provide reports with tabbed sections for each piece of equipment tested.
 2. Include all testing results associated with each piece of equipment under that equipment's tabbed section.
 - a. Include legible copies of all forms used to record field test information.
 3. Prior to start of testing, submit one copy of preliminary report format for Engineer review and comment
 - a. Include data gathering and sample test report forms that will be utilized.
 4. In the final report, include as a minimum, the following information for all equipment tested:
 - a. Equipment identification, including:
 - 1) Name and tag numbers identified in the Contract Documents.
 - 2) Manufacturer's serial numbers.
 - 3) Other pertinent manufacturer identification,
 - b. Date and time of each test.
 - c. Ambient conditions including temperature, humidity, and precipitation.
 - d. Visual inspection report.
 - e. Description of test and referenced standards, if any, followed while conducting tests.
 - f. Results of initial and all retesting.
 - g. Acceptance criteria.
 - h. "As found" and "as left" conditions.
 - i. Corrective action, if required, taken to meet acceptance.
 - j. Verification of corrective action signed by the equipment supplier and Owner's representative.

- k. Instrument calibration dates of all instruments used in testing.
- 5. Provide three bound final reports prior to Project final completion.

2.3 ACCESSORIES

A. Guards:

- 1. Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
- 2. Interior applications:
 - a. Construct from expanded galvanized steel rolled to conform to shaft or coupling surface.
 - b. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 IN spacing.
 - c. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.
- 3. Disinfection Channel Area applications:
 - a. Construct from 16 GA stainless steel or aluminum.
 - b. Construct to preclude entrance of rain, snow, or moisture.
 - c. Roll to conform to shaft or coupling surface.
 - d. Connect to equipment frame with stainless steel bolts and wing nuts.

B. Anchorage:

- 1. Cast-in-place anchorage:
 - a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
 - b. Configuration and number of anchor bolts shall be per manufacturer's recommendations.
 - c. Provide two nuts for each bolt.
- 2. Drilled anchorage:
 - a. Adhesive anchors with epoxy grout.
 - b. Threaded rods same as cast-in-place.

C. Data Plate:

- 1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.

2. Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.

D. Lifting Eye Bolts or Lugs:

1. Provide on all equipment 50 LBS or greater.
2. Provide on other equipment or products as specified in the narrow-scope Specification Sections.

2.4 FABRICATION

- A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.
- B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.
- C. Furnish like parts of duplicate units to be interchangeable.
- D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.
- E. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.
 1. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.
- F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.
 1. Provide drain connection for 3/4 IN PVC tubing.
- G. Machine the mounting feet of rotating equipment.
- H. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that cannot be properly prepared and painted.
 1. When such back to back fabrication cannot be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.

PART 3 - EXECUTION (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 01 65 50
PRODUCT DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.1 SUMMARY

- A. General work included in this section:
 - 1. Scheduling of product delivery.
 - 2. Packaging of products for delivery.
 - 3. Protection of products against damage from:
 - a. Handling.
 - b. Exposure to elements or harsh environments.
- B. Related sections include but are not necessarily limited to:
 - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 – General Requirements.
 - 3. Division 46 – Water and Wastewater Equipment

1.2 DELIVERY

- A. Scheduling:
 - 1. Arrange deliveries of products in accordance with the schedule in the Agreement.
 - 2. Immediately on delivery, Contractor or Contractor's duly authorized representative, and Owner or Owner's duly authorized representative shall inspect shipments to assure compliance with the Contract Documents and accepted submittals, and that products are properly protected and undamaged.
 - 3. Contractor or his representative and Owner or his representative shall agree in writing to conditions of delivery.
 - 4. Equipment shall be packaged for outdoor all-weather storage at the Owner's facility, except electrical control panels which are not rated NEMA 3, 4, 7, or 9.

PART 2 - PRODUCTS (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 PROTECTION, STORAGE, AND HANDLING

A. Preparation for shipment:

1. Package materials and equipment to facilitate handling and protect against damage during transit, handling or storage.
2. Box, crate, or otherwise completely enclose and protect all equipment.
3. Protect equipment from exposure to the elements and keep thoroughly dry and dust free at all times.
4. Protect painted surfaces against impact, abrasion, discoloration, or other damage.
5. Grease or oil all bearings and similar items.
6. Tag or mark each item per the delivery schedule or shop drawings.
7. Include complete packing lists and bills of materials with each shipment.
8. Provide permanent, labeled packing of spare parts.

B. Delivery and unloading:

1. Contractor shall deliver all parts and equipment to the City of Palmer Wastewater Treatment Facility, 1802 South Brooks Road, Alaska 99645
2. Contractor or his representative shall supervise unloading of equipment and Owner or Owner's duly authorized representative will unload equipment.
3. Contractor shall give Owner a minimum of 48 hours notice prior to shipping the goods.
4. Contractor shall give Owner a minimum of 24 hours written notice as to the time and date of delivery.
5. Contractor shall inform Owner of the type of equipment required to unload the goods 30 days prior to shipping.
6. Goods must be delivered between 8:00 am and 3:00 pm, Mondays through Thursday:
 - a. No deliveries on weekends accepted.
 - b. No deliveries on holidays accepted.
 - c. Owner has no obligation to accept products before or after specified times of day.

7. Owner or Owner's duly authorized representative shall unload equipment within 24 hours of time of delivery:
 - a. Contractor shall pay for all delivery truck and driver's time except that due to Owner's failing to unload equipment within 24 hours of time of delivery.
 - b. Owner shall pay for additional delivery truck and driver's time resulting from Owner's failure to unload equipment within 24 hours of time of delivery.
8. Contractor or his representative shall insure equipment is properly stored after off-loading.
9. If equipment is not delivered within 2 hours of the specified time and date in Contractor's written notice, Contractor shall reimburse Owner for standby charges for unloading equipment and personnel.

C. Storage:

1. Owner shall store equipment after delivery.
2. Owner shall store and protect equipment in accordance with the following requirements:
 - a. Store immediately upon delivery.
 - b. Store products in accordance with Contractor's instruction.
 - c. Store electrical equipment in weather-tight structures.
 - d. Protect electrical equipment, controls and insulation against moisture, water, and dust damage.
 - e. Store fabricated products above the ground on blocking or skids.
 - f. Arrange storage in a manner to provide easy access for inspecting. Make periodic inspections of stored products to assure that products are maintained under specific conditions, and free from damage or deterioration.

3.2 FIELD QUALITY CONTROL

A. Inspect all Deliveries:

1. Contractor or his representative and Owner or Owner's duly authorized representative shall inspect all goods upon delivery.
2. All products that are damaged, used, or in any other way unsatisfactory for use on the project shall be rejected.

END OF SECTION

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SECTION 01 71 21
SPECIALTY ENGINEERING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish engineering design, drawings and calculations for Specialty Engineering Requirements, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 DEFINITIONS

- A. Structural Engineer of Record (SER):
 - 1. Structural engineer legally eligible to seal structural Contract Documents for project.
 - 2. Seal acknowledges SER performed or supervised analysis, design, and document preparation for building structure and has knowledge of requirements for structural system.
 - 3. The SER is responsible for the design of the primary structural system.
- B. Specialty Structural Engineer (SSE):
 - 1. Registered Engineer other than Structural Engineer of Record (SER), licensed to practice structural engineering in state in which project is located.
 - 2. Undertakes engineering calculations, design and drawing preparation of components, systems, or installation methods and equipment for specific temporary portions of Work or special items of permanent Work required to be furnished by Contractor.
 - 3. Provide designs and details for items of permanent Work declared to be minor or non-structural.
 - 4. Employee or officer of Contractor or fabricator, employee or officer of an entity providing components to a fabricator, or an independent consultant.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 SYSTEM DESIGN

- A. Contract Documents show conceptually detailed components describing aesthetic intent and provides a performance-type prescription for the design, fabrication and installation.
- B. Contractor is responsible for the engineering and design of components and materials as well as fabrication and installation.
- C. Develop conditions not shown in Contract Documents to same level of aesthetics in compliance with performance and aesthetic criteria specified and indicated for detailed areas.
- D. Provide engineering design with drawings and calculations sealed by registered Engineer, licensed to practice structural engineering in State of Alaska.
- E. Comply with requirements of Contract Documents, codes, regulations, standards and guidelines including:
 - 1. Nationally published amendments.
 - 2. Local Amendments.
 - 3. Structural criteria provided.
 - 4. Additional requirements indicated in specification sections.
- F. Reference Standards:
 - 1. Refer to technical specification sections for listed standards.
- G. Minor deviations in dimensions and profiles may be considered provided design concept is unchanged or intended performance is not compromised as judged by the Architect.
- H. Where SSE exercises professional judgment and takes exception to specified criteria or reference standards, disclose exception in writing.

3.2 DOCUMENTATION

- A. Include following items common to project:
 - 1. Project Identification
 - a. Project name
 - b. Project location
 - c. Identifying project numbers
 - d. North arrow
 - e. Scale

2. Governing Codes
 - a. Building code and edition
 - b. Referenced codes and standards
 - c. Design method used for the design
 3. Service Loads
 4. Strength loads or factors
 5. Design Load
 - a. Dead loads
 - b. Live loads
 - c. Snow loads
 - d. Wind loads
 - e. Seismic loads
 6. Material Properties
 - a. Design properties
 - b. ASTM designations
 7. Computer Submittals
 - a. Documentation of computer programs including the program name and version should be included with any submittal of computer calculations. In the case of custom software or spreadsheet developed in house it may be necessary to provide hand calculation of representative elements to verify the use of the program.
- B. Include maximum design loads at connection points to primary structure.
1. Indicate values consistent with method used for design including service loads or strength loads with factors.
 2. Design system to apply loads to the structure through the centerlines of the supporting element.
 3. Assume building supports are free to rotate. Torsional or flexural fixed supports shall not be used unless approved by the SER.
 4. When fixed or eccentric supports are used, provide additional framing as deemed necessary by the SER at no additional cost.
- C. Include member sizes, required reinforcing, connection details and material specifications.

- D. Include statements where the SSE has exercised professional judgment and takes exception to the specified criteria or referenced standard. Final authority and responsibility for decisions concerning structural design criteria shall belong to the SER. When exceptions are stated as qualifications to the contractor's proposal, the SER shall be notified and respond prior to award.
- E. SSE shall review and approve the shop drawings and special erection drawings prepared by a fabricator or supplier and attest to that review with a signed shop drawing stamp, or other means, prior to submittal of the drawings to the SER. When standardized erection drawings are used, there is no need to provide a shop drawing approval stamp.

END OF SECTION

SECTION 01 73 20
OPENINGS AND PENETRATIONS IN CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Methods of installing and sealing openings and penetrations in construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 05 50 00 - Miscellaneous Metals.
4. Section 06 82 00 - Fiberglass Reinforced Plastic Fabrications.
5. Section 07 92 00 - Joint Sealants.
6. Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. 318, Building Code Requirements for Structural Concrete.
2. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - c. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - d. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - e. A351, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
 - f. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.

- g. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - h. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - i. A995, Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts.
3. National Fire Protection Association (NFPA):
- a. 70, National Electrical Code (NEC):
 - 1) Article 501, Class 1 Locations.
 - b. 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
 - c. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

1.3 DEFINITIONS

- A. Corrosive Areas: For the purpose of this specification section, see area classification for areas defined as corrosive:
- B. Hazardous Areas: Areas shown in the Contract Documents as having Class I or Class II area classifications.
- C. Washdown Areas: Areas having floor drains or hose bibs.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. For each structure provide dimensioned or scaled (minimum 1/8 IN = 1 FT) plan view drawings containing the following information:
 - a. Vertical and horizontal location of all required openings and penetrations.
 - b. Size of all openings and penetrations.
 - c. Opening type.
 - d. Seal type.
 - 3. Manufacturer's installation instructions for standard manufactured products.

1.5 PROJECT SITE CONDITIONS

- A. For purposes of this Project refer to the Project Geotechnical Report for water table levels used for this Project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe Sleeves

- 1. Areas listed as Corrosive Areas in PART 1:
 - a. Stainless steel, Type 304L.
 - b. Penetrations 24 IN DIA or less: ASTM A269, ASTM A312 or ASTM A554, Schedule 40.
 - c. Penetrations larger than 24 IN DIA: Stainless steel, ASTM A666, Minimum 1/4 IN thickness.
- 2. All other Areas:
 - a. Steel, Hot-dipped galvanized after fabrication.
 - b. Steel, painted in accordance with specification section 09 96 00.
 - c. Penetrations 24 IN DIA or less: ASTM A53, Schedule 40.
 - d. Penetrations larger than 24 IN DIA: ASTM A36, Minimum 1/4 IN thickness.

B. Backing Rod and Sealant: See Specification Section 07 92 00.

C. Modular Mechanical Seals:

- 1. Acceptable manufacturers:
 - a. Link-Seal.
- 2. 304 stainless steel bolts, nuts and washers.

D. Sheet Metal Sleeves:

- 1. Areas listed as Corrosive Areas in PART 1: Stainless steel: ASTM A240, Type 304L.
- 2. All other areas: Galvanized steel: ASTM A653, G90.
- 3. Minimum 12 GA.

- E. Commercial Wall Castings:
 - 1. Ductile iron, ASTM A536.
 - 2. For wet/corrosive areas either side of penetration: Stainless Steel, ASTM A352 or ASTM A995.
 - 3. Grade equal to connecting piping system.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Fabricate pipe sleeves in accordance with Specification Section 05 50 00.
- B. Provide waterstop plate/anchor flange for piping, ducts, castings and sleeves cast-in-place in concrete.
 - 1. For fabricated units, weld plate to sleeve, pipe, or ductwork.
 - 2. For commercial castings, cast water stop/anchor with wall pipe.
 - 3. Plate is to be same thickness as sleeve, pipe, casting or ductwork.
 - 4. For fabricated units, diameter of plate or flange to be 4 IN larger than outside diameter of sleeve, pipe or ductwork.
 - 5. For commercial castings, waterstop/anchor size to be manufacturer standard.
 - 6. Provide continuous around entire circumference of sleeve, pipe, or ductwork.
- C. Factory or shop-coat painted components in accordance with Specification Section 09 96 00.

3.2 INSTALLATION AND APPLICATION

- A. Seal openings and penetrations in non-fire-resistance-rated construction in accordance with Specification Section 07 92 00.
- B. Obtain prior approval from Engineer when any opening larger than 100 SQ IN must be made in existing or newly completed construction.
- C. Perform HVAC penetrations in accordance with NFPA 90A.
- D. Perform electrical penetrations in accordance with NFPA 70, Article 501.
- E. Install sleeves and castings in accordance with ACI 318, Chapter #6.
- F. When mechanical or electrical work cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, insets, fixtures or devices necessary to permit installation later.

1. Lay out chases, holes or other openings which must be provided in masonry, concrete or other work.
- G. Where pipes, conduits or ducts pass through floors in washdown areas, install sleeves with top 3 IN above finish floors.
1. In non-washdown areas, install sleeves with ends flush with finished surfaces.
- H. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.
- I. For insulated piping and ducts, size sleeves, blockouts and cutouts large enough to accommodate full thickness of insulation.
- J. Where pipes, conduits or ducts pass through grating, provide banding at the entire perimeter of the opening.
1. Metal grating: See Specification Section 05 50 00.
 2. FRP grating: See Specification Section 06 82 00.
- K. Where pipes, conduits or ducts are removed where passing through grating:
1. Metal grating:
 - a. Provide banding at perimeter and cover opening with 1/4 IN plate of the same material of the grating.
 - b. See Specification Section 05 50 00.
 2. FRP grating:
 - a. Provide full depth cover meeting same loading requirement as existing material or replace grating section.
 - b. See Specification Section 06 82 00.
- L. Do not cut into or core drill any beams, joists, or columns.
- M. Do not install sleeves in beams, joists, or columns.
- N. Do not install recesses in beams, joists, columns, or slabs.
- O. Field Cutting and Coring:
1. Saw or core drill with non-impact type equipment.
 2. Mark opening and drill small 3/4 IN or less holes through structure following opening outline.

3. Sawcut opening outline on both surfaces.
 - a. Knock out within sawcuts using impact type equipment.
 - b. Do not chip or spall face of surface to remain intact.
 - c. Do not allow any overcut with saw kerf.
- P. Precast-Prestressed Concrete Construction:
1. Do not cut openings or core drill vertically or horizontally through stems of members.
 2. Do not locate or install sleeves or recess sleeves vertically or horizontally through or in stems of members.
 3. Cast openings and sleeves into flanges of units.
 4. Cast openings larger than 6 IN in diameter or 6 IN maximum dimension in units at time of manufacture.
 5. Cast openings smaller than 6 IN in diameter or 6 IN maximum dimensions in flanges of units at time of manufacture or field cut.
- Q. Where alterations are necessary or where new and old work join, restore adjacent surfaces to their condition existing prior to start of work.
- R. Where area is blocked out to receive sheet metal sleeve at later date:
1. If blockout size is sufficient to allow placement, utilize dowels for interface of initially placed concrete and sleeve encasement concrete which is placed later.
 - a. Size blockout based on sleeve size required plus 4 to 6 IN each side of sleeve for concrete encasement.
 - b. Provide #4 dowels at 12 IN spacing along each side of blockout with minimum of two (2) dowels required per side.
 2. If blockout size is not sufficient to allow placement of dowels, provide keyway along all sides of blockout.
 - a. Size blockout based on sleeve size required plus 2 to 4 IN each side of sleeve for concrete encasement.
- S. For interior wall applications where backer rod and sealant are specified, provide backer rod and sealant at each side of wall.
- T. Refer to Drawings for location of fire-rated walls, floors, and ceilings.
- U. Use full depth expanding foam sealant for seal applications where single or multiple pipes, conduits, etc., pass through a single sleeve.

- V. Do not make duct or conduit penetrations below high water levels when entering or leaving tankage, wet wells, or other water holding structures.
- W. Modular Mechanical Seals:
 - 1. Utilize one seal for concrete thickness less than 8 IN and two (2) seals for concrete, 8 IN thick or greater.
 - 2. Utilize two seals for piping 16 IN diameter and larger if concrete thickness permits.
 - 3. Install seals such that bolt heads are located on the most accessible side of the penetration.
- X. Backer Rod and Sealant:
 - 1. Install in accordance with Specification Section 07 92 00.
 - 2. Provide backer rod and sealant for modular mechanical seal applications.
 - a. Apply on top side of slab penetrations and on interior, dry side wall penetrations.

3.3 SCHEDULES

- A. General Schedule of Penetrations through Floors, Roofs, Foundation Base Slabs, Foundation Walls, Foundation Footings, Partitions and Walls for Ductwork, Piping, and Conduit:
 - 1. Provide the following opening and penetration types:
 - a. Type A - Block out 2 IN larger than outside dimensions of duct, pipe, or conduits.
 - b. Type B - Saw cut or line-drill opening. Place new concrete with integrally cast sheet metal or pipe sleeve.
 - c. Type C - Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe sleeve with water ring for wet and/or washdown areas.
 - d. Type D - Commercial type casting or fabrication.
 - e. Type E - Saw cut or line-drill opening. Place new concrete with integrally cast pipe, duct or conduit spools.
 - f. Type F - Integrally cast pipe, duct or conduit.
 - g. Type G - Saw cut or line-drill and remove area 1 IN larger than outside dimensions of duct, pipe or conduit.
 - h. Type H - Core drill.

- i. Type I - Block out area. At later date, place new concrete with integrally cast sheet metal or pipe sleeve.
 - j. Type J- Grating Banding for any field cut openings
2. Provide seals of material and method described as follows.
 - a. Category 1 - Modular Mechanical Seal.
 - b. Category 2 - Roof curb and flashing according to SMACNA specifications unless otherwise noted on Drawings. Refer to roofing Specification Sections for additional requirements.
 - c. Category 3 - 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing rod and sealant used in sleeve annulus.
 - d. Category 4 - Backer rod and sealant.
 - e. Category 5 - Full depth compressible sealant with escutcheons on both sides of opening.
 - f. Category 6 - Full depth compressible sealant and flanges on both sides of opening. Flanges constructed of same material as duct, fastened to duct and minimum 1/2 IN larger than opening.
 - g. Category 7 - Full depth compressible sealant and finish sealant or full depth expanding foam sealant depending on application.
 - h. Category 8 - Banding for all grating openings and banding and cover plate of similar materials for abandoned openings
 3. Furnish openings and sealing materials through new floors, roofs, grating, partitions and walls in accordance with Schedule A, Openings and Penetrations for New Construction.
 4. Furnish openings and sealing materials through existing floors, grating, roofs, partitions and walls in accordance with Schedule B, Openings and Penetrations for Existing Construction.

**SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE
FOR NEW CONSTRUCTION**

| APPLICATIONS | DUCTS | | PIPING | | CONDUIT | |
|--|--------------|-------------------|---|------------------------------|--|------------------------|
| | OPENING TYPE | SEAL CATEGORY | OPENING TYPE | SEAL CATEGORY | OPENING TYPE | SEAL CATEGORY |
| Through floors with bottom side a hazardous location | C F I | 7 Not Req 7 | D F I ⁽¹⁾ | Not Req Not Req 7 | C F | 7 Not Req |
| Through floors on grade above water table | C F I | 4 Not Req 4 | C F I ⁽¹⁾ | 7 Not Req 7 | C F I ⁽¹⁾ | 4 Not Req 7 |
| Through slab on grade below water table | F | Not Req | F | Not Req | F | Not Req |
| Through floors in washdown areas | C I | 4 4 | C H ⁽²⁾ I ⁽¹⁾ | 4 3 4 | F H ⁽²⁾ I ⁽¹⁾ | Not Req 3 7 |
| Through walls where one side is a hazardous area | C F I | 7 Not Req 7 | D F I ⁽¹⁾ | Not Req Not Req 7 | C F | 7 Not Req |
| Through exterior wall below grade above water table | C F I | 7 Not Req 7 | C D F I ⁽¹⁾ | 1 Not Req Not Req 1 | F I ⁽¹⁾ | Not Req 7 |
| Through wall from tankage or wet well (above high water level) to dry well or dry area | C F I | 7 Not Req 7 | C D F H ⁽²⁾ | 1 Not Req Not Req 1 | C F H ⁽²⁾ I ⁽¹⁾ | 7 Not Req 7 7 |
| Through wall from tankage or wet well (below high water level) to dry well or dry area | F | Not Req | F | Not Req | F | Not Req |
| Through exterior wall above grade | A B C | 6 6 6 | A B D H ⁽²⁾ | 5 5 Not Req 5 | C H ⁽²⁾ | 5 4 |
| Roof penetrations | A | 2 | A | 2 | A | 2 |
| Through interior walls and slabs not covered by the above applications | A C | 4 4 | A C | 4 4 | A C F | 4 4 Not Req |
| Grating openings and penetrations | J | 8 | J | 8 | J | 8 |

**SCHEDULE B. OPENINGS AND PENETRATIONS SCHEDULE
FOR EXISTING CONSTRUCTION**

| APPLICATIONS | DUCTS | | PIPING | | CONDUIT | |
|--|--------------|---------------|--|------------------------|--|-------------------|
| | OPENING TYPE | SEAL CATEGORY | OPENING TYPE | SEAL CATEGORY | OPENING TYPE | SEAL CATEGORY |
| Through floors with bottom side a hazardous location | B E | 7 Not Req | B ⁽¹⁾ E ⁽³⁾ H ⁽²⁾ | 7 Not Req 7 | B ⁽¹⁾ E ⁽³⁾ H ⁽²⁾ | 7 Not Req 7 |
| Through floors on grade above water table | B | 7 | B | 7 | B | 7 |
| Through slab on grade below water table | E | Not Req | E | Not Req | E | Not Req |
| Through floors in washdown areas | G | 3 | G H ⁽²⁾ | 3 3 | G H ⁽²⁾ | 3 3 |
| Through walls where one side is a hazardous area | B E | 7 Not Req | B ⁽¹⁾ B ⁽³⁾⁻ E H ⁽²⁾ | 7 1 Not Req 7 | B ⁽¹⁾⁽³⁾ E H ⁽²⁾ | 7 Not Req 7 |
| Through exterior wall below grade above water table | B | 7 | B ⁽¹⁾ B ⁽³⁾ H ⁽²⁾ | 7 1 7 | B ⁽¹⁾⁽³⁾ H ⁽²⁾ | 7 7 |
| Through wall from tankage or wet well (above high water level) to dry well or dry area | B E | 7 Not Req | B E H ⁽²⁾ | 1 Not Req 1 | B ⁽¹⁾⁽³⁾ E H ⁽²⁾ | 7 Not Req 7 |
| Through wall from tankage or wet well (below high water level) to dry well or dry area | E | Not Req | E | Not Req | E | Not Req |
| Through exterior wall above grade | G | 6 | G ⁽¹⁾⁽³⁾ H ⁽²⁾ | 5 5 | G ⁽¹⁾⁽³⁾ H ⁽²⁾ | 5 7 |
| Roof penetrations | G | 2 | G ⁽¹⁾⁽³⁾ H ⁽²⁾ | 2 | G | 2 |
| Through interior walls and slabs not covered by the above applications | G | 4 | G ⁽¹⁾⁽³⁾ H ⁽²⁾ | 4 4 | G ⁽¹⁾⁽³⁾ H ⁽²⁾ | 4 4 |
| Grating openings and penetrations | J | 8 | J | 8 | J | 8 |

- (1) Multiple piping 3 IN and smaller or multiple conduits.
(2) Single pipe 3 IN and smaller or single conduit.
(3) Single pipe or conduit larger than 3 IN.

END OF SECTION

SECTION 01 73 29
DEMOLITION, CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition, cutting and patching of existing construction where shown on Drawings, or as required to accommodate new work shown or specified.
2. Removal and protection of items identified to be saved or reused.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 31 30 - Concrete, Materials and Proportioning.
4. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.
5. Section 09 96 00 - High Performance Industrial Coatings.
6. Section 31 23 00 - Earthwork.
7. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.

1.2 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Provide documentation of demolition and removal. Indicate limits and sequencing to be used. Show and identify any items to be kept for Owner reuse or retention.
3. Provide schedule of demolition activities including overall schedule, planned utility interruptions, interruptions of Owner/Using Agency services and traffic control if required.
4. Indicating manufacturer and type of:
 - a. Proposed nonshrink grout.
 - b. Epoxy bonding adhesive.

- c. Proposed materials and methods to be used for matching and repairing existing construction.

1.3 DELIVERY, STORAGE, AND HANDLING

A. General:

1. Salvage items, designated for Owner's salvage, as a functional unit.
2. Clean, list and tag for storage.
3. Protect from damage and deliver to location designated.
4. Salvage each item with auxiliary or associated equipment required for operation.

1.4 PROJECT CONDITIONS

- A. Perform preliminary investigations as required to ascertain extent of work.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate and reschedule work as required to preclude interference with other operations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
 1. Epoxy bonding adhesive:
 - a. Euco No.452 MV by Euclid Chemical Co.
 - b. Sikadur 32, Hi-Mod by Sika Corporation.
 2. Epoxy patch:
 - a. Depth of patch:
 - 1) Greater than 3/4 IN: Five Star MP Epoxy Patch.
 - 2) Between 1/8 IN and 3/4 IN: Five Star Fluid Epoxy.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Temporary Partitions:

1. Plywood: 1/2 IN minimum for interior or exterior use.
2. Paneling: 1/4 IN minimum for interior use.

B. Nonshrink Grout:

1. See Section 03 31 30.

C. Epoxy Bonding Adhesive:

1. Two component, moisture insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide and maintain temporary partitions as required in public areas.

1. Construct partitions of braced plywood in exterior areas.
2. Adequately braced paneling may be used in interior areas.

B. Provide and maintain covered passageways where necessary to ensure safe passage of persons in or near areas of work.

C. Provide and maintain substantial barricades and safety lights as required.

D. Provide and maintain temporary dustproof partitions where indicated or necessary.

1. Prevent infiltration of dust into occupied areas.

E. Provide and maintain temporary weather protection as necessary.

F. Provide adequate temporary bracing to maintain safety, stability and to resist all loads to which the structure may be subjected.

3.2 DEMOLITION

A. Cutting and Removal:

1. Remove existing work indicated to be removed, or as necessary for installation of new work.
2. Neatly cut and remove materials, and prepare all openings to receive new work.
3. Remove masonry or concrete in small sections.

B. Modification of Existing Concrete:

1. Where indicated, remove existing concrete and finish remaining surfaces as specified in Specification Section 03 35 00.
 - a. Make openings by sawing through the existing concrete.
 - 1) Core drill with 6 IN DIA core at the corners of rectangular openings to avoid overcutting at corners.
 - b. Break out concrete after initial saw cuts in the event concrete thickness prevents cutting through.
 - c. Where saw cutting is not possible, make openings by drilling holes around perimeter of opening and then chipping out the concrete.
 - 1) Holes shall be sufficient in number to prevent damage to remaining concrete.
2. Oversize required openings in existing concrete 1 IN on all sides and build back to required opening size by means of nonshrink grout epoxy bonded to the existing concrete.
3. Where oversized openings cannot be made, remove the concrete to the required opening size and cut back exposed reinforcing 1 IN from face of concrete and fill resulting holes with nonshrink grout.
4. Protect remaining concrete from damage.
 - a. If existing concrete to remain becomes damaged, cease demolition and make corrections as required to avoid further damage.
 - b. Notify Engineer immediately of any damage to remaining concrete.

C. Removal of Existing Anchor Bolts or Other Protruding Elements:

1. Remove all protruding elements.
2. Remove to a depth of 1/4 IN from finished surface.
3. Fill void with epoxy patch.

D. Matching and Patching:

1. Walls, ceilings, floors or partitions:
 - a. Repair abutting walls, ceilings, floors or partitions disturbed by removal.
 - b. Match and patch existing construction disturbed during installation of new work.

2. Methods and materials:
 - a. Similar in appearance, and equal in quality to adjacent areas for areas or surfaces being repaired.
 - b. Subject to review of Owner.
 3. Reinforcing steel that is cut and exposed:
 - a. Remove to a depth of 1/2 IN.
 - b. Fill void with epoxy patch.
- E. Salvaged Items:
1. Thoroughly dry and clean all metal surfaces.
 2. Prime all bare metal in accordance with Specification Section 09 96 00.
 3. Clean and lubricate motors and other moving parts.
 4. Brace motors attached to flexible mountings until reinstallation.
 5. Dispose of items or materials not designated for Owner's salvage or reuse.
 - a. Promptly remove from site.
 6. Do not store or sell Contractor salvaged items or materials on-site.
 7. Carefully remove items to be salvaged and reused or to be delivered to Owner's storage.
 - a. Store and protect items indicated on Drawings or those which have been marked by Owner to be salvaged or to be reused in Work.
 - b. Replace any item damaged through carelessness in removal, storage, or handling with new items of same type.
 - c. Do not reuse materials or equipment not specifically indicated or specified to be reused.
 8. Preparation of equipment for storage:
 - a. Identify each component with markings or tags to show its position in the assembly and the assembly of which it belongs.
 - b. Place small parts of wooden boxes and clearly mark contents on the outside.
 - c. Remove oil from oil-lubricated bearings and gear boxes and replace with storage oil.
 - d. Grease grease-lubricated bearings.

- e. Replace any breather plug with solid plug.
 - f. Megger test motor windings: Attach report of the test results to the unit and furnish one (1) copy to the Engineer.
 - g. Attach unit to suitable crate bottom.
 - h. Enclose unit in polyethylene film and seal all seams and the film to the base of the unit with tape.
 - i. Construct crate of wooden slats around top and sides of unit.
 - j. Attach permanent instruction tag to outside of crate stating "This unit has been prepared for storage--replace oil, vent plugs, and lubricant in accordance with manufacturer's instructions before start-up."
- F. Clean Up: Transport debris and legally dispose of off-site.

END OF SECTION

SECTION 01 74 13
CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Intermediate and final cleaning of Work not including special cleaning of closed systems specified elsewhere.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 STORAGE AND HANDLING

A. Store cleaning products and cleaning wastes in containers specifically designed for those materials.

1.3 SCHEDULING

A. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process will not fall on newly painted surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents:

1. Compatible with surface being cleaned.
2. New and uncontaminated.
3. For Manufactured Surfaces: Material recommended by manufacturer.

PART 3 - EXECUTION

3.1 CLEANING - GENERAL

A. Prevent accumulation of wastes that create hazardous conditions.

B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities.

- C. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains or sewers.
- D. Dispose of degradable debris at an approved solid waste disposal site.
- E. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate manner approved by Engineer and regulatory agencies.
- F. Handle materials in a controlled manner with as few handlings as possible.
- G. Do not drop or throw materials from heights greater than 4 FT or less than 4 FT if conditions warrant greater care.
- H. On completion of work, leave area in a clean, natural looking condition.
 - 1. Remove all signs of temporary construction and activities incidental to construction of required permanent Work.
- I. Do not burn on-site.

3.2 INTERIOR CLEANING

A. Cleaning During Construction:

- 1. Keep work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations.
- 2. At maximum weekly intervals, dispose of waste materials, debris, and rubbish.
- 3. Vacuum clean interior areas when ready to receive finish painting.
 - a. Continue vacuum cleaning on an as-needed basis, until substantial completion.

B. Final Cleaning:

- 1. Complete immediately prior to Demonstration Period.
- 2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed surfaces.
- 3. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
- 4. Replace all burned out light bulbs and lamps.
- 5. Broom clean process area floors.

3.3 EXTERIOR (SITE) CLEANING

A. Cleaning During Construction:

1. Construction debris:
 - a. Confine in strategically located container(s):
 - 1) Cover to prevent blowing by wind.
 - 2) Haul from site minimum once a week.
 - b. Remove from work area to container daily.
2. Vegetation: Keep weeds and other vegetation trimmed to 3 IN maximum height.
3. Soils, sand, and gravel deposited on paved areas and walks:
 - a. Remove as required to prevent muddy or dusty conditions.

B. Final Cleaning:

1. Remove trash and debris containers from site.
 - a. Re-seed areas disturbed by location of trash and debris containers.
2. Clean paved roadways.

3.4 FIELD QUALITY CONTROL

- A. Immediately prior to Demonstration Period, conduct an inspection with Engineer or Owner's Representative to verify condition of all work areas.

END OF SECTION

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SECTION 01 75 00
FACILITY START-UP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Procedures and actions, required of the Contractor, which are necessary to achieve and demonstrate Substantial Completion.
2. Requirements for Substantial Completion Submittals.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 01 61 03 - Equipment: Basic Requirements.
4. Section 40 90 00 - Instrumentation for Process Control: Basic Requirements.

1.2 QUALITY ASSURANCE

1. Operations and maintenance specialist for liaison:

- a. Licensed in any state at a level equivalent to a Wastewater Treatment Grade 3 operator's license issued by State of Alaska
- b. Alternate to licensed operator:
 - 1) Registered Professional Engineer with Master of Sciences degree in sanitary or environmental engineering.

1.3 DEFINITIONS

A. Project Classified System (PCS): A defined part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent system.

B. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from manufacturer's representatives, performs in the following sequence:

1. Finishing type construction work to ensure the Project has reached a state of Substantial Completion.

2. Equipment start-up.
 3. Personnel training.
- C. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates process flow through the facility and starts up and operates the facility, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.
- D. Substantial Completion: See the General Conditions.

1.4 SUBMITTALS

- A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- B. Submit in the chronological order listed below prior to the completion of the Pre-Demonstration Period.
1. Master operation and maintenance training schedule:
 - a. Submit 30 days (minimum) prior to first training session for Owner's personnel.
 - b. Schedule to include:
 - 1) Target date and time for Owner witnessing of each system initial start-up.
 - 2) Target date and time for Operation and Maintenance training for each system, both field and classroom.
 - 3) Target date for initiation of Demonstration Period.
 - c. Submit for review and approval by Owner.
 - d. Include holidays observed by Owner.
 - e. Attend a schedule planning and coordination meeting 90 calendar days prior to first anticipated training session.
 - 1) Provide a status report and schedule-to-complete for requirements prerequisite to manufacturer's training.
 - 2) Identify initial target dates for individual manufacturer's training sessions.
 - f. Owner reserves the right to insist on a minimum seven (7) days' notice of rescheduled training session not conducted on master schedule target date for any reason.
 - g. Schedule to be resubmitted until approved.

2. Substantial Completion Submittal:
 - a. File Contractor's Notice of Substantial Completion and Request for Inspection.
 - b. Approved Operation and Maintenance manuals received by Engineer minimum 30 days prior to scheduled training.
 - c. Written request for Owner to witness each system pre-demonstration start-up.
 - 1) Request to be received by Owner minimum one (1) week before scheduled training of Owner's personnel on that system.
 - d. Equipment installation and pre-demonstration start-up certifications.
 - e. Letter verifying completion of all pre-demonstration start-up activities including receipt of all specified items from manufacturers or suppliers as final item prior to initiation of Demonstration Period.

1.5 COST OF START-UP

- A. Contractor to pay all costs associated with Facility start-up.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 GENERAL

- A. Facility Start-up Divided into Two Periods:
 1. Pre-Demonstration Period including:
 - a. Completion of construction work to bring Project to a state of Substantial Completion.
 - b. Start-up of Equipment.
 - c. Training of Personnel.
 - d. Completion of the filing of all required submittals.
 - e. Filing of Contractor's Notice of Substantial Completion and Request for Inspection.
 2. Demonstration Period including:
 - a. Demonstration of functional integrity of facility or PCS.

3.2 PRE-DEMONSTRATION PERIOD

A. Completion of Construction Work:

1. Complete the work to bring the Project to a state of substantial completion.

B. Equipment Start-up:

1. Requirements for individual items of equipment are included in the Technical Specification Sections.
2. Prepare the equipment so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
3. Perform Equipment Start-up to extent possible without introducing product flow.
4. Test tanks, pumping and similar equipment requiring a fluid, using clean water supplied at Contractor's expense.
5. Dispose of water used for Equipment Start-up.
6. Introduce product flow to complete Equipment Start-up for the following equipment:
 - a. Secondary Scum Pump Station
 - b. Secondary Clarifiers No. 1 and No. 2
 - c. WAS Pump Station
7. Procedures include but are not necessarily limited to the following:
 - a. Test or check and correct deficiencies of:
 - 1) Power, control, and monitoring circuits for continuity prior to connection to power source.
 - 2) Voltage of all circuits.
 - 3) Phase sequence.
 - 4) Cleanliness of connecting piping systems.
 - 5) Alignment of connected machinery.
 - 6) Vacuum and pressure of all closed systems.
 - 7) Lubrication.
 - 8) Valve orientation and position status for manual operating mode.
 - 9) Tankage for integrity using product flow.
 - 10) Pumping equipment using product flow.

- 11) Instrumentation and control signal generation, transmission, reception, and response.
 - a) See Specification Section 40 90 00.
 - 12) Tagging and identification systems.
 - 13) All equipment: Proper connections, alignment, calibration and adjustment.
- b. Calibrate all safety equipment.
 - c. Manually rotate or move moving parts to assure freedom of movement.
 - d. "Bump" start electric motors to verify proper rotation.
 - e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.
 - f. Documentation:
 - 1) Prepare a log showing each equipment item subject to this paragraph and listing what is to be accomplished during Equipment Start-up.
 - 2) Provide a place for the Contractor to record date and person accomplishing required work.
 - 3) Submit completed document before requesting inspection for Substantial Completion certification.
8. Obtain certifications, without restrictions or qualifications, and deliver to Engineer:
- a. Manufacturer's equipment installation check letters (sometimes referred to as Manufacturer's Field Services report).
 - b. Instrumentation Supplier's Instrumentation Installation Certificate.
- C. Cleanup:
- 1. After successful demonstration, discontinue process flow, drain system and clean as necessary to achieve safe and sanitary conditions.
- D. Personnel Training:
- 1. See individual equipment specification sections.
 - 2. Conduct all personnel training after completion of Equipment Start-up for the equipment for which training is being conducted.
 - a. Personnel training on individual equipment or systems will not be considered completed unless:
 - 1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.

- 2) No system malfunctions occur during training.
 - 3) All provisions of field and classroom training specifications are met.
- b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to Owner.
3. Field and classroom training requirements:
- a. Hold classroom training on-site.
 - b. Notify each manufacturer specified for on-site training that the Owner reserves the right to video record any or all training sessions.
 - 1) Organize each training session in a format compatible with video recording.
 - c. Training instructor qualification: Factory trained and familiar with giving both classroom and "hands-on" instructions.
 - d. Training instructors:
 - 1) Be at classes on time.
 - 2) Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule.
 - 3) Normal time lengths for class periods can vary, but brief rest breaks should be scheduled and taken.
 - e. Organize training sessions into maintenance verses operation topics and identify on schedule.
 - f. Plan for minimum class attendance of 10 people at each session and provide sufficient classroom materials, samples, and handouts for those in attendance.
 - g. Instructors to have a typed agenda and well prepared instructional material.
 - 1) The use of visual aids, e.g., films, pictures, and slides is recommended for use during the classroom training programs.
 - 2) Deliver agendas to the Engineer a minimum of seven (7) days prior to the classroom training.
 - 3) Provide equipment required for presentation of films, slides, and other visual aids.
 - h. In the on-site training sessions, cover the information required in the Operation and Maintenance Manuals submitted according to Specification Section 01 33 04 and the following areas as applicable to PCS's.
 - 1) Operation of equipment.
 - 2) Lubrication of equipment.

- 3) Maintenance and repair of equipment.
- 4) Troubleshooting of equipment.
- 5) Preventive maintenance procedures.
- 6) Adjustments to equipment.
- 7) Inventory of spare parts.
- 8) Optimizing equipment performance.
- 9) Capabilities.
- 10) Operational safety.
- 11) Emergency situation response.
- 12) Takedown procedures (disassembly and assembly).

- i. Address above Paragraphs 1), 2), 8), 9), 10), and 11) in the operation sessions. Address above Paragraphs 3), 4), 5), 6), 7), and 12) in the maintenance sessions.
- j. Maintain a log of classroom training provided including: Instructors, topics, dates, time, and attendance.

E. Complete the filing of all required submittals:

1. Shop Drawings.
2. Operation and Maintenance Manuals.
3. Training material.

F. Filing of Contractor's Notice of Substantial Completion and Request for Inspection of Project or PCS:

1. File the notice when the following have been completed:
 - a. Construction work (brought to state of Substantial Completion).
 - b. Equipment Start-up.
 - c. Personnel Training.
 - d. Submittal of required documents.
2. Engineer will review required submittals for completeness within 5 calendar days of Contractor's notice. If complete, Engineer will complete inspection of the Work, within 10 calendar days of Contractor's notice.

3. Engineer will inform Contractor in writing of the status of the Work reviewed, within 14 calendar days of Contractor's notice.
 - a. Work determined not meeting state of Substantial Completion:
 - 1) Contractor: Correct deficiencies noted or submit plan of action for correction within 5 days of Engineer's determination.
 - 2) Engineer: Reinspect work within 5 days of Contractor's notice of correction of deficiencies.
 - 3) Reinspection costs incurred by Engineer will be billed to Owner who will deduct them from final payment due Contractor.
 - b. Work determined to be in state of tentative Substantial Completion: Engineer to prepare tentative "Engineer's Certificate of Substantial Completion."
 - c. Engineer's Certificate of Substantial Completion:
 - 1) Certificate tentatively issued subject to successful Demonstration of functional integrity.
 - 2) Issued for Project as a whole or for one or more PCS.
 - 3) Issued subject to completion or correction of items cited in the certificate (punch list).
 - 4) Issued with responsibilities of Owner and Contractor cited.
 - 5) Executed by Engineer.
 - 6) Accepted by Owner.
 - 7) Accepted by Contractor.
 - d. Upon successful completion of Demonstration Period, Engineer will endorse certificate attesting to the successful demonstration, and citing the hour and date of ending the successful Demonstration Period of functional integrity as the effective date of Substantial Completion.

3.3 DEMONSTRATION PERIOD

A. General:

1. Demonstrate the functional integrity of the mechanical, electrical, and control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.
2. Duration of Demonstration Period: 120 consecutive hours.

3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments to any equipment or systems that renders the affected equipment or system inoperative exceed 10 percent of the Demonstration Period, the demonstration of functional integrity will be deemed to have failed.
 - a. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure.
 - b. The new Demonstration Period shall have the same requirements and duration as the Demonstration Period previously conducted.
4. Conduct the demonstration of functional integrity under full operational conditions.
5. Owner will provide operational personnel to provide process decisions affecting plant performance.
 - a. Owner's assistance will be available only for process decisions.
 - b. Contractor will perform all other functions including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period.
6. Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional integrity of automatic and manual backup systems and alternate operating modes.
7. Demonstration by PCS:
 - a. Contractor may demonstrate by PCS, either individually or a combination of two or more PCS.
8. Time of beginning and ending any Demonstration Period shall be agreed upon by Contractor, Owner, and Engineer in advance of initiating Demonstration Period.
9. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions, provide final field instruction on select systems and to respond to any system problems or failures which may occur.
 - a. Provide final field instruction on the following systems:
 - 1) Secondary Scum Pump Station
 - 2) Secondary Clarifiers No. 1 and No. 2
 - 3) WAS Pump Station
10. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles or any other item necessary to operate and demonstrate all systems being demonstrated.

END OF SECTION

SECTION 01 77 23
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Procedures and submittals required for Contract Closeout.
 - a. Record documents.
 - b. As-built drawings.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Division 43– Process GAS and Liquid Handling, Purification and Storage Equipment
4. Division 46 Water and Wastewater Equipment

1.2 SUBMITTALS

A. Project Record Documents:

1. Maintain one set of each of the following Project Record Documents; record actual revisions to the Work:
 - a. Contract Drawings.
 - b. Specifications.
 - c. Incorporate Addenda.
 - d. Incorporate Change Orders and Field Modifications as coordinated with the General Contractor, and other written notices.
 - e. Approved Shop Drawings and product data.
2. Store Project Record Documents separate from documents used for fabrication.
3. Record information concurrent with start-up and checkout.

4. In the Project Record Documents, legibly mark and record actual construction.
 - a. Manufacturer's name and product model and number.
 - b. Product substitutions or alternates utilized.
 - c. Changes made by Addenda, Field Modifications, and Change Orders.
 - d. Changes due to start-up, checkout and testing.
 - e. Show location of buried and embedded items.
 - f. Record range and scale of instrumentation and devices.
 - 1) Include the calibration documents in the final O&M Manual.
5. Legibly mark product data to show variations in actual work.
 - a. Include both variations in products as delivered to site, and variations from manufacturer's instructions and recommendations for installation.

B. As-Built Drawings:

1. Deliver final as-built drawings to the Engineer within 30-days after Performance Demonstration acceptance by Buyer.
2. Provide final as-built drawings on CD-ROM, on the most current version of AutoCAD formatted.

1.3 OPERATING AND MAINTENANCE MANUALS

- A. Operating and maintenance data requirements are detailed in Specification Section 01 33 04.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION



DIVISION 03

CONCRETE



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SECTION 03 05 05
CONCRETE TESTING AND INSPECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Contractor requirements for testing of concrete and grout.
 - 2. Definition of Owner-provided testing.
 - 3. Acceptance criteria for concrete.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 03 21 00 - Reinforcement.
 - 4. Section 03 31 30 - Concrete, Materials and Proportioning.

1.2 RESPONSIBILITY AND PAYMENT

- A. Owner will hire an independent Testing Agency/Service Provider to perform the following testing and inspection and provide test results to the Engineer and Contractor.
 - 1. Testing and inspection of concrete and grout produced for incorporation into the work during the construction of the Project for compliance with the Contract Documents.
 - 2. Additional testing or retesting of materials occasioned by their failure, by test or inspection, to meet requirements of the Contract Documents.
 - 3. Strength testing on concrete required by the Engineer or Special Inspector when the water-cement ratio exceeds the water-cement ratio of the typical test cylinders.
 - 4. In-place testing of concrete as may be required by Engineer when strength of structure is considered potentially deficient.
 - 5. Other testing services needed or required by Contractor such as field curing of test specimens and testing of additional specimens for determining when forms, form shoring or reshoring may be removed.
 - 6. Owner will pay for services defined in Paragraph 1.2A.1.

7. See Specification Section 01 30 00.
- B. Contractor shall hire a qualified testing agency to perform the following testing and provide test results to the Engineer.
1. Testing of materials and mixes proposed by the Contractor for compliance with the Contract Documents and retesting in the event of changes.
 2. Additional testing and inspection required because of changes in materials or proportions requested by Contractor.
 3. Contractor shall pay for services defined in Paragraphs 1.2B.1. and 1.2B.2.
 4. Contractor shall reimburse Owner for testing services defined in Paragraphs 1.2A.2., 1.2A.3., 1.2A.4. and 1.2A.5.
 5. See Specification Section 01 30 00.
- C. Duties and Authorities of Testing Agency/Service Provider:
1. Any Testing Agency/Service Provider or agencies and their representatives retained by Contractor or Owner for any reason are not authorized to revoke, alter, relax, enlarge, or release any requirement of Contract Documents, nor to reject, approve or accept any portion of the Work.
 2. Testing Agency/Service Provider shall inform the Contractor and Engineer regarding acceptability of or deficiencies in the work including materials furnished and work performed by Contractor that fails to fulfill requirements of the Contract Documents.
 3. Testing Agency shall submit test reports and inspection reports to Engineer and Contractor immediately after they are performed.
 - a. All test reports shall include exact location in the work at which batch represented by a test was deposited.
 - b. Reports of strength tests shall include detailed information on storage and curing of specimens prior to testing.
 4. Owner retains the responsibility for ultimate rejection or approval of any portion of the Work.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. 318, Building Code Requirements for Structural Concrete.
2. ASTM International (ASTM):
 - a. ASTM Cement and Concrete Reference Laboratory (CCRL).

- b. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- c. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- d. C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- e. C94, Standard Specification for Ready-Mixed Concrete.
- f. C138, Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
- g. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
- h. C172, Standard Practice for Sampling Freshly Mixed Concrete.
- i. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- j. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- k. C1019, Standard Test Method for Sampling and Testing Grout.
- l. C1218, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
- m. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

B. Qualifications:

1. Contractor's Testing Agency:

- a. Meeting requirements of ASTM E329 and ASTM C94.
- b. Provide evidence of recent inspection by CCRL of NBS, and correction of deficiencies noted.

C. Use of Testing Agency and approval by Engineer of proposed concrete mix design shall in no way relieve Contractor of responsibility to furnish materials and construction in full compliance with Contract Documents.

1.4 DEFINITIONS

A. Testing Agency/Service Provider: An independent professional testing/inspection firm or service hired by Contractor or by Owner to perform testing, inspection or analysis services as directed, and as provided in the Contract Documents.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Concrete materials and concrete mix designs proposed for use.
 - 1) Include results of all testing performed to qualify materials and to establish mix designs.
 - 2) Place no concrete until approval of mix designs has been received in writing.
 - 3) Submittal for each concrete mix design shall include:
 - a) Sieve analysis and source of fine and coarse aggregates.
 - b) Test for aggregate organic impurities.
 - c) Proportioning of all materials.
 - d) Type of cement with mill certificate for the cement.
 - e) Brand, quantity and class of fly ash proposed for use along with other submittal data as required for fly ash by Specification Section 03 31 30.
 - f) Slump.
 - g) Brand, type and quantity of air entrainment and any other proposed admixtures.
 - h) Shrinkage test results.
 - i) Total water soluble chloride ion concentration in hardened concrete from all ingredients determined per ASTM C1218.
 - j) 28-day compression test results and any other data required by Specification Section 03 31 30 to establish concrete mix design.
3. Certifications:
 - a. Testing Agency qualifications.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 TESTING SERVICES TO BE PERFORMED SERVICE PROVIDER/TESTING AGENCY

- ### A. The following concrete testing will be performed by the Service Provider/Testing Agency:

1. Concrete strength testing:
 - a. Secure concrete samples in accordance with ASTM C172.
 - 1) Obtain each sample from a different batch of concrete on a random basis, avoiding selection of test batch other than by a number selected at random before commencement of concrete placement.
 - b. For each strength test, mold and cure cylinders from each sample in accordance with ASTM C31.
 - 1) Record any deviations from requirements on test report.
 - 2) Cylinder size: Per ASTM C31.
 - a) 4 IN cylinders shall not be used for concrete mixes with maximum aggregate size larger than 1 IN.
 - b) Use the same size cylinder for all tests for each concrete mix.
 - 3) Quantity:
 - a) 6 IN DIA by 12 IN high: Five (5) cylinders.
 - b) 4 IN DIA by 8 IN high: Six (6) cylinders.
 - c. Field cure one (1) cylinder for the seven (7) day test.
 - 1) Laboratory cure the remaining.
 - d. Test cylinders in accordance with ASTM C39.
 - 1) 6 IN DIA cylinders:
 - a) Test two (2) cylinders at 28 days for strength test result and the one (1) field cured sample at seven (7) days for information.
 - b) Hold remaining cylinder in reserve.
 - 2) 4 IN DIA cylinders:
 - a) Test three (3) cylinders at 28 days for strength test result and the one (1) field cured cylinder at seven (7) days for information.
 - b) Hold remaining cylinders in reserve.
 - e. Strength test result:
 - 1) Average of strengths of two (2) 6 IN DIA cylinders or three (3) 4 IN DIA cylinders from the same sample tested at 28 days.
 - 2) If one (1) cylinder in a test manifests evidence of improper sampling, molding, handling, curing, or testing, discard and test reserve cylinder(s); average strength of remaining cylinders shall be considered strength test result.
 - 3) Should all cylinders in any test show any of above defects, discard entire test.
 - f. Frequency of tests:

- 1) Concrete sand cement grout: One (1) strength test for each 4 HR period of grout placement or fraction thereof.
 - a) Test grout in accordance with ASTM C1019.
 - 2) Concrete topping, concrete fill and lean concrete: One (1) strength test for each 10 CY of each type of concrete or fraction thereof placed.
 - 3) All other concrete:
 - a) One (1) strength test to be taken not less than once a day, nor less than once for each 50 CY or fraction thereof placed in any one (1) day.
 - b) Once for each 1000 SQ FT of slab or wall surface area placed each day
 - c) If total volume of concrete on Project is such that frequency of testing required in above paragraph will provide less than five (5) strength tests for each concrete mix, tests shall then be made from at least five (5) randomly selected batches or from each batch if fewer than five (5) batches are provided.
2. Slump testing:
- a. Determine slump of concrete sample for each strength test.
 - 1) Determine slump in accordance with ASTM C143.
 - b. If consistency of concrete appears to vary, the Engineer or Owner's Representative shall be authorized to require a slump test for each concrete truck.
 - 1) This practice shall continue until three consecutive batches are determined to be consistent and meet the slump requirements specified.
3. Air content testing: Determine air content of concrete sample for each strength test in accordance with either ASTM C231, ASTM C173, or ASTM C138.
4. Temperature testing: Determine temperature of concrete sample for each strength test.
5. Fresh concrete density testing: Determine density of fresh concrete for each strength test in accordance with ASTM C138.
6. In-place concrete testing (if required).

3.2 SPECIAL INSPECTIONS

A. See Section 01 45 33.

1. Special Inspections listed are for the Contractor reference only and is not part of the Contract Documents.

2. It is included to assist the Contractor in understanding the Owner-provided Services so that those services may be factored into the Contractor's pricing and schedule.
- B. Formwork Special Inspections:
1. Shape, location, and dimensions.
 - a. Inspect in accordance with dimensions and details on Drawings.
 - b. Frequency: Inspect prior to each concrete pour.
- C. Reinforcing Special Inspections:
1. Rebar size, spacing, lap length and concrete cover.
 - a. Inspect in accordance with Drawings and Specification.
 - b. Frequency: Inspect prior to each concrete pour.
 2. Rebar adhesive anchoring system:
 - a. Inspect in accordance with ICC-ES report.
 - b. Frequency:
 - 1) Continuously inspect all adhesive anchors for the first 8 HRS of installation.
 - 2) Continuously inspect approximately 25 percent of adhesive anchors thereafter.
 - 3) Additional inspection will be required for different installer or if the quality of installation appears to vary.
 3. Mechanical splices:
 - a. Inspect in accordance with ICC-ES report.
 - b. Frequency:
 - 1) Continuously inspect all mechanical splices prior to placing concrete for the first 8 HRS of installation.
 - 2) Continuously inspect approximately 25 percent of mechanical splices thereafter.
 - 3) Additional inspection will be required for different installer or if the quality of installation appears to vary.
- D. Mixing Placing Jointing Curing Special Inspections:
1. Perform concrete tests per Specification Section 03 05 05.
 2. Verification of proper mix design.

- a. Frequency: Periodically, prior to concrete pour.
- 3. Proper concrete placement techniques.
 - a. Inspect per requirements of Section 03 31 31.
 - b. Frequency: During each concrete pour.
- 4. Proper curing temperature and techniques.
 - a. Inspect per requirements of Section 03 31 31.
 - b. Frequency: Periodically, but not less than every third day.
- 5. Joints:
 - a. Inspect joints for proper joint type, dimensions, reinforcing, dowel alignment, surface preparation and location.
 - b. Frequency: Prior to each concrete pour.
- 6. Waterstops:
 - a. Visually inspect waterstops for proper location, continuity, installation to prevent displacement, cleanliness and damage to waterstop.
 - b. Frequency:
 - 1) Prior to each concrete pour.
- E. Anchor to Concrete Special Inspection:
 - 1. Post installed anchors as required by the Building Code, ICC-ES Evaluation Reports, and as specified by the Engineer.
 - a. Frequency: Per ICC-ES Report.
 - 2. Cast-in-place concrete anchors, including anchor size, embedment, material and location.
 - a. Frequency: Prior to each concrete pour.

3.3 SAMPLING ASSISTANCE AND NOTIFICATION FOR OWNER

- A. To facilitate testing and inspection, perform the following:
 - 1. Furnish any necessary labor to assist Testing Agency in obtaining and handling samples at site.
 - 2. Provide and maintain for sole use of Testing Agency adequate facilities for safe storage and proper curing of test specimens on site for first 24 HRS as required by ASTM C31.
 - 3. Take samples at point of placement into concrete member.

- B. Notify Engineer and Owner's Testing Agency sufficiently in advance of operations (minimum of 24 HRS) to allow for assignment of personnel and for scheduled completion of quality tests.

3.4 ACCEPTANCE

- A. Completed concrete work which meets applicable requirements will be accepted without qualification.
- B. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.
- C. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Contract Documents.
 - 1. In this event, modifications may be required to assure that concrete work complies with requirements.
 - 2. Modifications, as directed by Engineer, shall be made at no additional cost to Owner.
- D. Dimensional Tolerances:
 - 1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances shall be considered potentially deficient in strength and subject to modifications required by Engineer.
 - 2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances may be rejected and excess material subject to removal.
 - a. If removal of excess material is permitted, accomplish in such a manner as to maintain strength of section and to meet all other applicable requirements of function and appearance.
 - 3. Concrete members cast in wrong location may be rejected if strength, appearance or function of structure is adversely affected or misplaced items interfere with other construction.
 - 4. Inaccurately formed concrete surfaces exceeding limits of tolerances and which are exposed to view, may be rejected.
 - a. Repair or remove and replace if required.
 - 5. Finished slabs exceeding tolerances may be required to be repaired provided that strength or appearance is not adversely affected.
 - a. High spots may be removed with a grinder, low spots filled with a patching compound, or other remedial measures performed as permitted or required.
- E. Appearance:

1. Concrete surfaces exposed to view with defects which, in opinion of Engineer, adversely affect appearance as required by specified finish shall be repaired by approved methods.
2. Concrete not exposed to view is not subject to rejection for defective appearance unless, in the opinion of the Engineer, the defects impair the long-term strength or function of the member.

F. High Water-Cement Ratio:

1. Concrete with water in excess of the specified maximum water-cement ratio will be rejected.
2. Remove and replace concrete with high water-cement ratio or make other corrections as directed by Engineer.

G. Strength of Structure:

1. Strength of structure in place will be considered potentially deficient if it fails to comply with any requirements which control strength of structure, including but not necessarily limited to following:
 - a. Low concrete strength:
 - 1) Test results for standard molded and cured test cylinders shall be evaluated separately for each mix design.
 - a) Such evaluation shall be valid only if tests have been conducted in accordance with specified quality standards.
 - b) For evaluation of potential strength and uniformity, each mix design shall be represented by at least three (3) strength tests.
 - c) A strength test shall be the average of two (2) 6 IN diameter cylinders or three (3) 4 IN diameter cylinders from the same sample tested at 28 days.
 - 2) Acceptance:
 - a) Strength level of each specified compressive strength shall be considered satisfactory if both of the following requirements are met:
 - (1) Average of all sets of three (3) consecutive strength tests equal or exceed the required specified 28 day compressive strength.
 - (2) No individual strength test falls below the required specified 28 day compressive strength by more than 500 psi.
 - b. Reinforcing steel size, configuration, quantity, strength, position, or arrangement at variance with requirements in Specification Section 03 21 00 or requirements of the Contract Drawings or approved Shop Drawings.

- c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
 - d. Curing time and procedure not meeting requirements of this Specification Section.
 - e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
 - f. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.
 - g. Concrete defects such as voids, honeycomb, cold joints, spalling, cracking, etc., likely to result in deficient strength or durability.
2. Structural analysis and/or additional testing may be required when strength of structure is considered potentially deficient.
 3. In-place testing of concrete may be required when strength of concrete in place is considered potentially deficient.
 - a. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer to determine relative strengths at various locations in the structure or for selecting areas to be cored.
 - 1) Such tests shall not be used as a basis for acceptance or rejection.
 - b. Core tests:
 - 1) Where required, test cores will be obtained in accordance with ASTM C42.
 - a) If concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 Deg F, relative humidity less than 60 percent) for seven (7) days before test then test dry.
 - b) If concrete in structure will be wet or subjected to high moisture atmosphere under service conditions, test cores after immersion in water for at least 40 HRS and test wet.
 - c) Testing wet or dry shall be determined by Engineer.
 - 2) Three (3) representative cores may be taken from each member or area of concrete in place that is considered potentially deficient.
 - a) Location of cores shall be determined by Engineer so as least to impair strength of structure.
 - b) If, before testing, one (1) or more of cores shows evidence of having been damaged subsequent to or during removal from structure, damaged core shall be replaced.
 - 3) Concrete in area represented by a core test will be considered adequate if average strength of three (3) cores is equal to at least 85 percent of specified strength and no single core is less than 75 percent of specified strength.

- 4) Fill core holes with nonshrink grout and finish to match surrounding surface when exposed in a finished area.
4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm safety of structure, load tests may be required and their results evaluated in accordance with ACI 318, Chapter 20.
5. Correct or replace concrete work judged inadequate by structural analysis or by results of core tests or load tests with additional construction, as directed by Engineer, at Contractor's expense.
6. Contractor to pay all costs incurred in providing additional testing and/or structural analysis required.

END OF SECTION

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SECTION 03 11 13
FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork requirements for concrete construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 05 05 - Concrete Testing and Inspection.
4. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
5. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. CT-13, Concrete Terminology.
 - b. 117, Specification for Tolerances for Concrete Construction and Materials.
 - c. 347R, Guide to Formwork for Concrete.
2. Building code:
 - a. International Code Council (ICC):
 - 1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.

B. Qualifications:

1. Formwork, shoring and reshoring shall be designed by a licensed professional engineer currently registered or having a minimum of three (3) years' experience in this type of design work.
 - a. Above qualifications apply to slabs and beams not cast on the ground surface.

C. Miscellaneous:

1. Design and engineering of formwork, shoring and reshoring as well as its construction is the responsibility of the Contractor.
2. Design requirements:
 - a. Design formwork for loads, lateral pressures and allowable stresses outlined in ACI 347R and for design considerations, wind loads, allowable stresses and other applicable requirements of the controlling local Building Code.
 - 1) Where conflicts occur between the above two (2) standards, the more stringent requirements shall govern.
 - b. Design formwork shall limit maximum deflection of form facing materials reflected in concrete surfaces exposed to view to 1/240 of span between structural members.
3. For slabs and beams not cast on the ground surface, develop a procedure and schedule for removal of shores and installation of reshores and for calculating the loads transferred to the structure during this process in accordance with ACI 347R.
 - a. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon. Calculations shall be performed by a licensed professional engineer registered in the State of Alaska.
 - b. When developing procedure, schedule and structural calculations, consider the following at each stage of construction:
 - 1) The structural system that exists.
 - 2) Effects of all loads during construction.
 - 3) Strength of concrete.
 - 4) The influence of deformations of the structure and shoring system on the distribution of dead loads and construction loads.
 - 5) The strength and spacing of shores or shoring systems used, as well as the method of shoring, bracing, shore removal, and reshoring including the minimum time intervals between the various operations.
 - 6) Any other loading or condition that affects the safety or serviceability of the structure during construction.

1.3 DEFINITIONS

- A. Words and terms used in these Specifications are defined in ACI CT-13.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for the requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Manufacturer and type of proposed form ties.

B. Samples:

1. A 12 IN SQ sample of each of the following form finishes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms for Surfaces Exposed to View:

1. Wood forms:
 - a. 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
 - b. Built-in-place or prefabricated type panel.
2. Metal forms:
 - a. Except for aluminum, metal forms may be used in contact with concrete.
 - b. Forms shall be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.

B. Forms for Surfaces Not Exposed to View:

1. Wood or metal sufficiently tight to prevent leakage.
2. Do not use aluminum forms.

2.2 ACCESSORIES

A. Form Ties:

1. Commercially fabricated for use in form construction.
 - a. Field fabricated ties are unacceptable.
2. Constructed so that ends or end fasteners can be removed without causing spalling at surfaces of the concrete.
3. Embedded portion of ties shall be not less than 1.5 IN from face of concrete after ends have been removed.

4. Cone size:
 - a. 1 IN minimum diameter cones on both ends.
 - b. Depth of cone shall be at least 1.5 IN, but shall not exceed the concrete reinforcing cover.
 5. Provide ties with built-in waterstops in all walls that will be in contact with process liquid during plant operation and below-grade soil.
 6. Through-wall ties that are designed to be entirely removed are not allowed in any walls that will be in contact with process liquid during plant operation.
- B. Void Forms:
1. Constructed from double faced corrugated cardboard or fiberboard which is wax impregnated and laminated with moisture-resistant adhesive.
 2. Capable of resisting moisture with no loss of load carrying strength or change in depth or configuration.
- C. Moldings for chamfers and rustications and the recesses for joint sealants shall be smooth and of non-absorbent material.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Form Surface Treatment:
1. Before placing of reinforcing steel or concrete, cover surfaces of forms with an approved, commercially-manufactured release material that will effectively prevent absorption of moisture and prevent bond with concrete, will not stain concrete or prevent bonding of future finishes.
 - a. A field-applied form release agent or sealer of approved type or a factory-applied non-absorptive liner may be used.
 2. Do not allow excess form release material to stand in puddles in forms nor in contact with hardened concrete against which fresh concrete is to be placed.
- B. Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed, and to limit height of free fall of concrete to prevent aggregate segregation.
1. Temporary openings to limit height of free fall of concrete shall be spaced no more than 8 FT apart.

- C. Clean surfaces of forms, reinforcing steel and other embedded materials of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.

3.2 ERECTION

- A. Install products in accordance with manufacturer's instructions.
- B. Tolerances:
 - 1. Conform to ACI 117.
 - 2. Variation from plumb:
 - a. In lines and surfaces of columns, piers, walls, and in risers.
 - 1) Maximum in any 10 FT of height: 1/4 IN.
 - 2) Maximum for entire height: 1/2 IN.
 - b. For exposed corner columns, control-joint grooves, and other exposed to view lines:
 - 1) Maximum in any 20 FT length: 1/4 IN.
 - 2) Maximum for entire length: 1/2 IN.
 - 3. Variation from level or from grades specified:
 - a. In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores.
 - 1) Maximum in any 10 FT of length: 1/4 IN.
 - 2) Maximum in any bay or in any 20 FT length: 3/8 IN.
 - 3) Maximum for entire length: 3/4 IN.
 - b. In exposed lintels, sills, parapets, horizontal grooves, and other exposed to view lines:
 - 1) Maximum in any bay or in 20 FT length: 1/4 IN.
 - 2) Maximum for entire length: 1/2 IN.
 - 4. Variation of linear structure lines from established position in plan and related position of columns, walls, and partitions:
 - a. Maximum in any bay: 1/2 IN.
 - b. Maximum in any 20 FT of length: 1/2 IN.
 - c. Maximum for entire length: 1 IN.
 - 5. Variation in sizes and location of sleeves, floor openings, and wall openings: Maximum of +1/2 IN.

6. Variation in horizontal plan location of beam, column and wall centerlines from required location: Maximum of +1/2 IN.
7. Variation in cross sectional dimensions of columns and beams and in thickness of slabs and walls: Maximum of -1/4 IN, +1/2 IN.
8. Footings and foundations:
 - a. Variations in concrete dimensions in plan: -1/2 IN, +2 IN.
 - b. Misplacement or eccentricity:
 - 1) 2 percent of footing width in direction of misplacement but not more than 2 IN.
 - c. Thickness:
 - 1) Decrease in specified thickness: 5 percent.
 - 2) Increase in specified thickness: No limit except that which may interfere with other construction.
9. Variation in steps:
 - a. In a flight of stairs:
 - 1) Rise: +1/8 IN.
 - 2) Tread: +1/4 IN.
 - b. In consecutive steps:
 - 1) Rise: +1/16 IN.
 - 2) Tread: +1/8 IN.
10. Establish and maintain in an undisturbed condition and until final completion and acceptance of Project, sufficient control points and bench marks to be used for reference purposes to check tolerances.
11. Regardless of tolerances listed allow no portion of structure to extend beyond legal boundary of Project.
12. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete.
- C. Make forms sufficiently tight to prevent loss of mortar from concrete.
- D. Place 3/4 IN chamfer strips in forms to produce 3/4 IN wide beveled edges on permanently exposed corners. Do not bevel reentrant corners of concrete unless otherwise specified.
- E. At construction joints, overlap contact surface of form sheathing for flush surfaces exposed to view over hardened concrete in previous placement by at least 1 IN.

1. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface.
 2. Where possible, locate juncture of built-in-place wood or metal forms at architectural lines, control joints or at construction joints.
- F. Where circular walls are to be formed and forms made up of straight sections are proposed for use, provide straight lengths not exceeding 2 FT wide.
1. Brace and tie formwork to maintain correct position and shape of members.
- G. Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling.
- H. Anchor formwork to shores or other supporting surfaces or members so that movement of any part of formwork system is prevented during concrete placement.
- I. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.
- J. Provide positive means of adjustment (wedges or jacks) of shores and struts and take up all settlement during concrete placing operation.
1. Securely brace forms against lateral deflection.
 2. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check.

3.3 REMOVAL OF FORMS

- A. No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its weight and loads placed thereon.
- B. When required for concrete curing in hot weather, required for repair of surface defects or when finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations or lack of support.
- C. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging.
1. Perform any needed repairs or treatment required on such sloping surfaces at once, followed by curing specified in Specification Section 03 31 31.
- D. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete.
- E. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.

- F. Where no reshoring is planned, leave forms and shoring used to support weight of concrete in place until concrete has attained its specified 28 day compressive strength.
 - 1. Where a reshoring procedure is planned, supporting formwork may be removed when concrete has reached the concrete strength required by the formwork designer's structural calculations.
- G. When shores and other vertical supports are so arranged that non-load-carrying form facing material may be removed without loosening or disturbing shores and supports, facing material may be removed when concrete has sufficiently hardened to resist damage from removal.

3.4 RESHORING

- A. No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its weight and loads placed thereon.
- B. While reshoring is underway, no superimposed dead or live loads shall be permitted on the new construction.
- C. During reshoring, do not subject concrete in structural members to combined dead and construction loads in excess of loads that structural members can adequately support.
- D. Place reshores as soon as practicable after stripping operations are complete but in no case later than end of working day on which stripping occurs.
- E. Tighten reshores to carry their required loads without overstressing.
- F. Shoring, reshoring and supporting formwork may be removed when concrete has reached the concrete strength required by the formwork designer's structural calculations.
- G. For floors supporting shores under newly placed concrete leave original supporting shores in place or reshore.
 - 1. Reshoring system shall have a capacity sufficient to resist anticipated loads.
 - 2. Locate reshores directly under a shore position above.

3.5 FIELD QUALITY CONTROL

- A. Special Inspection:
 - 1. See Section 01 45 33.

END OF SECTION

SECTION 03 15 19
ANCHORAGE TO CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for all cast-in-place anchor bolts, anchor rods, reinforcing adhesive anchorage, and post-installed concrete anchors required for the Project but not specified elsewhere in the Contract Documents.
2. Design of all concrete anchors not indicated on the Drawings including, but not limited to, installation of anchors into concrete for the following structural and non-structural components:
 - a. Structural members and accessories.
 - b. Metal, wood, and plastic fabrications.
 - c. Architectural components.
 - d. Mechanical and electrical equipment and components.
 - e. Plumbing, piping, and HVAC work.
 - f. All other components requiring attachment to concrete.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 05 05 - Concrete Testing and Inspection.
4. Section 09 96 00 – High Performance Industrial Coatings.
5. Section 40 05 07 - Pipe Support Systems.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. 318, Building Code Requirements for Structural Concrete and Commentary.

- b. 350, Code Requirements for Environmental Engineering Concrete Structures and Commentary.
 - c. 355.2, Evaluating the Performance of Post-Installed Mechanical Anchors in Concrete.
 - d. 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete
2. American Concrete Institute/Concrete Reinforcing Steel Institute (ACI-CRSI):
 - a. Adhesive Anchor Installation Certification Program: Adhesive Anchor Installer.
 3. American Institute of Steel Construction (AISC):
 - a. 303, Code of Standard Practice for Steel Buildings and Bridges.
 4. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - c. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - d. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - e. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - f. A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 - g. A563, Standard Specification for Carbon and Alloy Steel Nuts.
 - h. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - i. F436, Standard Specification for Hardened Steel Washers.
 - j. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - k. F594, Standard Specification for Stainless Steel Nuts.
 - l. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
 5. ICC Evaluation Service (ICC-ES):

- a. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
 - b. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
 - c. AC355,
6. Building Code:
- a. International Code Council (ICC):
 - 1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.
- B. Qualifications:
- 1. Anchor designer for Contractor-designed post-installed anchors and cast-in-place anchorage shall be a professional Structural Engineer licensed in the State of Alaska.
 - 2. Installer for post-installed anchors shall be trained by the manufacturer or certified by a training program approved by the Engineer.
- C. Post-installed anchors and related materials shall be listed by the following agencies:
- 1. ICC-ES.
 - 2. Engineer-approved equivalent.
- D. Post-installed anchors and related materials shall be pre-qualified for seismic loading in accordance with ACI 355.2 and ACI 355.4.

1.3 DEFINITIONS

- A. Adhesive Anchors:
- 1. Post-installed anchors developing their strength primarily from chemical bond between the concrete and the anchor.
 - 2. Includes anchors using acrylics, epoxy and other similar adhesives.
- B. Anchor Bolt: Any cast-in-place anchorage that is made of a headed (i.e. bolt) material.
- C. Anchor Rod: Any cast-in-place or post-installed anchorage made from unheaded, threaded, rod or deformed bar material.
- D. Concrete Anchor: Generic term for either an anchor bolt or an anchor rod.
- E. Galvanizing: Hot-dip galvanizing per ASTM A123 or ASTM A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

- F. Hardware: As defined in ASTM A153.
- G. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 2. Installer and applicator are synonymous.
- H. MPII: Manufacturer's printed installation instructions.
- I. Mechanical Anchors:
 - 1. Post-installed anchors developing their strength from attachment other than through adhesives or chemical bond to concrete.
 - 2. Includes expansion anchors, expansion sleeve, screw anchors, undercut anchors, specialty inserts and other similar types of anchorages.
 - 3. Drop-in anchors and other similar anchors are not allowed.
- J. Post-Installed Anchor: Any adhesive or mechanical anchor installed into previously placed and adequately cured concrete.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that submitted products meet requirements of referenced standards.
 - b. Manufacturer material data sheet for each anchor.
 - 1) Clearly indicate which products on the data sheet are proposed for use on the Project.
 - c. Manufacturer's printed installation instructions.
 - d. Current ICC-ES report for each post-installed anchor system indicating the following:
 - 1) Certification that anchors meet all requirements indicated in this Specification.
 - 2) Performance data showing that anchor is approved for use in cracked concrete.
 - 3) Seismic design categories for which anchor system has been approved.
 - 4) Required installation procedures.

- 5) Special inspection requirements for installation.
- e. Anchorage layout drawings and details:
- 1) Indicate anchor diameter, embedment, length, anchor type, material and finish.
 - 2) Drawings showing location, configuration, spacing and edge distance.
- f. Contractor Designed Post-Installed Anchors:
- 1) Show diameter and embedment depth of each anchor.
 - 2) Indicate compliance with ACI 350 Appendix D.
 - 3) Design tension and shear loads used for anchor design.
 - 4) Engineering design calculations:
 - a) Indicate design load to each anchor.
 - b) When the design load is not indicated on Drawings, include calculations to develop anchor forces based on Design Criteria listed herein.
 - c) Sealed and signed by contractor's professional Structural Engineer.
 - d) Calculations will be submitted for information purposes only.
 - 5) Type of post-installed anchor system used.
 - a) Provide manufacturer's ICC-ES report for the following:
 - (1) Mechanical anchorage per ICC-ES AC193.
 - (2) Adhesive anchorage per ICC-ES AC308.
 - b) Provide manufacturer's written certifications for meeting ACI 355.2 and 355.4 as applicable for mechanical or adhesive anchors in resisting earthquake loads.

B. Samples:

1. Representative samples of concrete anchors may be requested by Engineer. Review will be for type and finish only. Compliance with all other requirements is exclusively the responsibility of the Contractor.

C. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Certification of qualifications for each installer of post-installed anchors.
 - a. Indicate successful completion or certification for each type of approved post-installed anchor as required by the Contract Documents.

- b. Provide one of the following for each type of anchor, as required by this specification section:
 - 1) Letter from manufacturer documenting successful training completion.
 - 2) Certification of completion for Engineer-approved program.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to job site in manufacturer's or distributor's packaging undamaged and complete with installation instructions.
- B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.
- C. Protect and handle materials in accordance with manufacturer's recommendations to prevent damage or deterioration.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cast-in-place Concrete Anchors:
 - 1. Building, non-building (non-submerged) structures, and equipment:
 - a. ASTM F1554, Grade 36 or Grade 55 with weldability supplement S1 for galvanized or non-galvanized threaded rods.
 - b. ASTM A307, Grade A for galvanized headed bolts.
 - 2. All other cast-in-place concrete anchors:
 - a. Headed stainless steel bolts with matching nuts and washers.
 - b. Submerged application: ASTM F593, Type 316, Condition CW2, 40 ksi yield strength, 80 ksi tensile strength.
 - c. Non-submerged application: ASTM F593, Type 304 or Type 316, Condition CW2, 40 ksi yield strength, 80 ksi tensile strength.
- B. Post-Installed Mechanical and Adhesive Concrete Anchors:
 - 1. Stainless steel with matching nut and washer.
 - 2. Submerged application: ASTM F593, Type 316.
 - 3. Non-submerged application: ASTM F593, Type 304 or Type 316.
- C. Reinforcement: See Section 03 21 00.
- D. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

- E. Deformed Bar Anchors: ASTM A496 with minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.
- F. Washers:
 - 1. ASTM F436 unless noted otherwise.
 - 2. If stainless steel anchorage is being used for cast-in-place anchorage, furnish washers of the same material, alloy and corrosion protection as in the accompanying anchorage.
 - 3. Plate washers: Minimum 1/2 IN thick fabricated ASTM A36 square plates as required. Plate washers shall be hot-dipped galvanized unless specifically required to be epoxy-coated.
 - 4. Follow manufacturer's requirements for all post-installed anchorage.
- G. Nuts:
 - 1. ASTM A563 for all cast-in-place anchorage.
 - 2. If stainless steel anchorage is being used for cast-in-place anchorage, nuts shall meet ASTM F594 and be the matching material and alloy as in the accompanying anchorage.
 - 3. Follow manufacturer's requirements if using post-installed anchorage.
- H. Galvanizing Repair Paint:
 - 1. High zinc dust content paint for regalvanizing welds and abrasions.
 - 2. ASTM A780.
 - 3. Zinc content: Minimum 92 percent in dry film.
 - 4. ZRC "ZRC Cold Galvanizing" or Clearco "High Performance Zinc Spray."
- I. Dissimilar Materials Protection: See Specification Section 09 96 00.

2.2 CONTRACTOR-DESIGNED ANCHORAGE

- A. Acceptable Manufacturers:
 - 1. Post-installed anchor systems for the listed manufacturers will be considered only if a current ICC-ES evaluation report and ACI 355 certification is submitted in accordance with the SUBMITTALS Article in PART 1 of this Specification Section and if the anchor system is approved by the Engineer.
 - a. Hilti.
 - b. Powers Fasteners.

- c. Simpson Strong-Tie.
- 2. Submit request for substitution in accordance with Specification Section 01 25 13.
- B. Contractor shall design the anchorage when any of the following occur:
 - 1. Design load for concrete anchorage is shown on the Drawings.
 - 2. When specifically required by the Contract Documents.
 - 3. When an anchorage is required but not specified in the Drawings.
 - 4. When anchorage is shown on Drawings other than Structural Drawings.
- C. Anchorage Design Loads:
 - 1. Determine all of the design loads, including wind and seismic loads, per the Building Code.
 - a. Anchorage of equipment and non-structural components: Use the actual dead and operating loads provided by the manufacturer.
- D. When Contract Drawings, other than the Structural Drawings, indicate an anchor diameter or length, the Contractor design shall incorporate these as “minimums.”
- E. Cast-in-Place Concrete Anchors:
 - 1. Provide the material, nominal diameter, embedment length, spacing, edge distance and design capacity to resist the calculated load based on the requirements given in the Building Code including ACI 350, Appendix D.
 - 2. Design shall assume cracked concrete.
- F. Post-installed Concrete Anchors:
 - 1. Provide the manufacturer’s system name/type, nominal diameter, embedment depth, spacing, minimum edge distance, cover, and design capacity to resist the specified or calculated load based on requirements given in the Building Code, ACI 350 Appendix D, and current ICC-ES report, for the anchor to be used.
 - 2. Design shall assume cracked concrete.

2.3 ENGINEER-DESIGNED ANCHORAGE

- A. When the size, length and details of anchorages are shown on Contract Structural Drawings, Contractor design of anchorage is not required unless otherwise indicated.
- B. Acceptable Manufacturers:

1. Additional newer post-installed anchor systems for the listed manufacturers will be considered only if a current evaluation agency report is submitted in accordance with the SUBMITTALS Article in PART 1 of this Specification Section, the anchor system is certified by ICC-ES for cracked concrete conditions, and if approved by the Engineer.
2. Mechanical Anchors:
 - a. Hilti:
 - 1) Kwik Bolt 3 (ICC-ES ESR-2302).
3. Adhesive Concrete Anchors:
 - a. Hilti:
 - 1) HIT RE 500 V3 (ICC ESR-3814).
 - 2) HIT HY 200-A (ICC ES-3187)
4. Screw Concrete Anchors:
 - a. Hilti: Kwik HUS-EZ Screw (ICC-ES ESR-3027).
5. Submit request for substitution in accordance with Specification Section 01 25 13.
 - a. Substitution request to indicate the proposed anchor has at least the same tension and shear strength as the specified anchor installed as indicated in the Contract Drawings.
 - b. Calculations shall be stamped by a Professional Engineer registered in the State of Alaska.

PART 3 - EXECUTION

3.1 GENERAL

- A. Cast-in-Place Anchorage:
 1. Use where anchor rods or bolts are indicated on the Drawings, unless another anchor type is approved by the Engineer.
 2. Provide concrete anchorage as shown on the Drawings or as required to secure components to concrete.
- B. Adhesive Anchorage:
 1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
 2. May be used where subjected to vibration or where buried or submerged.

3. Do not use in overhead applications or sustained tension loading conditions such as utility hangers.
 4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.
- C. Mechanical Anchorage:
1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
 2. Do not use where subjected to vibration.
 3. May be used in overhead applications.
 4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.
- D. Do not use powder-actuated fasteners and other types of bolts and fasteners not specified herein for structural applications unless approved by the Engineer or specified in Contract Documents.

3.2 PREPARATION

- A. Provide adequate time to allow for proper installation and inspection prior to placing concrete for cast-in-place concrete anchorage.
- B. Prior to installation, inspect and verify areas and conditions under which concrete anchorage is to be installed.
1. Notify Engineer of conditions detrimental to proper and timely completion of work.
 2. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.
- C. Special Inspection is required in accordance with the Building Code for all concrete anchorage.
1. Notify the Special Inspector that an inspection is required prior to concrete placement (or during post-installed anchorage installation).
 2. See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section for additional requirements.
- D. Post-installed anchor manufacturer's representative shall demonstrate and observe the proper installation procedures for the post-installed anchors at no additional expense to the Owner.
1. Follow such procedures to assure acceptable installation.

3.3 INSTALLATION

- A. Tie cast-in-place anchorage in position to embedded reinforcing steel using wire.
 - 1. Tack welding of anchorage is prohibited.
 - 2. Coat the projected portion of carbon steel anchors and nut threads with a heavy coat of clean grease after concrete has cured.
 - 3. Anchorage location tolerance shall be in accordance with AISC 303.
 - 4. Provide steel or durable wood templates for all column and equipment anchorage.
 - a. Templates shall be placed above top of concrete and not impede proper concrete placement and consolidation.

- B. Unless noted or specified otherwise:
 - 1. Connect aluminum and steel members to concrete and masonry using stainless steel cast-in-place anchorage unless shown otherwise.
 - a. Provide dissimilar materials protection per Specification Section 09 96 00.
 - 2. Provide washers for all anchorage, except where plate washers are required.
 - 3. Where exposed, extend threaded anchorage a maximum of 3/4 IN and a minimum of 1/2 IN above the top of the fully engaged nut.
 - a. If anchorage is cut off to the required maximum height, threads must be dressed to allow nuts to be removed without damage to the nuts.

- C. Do the following after nuts are snug-tightened down:
 - 1. If using post-installed anchorage, follow MP11.
 - 2. Upset threads of anchorage to prevent nuts from backing off.
 - a. Provide double nut or lock nut in lieu of upset threads for items that may require removal in the future.
 - 3. For all other cast-in-place anchorage material, tighten nuts down an additional 1/8 turn to prevent nuts from backing off.
 - 4. If two (2) nuts are used per concrete anchor above the base plate, tighten the top nut an additional 1/8 turn to "lock" the two (2) nuts together.
 - 5. If using post-installed anchorage, follow manufacturer's installation procedures.

- D. Assure that embedded items are protected from damage and are not filled in with concrete.
- E. Secure architectural components such that it will not be aesthetically distorted nor fasteners overstressed from expansion, contraction or installation.
- F. Coat aluminum surfaces in contact with dissimilar materials in accordance with Specification Section 09 96 00.
- G. Repair damaged galvanized surfaces in accordance with ASTM A780.
 - 1. Prepare damaged surfaces by abrasive blasting or power sanding.
 - 2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions and ASTM A780.
- H. For post-installed anchors, comply with the MPII on the hole diameter and depth required to fully develop the tensile strength of the anchor or reinforcing bar.
 - 1. Use hammer drills to create holes.
 - 2. Properly clean out the hole per the ICC-ES reports utilizing a non-metallic fiber bristle brush and compressed air or as otherwise required to remove all loose material from the hole prior to installing the anchor in the presence of the Special Inspector.

3.4 FIELD QUALITY CONTROL

- A. Special Inspection:
 - 1. See Section 01 45 33.
 - 2. See Section 03 05 05.

3.5 CLEANING

- A. After concrete has been placed, remove protection and clean all anchorage of all concrete, dirt, and other foreign matter.
- B. Provide surface acceptable to receive field-applied paint.

END OF SECTION

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SECTION 03 21 00
REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing bar requirements for concrete construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 15 19 - Anchorage to Concrete.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):

- a. SP 66, ACI Detailing Manual.
- b. 117, Specification for Tolerances for Concrete Construction and Materials.
- c. 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
- d. 318, Building Code Requirements for Structural Concrete.
- e. 350, Code Requirements for Environmental Engineering Concrete Structures.

2. ASTM International (ASTM):

- a. A36, Standard Specification for Carbon Structural Steel.
- b. A276, Standard Specification for Stainless Steel Bars and Shapes.
- c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- d. A675, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.

- e. A706, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - f. A970, Standard Specification for Headed Steel Bars for Concrete Reinforcement.
 - g. A1022, Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement.
 - h. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
3. Concrete Reinforcing Steel Institute (CRSI):
- a. Manual of Standard Practice.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Mill certificates for all reinforcing.
 - d. Manufacturer and type of proprietary reinforcing mechanical splices.
3. Qualifications of welding operators, welding processes and procedures.
4. Reinforcing number, sizes, spacing, dimensions, configurations, locations, mark numbers, lap splice lengths and locations, concrete cover and reinforcing supports.
5. Sufficient reinforcing details to permit installation of reinforcing.
6. Reinforcing details in accordance with ACI SP 66 and ACI 315.
7. Locations where proprietary reinforcing mechanical splices are required or proposed for use.
8. Shop Drawings shall be in sufficient detail to permit installation of reinforcing without reference to Contract Drawings.
 - a. Shop Drawings shall not be prepared by reproducing the plans and details indicated on the Contract Drawings but shall consist of

completely redrawn plans and details as necessary to indicate complete fabrication and installation of all reinforcing steel.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Support and store all reinforcing above ground.
- B. Ship to jobsite with attached plastic or metal tags with permanent mark numbers which match the Shop Drawing mark numbers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents and American Iron and Steel Act requirements, the following manufacturers are acceptable:
 - 1. Reinforcing adhesive anchors:
 - a. See Specification Section 03 15 19.
 - 2. Reinforcing mechanical splices:
 - a. Lenton Rebar Splicing by Erico, Inc.
 - b. Richmond dowel bar splicer system by Richmond Screw and Anchor Co., Inc.
 - c. Bar-Grip Systems by Barsplice Products, Inc.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

- A. Reinforcing Bars: ASTM A615, grade 60, deformed.
- B. Welded Wire Reinforcement: ASTM A1064 (carbon steel wire) or ASTM A1022 (stainless steel wire), where noted on Drawings.
- C. Smooth Dowel Bars: provide with metal end cap to allow longitudinal movement equal to joint width plus 1.5 IN, and approved bond breaker on one side of the smooth dowel.
 - 1. Water-containing structures: ASTM A276, Type 304 or Type 316.
 - 2. All other locations: ASTM A675, Grade 60.
- D. Proprietary Reinforcing Mechanical Splices:
 - 1. Shall develop in tension and compression a minimum of 125 percent of the yield strength of the reinforcing bars being spliced.

2. Mechanical splices used for connecting steel reinforcing of future concrete work or otherwise exposed to moisture or soil conditions shall be epoxy-coated or Type 304 or Type 316 stainless steel.

E. Headed Deformed Bars:

1. ASTM A970, Class HA.

F. Reinforcing Adhesive Anchors:

1. See Specification 03 15 19.

2.3 ACCESSORIES

A. Chairs, Runners, Bolsters, Spacers, Hangers, and Other Reinforcing Supports:

1. Metal fabrications with plastic-coated tips in contact with forms.
 - a. Plastic coating meeting requirements of CRSI Manual of Standard Practice.
2. All plastic construction meeting the requirements of CRSI Manual of Standard Practice.
 - a. 100 percent non-metallic, non-corrosive.
 - b. Required for all walls elevated construction exposed to liquid containing structures.

B. Protective plastic caps at mechanical splices.

2.4 FABRICATION

A. Tolerances:

1. Conforms to ACI 117, except as modified herein.
2. Sheared lengths: +1 IN.
3. Overall dimensions of stirrups, ties and spirals: +1/2 IN.
4. All other bends: +0 IN, -1/2 IN.

B. Minimum diameter of bends measured on the inside of the reinforcing bar shall be as indicated in ACI 350 Paragraph 7.2.

C. Ship reinforcing to jobsite with attached plastic or metal tags.

1. Place on each tag the mark number of the reinforcing corresponding to the mark number indicated on the Shop Drawing.
2. Mark numbers on tags shall be so placed that the numbers cannot be removed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Tolerances:

1. Conform to ACI 117, except as modified herein.
2. Reinforcing placement:
 - a. Clear distance to formed surfaces: +1/4 IN.
 - b. Minimum spacing between bars: -1/4 IN.
 - c. Top bars in slabs and beams:
 - 1) Members 8 IN deep or less: +1/4 IN.
 - 2) Members between 8 IN and 2 FT deep: -1/4 IN, +1/2 IN.
 - 3) Members more than 2 FT deep: -1/4 IN, +1 IN.
 - d. Crosswise of members: Spaced evenly within +1 IN.
 - e. Lengthwise of members: +2 IN.
3. Minimum clear distances between reinforcing bars:
 - a. Beams, walls and slabs: Distance equal to bar diameter or 1 IN, whichever is greater.
 - b. Columns: Distance equal to 1-1/2 times the bar diameter or 1-1/2 IN, whichever is greater.
 - c. Beam and slab reinforcing shall be threaded through the column vertical rebars without displacing the column vertical bars and still maintaining the clear distances required for the beam and slab reinforcing bars.

B. Minimum concrete protective covering for reinforcement:

| Reinforcement Location | | Minimum Concrete Cover |
|--|----------------------------|------------------------|
| Footings and Concrete Formed Against Earth | | 3 inches |
| Concrete exposed to earth, liquid or weather | No. 6 bars and larger | 2 inches |
| | No. 5 bars and smaller | 2 inches |
| Supported Slabs, Walls, and Joists | No. 14 bars and larger | 2 inches |
| | No. 11 bars and smaller | 2 inches |
| Beams and Columns | Stirrups, spirals and ties | 2 inches |
| | Primary Reinforcement | 2-1/2 inches |

C. Unless indicated otherwise on Drawings, provide splice lengths for reinforcing as follows:

1. For reinforcing: Class B splice meeting the requirements of ACI 350, or as shown in the drawings, whichever is greater.
2. For welded wire reinforcement:
 - a. Splice lap length measured between outermost cross wires of each fabric sheet shall not be less than one (1) spacing of cross wires plus 2 IN, nor less than 1.5 x development length nor less than 6 IN.
 - b. Development length shall be as required for the yield strength of the welded wire reinforcement in accordance with ACI 350.
3. Provide splices of reinforcing not specifically indicated or specified subject to approval of Engineer.
 - a. Mechanical proprietary splice connectors may only be used when approved or indicated on the Contract Drawings.

D. Welding:

1. Welding reinforcing is not permitted.

E. Placing Reinforcing:

1. Assure that reinforcement at time concrete is placed is free of mud, oil or other materials that may affect or reduce bond.
2. Reinforcement with rust, mill scale or a combination of both will be accepted as being satisfactory without cleaning or brushing provided dimensions and weights including heights of deformations on a cleaned sample is not less than required by applicable ASTM specification that governs for the reinforcing supplied.
3. Reinforcing support:
 - a. Uncoated reinforcing:
 - 1) Support reinforcing and fasten together to prevent displacement by construction operations.
 - a) Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - b) Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
 - c) Reinforcement shown on the Contract Documents may not be repositioned for use as a support for reinforcement. Additional drop bars may be provided for support of reinforcing.

- 2) Reinforcing supported on ground:
 - a) Slab on grade and other members with only one mat of reinforcing:
 - (1) Provide metal bar supports with bottom plate.
 - (2) Do not use concrete blocks to support slab-on-grade reinforcing.
 - b) All other members: Provide supporting concrete blocks or metal bar supports with bottom plate.
- 3) Reinforcing supported on formwork:
 - a) Concrete surfaces in contact with or over process liquid: All-Plastic chairs, runners and bar supports.
 - b) All other formed surfaces:
 - (1) Provide plastic-coated metal chairs, runners, bolsters, spacers, hangers and other reinforcing support.
 - (2) Only tips in contact with the forms need to be plastic coated.
4. Support reinforcing over cardboard void forms by means of concrete supports which will not puncture or damage the void forms during construction nor impair the strength of the concrete members in any way.
5. Where parallel horizontal reinforcement in beams is indicated to be placed in two or more layers, bars in the upper layers shall be placed directly above bars in the bottom layer with clear distance between layers to be 1 IN.
 - a. Place spacer bars at 3 FT maximum centers to maintain the required 1 IN clear distance between layers.
6. Extend reinforcement to within 2 IN of concrete perimeter edges.
 - a. If perimeter edge is formed by earth or stay-in-place forms, extend reinforcement to within 3 IN of the edge.
7. To assure proper placement, furnish templates for all column vertical bars and dowels.
8. Do not bend reinforcement after embedding in hardened concrete unless approved by Engineer.
 - a. Do not bend reinforcing by means of heat.
9. Do not tack weld reinforcing.
10. Embed reinforcing into hardened concrete utilizing adhesive anchor system specifically manufactured for such installation:
 - a. See Specification Section 03 15 19.

3.2 FIELD QUALITY CONTROL

A. Reinforcement Congestion and Interferences:

1. Notify Engineer whenever the specified clearances between bars cannot be met.
2. Do not place any concrete until the Engineer submits a solution to reinforcing congestion problem.
3. Reinforcing may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.
4. If bars are moved more than one bar diameter, obtain Engineer's approval of resulting arrangement of reinforcing.
5. No cutting of reinforcing shall be done without written approval of Engineer.

B. Special Inspection:

1. See Section 01 45 33.
2. See Section 03 05 05.

END OF SECTION

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SECTION 03 31 30
CONCRETE, MATERIALS AND PROPORTIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete materials, strengths and proportioning for concrete work.
2. Grouting:
 - a. Base plates for columns and equipment.
 - b. Patching cavities in concrete.
 - c. As specified and indicated in the Contract Document.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 05 05 – Concrete Testing and Inspection.
4. Section 03 15 19 - Anchorage to Concrete.
5. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. CT-13, Concrete Terminology.
 - b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
 - c. 212.3R, Chemical Admixtures for Concrete.
 - d. 232.2R, Use of Fly Ash in Concrete.
 - e. 318, Building Code Requirements for Structural Concrete.
 - f. 350, Code Requirements for Environmental Engineering Concrete Structures.

2. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - c. C94/C94M, Standard Specification for Ready-Mixed Concrete.
 - d. C150, Standard Specification for Portland Cement.
 - e. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.
 - f. C192, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
 - g. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - h. C227, Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
 - i. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
 - j. C494, Standard Specification for Chemical Admixtures for Concrete.
 - k. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - l. C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
 - m. C1116, Standard Specification for Fiber-Reinforced Concrete.
 - n. C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
 - o. C1399, Standard Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete.
 - p. C1567, Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
 - q. C1609, Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point Loading).
3. Steel Deck Institute (SDI):
 - a. 31, Design Manual for Composite Decks, Form Decks and Roof Decks.

1.3 DEFINITIONS

- A. Words and terms used in these Specifications are defined in ACI CT-13.
- B. Water-Bearing Concrete: Any concrete surface that could be in contact with process fluids during operation of the facility, including, but not limited to, tank, channels, wet wells and distribution chambers.
- C. Supplementary Cementitious Materials (SCM): Fly ash, silica fume and ground granulated blast furnace slag.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's instructions.
 - c. Concrete mix designs as required by Specification Section 03 05 05.
 - d. Manufacturer and type of proposed admixtures.
 - e. Manufacturer and type of proposed non-shrink grout and grout cure/seal compound.
 - 3. Certifications:
 - a. Certification of standard deviation value in psi for ready mix plant supplying the concrete.
 - b. Certification that the SCM meet the quality requirements stated in this Specification Section, and SCM supplier's certified test reports for each shipment of SCM delivered to concrete supplier.
 - c. Certification that the class of coarse aggregate meets the requirements of ASTM C33 for type and location of concrete construction.
 - d. Certification of aggregate gradation.
 - e. Certification of coarse aggregate impurities as relates to alkali-silica reactivity per ASTM C33, Appendix X.
 - f. Certification of shrinkage test results.
 - 4. Test reports:

- a. Cement and SCM mill reports for all cement shall be supplied.
- b. Provide test results for alkali-silica reactive impurities on coarse aggregates per referenced ASTM standards.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage of Materials:

1. Store cement and SCM in weathertight buildings, bins, or silos which will exclude moisture and contaminants.
2. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
3. Allow natural sand to drain until it has reached a relatively uniform moisture content before use.
4. Do not use frozen or partially frozen aggregates.
5. Do not use bottom 6 IN layer of stockpiled material in contact with ground surface.
6. Store admixtures in such a manner as to avoid contamination, evaporation, or damage.
 - a. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure thorough distribution of ingredients.
 - b. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics and performance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers are acceptable:
 1. Non-shrink grout:
 - a. BASF Corporation.
 - b. Euclid Chemical Company.
 - c. Five Star Products, Inc.
 2. Epoxy grout:
 - a. BASF Corporation.
 - b. Five Star Products, Inc.

- c. Euclid Chemical Company.
- d. Sika Corporation.
- 3. Synthetic fibers:
 - a. GCP Applied Technologies, Inc.
 - b. BASF Corporation.
 - c. Euclid Chemical Company.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Cement:

- 1. ASTM C150, Type I or II.
- 2. Cement type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

B. SCM:

- 1. Fly Ash:
 - a. ASTM C618, Class F or Class C.
 - b. Non-staining.
 - c. Suited to provide hardened concrete of uniform light gray color.
 - d. Compatible with other concrete ingredients and having no deleterious effects on the hardened concrete.
 - e. Produced by source approved by the State Highway Department in the state where the Project is located for use in concrete for bridges.
 - f. Evaluate and use in accordance with ACI 232.2R.
- 2. Cement and SCM type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

C. Admixtures:

- 1. Air entraining: ASTM C260.
- 2. Water reducing, retarding, and accelerating: Conform to ASTM C494, Types A through E, and provisions of ACI 212.3R.
- 3. High range water reducers (superplasticizers): Conform to ASTM C494, Types F or G.

4. All concrete mixes require the use of water reducers to maintain the specified water-to-cement ratios without additional cement.
5. SCM: Per above.
6. Admixtures shall be chloride free.
 - a. Do not use calcium chloride.
7. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.
8. Provide admixtures certified by manufacturer to be compatible with other admixtures.
9. Shrinkage reducing admixtures:
 - a. Admixture used to compensate or reduce the shrinkage of Portland Cement concrete.
 - b. Utilize at dosage necessary to help achieve required shrinkage value stated herein.
 - c. Similar to:
 - 1) Eclipse 4500 by GCP Applied Technologies, Inc.
 - 2) Conex by Euclid Chemical Co.
 - 3) MasterLife SRA 20 or MasterLife CRA 007 by BASF Corporation.

D. Microsynthetic Fibers:

1. Conform to ASTM C1116.
2. Minimum average residual strength at a net deflection of L/150: 170 psi in accordance with ASTM C1609.
3. Acceptable manufacturers:
 - a. BASF Corporation; MasterFiber F or M Series.
 - b. Fiberstrand by Euclid Chemical Company.
 - c. Gilco Fibers by GCP Applied Technologies, Inc.

E. Water:

1. Potable.
2. Clean and free from deleterious substances.
3. Free of oils, acids and organic matter.

F. Aggregates for Normal Weight Concrete:

1. ASTM C33.
 2. Fine and coarse aggregates shall be regarded as separate ingredients.
 3. Provide aggregates approved for bridge construction by the State of Alaska Department of Transportation.
 4. Coarse aggregate:
 - a. Use only washed aggregates.
 - b. Coarse aggregate sieve analysis:
 - 1) Per Table 1 in the PART 2 MIXES Article.
 5. Fine aggregates shall be natural, not manufactured.
 6. Do not use aggregates that may be deleteriously reactive when combined with alkalis in cement.
 - a. Evaluate proposed aggregates for potential deleterious expansion due to alkali silica reactivity per ASTM C33 (Appendix X), ASTM C289, ASTM C227, ASTM C1260 or ASTM C1567.
- G. Maximum total chloride ion content for concrete mix including all ingredients measured as a weight percent of cement in accordance with ASTM C1218:
1. Prestressed concrete: 0.06.
 2. All other concrete: 0.10.
- H. Sand Cement Grout (referred to as "Grout" on the Drawings):
1. Approximately three (3) parts sand, one (1) part Portland cement, 6 ± 1 percent entrained air and water shall produce a slump which allows grout to completely fill required areas and surround adjacent reinforcing.
 - a. Provide sand in accordance with requirements for fine aggregate for concrete.
 2. Minimum 28-day compressive strength:
 - a. 3000 psi.
 - b. Shall be at least strength of parent concrete when used at construction joints.
- I. Non-shrink Grout:
1. Non-shrink, non-metallic, non-corrosive, and non-staining.
 - a. Conform to ASTM C1107.

2. Premixed with only water shall be added in accordance with manufacturer's instructions at jobsite.
3. Grout shall produce a positive but controlled expansion.
 - a. Mass expansion shall not be created by gas liberation or by other means.
4. Minimum 28-day compressive strength: 7,000 psi.
5. Acceptable manufacturers:
 - a. BASF Admixtures, Inc. "Masterflow 713".
 - b. Euclid Chemical "NS Grout".
 - c. Sika Corporation "Sika Grout 212".
 - d. Sauereisen, Inc. "F-100 Level Fill Grout".

J. Epoxy Grout:

1. Three-component epoxy resin system:
 - a. Two (2) liquid epoxy components.
 - b. One (1) inert aggregate filler component.
2. Adhesive acceptable manufacturers:
 - a. BASF "Masterflow 648".
 - b. Five Start Products, Inc. "DP Five Start Epoxy Grout."
 - c. Euclid Chemical "E3-G."
 - d. Sika "Sikadur Hi-Mod."
3. Aggregate acceptable manufacturers:
 - a. BASF "Masterflow 648".
 - b. Five Start Products, Inc. "DP Five Start Epoxy Grout."
 - c. Euclid Chemical "Euclid aggregate."
 - d. Sika aggregate.
4. Aggregate manufacturer shall be the same as the adhesive manufacturer.
5. The aggregate shall be compatible with the adhesive.
6. Each component furnished in separate package for mixing at jobsite.

K. See Specification Section 03 31 31 for Grout Schedule of use.

2.3 MIXES

A. General:

1. Provide concrete capable of being placed without aggregate segregation and, when cured, of developing all properties specified.
2. Ready-mixed concrete shall conform to ASTM C94/C94M.
3. All concrete shall be normal weight concrete, weighing approximately 145 to 150 LBS per cubic foot at 28 days after placement.

B. Concrete Mixes: Refer to Table 1 below.

C. Air Entrainment:

1. Provide air entrainment in concrete resulting in a total air content percent by volume per Table 1 below.
 - a. Adjust dosage rate as necessary to compensate for shrinkage reducing admixtures.

D. Slump:

1. Measure slump at point of discharge into concrete members.
2. Walls and columns:
 - a. 8 IN maximum, 4 IN minimum measured at the point of discharge into the concrete member.
 - b. Slump shall be obtained by use of mid-range or high-range water reducer conforming to ASTM C494.
3. All other members:
 - a. Concrete using a water reducer per ASTM C494: 8 IN maximum, 4 IN minimum measured at the point of discharge into the concrete member.
 - b. Concrete without a water reducer per ASTM C494: 5 IN maximum, 1 IN minimum measured at point of discharge into the concrete member.
4. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
5. Provide additional water or water reducing admixture at ready mix plant for concrete that is to be pumped to allow for slump loss due to pumping.
 - a. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified and the maximum specified water-cement ratio is not exceeded.

6. Slump may be adjusted in the field through the use of water reducers.
 - a. Coordinate dosage and mixing requirements with concrete supplier.
7. Slump tolerances shall comply with the requirements of ACI 117.

E. Proportioning:

1. General:
 - a. Proportion ingredients to produce a mixture which will work readily into corners and angles of forms and around reinforcement by methods of placement and consolidation employed without permitting materials to segregate or excessive free water to collect on surface.
 - b. Proportion ingredients to produce proper placeability, durability, strength and other required properties.
2. Normal weight concrete target cementitious materials contents and maximum water cementitious ratios per Table 1 below.
 - a. Cement is intended to provide a crack-free, durable, finished product, not one with excessive strength.
3. SCM:
 - a. Fly ash:
 - 1) For cast-in-place concrete only, a maximum of 25 percent by weight of Portland cement content per cubic yard may be replaced with fly ash at a rate of 1 LB fly ash for 1 LB cement.
 - 2) If fly ash is used, the water-to-fly ash plus cement ratio shall not exceed the maximum water cement ratio specified in this Specification Section.
 - 3) Concrete containing fly ash shall not be used in the construction of the precast concrete units.
4. Water reducing, retarding, and accelerating admixtures:
 - a. Use in accordance with manufacturer's instructions.
 - b. Add to mix at batching plant.
 - c. Use water-reducing or high-range water reducing admixture in concrete, as required, for placement and workability.
 - 1) Water reducers are required to maintain specified maximum water to cement ratios.

5. High range water reducers (superplasticizers):
 - a. Use required for:
 - 1) All concrete shall be pumped except slabs on grade.
 - 2) All concrete for water containing structures.
 - 3) Other concrete members at Contractor's option.
 - b. Use required for all non-pumped concrete except slabs on grade and foundations.
 - c. Maximum concrete slump before addition of admixture shall be 3 IN; maximum slump after addition shall be 8 IN.
 - d. Reference Specification Section 03 31 31 for additional requirements.
6. Concrete mix proportioning methods for normal weight concrete:
 - a. Method 1:
 - 1) Used when combination of materials proposed is to be evaluated and proportions selected to be on a basis of trial mixes.
 - 2) Produce mixes having suitable proportions and consistencies based on ACI 211.1, using at least three (3) different water cement ratios or cement contents which will produce a range of compressive strengths encompassing the required average strength.
 - 3) Design trial mixes to produce a slump within 0.75 IN of maximum specified, and for air entrained concrete, air content within 0.5 percent specified.
 - 4) For each water cement ratio or cement content, make at least three (3) trial strength tests for specified test age, and cure in accordance with ASTM C192.
 - a) Cylinder size: Per ASTM C31.
 - b) Test for strength at 28 days in accordance with ASTM C39.
 - (1) Quantity of cylinders per trial strength test:
 - (a) 6 IN DIA cylinders: Two (2).
 - (b) 4 IN DIA cylinders: Three (3).
 - 5) From results of these tests, plot a curve showing relationship between water cement ratio or cement content and compressive strength.
 - 6) From this curve select water cement ratio or cement content to be used to produce required average strength.
 - 7) Use cement content and mixture proportions such that maximum water cement ratio is not exceeded when slump is maximum specified.

- 8) Base field control on maintenance of proper cement content, slump, air content and water cement ratio.
- 9) See paragraph hereafter for definition of required average strength.

b. Method 2:

- 1) In lieu of trial mixes, field test records for concrete made with similar ingredients may be used.
 - 2) Use of proposed concrete mix proportions based on field test records subject to approval by Engineer based on information contained in field test records and demonstrated ability to provide the required average strength.
 - 3) Field test records shall represent materials, proportions and conditions similar to those specified.
 - a) Changes in the materials, proportions and conditions within the test records shall have not been more restricted than those for the proposed concrete mix.
 - b) Field test records shall meet the requirements of ACI 350 Chapter 5.
 - 4) Required concrete proportions may be established by interpolation between the strengths and proportions of two (2) or more test records each of which meets the requirements of this Specification Section.
7. Required average strength shall exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with ACI 350, Chapter 5 using the standard deviation of the proposed concrete production facility as described in ACI 350, Chapter 5.

F. Controlled Low-Strength Material (CLSM):

1. A mixture of cement, fly ash, fine sand, water and air having a consistency which will flow under a very low head.
2. Approximate quantities of each component per cubic yard of mixed material:
 - a. Cement (Type I or II): 50 LBS.
 - b. Fly ash: 200 LBS.
 - c. Fine sand: 2,700 LBS.
 - d. Water (approximate): 420 LBS.
 - e. Air content (approximate): 10 percent.
3. Actual quantities shall be adjusted to provide a yield of 1 CY with the materials used.
4. Approximate compressive strength should be 85 to 175 psi.

5. Fine sand shall be an evenly graded material having not less than 95 percent passing the No. 4 sieve and not more than 5 percent passing the No. 200 sieve.

G. Allowable Shrinkage:

1. Per Table 1 when tested in accordance with ASTM C157 at 28 Days.
2. Continue testing to 64 weeks for informational purposes.

| TABLE 1 | | | | | | | |
|---|-----------------------------|-----------|---------------------|--------|-------------------|----------------|---------------------------|
| TYPE OF CONCRETE | 28 DAY COMPRESSIVE STRENGTH | W/C RATIO | TARGET TOTAL CEMENT | SCM | ASTM C33 Size No. | AIR CONTENT | ALLOWABLE SHRINKAGE LIMIT |
| Normal weight lean concrete | 3000 psi | 0.45 | 517 | Note 1 | 7 | 5-1/2 to 8 | None |
| Normal weight concrete fill (for utility encasement concrete) | 4500 psi | 0.42 | 611 | Note 1 | 67 | 4-1/2 to 7-1/2 | None |
| Normal weight concrete topping | 4500 psi | 0.42 | 611 | Note 1 | 7 | 5-1/2 to 8 | None |
| Normal weight precast concrete | 5000 psi | 0.42 | 611 | | 67 | 4-1/2 to 7-1/2 | None |
| Normal weight concrete integral wearing course | 6000 psi | 0.40 | 658 | Note 1 | 67 | 4-1/2 to 7-1/2 | None |
| Normal weight concrete w/ power trowel finish | 4500 psi | 0.42 | 611 | Note 1 | 67 | 0 to 2 | 0.048 |
| Normal weight water-bearing concrete | 4500 psi | 0.42 | 611 | Note 1 | 67 | 4-1/2 to 7-1/2 | 0.032 |
| Normal weight all other concrete | 4500 psi | 0.42 | 611 | Note 1 | 67 | 4-1/2 to 7-1/2 | 0.048 |

Table 1 Notes:

1. If fly ash is proposed for use, the weight of fly ash plus weight of Portland cement shall be used to meet total target cement requirement.

2.4 SOURCE QUALITY CONTROL

- A. To assure stockpiles are not contaminated or materials are segregated, perform any test for determining conformance to requirements for cleanness and grading on samples secured from aggregates at point of batching.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Special Inspection:

1. See Specification Section 01 45 33.

2. See Specification Section 03 05 05.
- B. Perform concrete tests per Specification Section 03 05 05.
1. Perform a strength test on all concrete to which water or superplasticizer, above the amount stated in the approved concrete mix design, has been added.
 - a. Perform sampling after water or superplasticizer has been added and additional mixing has been performed.
- C. Perform strength test on any concrete to which water has been added at the jobsite.

END OF SECTION

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SECTION 03 31 31
CONCRETE MIXING, PLACING, JOINTING, AND CURING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mixing, placing, jointing, and curing of concrete construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 05 05 – Concrete Testing and Inspection.
4. Section 03 11 13 - Formwork.
5. Section 03 21 00 - Reinforcement.
6. Section 03 31 30 - Concrete, Materials and Proportioning.
7. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.
8. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. CT-13, Concrete Terminology.
 - b. 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - c. 304.2R, Placing Concrete by Pumping Methods.
 - d. 305.1, Specification for Hot Weather Concreting.
 - e. 306.1, Standard Specification for Cold Weather Concreting.
 - f. 308.1, Specification for Curing Concrete.
 - g. 309R, Guide for Consolidation of Concrete.
 - h. 360R, Guide to Design of Slabs-on-Ground.

2. ASTM International (ASTM):
 - a. C94/C94M, Standard Specification for Ready-Mixed Concrete.
 - b. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - c. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - d. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - e. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
 - f. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
3. Corps of Engineers (COE):
 - a. CRD-C572, Specifications for Polyvinylchloride Waterstop.
4. National Ready Mixed Concrete Association (NRMCA):
 - a. Checklist for Certification of Ready Mixed Concrete Production Facilities.
5. NSF International (NSF).
6. Qualifications: Concrete Contractor:
 - a. Company, on-site superintendent and crew foremen shall have minimum 10 years' documented experience in the construction of vertical concrete structures greater than 20 feet in height and in the construction of environmental concrete tank structures of similar size to the concrete tank structures included in this project.
 - b. With an active and enforced quality assurance program in place, as described in the applicable Codes.
7. Ready Mixed Concrete Batch Plant: Certified by NRMCA. Waterstop manufacturer's representative shall provide on-site training of waterstop installation, field splicing, welding and inspection procedures prior to construction, and at no additional cost.

1.3 DEFINITIONS

- A. Words and terms used in this Specification Section are defined in ACI CT-13.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 1) Procedure for adding high-range water reducer at the jobsite.
 - c. Scaled (minimum 1/8 IN per foot) drawings showing proposed locations of construction joints, control joints, expansion joints (as applicable) and joint profile dimensions for each joint type.
 - d. Manufacturers and types:
 - 1) Joint fillers.
 - 2) Curing agents.
 - 3) Construction joint bonding adhesive.
 - 4) Waterstops.
3. Qualifications and Certifications:
 - a. Concrete contractor qualifications: project work history and facility owner references.
 - b. Ready mix concrete plant certification.

B. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Copies of concrete delivery tickets.
3. Description of proposed curing methods.

C. Placement Plan for Concrete: Show sequence and extents of concrete pours between approved construction joint locations for the structures listed in Paragraph 1.7B, below.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Concrete Delivery:

1. Prepare a delivery ticket for each load of ready mixed concrete.

2. Truck operator shall hand ticket to Contractor at the time of delivery.
3. Ticket shall show:
 - a. Mix identification.
 - b. Quantity delivered.
 - c. Amount of material in each batch.
 - d. Outdoor temperature in the shade.
 - e. Time at which cement was added.
 - f. Time of delivery.
 - g. Time of discharge.
 - h. Amount of water that may be added at the site without exceeding the specified water-cement ratio.
 - i. Amount of water added at the site.

1.6 PROJECT CONDITIONS

- A. Adjust concrete mix design when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
 1. Do not use revised concrete mixes unless submitted to and approved by Engineer.
- B. Concrete structures that will contain wastewater (i.e. "environmental structures") are intended to be watertight, as defined in Section 01 45 25. Contractor shall provide means and methods as needed to provide watertight environmental structures. Such measures taken by Contractor shall include, but are not limited to, the following:
 1. Providing well-proportioned concrete design mix, including air entrainment for durability and low permeability, and water reducers for improving workability of low water-cement ratio concrete during placement.
 2. Providing properly-consolidated concrete and placing it as nearly as practical to its final position.
 3. Sequencing and scheduling the placement of concrete sections to allow sufficient shrinkage of concrete before placing concrete of adjoining sections.
 4. Providing continuous, monolithic concrete placement between construction joints and expansion joints in approved locations.
 5. Not exceeding specified maximum distances between adjacent construction joints.

6. Ensuring that waterstops are properly installed in all construction joints that may otherwise become a leak path for contained fluids.

1.7 SEQUENCING AND SCHEDULING

- A. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
 1. Approval of concrete mix design does not relieve Contractor of his responsibility to provide concrete that meets the requirements of the Contract Documents.
- B. Submit Layout and Sequencing Plan for Concrete for review by Engineer no later than 10 days prior to scheduled concrete placement for each of the following structures:
 1. Clarifiers.
 2. Splitter Vault.
 3. WAS Pump Vault

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in this article are acceptable.
- B. Neoprene Expansion Joint Fillers:
 1. Acceptable manufacturers:
 - a. Permaglaze.
 - b. Rubatex.
 - c. Williams Products.
 2. Materials:
 - a. Closed cell neoprene.
 - b. ASTM D1056, Type 2, Class A or C.
 - c. Grade: Compression deflection as required to limit deflection to 25 percent of joint thickness under pressure from concrete pour height.
- C. Asphalt Expansion Joint Fillers:
 1. Acceptable manufacturers:
 - a. W.R. Meadows.

- b. J and P Petroleum Products.
 - 2. Materials: ASTM D994.
- D. Fiber Expansion Joint Fillers:
 - 1. Materials: ASTM D1751.
- E. Waterstops, PVC Type:
 - 1. Acceptable manufacturers:
 - a. Greenstreak Plastic Products.
 - b. W.R. Meadows.
 - c. Vinylex Corporation.
 - d. Bometals, Inc.
 - 2. Materials:
 - a. Virgin polyvinyl chloride compound not containing any scrap or reclaimed materials or pigment.
 - b. Cast-in-place type: COE CRD-572.
 - 3. Approved profiles as listed.
 - a. Construction joints:
 - 1) Ribbed: 6 IN wide by 3/8 IN.
 - 2) Greenstreak Plastic Products Style #679, or equal.
 - b. Control joints:
 - 1) 6 IN wide by 3/8 IN thick with ribs and center bulb.
 - 2) Greenstreak Plastic Products Style #705, or equal.
 - c. Expansion joint:
 - 1) 9 IN wide by 3/8 IN thick tear web type waterstop.
 - 2) Greenstreak Plastic Products Style #700, or equal.
 - 4. Provide factory-made waterstop fabrications at all changes in direction, intersections and transitions, leaving only straight butt splices for the field. Butt welds shall be a minimum 6 IN from the intersection.
 - 5. Factory pre-punched (12 IN centers, each edge) for wire supports.
 - a. Provide hog rings or grommets at maximum 12 IN OC along the length of the waterstop at Contractor's option.

6. Use only PVC-type waterstops in environmental liquid-containing concrete structures.
7. See Drawings for application and other requirements.

F. Waterstops, Preformed Strip Type:

1. Acceptable manufacturers:
 - a. Greenstreak Plastics, Inc. (Hydrotite).
 - b. Adeka Ultra Seal USA (MC-2010MN).
 - c. DeNeef (Swellseal Plus).
2. Hydrophilic, nonbentonite composition.
3. Manufactured solely for the purpose of preventing water from traveling through construction joints.
4. Volumetric expansion limited to 3 times maximum.
5. Use only where specifically required or otherwise approved in writing by the Engineer for specific applications as submitted by Contractor.
6. See Drawings for application and other requirements.

G. Water Swelling Sealant:

1. Compatible with strip-type waterstop.
2. Single component, gun-applied.
3. Moisture-cured.
4. Minimum 70 percent volumetric expansion swelling capability.

H. Curing Products shall conform to one or more of the following:

1. Absorbent Covers.
2. Moisture Retaining Covers.
 - a. Moisture Retaining Fabric.
3. Dissipating curing compound:
 - a. Pigmented, waterborne, membrane-forming.
 - b. ASTM C309, Type 2, Class B, Dissipating shall be composed of hydrocarbon resins, and dissipating agents that begin to break down upon exposure to UV light, and traffic, approximately 4 to 6 weeks after applications, providing a film that is removable with standard degreasing

agents, and mechanized scrubbing actions so as to not impair the later addition of applied finishes.

c. Acceptable Products:

- 1) Dayton Superior Corporation; Day Chem Rez Cure (J-11-WD).
- 2) Euclid Chemical Company (The); Kurez DR VOX.
- 3) L&M Construction Chemicals, Inc.; L&M Cure R2.

4. Clear, water or solvent-borne, membrane-forming curing and sealing compound:

a. ASTM C1315, Type 1, Class A.

b. Moisture loss shall be not more than 0.40 Kg/m² when applied at 300 SQ FT/GAL.

c. Manufacturer's certification is required.

d. Subject to project requirements, provide one of the following products:

e. Products:

- 1) Euclid Chemical Company (The); Super Diamond Clear, Luster Seal 300 (exterior), Super Rez-Seal (interior).
- 2) L&M Construction Chemicals, Inc.; Lumiseal Plus.
- 3) Meadows, W.R., Inc.; CS-309/30.
- 4) Euclid Chemical Company (The); Super Diamond Clear VOX.
- 5) L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
- 6) Meadows, W.R., Inc.; Vocomp-30.

I. Vapor Retarder: See Specification Section 07 26 00.

J. Sand cement grout, non-shrink grout and epoxy grout: See Specification Section 03 31 30.

2.2 SOURCE QUALITY CONTROL

A. The concrete plant shall conform to the Checklist for Certification of Ready Mixed Concrete Production Facilities of the NRMCA.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:

1. Complete formwork.

a. See Specification Section 03 11 13.

2. Remove earth, snow, ice, water, and other foreign materials from areas that will receive concrete.
 3. Secure reinforcement in place.
 - a. See Specification Section 03 21 00.
 4. Position expansion joint material, anchors and other embedded items.
 5. Obtain approval of reinforcement erection and placement prior to placing concrete.
 6. Do not place concrete during rain, sleet, or snow, unless adequate protection is provided and approval is obtained.
 - a. Plan size of crews with due regard for effects of concrete temperature and atmospheric conditions on rate of hardening of concrete as required to obtain good surfaces and avoid unplanned cold joints.
 - b. Do not allow rainwater to increase mixing water nor to damage surface finish.
 7. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment and formwork.
 8. Provide slabs and beams of minimum indicated required depth when sloping structural foundation base slabs and elevated slabs to drains.
 - a. For floor slabs on grade, slope top of subgrade to provide slab of required uniform thickness.
- B. Preparation of Subgrade for Slabs-on-Ground:
1. Granular subgrade shall be wetted without standing water immediately prior to placing concrete.
 2. Obtain approval of granular subgrade compaction density prior to placing slabs on ground.
- C. Edge Forms and Screeds:
1. Set accurately to produce designated elevations and contours of finished surface.
 2. Sufficiently strong to support vibrating screeds or roller pipe screeds, if required.
 3. Use strike off templates, or approved vibrating type screeds, to align concrete surfaces to contours of screed strips.

3.2 CONCRETE MIXING

A. General:

1. Provide all concrete from a central plant conforming to Checklist for Certification of Ready Mixed Concrete Production Facilities of the NRMCA.
 2. Batch, mix, and transport in accordance with ASTM C94/C94M.
- B. Control of Admixtures:
1. Control at the batch plant:
 - a. All admixtures shall be introduced at the batch plant in accordance with manufacturer's recommendations.
 - b. Charge admixtures into mixer as solutions.
 - 1) Measure by means of an approved mechanical dispensing device.
 - 2) Liquid considered a part of mixing water.
 - 3) Admixtures that cannot be added in solution may be weighed or measured by volume if so recommended by manufacturer.
 - c. Add separately, when two or more admixtures are used in concrete, to avoid possible interaction that might interfere with efficiency of either admixture, or adversely affect concrete.
 - d. Complete addition of retarding admixtures within one minute after addition of water to cement has been completed, or prior to beginning of last three quarters of required mixing, whichever occurs first.
 2. Control of Admixtures in the Field:
 - a. Additional quantities of admixtures (with the exception of retarders) may be added in the field provided:
 - 1) Addition of admixtures shall be under the supervision of the ready mix quality control representative.
 - 2) Addition of each admixture shall be documented on the delivery ticket.
 - 3) Provide additional mixing per ASTM C94.
- C. Tempering and Control of Mixing Water:
1. Mix concrete only in quantities for immediate use.
 2. Discard concrete which has set.
 3. Discharge concrete from ready mix trucks within time limit and drum revolutions stated in ASTM C94/C94M.
 4. Addition of water at the jobsite:
 - a. See Specification Section 03 31 30 for specified water cement ratio and slump.

- b. Do not exceed maximum specified water cement ratio or slump.
- c. Incorporate water by additional mixing equal to at least half of total mixing required.

3.3 PLACING OF CONCRETE

A. General:

1. Place concrete at such a rate that concrete, which is being integrated with previously-placed fresh concrete, is still workable.
 - a. Select placement equipment and manpower in order to assure timely delivery of concrete into forms to avoid cold joints and placement issues.
2. Comply with ACI 304R and ACI 304.2R.
3. Do not begin placing concrete during rain, sleet, or show.
 - a. Protect fresh concrete from ensuing inclement weather.
4. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
5. Begin work only when work of other trades affecting concrete is complete.
6. Deposit concrete:
 - a. Continuously to avoid cold joints.
7. Locate construction joints at locations approved by Engineer.
 - a. Plan size of crews with due regard for effects of concrete temperature and atmosphere conditions to avoid unplanned cold joints.
8. Spreaders:
 - a. Temporary: Remove as soon as concrete placing renders their function unnecessary.
 - b. Embedded:
 - 1) Obtain approval of Engineer.
 - 2) Materials: Concrete or metal.
 - 3) Ends of metal spreaders coated with plastic coating 2 IN from each end.

9. Deposit concrete as nearly as practicable in its final position to avoid segregation.
 - a. Maximum free fall: 4 FT.
 - b. Place concrete by means of hopper, elephant trunk or tremie pipe extending down to within 4 FT of surface placed upon.
10. Perform the following operations before bleeding water has an opportunity to collect on surface:
 - a. Spread.
 - b. Consolidate.
 - c. Straightedge.
 - d. Darby or bull float.
11. No water shall be added to the concrete surface to ease finishing operation.
12. For concrete structures containing wastewater, a minimum of 48 hours shall elapse between casting of adjoining monolithic sections.

B. Cold Weather Concrete Placement:

1. Comply with ACI 306.1.
2. Do not place concrete on subgrades that are below 32 Deg F or contain frozen material.
3. Maintain all materials, forms, reinforcement, subgrade and any other items which concrete will come in contact with free of frost, ice or snow at time of concrete placement.
4. Temperature of concrete when discharged at site: Per ACI 306.1.
5. Heat subgrade forms, embedments and reinforcement to between 45 and 70 Deg F, when temperature of surrounding air is 40 Deg F or below at time concrete is placed.
 - a. Remove all frost from subgrade, forms and reinforcement before concrete is placed.
6. Combine water with aggregate in mixer before cement is added, if water or aggregate is heated above 90 Deg F.
7. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 90 Deg F.
8. Follow ACI 360R-10 for specific requirements dealing with elevated steel troweled slabs that will be exposed to freeze-thaw cycles.

C. Hot Weather Concrete Placement:

1. Comply with ACI 305.1.
2. Cool ingredients before mixing, or add flake ice or well crushed ice of a size that will melt completely during mixing for all or part of mixing water if high temperature, low slump, flash set, cold joints, or shrinkage cracks are encountered.
3. Temperature of concrete at point of delivery (i.e. truck discharge) when placed:
 - a. Not to exceed 90 Deg F.
 - b. Not so high as to cause:
 - 1) Shrinkage cracks.
 - 2) Difficulty in placement due to loss of slump.
 - 3) Flash set.
4. Temperature of forms and reinforcing when placing concrete:
 - a. Not to exceed 90 Deg F.
 - b. May be reduced by spraying with water to cool below 90 Deg F.
 - 1) Leave no standing water to contact concrete being placed.
5. Prevent plastic shrinkage cracking and/or slab curling due to evaporation.

D. Consolidating:

1. Consolidate in accordance with ACI 309R except as modified herein.
2. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items and into corners of forms.
 - a. Eliminate:
 - 1) Air or stone pockets.
 - 2) Honeycombing or pitting.
 - 3) Planes of weakness.
3. Use suitable form vibrators located just below top surface of concrete, where internal vibrators cannot be used in areas of congested reinforcing.
 - a. Size and coordinate external vibrators to specifically match forming system used.
4. Internal vibrators:
 - a. Minimum frequency of 8000 vibrations per minute.

- b. Insert and withdraw at points approximately 18 IN apart.
 - 1) Allow sufficient duration at each insertion to consolidate concrete but not sufficient to cause segregation.
- c. Use in:
 - 1) Beams and girders of framed slabs.
 - 2) Columns and walls.
 - 3) Vibrating concrete around all waterstops.
- d. Size of vibrators shall be in accordance with ACI 309R, Table 5.1.5.
- 5. Obtain consolidation of slabs with internal vibrators, vibrating screeds, roller pipe screeds, or other approved means.
- 6. Do not use vibrators to transport concrete within forms.
- 7. Provide spare vibrators on jobsite during all concrete placing operations.
- 8. Bring a full surface of mortar against form by vibration, supplemented (if necessary) by spading to work coarse aggregate back from formed surface, where concrete is to have an as-cast finish.
- 9. Prevent construction equipment, construction operations, and personnel from introducing vibrations into freshly placed concrete after the concrete has been placed and consolidated.
- E. Handle concrete from mixer to place of final deposit by methods which will prevent segregation or loss of ingredients and in a manner which will assure that required quality of concrete is maintained.
 - 1. Use truck mixers, agitators, and non-agitating units in accordance with ASTM C94/C94M.
 - 2. Horizontal belt conveyors:
 - a. Mount at a slope which will not cause segregation or loss of ingredients.
 - b. Protect concrete against undue drying or rise in temperature.
 - c. Use an arrangement at discharge end to prevent segregation.
 - d. Do not allow mortar to adhere to return length of belt.
 - e. Discharge conveyor runs into equipment specially designed for spreading concrete.
 - 3. Metal or metal lined chutes:
 - a. Slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal.

- b. Chutes more than 20 FT long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.
 - c. Provide end of each chute with a device to prevent segregation.
4. Pumping or pneumatic conveying equipment:
- a. Designed for concrete application and having adequate pumping capacity.
 - b. Control pneumatic placement so segregation is avoided in discharged concrete.
 - c. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 1-1/2 IN.
 - d. Do not convey concrete through pipe made of aluminum or aluminum alloy.
 - e. Provide pumping equipment without Y sections.
- F. Placing of Concrete on Metal Deck:
- 1. Prior to concrete placement, the metal deck shall be free of soil, debris, standing water, loose mill scale, and all other foreign matter.
 - 2. Care shall be exercised when placing concrete so that the deck will not be subject to construction loads or impact that exceed the design capacity of the deck.
 - 3. Concrete shall be placed in a uniform manner and spread toward the center of the deck span.
 - 4. If buggies are used to place concrete, runways shall be planked, and the buggies shall only operate on planking.
 - a. Planks shall be of adequate stiffness to transfer loads to the steel supports without damaging the deck.
 - 5. Deck damage caused by careless placement of concrete shall be repaired or replaced.
 - 6. Pour concrete to the thickness and elevations noted on Drawings.

3.4 JOINTS AND EMBEDDED ITEMS

A. Construction Joints - General:

- 1. Locate joints as indicated on Contract Drawings or as shown on approved Shop Drawings.

- a. Where construction joint spacing shown on Drawings exceeds the joint spacing indicated in Paragraph B. below, submit proposed construction joint location in conformance with this Specification Section.
2. Unplanned construction joints will not be allowed.
 - a. If concrete cannot be completely placed between planned construction joints, then it must be removed.
3. In general, locate joints near middle of spans of slabs, beams and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice the width of the beam.
4. Locate joints in walls and columns at underside of floors, slabs, beams, or girders, and at tops of foundations or floor slabs, unless shown otherwise.
 - a. Beam pockets shall be formed into walls where shown in the Drawings.
 - b. Size pockets to allow beam reinforcing to be placed as detailed on Drawings.
5. Place beams, girders, column capitals and drop panels at same time as slabs.
6. Place corbels monolithically with walls.
 - a. Locate wall vertical construction joints midway between corbels.
 - b. Where only a single corbel is located place it also monolithically with wall and locate wall vertical construction joint a minimum of 3 FT from face of corbel.
7. Make joints perpendicular to main reinforcement with all reinforcement continuous across joints.
8. Provide the following joints unless noted otherwise on Drawings:
 - a. Roughen joints: vertical and horizontal construction joints.
 - b. Keyed joints: as option approved by Engineer for specific construction joint applications.
9. Roughen construction joints:
 - a. Clean the previously hardened concrete interface and remove all laitance.
 - b. Intentionally roughen the interface to a full amplitude of 1/4 IN.
10. Keyways:
 - a. Construction joint keyways shall have the following dimensions, unless shown otherwise on Drawings.

- b. Wall keys:
 - 1) Keyway width, not less than 1/3 and not more than 1/2 the wall thickness measured perpendicular to wall faces.
 - 2) Keyway depth shall be not less than 1-1/2 IN.
 - 3) Continuous along length of wall.
 - 4) Place keyway in wall center unless shown otherwise on Drawings.
- c. Keyways in footings, foundations, base slabs, and structural or elevated slabs:
 - 1) Keyway height not less than 1/3 and not more than 1/2 the footing or slab thickness.
 - 2) Keyway depth not less than 1-1/2 IN.
 - 3) Continuous along footing or slab.
 - 4) Keyway in footing or slab center unless shown otherwise on Drawings.
- d. Beam keyways:
 - 1) Full width of beam.
 - 2) Keyway height not less than 5-1/2 IN.
 - 3) Keyway depth not less than 1-1/2 IN.
 - 4) Keyway located in initial beam pour, directly above the bottom reinforcing, unless shown otherwise on Drawings.

11. Minimum time before placement of adjoining concrete construction:

- a. All concrete: 48 HRS.

B. Construction Joints - Spacing Unless Otherwise Specified:

1. Structures not intended to contain liquid:

a. Wall vertical construction joints:

- 1) 50 FT maximum centers.
- 2) At wall intersections, 4 FT minimum from corner.

b. Base slab, floor, and roof slab construction joints:

- 1) Placements shall be approximately square and not to exceed 2500 SQ FT.
- 2) Maximum side dimension of a slab pour shall be 70 FT.

2. Water-retaining structures:

a. Wall vertical construction joints:

- 1) 30 FT maximum centers.

- 2) At wall intersections, as shown in Drawings (10 FT minimum from corners).
 - b. Wall horizontal construction joints: 25 FT centers.
 - c. Floor slab, construction joints:
 - 1) Placements shall be approximately square and not to exceed 1000 SQ FT.
 - 2) Maximum side dimension of a slab pour shall be less than:
 - a) Twice the length of the short side.
 - b) 30 FT.
 - d. Elevated slab construction joints:
 - 1) Placements shall be approximately square and not to exceed 1000 SQ FT.
 - 2) Maximum side dimension of a slab pour shall be less than:
 - a) Twice the length of the short side.
 - b) 30 FT.
- C. Construction Joints - Bonding:
- 1. Obtain bond between concrete pours at construction joints by thoroughly cleaning and removing all laitance from construction joints.
 - 2. Before new concrete is placed, all construction joints shall be coated with cement grout, or dampened, as outlined below:
 - 3. Roughen construction joints:
 - a. Roughen the surface of the concrete to expose the coarse aggregate uniformly with 1/4 IN minimum amplitude.
 - 1) Remove laitance, loosened particles of aggregate or damaged concrete at the surface, or at the Contractor's option, use an approved chemical retarder which delays but does not prevent setting of the surface of the mortar in accordance with the manufacturer's recommendations.
 - a) Retarded mortar shall be removed within 24 HRS after placing to produce a clean exposed aggregate bonding surface.
 - b. Dampen the hardened concrete immediately prior to placing of fresh concrete or grout.
 - 4. Keyed construction joints:
 - a. Thoroughly clean construction joints and remove all laitance.
 - b. Dampen the hardened concrete immediately prior to placing of fresh concrete.

D. Slab-on-Grade Joints:

1. Locate construction and control joints in slabs on grade as indicated on Drawings.
2. Time cutting properly with set of concrete, if saw cut joints are required or permitted.
 - a. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw.
 - b. Complete before shrinkage stresses become sufficient to produce cracking.

E. Expansion Joints:

1. Do not permit reinforcement or other embedded metal items bonded to concrete (except smooth dowels bonded on only one side of joint) to extend continuously through an expansion joint.
2. Use neoprene expansion joint fillers, unless noted otherwise on Drawings.
3. Seal expansion joints as shown on Drawings.
 - a. See Specification Section 07 92 00 for requirements.

F. Waterstops - General:

1. Waterstop shall be continuous with splices in accordance with manufacturer's instructions and create watertight joints.
2. Do not mix different types of waterstop materials in the same structure without specific approval from the Engineer unless shown on Drawings.
3. Preformed strip type:
 - a. Locate waterstop at center of wall, unless noted otherwise on Drawings.
 - 1) Maintain at least 3 IN from edge of concrete.
 - b. Install in a bed of swelling sealant on smooth surface of hardened concrete by use of nails, adhesive or other means as recommended by manufacturer to prevent movement of waterstop during placement of concrete.
 - c. Roughened joints shall be especially prepared during concrete placement to provide smooth surface for proper water stop installation.
 - d. Use in joints against existing concrete where indicated on Drawings.
4. PVC waterstops:
 - a. Position waterstop accurately in joints, with adequate clearance from all reinforcing.

- b. Secure waterstops in correct position using hog rings or grommets spaced 24 IN maximum staggered along each edge full length and passed through the edge of the waterstop.
 - 1) Tie wire to adjacent reinforcing.
- c. Hold horizontal waterstops in place with continuous supports.
- d. Install according to manufacturer's instructions.
 - 1) Do not displace reinforcement from required location.
- e. Splice ends and intersections with perpendicular butt splice using electrical splicing iron in accordance with manufacturer's instructions.
 - 1) Use factory fabricated "T" and corner intersection fittings.
 - 2) Field splice straight runs of material.
- f. Unless otherwise noted, use for all construction joints in new construction for all structures indicated on Drawings.

G. Other Embedded Items:

- 1. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to initiating concreting.
 - a. Give Contractor whose work is related or integral to concrete, or supported by it, ample notice and opportunity to furnish and install items before placing concrete.
- 2. Do not route electrical conduit, drains, or pipes in concrete slabs, walls, columns, foundations, beams or other structural members unless approved by Engineer.

H. Placing Embedded Items:

- 1. Support against displacement.
- 2. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.
- 3. Provide adequate means for anchoring waterstop in concrete.
 - a. Provide means to prevent waterstops in the forms from being folded over by the concrete as it is placed.

3.5 FINISHING

- A. See Specification Section 03 35 00.
- B. Coordinate mixing and placing with finishing.

3.6 INSTALLATION OF GROUT

A. Grout Schedule of Use:

1. Sand cement grout:
 - a. Fill keyways if precast hollow core unit (HCU).
 - b. Other uses indicated on the Drawings.
2. Non-shrinking non-metallic grout:
 - a. Filling form tie holes.
 - b. Under column and beam base plates.
 - c. Other uses indicated on the Drawings.
3. Epoxy grout:
 - a. Patching cavities in concrete.
 - b. Grouting of dowels and anchor bolts into existing concrete.
 - c. Grouting of equipment base plates.
 - d. Other uses indicated on the Drawings.

B. Grout Installation:

1. Sand cement grout:
 - a. Fill keyways between precast concrete hollow core slabs with sand cement grout.
 - b. Consolidate grout by rodding or by other means to assure complete filling of keyways.
 - c. Cure grout by one of methods specified.
2. Non-shrink non-metallic grout:
 - a. Clean concrete surface to receive grout.
 - b. Saturate concrete with water for 24 HRS prior to grouting.
 - c. Mix in a mechanical mixer.
 - d. Use no more water than necessary to produce flowable grout.
 - e. Place in accordance with manufacturer's instructions.

- f. Provide under beam, column, and equipment base plates, in joints between precast concrete filter slabs, and in other locations indicated on the Drawings.
 - g. Completely fill all spaces and cavities below the top of base plates.
 - h. Provide forms where base plates and bed plates do not confine grout.
 - i. Where exposed to view, finish grout edges smooth.
 - j. Except where a slope is indicated on the Drawings, finish edges flush at the base plate, bed plate, member or piece of equipment.
 - k. Coat exposed edges of grout with cure or seal compound recommended by the grout manufacturer.
3. Epoxy grout:
- a. Mix and place in accordance with manufacturer's instructions.
 - b. Apply only to clean, dry, sound surface.
 - c. Completely fill all cavities and spaces around dowels and anchors without voids.
 - d. Grout base and bed plates as specified for non-shrinking, non-metallic grout.
 - e. Obtain manufacturer's field technical assistance as required to assure proper placement.

3.7 CURING AND PROTECTION

- A. Protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury immediately after placement, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement, hardening, and compressive strength gain.
 - 1. Follow recommendations of ACI 308.1 except as modified herein.
 - 2. All traffic shall be kept from the surface as necessary to protect the concrete but not less than the first 48 HRS of curing.
- B. For surfaces of non-water bearing structures, apply one of the following curing procedures immediately after completion of placement and finishing (surfaces not in contact with forms).
 - 1. Ponding or continuous sprinkling. Take care to avoid eroding the surface of freshly placed concrete.
 - 2. Application of wet Absorbent Covers:
 - a. Minimum lap: 12 IN.

- b. Provide continuous uniform supply of moisture, such as sprinklers or soaker hoses as required to keep concrete surface continuously wet.
 - c. Monitor Absorbent Covers as required to prevent cover materials or concrete surface from drying out.
 3. Application of sand kept continuously wet.
 4. Continuous application of steam (not exceeding 150 Deg F) or mist spray.
 5. Application of Moisture Retaining Cover sheet materials.
 - a. Place as soon as possible after final finishing and without marring the surface.
 - b. Minimum lap: 12 IN.
 - c. Seal all edges to make watertight.
 - d. Place Moisture Retaining Cover in intimate contact with the concrete surface, without wrinkles and weighted to hold in place.
 - e. Hold cover and edges in place as required to prevent wind from displacing the cover.
 - f. Moisture Retaining Fabric:
 - 1) Install in accordance with manufacturer's written recommendations.
 - 2) Saturate concrete surface and fabric side of cover immediately prior to placing.
 - g. Monitor continuously during the curing period:
 - 1) Repair any holes, tears or displaced cover.
 - 2) Rewet as required to keep concrete moist under cover.
 6. Application of other moisture retaining covering as approved by Engineer.
 7. Water used for curing shall be within 20 Deg F of the concrete temperature.
 8. Application of a curing compound.
 - a. Apply curing compound in accordance with manufacturer's recommendations immediately after any water sheen, which may develop after finishing, has disappeared from concrete surface.
 - b. Do not use on any surface against which additional concrete or other material is to be bonded unless it is proven that curing compound will not prevent bond.
 - c. Where a vertical surface is cured with a curing compound, the vertical surface shall be covered with a minimum of two (2) coats of the curing compound.

- 1) Apply the first coat of curing compound to a vertical surface immediately after form removal.
 - 2) The vertical concrete surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - 3) Allow the preceding coat to completely dry prior to applying the next coat.
 - 4) A vertical surface: Any surface steeper than 1 vertical to 4 horizontal.
- d. Curing compounds used in water treatment plant construction shall be non-toxic and taste and odor free, and NSF approved.
- 1) Alternately, all tank surfaces shall be cleaned to remove non-NSF approved curing compound without damaging the concrete finish.
9. Surfaces In Contact with Forms:
- a. Formed surfaces: Cure formed concrete surfaces utilizing final curing methods per ACI 308.1, including underside of beams, supported slabs, and other similar surfaces,
 - 1) See Section 03 11 13.
 - b. Minimize moisture loss from and temperature gain of concrete placed in forms exposed to heating by sun by keeping forms wet and cool until they can be safely removed.
 - c. Make provisions to keep concrete wall moist while stripping forms and until curing measures are in place.
 - d. After form removal, cure concrete until end of time prescribed.
 - e. Use one of the methods listed above.
 - f. Forms left in place shall not be used as a method of curing in hot weather.
 - g. The term "hot weather", where used in these specifications, is defined in ACI 305.1.
 - h. In hot weather, remove forms from vertical surfaces as soon as concrete has gained sufficient strength so that the formwork is no longer required to support the concrete.

C. Curing Period:

1. Continue curing for at least seven (7) days for all concrete except Type III, high early strength concrete, for which period shall be at least three (3) days.
 - a. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is

(7) days old, provided concrete is not permitted to become surface dry during transition.

D. Cold Weather:

1. Follow recommendations of ACI 306.1.
2. Maintain temperature of concrete per ACI 306.1 for a minimum of 72 HRs after concrete is placed, when outdoor temperature is 40 Deg F, or less.
 - a. Maximum temperature rate of decrease: Per ACI 306.1.
3. Use heating, covering, insulating, or housing of the concrete work to maintain required temperature without injury due to concentration of heat.
4. Do not use combustion heaters unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
5. Interior slabs in areas intended to be heated shall be adequately protected so that frost does not develop in the supporting subgrade.

E. Hot Weather:

1. Follow recommendations of ACI 305.1 and ACI 308.1.
2. Make provision for cooling forms, reinforcement and concrete, windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
3. Provide protective measures as quickly as concrete hardening and finishing operations will allow.
4. Maximum temperature rate of decrease: Per ACI 305.1.

F. Rate of Temperature Change:

1. Keep changes in temperature of air immediately adjacent to concrete as uniform as possible, during and immediately following curing period.

G. Protection from Mechanical Injury:

1. Protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.
2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
3. Do not load self-supporting structures in such a way as to overstress concrete.

3.8 FIELD QUALITY CONTROL

A. Special Inspection:

1. See Section 01 45 33.
2. See Section 03 05 05.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete finishing and repair of surface defects.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 11 13 - Formwork.
4. Section 03 31 30 - Concrete, Materials and Proportioning.
5. Section 03 31 31 - Concrete Mixing, Placing, Jointing and Curing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. CT-13, Concrete Terminology.
2. ASTM International (ASTM):
 - a. C150, Standard Specification for Portland Cement.
 - b. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - c. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - d. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
 - e. D4259, Standard Practice for Abrading Concrete.
3. The Society for Protective Coatings/NACE International (SSPC/NACE):
 - a. SP 13/NACE No. 6, Surface Preparation of Concrete.

B. Qualifications:

1. Applicator of metallic aggregate topping, acrylic or epoxy surfacer/filler must be approved, in writing, by manufacturer.
2. Manufacturer of metallic aggregate topping, acrylic or epoxy surfacer/filler shall have minimum of five (5) years' experience in manufacturing of same with documented performance history for similar installations.
3. Installer/applicator of metallic aggregate topping, acrylic, or epoxy surfacer/filler shall have minimum of three (3) years' experience installing similar coatings and shall be licensed or approved in writing by manufacturer to install/apply this product.
4. Applicator of concrete sealer, hardener, densifier shall be factory-trained and approved, in writing, by the manufacturer to apply the product.
 - a. Applicator shall have a minimum of five (5) years' experience successfully applying materials specified.

1.3 DEFINITIONS

A. Vertical Surface Defects:

1. Any void in the face of the concrete deeper than 1/8 IN, such as:
 - a. Tie holes.
 - b. Air pockets (bug holes).
 - c. Honeycombs.
 - d. Rock holes.
2. Scabbing:
 - a. Scabbing is defect in which parts of the form face, including release agent, adhere to concrete.
3. Foreign material embedded in face of concrete.
4. Fins 1/16 IN or more in height.

B. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

C. Other words and terms used in this Specification Section are defined in ACI CT-13.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
3. Certifications:
 - a. Certification of aggregate gradation.
 - b. Certification that products being used will not interfere with bonding of future floor or wall finishes.

B. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

1.5 DELIVERY, STORAGE, AND HANDLING

- ### **A. Comply with manufacturer's recommendations and requirements for materials used.**

1.6 WARRANTY

- ### **A. Provide warranty equal to specified manufacturer's standard warranty for all products used.**

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- #### **A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:**
1. Chemical floor sealer (CS-1), (CS-2):
 - a. L&M Construction Chemicals, Inc.
 - b. Euclid Chemical Co.
 - c. Dayton Superior.
 2. Bonding agents:

- a. Euclid Chemical Co.
 - b. BASF Admixtures, Inc.
 - c. L&M Construction Chemicals, Inc.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Chemical Floor Sealer CS-1:

- 1. Colorless low VOC water-based solution containing acrylic copolymers.
 - a. ASTM C1315, Class B, minimum 30 percent solids.
 - b. ASTM C309, Type 1.
 - c. Non-yellowing UV-resistant.
 - d. Capable of being painted after cured.
- 2. L&M Construction Chemicals, Inc. Dress and Seal WB 30.

B. Bonding Agent:

- 1. For use only on concrete surfaces not receiving liquid water repellent coating:
 - a. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.
 - b. Euclid Chemical Co. "Flex-Con."
 - c. BASF Admixtures, Inc. "Acryl-Set."
 - d. L&M Construction Chemicals, Inc. "Everbond."
 - e. Thoro System Products "Acryl 60."
- 2. For use only on concrete surface receiving liquid water repellent:
 - a. Non-acrylic base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.

C. Cement:

- 1. ASTM C150, Type II Portland for concrete areas exposed to sewage.
- 2. ASTM C150, Type I or II Portland elsewhere.

D. Aggregate:

1. Sand: Maximum size #30 mesh sieve.
2. For exposed aggregate finish surfaces: Same as surrounding wall.

E. Water: Potable.

F. Non-shrink Grout: See Specification Section 03 31 30 and Specification Section 03 31 31.

2.3 MIXES

A. Bonding Grout: One (1) part cement to one (1) part aggregate.

B. Patching Mortar:

1. One (1) part cement to two and one-half (2-1/2) parts aggregate by damp loose volume.
 - a. Substitute white Portland cement for a part of gray Portland cement to produce color matching surrounding concrete.

PART 3 - EXECUTION

3.1 PREPARATION

A. For methods of curing, see Specification Section 03 31 31.

B. Preparation of Bonding Grout Mixture:

1. Mix cement and aggregate.
2. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions.
3. Add bonding agent/water mixture to cement/aggregate mixture.
4. Mix to consistency of thick cream.
5. Bonding agent itself may be used as bonding grout if approved by manufacturer and Engineer.

C. Preparation of Patching Mortar Mixture:

1. Mix cement and aggregate.
2. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions.
3. Add only enough bonding agent/water mixture to cement/aggregate mixture to allow handling and placing.

4. Let stand with frequent manipulation with a trowel, until mix has reached stiffest consistency to allow placement.
- D. Clean surfaces in accordance with ASTM D4258 to remove dust, dirt, form oil, grease, or other contaminants prior to abrasive blasting, chipping, grinding or wire brushing.
1. Abrasive blast surfaces in accordance with ASTM D4259 and SSPC SP 13/NACE No. 6 to completely open defects down to sound concrete and remove laitance.
 - a. If additional chipping or wire brushing is necessary, make edges perpendicular to surface or slightly undercut.
 - b. No feathered edges will be permitted.
 2. Rinse surface with clean water and allow surface water to evaporate prior to repairing surface defects.
- E. Repairing Surface Defects:
1. This method of repairing surface defects is to be used only on vertical concrete surfaces, in tanks containing water, surfaces to receive liquid water repellent and exterior surfaces.
 2. Fill and repair using patching mortar mix specified in the MIXES Article in PART 2 of this Specification Section.
 - a. Use non-shrink grout to fill tie holes as outlined in this Specification Section.
 3. If required by bonding agent manufacturer, etch surfaces with a muriatic acid solution followed by a thorough rinse with clean water.
 - a. Test concrete to determine pH level and continue flushing with clean water until surface pH is within acceptable limits.
 4. Dampen area to be patched and an area at least 6 IN wide surrounding it prior to application of bonding grout.
 5. Brush bonding grout into the surface after the surface water has evaporated.
 6. Allow bonding grout to set for period of time required by bonding agent manufacturer before applying premixed patching mortar.
 7. Fill tie holes with non-shrink, non-metallic grout.
 - a. Where exposed to view and scheduled to receive concrete Finish #2 or #5, hold grout below surface of concrete and fill with patching mortar to match surrounding concrete.
 8. Fill all other defects with patching mortar.

- a. Match color of surrounding wall.
 - b. Do not use acrylic bonding agent in patching mortar for filling defects in surfaces to be treated with liquid water repellent.
9. Consolidate grout or mortar into place and strike off so as to leave patch slightly higher than surrounding surface.
 10. Leave undisturbed for at least 60 minutes before finishing level with surrounding surface.
 - a. Do not use metal tools in finishing a patch in a formed wall which will be exposed or coated with other materials.
 11. Keep areas damp in accordance with grout manufacturer or bonding agent manufacturer's directions.

3.2 INSTALLATION AND APPLICATION

A. Do not repair surface defects or apply wall or floor finishes when temperature is or is expected to be below 50 Deg F.

1. If necessary, enclose and heat area to between 50 and 70 Deg F during repair of surface defects and curing of patching material.
 - a. Use only clean fuel, indirect fired heating apparatus.

B. Chemical Floor Sealer Application:

1. General:

- a. Immediately prior to Substantial Completion, thoroughly clean floor in accordance with ASTM D4258 and prepare to receive chemical floor sealer.
 - 1) Remove previously applied membrane curing compounds.
 - 2) Remove soil, oils, stains, discoloration, or any other imperfection having a negative impact on the appearance of the finished floor.
- b. Apply product to floor areas indicated on the Drawings.
- c. Apply in accordance with manufacturer's published installation instructions.

2. Chemical Floor Sealer (CS-1):

- a. Apply two (2) uniform coats at rate recommended by manufacturer.
 - 1) Apply using manufacturer's recommended equipment with a fan-tip nozzle.
 - 2) Do not allow material to puddle.
- b. Allow first coat to completely dry before applying second coat.

- c. Spotted or mottled appearances will not be accepted.
- 3. Chemical Floor Sealer, Hardener, Densifier (CS-2):
 - a. Apply two (2) uniform coats at rate recommended by manufacturer.
 - 1) Scrub the material into the floor, keeping the material wet. After material has gelled, keep wet and continue scrubbing in accordance with manufacturer's application instructions.
 - 2) Flush and remove excess material.
 - 3) Damp mop to remove any streaks.
 - 4) Do not allow residue to dry on floor surface.
 - 5) Thoroughly rinse, using clean water, to remove all residue.
 - b. After rinsing, allow floor to dry completely and apply second coat following the same procedures.
 - c. Final floor finish shall have uniform sheen without streaking, stains or white residue.

C. Concrete Finishes for Vertical Wall Surfaces:

- 1. General: Give concrete surfaces finish as specified below after removal of formwork and repair of surface defects.
- 2. Finish #1 - As cast rough form finish:
 - a. Selected forming materials are not required.
 - b. Prepare surface in accordance with the PREPARATION Article in PART 3 of this Specification Section and repair the following surface defects:
 - 1) Tie holes.
 - 2) Honeycombs deeper than 1/4 IN.
 - 3) Air pockets deeper than 1/4 IN.
 - 4) Rock holes deeper than 1/4 IN.
 - c. Chip or rub off fins exceeding 1/4 IN in height.
 - d. Use at unexposed surfaces such as foundations and backfilled surfaces of walls not to be waterproofed.
- 3. Finish #2 - As cast form finish:
 - a. Form facing material shall produce a smooth, hard, uniform texture.
 - 1) Use forms specified for surfaces exposed to view in accordance with Specification Section 03 11 13.
 - b. Prepare surface in accordance with the PREPARATION Article in PART 3 of this Specification Section and repair the following surface defects:

- 1) Tie holes.
 - 2) Honeycombs deeper than 1/4 IN or larger than 1/4 IN DIA.
 - 3) Air pockets deeper than 1/4 IN or larger than 1/4 IN DIA.
 - 4) Rock holes deeper than 1/4 IN or larger than 1/4 IN DIA.
 - 5) Scabbing.
- c. Chip or rub off fins exceeding 1/8 IN in height.
- 1) Finish shall provide uniform color and texture.
- d. Provide this finish for:
- 1) See Schedule in the CONCRETE FINISH SCHEDULE Article at the end of this Specification Section.
 - 2) Inside walls of wet wells, basins, clarifiers, tanks, and manholes.
 - 3) Walls being waterproofed or coated with some other material.
 - 4) Exposed surfaces not specified to receive another finish.
4. Finish #5 - Smooth form finish:
- a. Form facing material shall produce a smooth, hard, uniform texture.
 - 1) Use forms specified for surfaces exposed to view in accordance with Specification Section 03 11 13.
 - b. Prepare surface in accordance with the PREPARATION Article in PART 3 of this Specification Section and repair the following surface defects:
 - 1) Tie holes.
 - 2) Honeycombs, air pockets, rock holes and other holes deeper than 1/16 IN or larger than 1/16 IN DIA.
 - 3) Scabbing.
 - c. Chip or rub off fins exceeding 1/16 IN in height.
 - d. Provide this finish for:
 - 1) See the Schedule in the CONCRETE FINISH SCHEDULE Article in PART 3 of this Specification Section.
 - 2) All surfaces which are to be painted, are to receive tank linings or are to remain exposed to view.
 - e. Construct mock-up per the Mock-Ups paragraph in the QUALITY ASSURANCE Article in PART 1 of this Specification Section.

D. Related Unformed Surfaces (Except Slabs):

1. Strike smooth and level tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces after concrete is placed.

2. Float surface to a texture consistent with that of formed surfaces.
 - a. If more than one (1) finish occurs immediately adjacent to unformed surface, provide surface with most stringent formed surface requirement.
 3. Continue treatment uniformly across unformed surfaces.
- E. Concrete Finishes for Horizontal Slab Surfaces:
1. General:
 - a. Tamp concrete to force coarse aggregate down from surface.
 - b. Screed with straightedge, eliminate high and low places, bring surface to required finish elevations; slope uniformly to drains.
 - c. Dusting of surface with dry cement or sand during finishing processes not permitted.
 2. Unspecified slab finish:
 - a. When type of finish is not indicated, use following finishes as applicable:
 - 1) Surfaces intended to receive bonded applied cementitious applications: Scratched finish.
 - 2) Surfaces intended to receive roofing or waterproofing membranes: Floated finish.
 - 3) Interior floors: Troweled finish with CS-2.
 - 4) Garage floors and ramps: Broom or belt finish.
 - 5) Exterior slabs, sidewalks, platforms, steps and landings, and ramps, not covered by other finish materials: Broom or belt finish.
 - 6) All slabs shall receive a floated finish before final finishing.
 3. Scratched slab finish: After concrete has been placed, consolidated, struck off, and leveled to a Class B tolerance, roughen surface with stiff brushes or rakes before final set.
 4. Floated finish:
 - a. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
 - b. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operations.
 - 1) Use wood or cork float.
 - c. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two (2) different angles.

- d. Cut down all high spots and fill all low spots to produce a surface with Class B tolerance throughout.
 - e. Refloat slab immediately to a uniform texture.
5. Troweled finish:
- a. Float finish surface to true, even plane.
 - b. Power trowel, and finally hand trowel.
 - c. First troweling after power troweling shall produce a smooth surface which is relatively free of defects, but which may still show some trowel marks.
 - d. Perform additional trowelings by hand after surface has hardened sufficiently.
 - e. Final trowel when a ringing sound is produced as trowel is moved over surface.
 - f. Thoroughly consolidate surface by hand troweling.
 - g. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Class A tolerance.
 - h. On surfaces intended to support floor coverings, remove any defects that would show through floor covering by grinding.
 - i. Provide CS-2 sealer on interior concrete floors.
6. Broom or belt finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom or burlap belt across surface.
7. Underside of concrete slab finish:
- a. Match finish as specified for adjacent vertical surfaces.
 - b. If more than one (1) finish occurs immediately adjacent to underside of slab surface, provide surface with most stringent formed surface requirement.

3.3 FIELD QUALITY CONTROL

- A. Horizontal slab finishes will be accepted provided:
- 1. Applicable specification requirements are satisfied.
 - 2. Water does not pond in areas sloped to drain.
 - 3. Gap between a 10 FT straightedge placed anywhere and the finished surface does not exceed:

- a. Class A tolerance: 1/8 IN.
 - b. Class B tolerance: 1/4 IN.
 - c. Class C tolerance: 1/2 IN.
4. Accumulated deviation from intended true plane of finished surface does not exceed 1/2 IN.
 5. Accuracy of floor finish does not adversely affect installation and operation of movable equipment, floor supported items, or items fitted to floor (doors, tracks, etc.).
- B. Unacceptable finishes shall be replaced or, if approved in writing by Engineer, may be corrected provided strength and appearance are not adversely affected.
1. High spots to be removed by grinding and/or low spots filled with a patching compound or other remedial measures to match adjacent surfaces.

3.4 PROTECTION

- A. All horizontal slab surfaces receiving chemical floor sealer shall be kept free of traffic and loads for minimum of 72 HRS following installation of sealer.

3.5 CONCRETE FINISH SCHEDULE

| DRAWING NO. | STRUCTURE NAME | SURFACE TO BE FINISHED | FINISH NO. |
|-----------------------------|------------------------------|--|--------------|
| Section 09 96 00 | Clarifiers | Interior surfaces to be coated plus minimum 12" margin beyond coated zone. | Finish #5 |
| 300S101 | Clarifiers | Uncoated interior surfaces. | Finish #2 |
| 300S104 | Flow Splitter Box | Interior surfaces. | Finish #2 |
| 300S401 Section 03 61 00 | Clarifier Slab | Interior floor slab. | Grout |
| 400S101 | WAS Vault | Interior wall surfaces. | Finish #5 |
| 400S101 | WAS Vault | Interior floor slab. | E.5 troweled |
| Various | Exterior Slabs and Sidewalks | Exposed surfaces. | E.6 broom |

END OF SECTION

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SECTION 03 61 00
CLARIFIER GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grouting basin bottom slabs.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 05 05 – Concrete Testing and Inspection.
4. Section 03 31 30 - Concrete, Materials and Proportioning.
5. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. CT-13, Concrete Terminology.

B. Pre-Installation Conference:

1. Schedule meeting with Engineer not less than 24 HRS before planned grouting operations to discuss the following items related to placement of grout:
 - a. Scheduling and sequencing of grout placements.
 - b. Contractor's grout pre-placement plan checklist.
 - c. Delivery time from batch plant and maximum waiting period prior to placing grout.
 - d. Curing procedures.
 - e. Temperature/weather issues.
 - f. Approval and rejection of work.

- 2.

1.3 DEFINITIONS

- A. Words and terms used in this Specification Section are defined in ACI CT-13.
- B. Unbonded Grout:
 - 1. Grout that, after placing and setting, has a hollow sound when tapped with a 4 FT long, nominal, 2 IN by 4 IN piece of lumber.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Grout mix design, similar to concrete mix designs required by Specification Section 03 31 30.
 - c. Manufacturer and type of synthetic fibers.
 - 3. Certifications:
 - a. Certification of standard deviation value in psi for ready mix plant supplying grout.
 - b. Certification of aggregate gradation.
 - 4. Test Reports:
 - a. Cement mill reports for cement to be supplied for grout.
- B. Informational Submittals:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Grout placement plan.
 - 3. Description of proposed curing methods.

1.5 PROJECT CONDITIONS

- A. Adjust grout mix design when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
 - 1. Do not use revised grout mix until submitted to and approved by Engineer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Grout:

- a. Prepare a delivery ticket for each load of ready mix grout.
- b. Truck operator shall hand ticket to Contractor at the time of delivery.
- c. Ticket to show:
 - 1) Mix identification.
 - 2) Quantity delivered.
 - 3) Amount of material in each batch.
 - 4) Outdoor temperature in the shade.
 - 5) Time at which cement was batched.
 - 6) Time of delivery.
 - 7) Time of discharge.
 - 8) Amount of water actually added at the site.

1.7 SEQUENCING AND SCHEDULING

A. Do not begin grout production until proposed grout mix design has been approved by Engineer.

1. Approval of grout mix design does not relieve Contractor of his responsibility to provide grout that meets the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cement: See Specification Section 03 31 30.
- B. Fine Aggregate: See Specification Section 03 31 30.
- C. Water: See Specification Section 03 31 30.
- D. Synthetic Fibers: See Specification Section 03 31 30.
- E. Bonding Agent: See Specification Section 03 35 00.

2.2 MIXES

A. Basin Bottom Grout:

1. One part Portland cement and 4-1/2 parts fine aggregate, by weight.
2. Water content:

- a. Sufficient to allow workability for spreading grout with screeds attached to arms of equipment mechanism, but not excessive to prevent formation of surface water and laitance and to allow grout to stay in placed after screeding.
3. Provide dosage of synthetic fibers in accordance with Specification Section 03 31 30.
 - a. Provide in accordance with manufacturer's instructions.
4. Bonding Agent: In accordance with Section 03 35 00

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface preparation:

1. Basin bottom slab surface preparation:
 - a. Ensure that slab surface has rough texture, suitable for bonding grout to slab.
 - b. Roughen smooth areas by heavy sandblasting.
 - c. Heavy sandblast and clean entire slab surface as required to remove dirt, oil, curing compound, laitance, dust, and other foreign materials that may prevent proper bonding of grout to slab.
 - d. Saturate concrete slab with water.
 - e. At time grout is placed, concrete shall be saturated and surface damp.

B. Equipment preparation:

1. Preparation of equipment for grouting basin bottom slabs:
 - a. Setting the screeds:
 - 1) Bolt nominal 2 IN by 4 IN section of lumber to blades on arms of equipment mechanism.
 - 2) Locate leading edge of lumber approximately 2 IN in front of blade and cut it parallel to centerline of arm.
 - 3) Securely nail nominal 2 IN by 6 IN screed board to ends of 2 IN by 4 IN lumber, in manner such that the screed runs parallel to the centerline of the arm.
 - 4) Nail bent sheet metal to lower edge of screed board.
 - 5) Ensure that bottom of screed board is 1-1/2 IN below steel blades on arms of equipment mechanism.

3.2 APPLICATION

A. Grouting basin bottom slabs:

1. Placement, general:
 - a. Place grout in accordance with equipment manufacturer's instructions and in accordance with limitations and precautions given in such instructions.
 - b. Bring promptly to attention of the Engineer any conflicts between manufacturer's instructions and this section.
2. Placing grout:
 - a. Use grouting equipment to apply grout for basin bottom slabs.
 - b. Perform grouting continuously without interruptions until basin slab is covered.
 - c. Place ring of grout approximately 3 FT wide on outer edge of slab and gradually widened towards center following spiral pattern until basin bottom slab is covered.
 - d. Unacceptable placing procedure: Following procedures will not be accepted:
 - 1) Grouting by circular sectors or pie-shaped sections.
 - 2) Grouting from center outward.
 - e. Use finishing workers to control area immediately in front of screed boards in manner so that:
 - 1) Grout is installed to specified thickness.
 - 2) No low areas occur.
 - 3) No excessive amount of grout accumulates.
 - f. Coordinate grout placement rate and number of finishing workers with travel speed of arms of equipment mechanism.
 - g. Last grout area to be grouted in center may be finished by worker operating from one of the arms of equipment mechanism.
3. Following grout placement:
 - a. After completion of slab grouting, allow mechanism to run continuously until there is no more danger that grout sloughing may occur.
 - b. Prevent dry clumps of grout or rocks from being caught under screed board and gouging finished surface of grout.
4. Corrections:

- a. Before grout has set:
 - 1) Where sloughing has occurred, remove grout from sloughed areas and place grout in low areas.
 - 2) Repair gouges in grouted surface.
- 5. Curing:
 - a. Water cure grout for 14 days.
 - b. Keep grout surface continuously wet for entire duration of curing period.
- B. Tolerances:
 - 1. For grouting basin bottom slabs:
 - a. Tolerance in elevation of finished grout surface: Plus or minus 1/8 IN.
 - 1) Specified tolerance is more exacting than customary industry standards for slab finish.
 - 2) Tolerance is required for proper operation of equipment.
 - b. Thickness of grout layer:
 - 1) Not less than 1 IN at any point.
 - 2) Provide average thickness of grout as indicated on the Drawings.

3.3 FIELD QUALITY CONTROL

- A. Inspection:
 - 1. Verify tolerance of grouting elevation tolerance on basin bottom slabs as follows:
 - a. After grout is set, operate equipment with blades set to clear grout surface.
 - b. Under these conditions, blades shall not clear grout surface by more than 1/4 IN at any point:
 - 1) Excess clearance: Correct as specified in article titled "Adjusting" in this Specification Section.

3.4 ADJUSTING

- A. Grouting basin bottom slabs:
 - 1. After grout has set:
 - a. Where clearance between blades and grouted surface exceeds tolerance specified in this Section, grind high points in grout surface using terrazzo machine until specified tolerance is met.

- b. Unbonded grout is not acceptable. Remove and replace unbonded grouted.

END OF SECTION

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DIVISION 05

METALS



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SECTION 05 12 00
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel, including the fabrication and erection of support and bracing members, including connections.
2. Connection detail design as required.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 15 19 - Anchorage to Concrete.
4. Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Institute of Steel Construction (AISC):
 - a. 303, Code of Standard Practice for Steel Buildings and Bridges.
 - b. 360, Specifications for Structural Steel Buildings.
 - c. Quality Certification Program for Fabricators.
2. American Society of Mechanical Engineers (ASME):
 - a. B18.21.1, Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series).
3. ASTM International (ASTM):
 - a. A2, Standard Specification for Carbon Steel Girder Rails of Plain, Grooved, and Guard Types.
 - b. A6/A6M, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 - c. A36/A36M, Standard Specification for Carbon Structural Steel.

- d. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - e. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - f. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - g. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - h. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - i. A325, Standard Specification of Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - j. A490, Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
 - k. A500/A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - l. A563, Standard Specification for Carbon and Alloy Steel Nuts.
 - m. A992/A992M, Standard Specification for Structural Steel Shapes.
 - n. A1064/A1064M, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - o. F436, Standard Specification for Hardened Steel Washers.
 - p. F959, Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
 - q. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
 - r. F1852, Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
4. American Welding Society (AWS):
- a. A5.1/A5.1M, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
 - b. A5.5/A5.5M, Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding.
 - c. A5.17/A5.17M, Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.

- d. A5.18/A5.18M, Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding.
- e. A5.20/A5.20M, Specification for Carbon Steel Electrodes for Flux Cored Arc Welding.
- f. A5.23/A5.23M, Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding.
- g. A5.28/A5.28M, Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding.
- h. A5.29/A5.29M, Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding.
- i. D1.1/D1.1M, Structural Welding Code - Steel.
 - 1) Steel stud connectors and their installation shall comply with requirements of AWS D1.1/D1.1M.

5. National Institute of Steel Detailing (NISD).

6. Research Council on Structural Connections (RCSC):

- a. Specification for Structural Joints Using High-Strength Bolts.

7. Building code:

a. International Code Council (ICC):

- 1) International Building Code and associated standards, 2012 Edition, including all amendments, referred to herein as Building Code.

B. Qualifications:

1. Steel fabricator:

- a. Minimum of 10 years' experience in fabrication of structural steel or participate in the AISC Certification program and is designated an AISC Certified Plant, Category BU (formally known as STD), SBR at time of bid.
- b. Fabricator plant quality control and inspection program: Meet requirements of the Building Code and/or be an Approved Fabricator.
- c. Plants that are not an Approved Fabricator may be acceptable, provided:
 - 1) Plant meets all remaining qualifications.
 - 2) Contractor reimburses the Owner the cost of required Special Inspection services.

2. Steel erector:

- a. Minimum of 10 years of experience in erection of structural steel similar in the scope of this project or certified as CSE under the AISC Quality Certification Program.
 - b. With an active and enforced quality assurance program in place, as described in the applicable Codes.
3. Qualify welding procedures and welding operators in accordance with AWS.

1.3 DEFINITIONS

- A. Owner: May mean the Owner's Designated Representative for Construction as defined by the AISC 303.
- B. Galvanizing: Hot-dipped galvanizing per ASTM A153/A153M and/or ASTM A123/A123M with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by aforementioned standards.
- C. Approved Fabricator: Approved by the Building Official to perform the Building Code required Special Inspections.

1.4 SUBMITTALS

- A. Shop Drawings:
 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Detailed supplemental specification relating to load indicator washers or high-strength bolts.
 - 1) Alternate design for Engineer approval (submitted at Contractor's option if desired by Contractor for use).
 - d. Source and certification of quality for high-strength bolts, nuts and washers.
 3. Fabrication and/or layout drawings:
 - a. Prepare Shop Drawings under NISD Quality Procedures Program certification.
 - b. Complete Shop Drawings for all of the work showing clearly all pieces, sizes, dimensions, details, connections materials and shop coatings.

- 1) All Shop Drawings must be checked and signed "approved" before submittal.
 - 2) Show all cuts, copes, and holes.
 - 3) Indicate all shop and field bolts.
 - 4) Indicate all shop and field welds using AWS symbols.
- c. Prepare complete erection drawings showing the location and marks of all pieces.
- 1) Copies of up-to-date erection drawings shall accompany the Shop Drawings.
 - 2) Use match marks on the erection drawings to indicate the sheet number on which each particular member is detailed.
- d. Correct any incorrect or unacceptable material or fabrication due to incorrect detailing, shop work, or erection, without additional charge.
4. Certifications:
- a. Certificates of compliance with standards specified for all major components and fasteners incorporated into work.
 - b. Copies of current welding certificates for each welder assigned to perform welding indicating compliance with testing specified by AWS.
 - c. Welder qualification data and prequalified procedures.
 - d. Special Inspection reports.
 - e. Source Quality Control Documentation, including certificate of compliance stating that the work performed in the fabrication shop was done in accordance with the approved construction documents.
 - 1) Certification is required only if the fabricator is fabricator-approved by the Building Official.
5. Test reports:
- a. Certified copies of mill tests.
 - b. Manufacturer's load test and temperature sensitivity data for post-installed anchor bolts.
 - c. Test reports for all structural steel work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store steel members above ground on skids or other supports.
1. Keep free of dirt and other foreign material and protect against corrosion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents and American Iron and Steel Act requirements, the following manufacturers are acceptable:
1. High-strength bolts:
 - a. Portland Bolt and Manufacturing Company.
 - b. Lewis Bolt & Nut Company.
 - c. Nucor Fasteners.
 - d. St. Louis Screw and Bolt Company.
 2. Load indicator washers for high-strength bolts:
 - a. Portland Bolt and Manufacturing Company.
 - b. Mid-South Bolt and Screw Co., Inc.
 - c. J and M Turner, Inc.
 3. Alternate design high-strength bolts:
 - a. T. C. Bolt Corporation.
 - b. Construction Fastener Systems Division of Bristol Machine Company.
 - c. LeJuene Bolt Co.
 4. Headed studs and deformed bar anchors:
 - a. Nelson Stud Welding Division, TRW, Inc.
 - b. Stud Welding Products, Inc.
 5. Mechanical anchor bolts:
 - a. See Section 03 15 19.
 6. Adhesive anchors bolts:
 - a. See Section 03 15 19.
 7. Anchor bolt sleeves:
 - a. Sinco/Wilson.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

- A. Steel, Structural Shapes and Plate (unless noted otherwise on Drawings):
 - 1. All W-shapes and WT-shapes: ASTM A992/A992M.
 - 2. All other plates, bars and rolled shapes: ASTM A36/A36M.
- B. Pipe: ASTM A53/A53M, Grade B (Type E or S) (Fy=35 ksi).
- C. Hollow Structural Sections (HSS):
 - 1. Round: ASTM A500/A500M, Grade B (Fy=42 ksi).
 - 2. Square or rectangular: ASTM A500/A500M, Grade B (Fy=46 ksi).
- D. High-Strength Bolts, Nuts and Washers:
 - 1. ASTM A325 or ASTM F1852 or ASTM A490 with ASTM A563 nuts, galvanized:
 - 2. High-strength bolts:
 - a. Provide two (2) ASTM F436 washers for all bolts, galvanized.
 - b. Provide beveled washers at connections of sloped/tapered sections.
 - 3. High-strength bolts with compressible washer type direct tension indicators (DTI), ASTM F959.
 - a. Provide at Contractor's option and subject to approval of Engineer.
 - 4. Alternate high-strength design: Provide at Contractor's option and subject to approval of Engineer.
- E. Bolts, Non-high Strength: ASTM A307, Grade A.
- F. Threaded Rod: ASTM F1554, Grade 36.
- G. Washers, Plain (for Non-High Strength Bolts): ASME B18.22.1, Type B.
- H. Welding Electrodes:
 - 1. Shielded metal arc: AWS A5.1/A5.1M or AWS A5.5/A5.5M, E70XX or E801X-X.
 - 2. Submerged arc: AWS A5.17/A5.17M or AWS A5.23/A5.23M, F7XX-EXXX or F8XX-EXXX-XX.
 - 3. Gas metal arc: AWS A5.18/A5.18M, E70S-X or E70U-1 or AWS A5.28/A5.28M, ER80S-XX, E80C-XXX.
 - 4. Flux cored arc: AWS A5.20/A5.20M, E7XT-X (except 2, 3, 10, GS), AWS A5.29/A5.29M, E7XT-X or E8XTX-X, E8XTX-XM.

5. Use low-hydrogen electrodes.
- I. Anchor Rods and Bolts:
 1. See Section 03 15 19.
 - J. Headed Studs and Deformed Bar Anchors:
 1. Headed studs:
 - a. ASTM A108, complying with AWS D1.1/D1.1M, Section 7, Type B; minimum yield strength 50,000 psi, minimum tensile strength 60,000 psi.
 - b. Uniform diameter.
 - c. Heads: Concentric and normal to shaft.
 - d. Weld end: Chamfered and solid flux.
 2. Deformed bar anchor:
 - a. ASTM A1064/A1064M, complying with AWS D1.1/D1.1M, Section 7, Type C.
 - b. Minimum yield strength: 70,000 psi.
 - c. Minimum tensile strength: 80,000 psi.
 - d. Straight, unless indicated otherwise.
 - e. Solid flux.
 3. After welding, remove ceramic ferrules and maintain free from any substance which would interfere with function, or prevent bonding to concrete.
 - K. Non-shrink Grout: Section 03 31 30.
 - L. Crane Rails:
 1. Controlled-cooled, open-hearth carbon steel ASCE (American Society of Civil Engineers) rails per ASTM A2, Class A, #1 rails, unless noted otherwise, of size and weight indicated.
 - a. Furnish rails with milled tight end joints suitable for crane service, with standard drilling, removable end stops and all related accessories required, including:
 - 1) Joint bars: Match rail section and properties, drilled to match rail drilling.
 - 2) Joint bar bolts and nuts: High strength.
 - 3) Hardened washer: ASTM F436 for bar bolts.

- 4) Except as indicated otherwise, two-bolt type fixed or floating rail clamps to suit the conditions, of forged or pressed steel, complete with ASTM A325 bolts, reversible fillers, and self-locking nut or nut and lock washer.

M. Mechanical and Adhesive Anchor Bolts for Fastening to Concrete: Section 03 15 19.

2.3 FABRICATION

- A. Comply with requirements of applicable Building Code and AISC 360 with modifications and additional requirements specified herein.
 1. Identify high-strength steel material in fabricated members in accordance with ASTM A6/A6M.
- B. Minimize the amount of field welding.
 1. Shop assemble components into largest size possible commensurate with transportation and handling limitations.
 2. Shop connections: Bolted with high-strength bolts or welded.
- C. Connection Details:
 1. Provide as a minimum, two (2) 3/4 IN DIA, high-strength bolts for all bolted connections unless otherwise specified.
- D. Provide bearing type connections for all bolted connections, unless otherwise noted.
- E. Field Connections:
 1. Provide bolts for all field connections except where shown otherwise on the Drawings.
 2. Use high-strength bolts unless shown or specified otherwise.
 3. Use of high-strength bolts: Conform to RCSC Specification for Structural Joints Using High-Strength Bolts.
 4. Unfinished bolts may be used for attaching stair treads to stringers.
 5. If structural steel details (field welds versus shop welds, etc.) shown on design Drawings are not compatible with selected erection procedures, submit proposed modifications for review.
 6. Connections to structural steel provided by others: Provide all connectors and coordinate location of bolt holes to match connection holes in steel provided by others.
- F. Accurately mill column end bearing surfaces to true plane.

- G. Fabricate and erect beams with non-specified camber in accordance with AISC 360, Chapter L1.
- H. Cut, drill, or punch holes at right angles to surface of metal.
 - 1. Do not make or enlarge holes by burning.
 - 2. Make holes clean cut, without torn or ragged edges.
 - 3. Remove outside burrs resulting from drilling or reaming operations with tool making 1/16 IN bevel.
 - 4. Provide holes in members to permit connection of work of other trades or contractors.
- I. Make allowance for draw in all cross bracing to provide small amount of initial tension in members.
- J. Make splices only where indicated or where approved.
- K. Wall Girts:
 - 1. Extend past columns and miter ends unless noted otherwise.
 - 2. Connect girts to each other at corners unless noted otherwise.
- L. Cope at 45 degrees, corners of stiffener plates at junction of member flanges with webs.
- M. Flame cut bevels for welds, provided such cutting is done automatically.
 - 1. Leave free of burrs and slag by grinding or planing the cut edges.
- N. Grind smooth all rough welds and sharp steel edges shall be ground to approximately 1/8 IN radius.
- O. Tolerances (unless noted otherwise on Drawings):
 - 1. When material received from the mill does not satisfy ASTM A6/A6M tolerances for camber, profile, flatness or sweep, Contractor is permitted to perform corrective work by the use of controlled heating, and mechanical straightening, subject to the limitations of AISC 360.
 - 2. Fabrication tolerance:
 - a. Member length:
 - 1) Both ends finished for contact bearing: 1/32 IN.
 - 2) Framing members: 30 FT or less: 1/16 IN. Over 30 FT: 1/8 IN.
 - b. Member straightness:
 - 1) Compression members: 1/1000 of axial length between points laterally supported.

- 2) Non-compression members: ASTM A6/A6M tolerance for wide flange shapes.
- c. Specified member camber (except compression members and as specifically noted in the Drawings):
 - 1) 50 FT or less: -0/+1/2 IN.
 - 2) Over 50 FT: -0/+1/2 IN (plus 1/8 IN per 10 FT over 50 FT).
 - 3) Members received from mill with 75 percent of specified camber require no further cambering.
 - 4) Fabricate beams/trusses that are not identified with a specified camber so after erection, camber is upward.
 - 5) Measure camber in fabrication shop in unstressed condition.
- d. Use filler plates at bolted splices to take up depth deviation.
 - 1) At welded joints, adjust weld profile to conform to variation in depth.
 - 2) Slope weld surface per AWS requirements.
- e. Free finished members from twists, bends and open joints.
 - 1) Sharp kinks, bends and deviation from the above tolerances are cause for rejection of material.

2.4 WELDING

- A. Comply with AWS D1.1/D1.1M, and other requirements indicated herein, for all welding, techniques of welding employed, appearance and quality of welds, and methods used to correct defective work.
 - 1. Qualify joint welding procedures or test in accordance with AWS qualification procedures.
- B. Test and qualify welders, welding operators and tackers in compliance with AWS D1.1/D1.1M for position and type of welding to which they will be assigned.
 - 1. Conduct tests in presence of approved testing agency.
 - 2. Certification within previous 12 months will be acceptable, provided samples of the welder's work are satisfactory.
- C. Before Starting Welding:
 - 1. Carefully plumb and align members in compliance with specified requirements.
 - 2. Fully tighten all bolts.
 - 3. Comply with AWS D1.1/D1.1M, Section 5 for assembly and surface preparation.

4. Preheat base metal to temperature stated in AWS D1.1/D1.1M.
 - a. When no preheat temperature is given in AWS D1.1/D1.1M and base metal is below 50 Deg F, preheat base metal to at least 70 Deg F.
 - b. Maintain temperature during welding.
 - c. Preheat surface of all base metal within distance from point of welding equal to thickness of thicker part being welded or 3 IN, whichever is greater, to specified preheat temperature.
 - d. Maintain this temperature during welding.
 5. Mark welds with an identifying mark unique to each welder.
- D. Make flange welds before making web welds.
- E. Where groove welds have back-up plates, make first three (3) passes with 1/8 IN round electrodes.
1. Use backup plates in accordance with AWS D1.1/D1.1M, extending minimum of 1 IN either side of joint.
- F. Flame cut edges of stiffener plates at shop or field butt weld.
1. Do not shear.
- G. Grind flush web fillets at webs notched to receive backup plates for flange groove welds.
- H. Low-hydrogen electrodes shall be used. Dry and store electrodes in compliance with AWS D1.1/D1.1M.
- I. Do not perform welding when ambient temperature is lower than 0 Deg F or where surfaces are wet or exposed to rain, snow, or high wind, or when welders are exposed to inclement conditions.
- J. Headed Studs and Deformed Bar Anchors:
1. Automatically end welded in accordance with the AWS D1.1/D1.1M and manufacturer's recommendations.
 2. Fillet welding of headed studs and deformed bar anchors is not allowed unless approved by Engineer.
- K. Test in-place studs in accordance with requirements of AWS D1.1/D1.1M to ensure satisfactory welding of studs to members.
1. Replace studs failing this test.
- L. When headed stud-type shear connectors are to be applied, clean top surface of members to receive studs in shop to remove oil, scale, rust, dirt, and other materials injurious to satisfactory welding.

1. Do not shop paint or galvanize metal surfaces to receive field applied studs.

2.5 SHOP COATING

- A. Refer to Specification Section 09 96 00 and coordinate shop primer, surface preparation and coating with field applied primers and coatings where specified.
- B. Provide suitable methods of handling and transporting painted steel to avoid damage to coating.
- C. Do not coat following surfaces:
 1. Machined surfaces, surfaces adjacent to field welds, and surfaces fully embedded in concrete.
 2. All other members for which no coating is specified.
 3. Contact surfaces at bolted slip-critical connections, unless surface condition conforms to the RCSC Specification for Structural Joints Using High-Strength Bolts, Part 3.2.2.
- D. Clean thoroughly all surfaces not coated before shipping.
 1. Remove loose mill scale, rust, dirt, oil and grease.
 2. Protect machined surfaces.

2.6 SOURCE QUALITY CONTROL

- A. Special Inspection and Testing:
 1. See Specification Section 01 45 33.
 2. If the fabricator is not an Approved Fabricator, Owner will employ the services of an independent testing agency to inspect and test structural steel shop work for compliance with Specifications.
 - a. Contractor provides sufficient notification and access so inspection and testing can be accomplished.
 3. Contractor responsible for testing to qualify shop welders and as needed for Contractor's own quality control to ensure compliance with Contract Documents.
- B. Approved Fabricator or Testing Agency Responsibilities:
 1. Inspect shop and field welding in accordance with AWS D1.1/D1.1M, Section 6 including the following non-destructive testing:
 - a. Visually inspect all welds.
 - b. In addition to visual inspection, test 50 percent of full penetration welds and 20 percent of fillet welds with liquid dye penetrant.

- c. Test 20 percent of liquid dye penetrant tested full penetration welds with ultrasonic or radiographic testing.
2. Inspect high-strength bolting in accordance with the RCSC Specification for Structural Joints Using High-Strength Bolts, Section 9.
 - a. Verify proper pretension for slip-critical bolted connection only.
 - b. Verify direct tension indicator gaps for slip-critical bolted connection only.
3. Inspect stud welding in accordance with AWS D1.1/D1.1M, Section 7.8.
4. Prepare and submit inspection and test reports to Engineer.

PART 3 - EXECUTION

3.1 GENERAL

- A. Contractor is solely responsible for safety.
 1. Construction means and methods and sequencing of work is the prerogative of the Contractor.
 2. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until slabs, decks, bracing or rigid connections are installed.
 3. Partially complete structural members shall not be loaded without an investigation by the Contractor.
 4. Until all elements of the permanent structure and lateral bracing system are complete, provide temporary bracing designed, furnished, and installed by the Contractor for the partially complete structure.
- B. Adequate temporary bracing to provide safety, stability and to resist all loads to which the partially complete structure may be subjected, including wind, construction activities, and operation of equipment, is the responsibility of the Contractor.
 1. Use temporary guys, braces, shoring, connections, etc., necessary to maintain the structural framing plumb and in proper alignment until permanent connections are made, the succeeding work is in place, and temporary work is no longer necessary.
 2. Use temporary guys, bracing, shoring, and other work to prevent injury or damage to adjacent work or construction from stresses due to erection procedures and operation of erection equipment, construction loads, and wind.
 3. Design of the temporary bracing system and consideration of the sequence and schedule of placement of such elements and effects of loads imposed

on the structural steel members by partially or completely installed work, including work of all other trades, is the Contractor's responsibility.

- a. If not obvious from experience or from the Drawings, the Contractor shall confer with the Engineer to identify those structural steel elements that must be complete before the temporary bracing system is removed.
4. Remove and dispose of all temporary work and facilities off-site.
- C. Examine work-in-place on which specified work is in any way dependent to ensure that conditions are satisfactory for the installation of the work.
1. Report defects in work-in-place which may influence satisfactory completion of the work.
 2. Absence of such notification will be construed as acceptance of work-in-place.
- D. Field Measurement:
1. Take field measurements as necessary to verify or supplement dimensions indicated on the Drawings.
 2. Contractor is responsible for the accurate fit of the work.
- E. Check the elevations of all finished footings or foundations and the location and alignment of all anchor bolts before starting erection.
1. Notify Engineer of any errors or deviations found by such checking.

3.2 ERECTION

- A. Framing member location tolerances after erection shall not exceed the framing tolerances listed in the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.
- B. Erect plumb and level; introduce temporary bracing required to support erection loads.
- C. Use light drifting necessary to draw holes together.
1. Drifting to match unfair holes is not allowed.
- D. Welding:
1. Conform to AWS D1.1/D1.1M and requirements of this Specification Section.
 2. Join two (2) sections of steel of different ASTM designations using welding techniques in accordance with a qualified AWS D1.1/D1.1M procedure.
- E. Shore existing members when unbolting of common connections is required.

1. Use new bolts for rebolting connections.
- F. Clean stored material of all foreign matter accumulated during erection period.
- G. Clean bearing and contact surfaces before assembly.
- H. Set beam and column base and bearing plates accurately, as indicated, on non-shrink grout.
1. Set and anchor each base plate to proper line and elevation.
 2. Use metal wedges, shims or setting nuts as required and tighten anchor bolts.
 - a. Use same metal as base plate.
 - b. Cut off protrusions of wedges and shims flush with edge of base plate.
 3. Fill sleeves around anchor bolts with non-shrink grout.
 4. Pack grout solidly between bottom of plate and bearing surface.
 5. Refer to Specification Section 03 31 30 for non-shrink grout requirements.
- I. Cast-in-place Anchor Bolts:
1. See Specification Section 03 15 19.
- J. Install high strength bolts with hardened washers.
1. Install and tighten in accordance with the RCSC Specification for Structural Joints Using High-Strength Bolts, Section 8.
 2. Coordinate installation with inspection.
 - a. Do not start installation until coordination with Testing Agency is complete.
 3. Bearing-type connections: High-strength bolts shall be tightened to snug-tight condition.
 4. Slip-critical connections:
 - a. Perform calibration testing for all methods of installation of high-strength bolts in accordance with RCSC Specification for Structural Joints Using High-Strength Bolts, Section 8.2.
 - b. Turn-of-nut tightening:
 - 1) Inspector shall observe the pre-installation verification testing.
 - 2) Subsequently, ensure by routine observation that the bolting crew properly rotates the turned element relative to the unturned element by the amount specified.

- 3) Alternatively, when fastener assemblies are match-marked after the initial fit-up of the joint but prior to pretensioning, visual inspection after pretensioning is permitted in lieu of routine observation.
 - c. Calibrated wrench tightening: Calibrate on a daily basis.
 - d. Direct tension indicator tightening: If previously approved by Engineer.
 - e. Installation of alternate design bolts: If previously approved by Engineer.
 5. In the event any bolt in a connection is found to be defective, check and retighten all bolts in the connection.
- K. Do not use gas cutting to correct fabrication errors.
1. In case members do not fit or holes do not match, ream out the holes and insert the next larger size bolt.
 - a. Drill new holes if the connections require new holes.
 - b. Make no such corrections without prior approval of the Engineer.
 2. Burning of holes is not permitted.
- L. Prior to making field connections to existing structural steel, remove completely all paint from existing steel which will be in contact with new steel and new welds.
- M. Tighten and leave in place erection bolts used in welded construction.
- N. Provide beveled washers to give full bearing to bolt head or nut where bolts are to be used on surfaces having slopes greater than 1 in 20 with a plane normal to bolt axis.
- O. After bolts are tightened, upset threads of non-high strength bolts and anchor bolts to prevent nuts from backing off.
- P. After Erection:
1. Grind smooth all sharp surface irregularities resulting from field cutting or welding.
 2. Power tool clean welds, bolts, washers and abrasions to shop coat removing all rust and foreign matter.
- Q. Mechanical Anchor Bolts and Adhesive Anchor Bolts:
1. See Specification Section 03 15 19.

3.3 FIELD QUALITY CONTROL

- A. Special Inspection and Testing:

1. See Specification Section 01 45 33.
 2. Special Inspection shall be in accordance with the Building Code.
 3. Special Inspection is required for:
 - a. Material verification of high-strength bolts, nuts, and washers.
 - 1) Frequency: All high-strength bolts, prior to being covered up or substantial completion.
 - b. Inspection of high-strength boltings:
 - 1) Frequency:
 - a) All high-strength bolts, prior to being covered up or substantial completion.
 - b) Pretensioned and slip-critical joints using turn-of-nut without match marking or calibrated wrench methods of installation require continuous inspection.
 - c. Material verification of structural steel.
 - 1) Frequency: Prior to being covered up or substantial completion,
 - d. Material verification of weld filler materials.
 - 1) Frequency:
 - a) Prior to welding on site.
 - b) Randomly thereafter.
 - e. Inspection of welding.
 - 1) Frequency:
 - a) Visually inspect all welds.
 - b) In addition to visual inspection, test 50 percent of full penetration welds and 20 percent of fillet welds with liquid dye penetrant or magnetic particle.
 - c) Test 20 percent of liquid dye penetrant tested full penetration welds with ultrasonic or radiographic testing.
 - f. Inspect structural steel which has been erected.
 - 1) Frequency: Prior to members being covered up or substantial completion.
 - g. Inspect stud welding in accordance with AWS D1.1/D1.1M, Section 7.8.
- B. Erected Framing Tolerance, unless noted otherwise on the Drawings:
1. Do not exceed cumulative effect of rolling, fabrication and erection tolerance for overall finished dimensions.

2. Erection tolerances are defined relative to member working points and working lines as follows:
 - a. Actual centerline of top flange or surface at each end for horizontal members.
 - b. Actual center of member at each end for all other members.
 - c. Other points may be used, providing they are based on these definitions.
 - d. Working line is straight line connecting member working points.
3. Tolerances on position and alignment are as specified in the Code, unless otherwise modified.
 - a. Provide "adjustable items" such as lintels, wall supports, curb angles, window mullions and similar members with adjustable connections to supporting structural framing.
4. Certification by steel erector:
 - a. Certify the location of erected structural steel is acceptable for plumbness, level and aligned within tolerances specified.
 - b. Provide certification upon completion of any part of work.
 - c. Provide certification prior to start of work by other trades that may be supported; attach to structural steel work.

3.4 CLEANING AND REPAIR OF SHOP PRIMER PAINT

- A. After erection, clean all steel of mud or other foreign materials, and repair any damage.
 1. Touch up coatings to comply with Specification Section 09 96 00.

END OF SECTION

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SECTION 05 14 00
STRUCTURAL ALUMINUM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural aluminum including the fabrication and erection of framing and bracing members, including connection design as required.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 15 19 - Anchorage to Concrete.
4. Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Aluminum Association (AA):
 - a. ADM 1, The Aluminum Design Manual.
 - b. DAF 45, Designation System for Aluminum Finishes.
2. American Institute of Steel Construction (AISC):
 - a. 325, Manual of Steel Construction.
3. ASTM International (ASTM):
 - a. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - b. B210, Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
 - c. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - d. B247, Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.

- e. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
 - f. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - g. F467, Standard Specification for Nonferrous Nuts for General Use.
 - h. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use.
 - i. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - j. F594, Standard Specification for Stainless Steel Nuts
4. American Welding Society (AWS):
- a. D1.2, Structural Welding Code - Aluminum.
5. Building code:
- a. International Code Council (ICC):
 - 1) International Building Code and associated standards, 2012 Edition, including all amendments, referred to herein as Building Code.

B. Qualifications:

- 1. Minimum of 10 years experience in fabrication of structural aluminum.
- 2. For welding aluminum:
 - a. Qualify welding procedures and welding operators in accordance with AWS D1.2.
 - b. Welding operators shall have been qualified during the 12-month period prior to commencement of welding.

1.3 SUBMITTALS

A. Shop Drawings:

- 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- 2. Fabrication and/or layout drawings:
 - a. Erection plans and details of each piece including connection details:
 - 1) Show all cuts, copes and holes.
 - 2) Indicate all shop welds using AWS symbols.
 - 3) Indicate all shop and field bolts.

- b. Complete shop drawings for all of the work showing clearly all pieces, details, connections, materials and shop-applied coatings.
 - c. Prepare complete erection drawings showing the location and marks of all pieces.
3. Product technical data including:
- a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
4. Certifications.
- a. Certificates of compliance with standards specified for all major components and fasteners incorporated into work.
 - b. Copies of current welding certificates for each welder assigned to perform welding indicating compliance with testing specified by AWS.
5. Test reports.
- a. Certified copies of material mill tests.
 - b. Manufacturer's load test and temperature sensitivity data for expansion anchor bolt and adhesive anchor bolts.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents and American Iron and Steel Act requirements, the following manufacturers are acceptable:
 - 1. Mechanical anchor bolts: See Specification Section 03 15 19.
 - 2. Adhesive anchor bolts: See Specification Section 03 15 19.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

- A. Alloy 6061-T6: 32,000 psi tensile yield strength minimum.
 - 1. ASTM B209 for sheets and plates.
 - 2. ASTM B210 for tubes.
 - 3. ASTM B221 and ASTM B308 for shapes: Beams, channels, angles, tees and zees.

4. ASTM B247 for forgings.
- B. Alloy 6063-T5 or T6: 15,000 psi tensile yield strength minimum.
 1. ASTM B221 and ASTM B429 for bars, rods, wires, and pipes, and tubes.
- C. Nonferrous Bolts and Nuts: ASTM F467 and ASTM F468 of alloy 2024-T4 (60,000 psi tensile strength minimum).
- D. Stainless Steel Bolts and Nuts: ASTM F593 and ASTM F594, Type 304 or 316 with a minimum yield strength of 30,000 psi and a minimum tensile strength of 75,000 psi.
- E. Washers: Same material and alloy as found in bolts and nuts with which the washers are to be used.
- F. Electrodes for Welding Aluminum: AWS D1.2 filler alloy 5356.
- G. Mechanical and Adhesive Anchor Bolts for Fastening to Concrete:
 1. Where approved by Engineer.
 2. Stainless steel, Type 304 or 316.
 3. See Specification Section 03 15 19.

2.3 DESIGN

- A. All design shall consider effect of welds on material properties.
 1. Eliminate the use of field welding.
 2. Observe locations of any specified shop splice welds.
- B. Where final design of connections for any portion of structure is not indicated, perform final design of such connections in accordance with the Building Code.
- C. Final designs of connections shall conform to AA ADM 1 and to details and requirements stated in the Contract Documents.
 1. Design loads for connections to be designed by the Contractor shall be as shown on the Drawings.
 2. Where design loads are not specified, connections shall be detailed to develop the full capacity of the member.

2.4 FABRICATION

- A. Fabrication of bolted and welded connections of aluminum work shall be in accordance with AA ADM 1.
- B. Contractor to be solely responsible for correctness of all shop and field fabrication and fit. Verify field conditions and dimensions prior to fabrication.

- C. Fabricate aluminum work and assemble in shop to greatest extent possible.
 - 1. Make splices only where indicated or approved by Engineer.
- D. Provide connections as indicated.
 - 1. Where not indicated, design and provide connections in accordance with requirements of this Specification Section.
 - 2. One-sided or other types of eccentric connections are not acceptable unless indicated on Contract Drawings or approved on Shop Drawings.
- E. Drill or punch holes at right angles to surface of metal.
 - 1. Do not make or enlarge holes by burning.
 - 2. Provide holes clean and free of torn or ragged edges.
 - 3. Use tools which will make a 1/16 IN bevel to remove outside burrs resulting from drilling or punching operations.
 - 4. Punch or drill for field connections and for attachment of work by other trades.
- F. Cope at 45 degrees corners of stiffener plates at junction of member flanges with webs.
- G. Welding:
 - 1. Weld connections to members in shop and bolt connections in field.
 - 2. Perform welding using electrodes of filler alloy 5356.
 - 3. Perform welding in accordance with AWS D1.2.
 - 4. Use only welding procedures and welding operators qualified in accordance with requirements of Paragraph 1.2B. Qualifications.
- H. All full penetration welds shall be nondestructively tested by liquid penetrant or ultrasonic methods per AWS standards.
- I. Form to shapes indicated with straight lines, true angles and smooth curves.
 - 1. Grind smooth all rough welds and sharp edges.
 - 2. Round all corners to approximately 1/8 IN radius.
- J. Finish: Mill finish as fabricated or anodized as required.
 - 1. Architectural Class 1 coating per AA DAF 45:
 - a. Clear anodized: AA-M12C22A413.
 - b. Black, dark bronze, light bronze as required: AA-M12C22A42.

2.5 SOURCE QUALITY CONTROL

A. Special Inspection and Testing:

1. Contractor is responsible for testing to qualify shop welders and as needed for Contractor's own quality control to ensure compliance with Contract Documents.
2. Contractor shall inspect and test fabrication in accordance with the fabricators quality control procedures and in accordance with ADM-1 2015 or later.
3. Contractor shall inspect shop welding in accordance with AWS D1.2, Section 5 including the following non-destructive testing:
 - a. Visually inspect all welds.
 - b. In addition to visual inspection, test 50 percent of full penetration welds and 20 percent of fillet welds with liquid dye penetrant.
 - c. Test 20 percent of liquid dye penetrant tested full penetration welds with ultrasonic or radiographic testing.

PART 3 - EXECUTION

3.1 ERECTION

A. Contractor is solely responsible for safety.

1. Construction means and methods and sequencing of work is prerogative of the Contractor.
2. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until decks and diagonal bracing or rigid moment connections are installed.
3. Partially complete structural members shall not be loaded without an investigation by the Contractor.
4. Until all elements of the permanent structure and lateral bracing system are complete, provide temporary bracing designed, furnished and installed by the Contractor.

B. Bolting:

1. Protect bolt threads from damage.
2. Rest bolt heads and nuts squarely against surfaces.
3. Where bolt heads or nuts rest on beveled surfaces having slope greater than 1 in 20 with plane normal to bolt axis, use beveled washers to provide full bearing to head and nut.

4. Correct poor matching of holes by drilling to next larger size and use larger diameter bolt.
 5. Unless otherwise specified, connect aluminum members to:
 - a. Aluminum members using 3/4 IN DIA nonferrous bolts of alloy 2024-T4 or stainless steel bolts (ASTM F593 and ASTM F594).
 - b. Carbon and low alloy steel using 3/4 IN DIA stainless steel bolts (ASTM F593 and ASTM F594).
 - 1) Provide dissimilar materials protection.
 - c. Concrete or masonry using stainless steel expansion anchor bolts or adhesive anchor bolts unless shown otherwise.
 - 1) Provide dissimilar materials protection.
- C. Welding: Field welding of aluminum is not allowed unless indicated on Drawings.
- D. Correct fabrication errors and damaged members in shop.
1. Do not use cutting torch in shop or in field to cut any members, to correct fabrication errors, or to cut openings.
- E. Provide templates for anchors, bolts, and other items to be installed in other work.
- F. Field Assembly:
1. Tolerances shall comply with AISC 325 and the ADM-1.
 - a. Before members are assembled, thoroughly clean all bearing surfaces and surfaces that will be in permanent contact.
 - b. After assembly, carefully align all members of each frame or assembly and accurately adjust until final, correct and true location is achieved.
 - 1) As work progresses, securely fasten in place.
 2. Provide full length members without splices.
 3. Securely tighten and leave in place all erection bolts used in welded construction, unless removal is required.
- G. Set beam and column baseplates accurately, as indicated on non-shrink grout, in accordance with Division 03.
1. If not indicated, provide minimum of 1 IN grout thickness under base plates.
 2. Set and anchor each base plate to proper line and elevation.
 - a. Use aluminum wedges, shims, or setting nuts for leveling and plumbing columns and beams.

- 1) Tighten anchor bolts.
- b. Fill space between bearing surface and bottom of base plate with non-shrink grout.
 - 1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
- c. Do not remove wedges or shims and where they protrude, cut off flush with edge of base plate.

H. Temporary Protection:

1. Suitably protect aluminum surfaces against lime mortar stains, discoloration, surface abrasion and other construction abuses.
 2. Remove protection during Predemonstration Period.
- I. Contact with Dissimilar Materials: Where aluminum surfaces will be embedded in concrete, built into masonry, or in contact with steel, concrete, grout, masonry, or other dissimilar materials, coat the aluminum surfaces as described in Specification Section 09 96 00.

3.2 FIELD QUALITY CONTROL

A. Special Inspection and Testing:

1. See Section 01 45 33.
2. Special Inspection is required to:
 - a. Inspect structural aluminum delivered on site, prior to erection.
 - 1) Visually inspect all welds, bolts and general fabrication
 - b. Verify proper identification markings for bolts, nuts and washers per applicable standards. Verify proper hole and bolt size.
 - 1) Frequency: All bolts, prior to being covered up or substantial completion.
 - c. Inspect structural aluminum which has been erected.
 - 1) Inspect the following:
 - a) Details such as bracing and stiffening.
 - b) Member locations.
 - c) Erection tolerances.
 - d) Application of joint details at each connection.
- 2) Frequency: Prior to members being covered up or substantially complete.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be supplied under work of other Specification Sections.
2. Design of all temporary bracing not indicated on Drawings.
3. Design of systems and components, including but not limited to:
 - a. Stairs.
 - b. Landings.
 - c. Ladders.
 - d. Modular framing system.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 23 Pipe Stainless Steel

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Aluminum Association (AA):
 - a. ADM 1, Aluminum Design Manual.
2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. HB, Standard Specifications for Highway Bridges.
3. American Institute of Steel Construction (AISC):
 - a. 325, Manual of Steel Construction.

- b. 360, Specifications for Structural Steel Buildings (referred to herein as AISC Specification).
- 4. American National Standards Institute (ANSI):
 - a. A14.3, Ladders - Fixed - Safety Requirements.
- 5. American Society of Civil Engineers (ASCE):
 - a. 7, Minimum Design Loads for Buildings and Other Structures.
- 6. ASTM International (ASTM):
 - a. A6, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 - b. A36, Standard Specification for Carbon Structural Steel.
 - c. A47, Standard Specification for Ferritic Malleable Iron Castings.
 - d. A48, Standard Specification for Gray Iron Castings.
 - e. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - f. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
 - g. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - h. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - i. A197, Standard Specification for Cupola Malleable Iron.
 - j. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - k. A276, Standard Specification for Stainless Steel Bars and Shapes.
 - l. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - m. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - n. A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - o. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

- p. A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- q. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- r. A536, Standard Specification for Ductile Iron Castings.
- s. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
- t. A572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
- u. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- v. A668, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
- w. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- x. A786, Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
- y. A992, Standard Specification for Steel for Structural Shapes.
- z. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- aa. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- bb. B26, Standard Specification for Aluminum-Alloy Sand Castings.
- cc. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- dd. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- ee. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
- ff. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
- gg. B632, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
- hh. F467, Standard Specification for Nonferrous Nuts for General Use.

- ii. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
 - jj. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - kk. F835, Standard Specification for Alloy Steel Socket Button and Flat Countersunk Head Cap Screws.
 - ll. F879, Standard Specification for Stainless Steel Socket Button and Flat Countersunk Head Cap Screws.
 - mm. F1789, Standard Terminology for F16 Mechanical Fasteners.
7. American Welding Society (AWS):
- a. A5.1/A5.1M, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
 - b. D1.1, Structural Welding Code - Steel.
 - c. D1.2, Structural Welding Code - Aluminum.
 - d. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
8. National Association of Architectural Metal Manufacturers (NAAMM):
- a. AMP 510, Metal Stairs Manual.
 - b. AMP 555, Code of Standard Practice for the Architectural Metal Industry (Including Miscellaneous Iron).
 - c. MBG 531, Metal Bar Grating Manual.
9. NACE International (NACE).
10. Nickel Development Institute (NiDI):
- a. Publication 11 007, Guidelines for the welded fabrication of nickel-containing stainless steels for corrosion resistant services.
11. Occupational Safety and Health Administration (OSHA):
- a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
12. Building Code:
- a. International Code Council (ICC):
 - 1) International Building Code and associated standards, 2012 Edition, including all amendments, referred to herein as Building Code.

B. Qualifications:

1. Qualify welding procedures and welding operators in accordance with AWS.
2. Fabricator shall have minimum of 10 years' experience in fabrication of metal items specified.
3. Engineer for contractor-designed systems and components: Professional structural engineer licensed in the State of Alaska.

1.3 DEFINITIONS

- A. Fasteners: As defined in ASTM F1789.
- B. Galvanizing: Hot-dip galvanizing per ASTM A123/A123M or ASTM A153/A153M with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.
- C. Hardware: As defined in ASTM A153/A153M.
- D. Installer or Applicator:
 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 2. Installer and applicator are synonymous.

1.4 SUBMITTALS

- A. Shop Drawings:
 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. Fabrication and/or layout drawings and details:
 - a. Submit drawings for all fabrications and assemblies.
 - 1) Include erection drawings, plans, sections, details and connection details.
 - b. Identify materials of construction, shop coatings and third party accessories.
 3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Provide manufacturer's standard allowable load tables for the following:
 - 1) Grating and checkered plate.
 - 2) Castings, trench covers and accessories.

- 3) Modular framing systems.
4. Contractor designed systems and components:
 - a. Certification that manufactured units meet all design loads specified.
 - b. Shop Drawings and engineering design calculations:
 - 1) Indicate design live loads.
 - 2) Sealed by a licensed professional engineer, registered in the State of Alaska.
 - 3) Engineer will review for general compliance with Contract Documents.
 - c. Contractor designed systems and components include the following:
 - 1) Metal Stairs and associated landings.
 - 2) Concrete Filled Steel Pan Stairs.
 - 3) Ladders and associated landings.
 - 4) Gates.
 - 5) Steel checkered plate.
 - 6) Aluminum checkered plate.

B. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Certification of welders and welding processes.
 - a. Indicate compliance with AWS.
3. NACE inspector qualifications.
4. NACE certification of surface preparation.
5. NACE certification of paint application.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and handle fabrications to avoid damage.
- B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents and American Iron and Steel Act requirements, the following manufacturers are acceptable:
1. Abrasive stair nosings (embedded in concrete stairs):
 - a. American Safety Tread.
 - b. Balco.
 2. Headed studs and deformed bar anchors:
 - a. Nelson Stud Welding Division, TRW Inc.
 - b. Stud Welding Products, Inc.
 3. Mechanical anchor bolts: Section 03 15 19.
 4. Epoxy adhesive anchor bolts: Section 03 15 19.
 5. Self-tapping concrete anchors: Section 03 15 19.
 6. Castings, trench covers and accessories:
 - a. Neenah Foundry Co.
 - b. Deeter Foundry Co.
 - c. Barry Craft Construction Casting Co.
 - d. McKinley Iron Works.
 7. Aluminum ladders: Manufacturer capable of meeting the requirements of this Specification Section.
 8. Galvanizing repair paint:
 - a. Clearco Products Co., Inc.
 - b. ZRC Products.
 9. Modular framing system:
 - a. Unistrut Building Systems.
 - b. B-Line Systems.
 - c. Kindorf.
 - d. Superstrut.

10. Ladder safety extension post:

a. Bilco.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Steel:

1. Structural:

a. W-shapes and WT-shapes: ASTM A992, Grade 50.

b. All other plates and rolled sections: ASTM A36.

2. Pipe: ASTM A53, Types E or S, Grade B or ASTM A501.

3. Structural tubing:

a. ASTM A500, Grade B (46 ksi minimum yield).

4. Bolts, nuts and washers, high strength:

a. ASTM A325.

b. Provide two (2) washers with all bolts.

5. Bolts and nuts:

a. ASTM A307, Grade A.

6. Welding electrodes: AWS D1.1, E70 Series.

7. Steel forgings: ASTM A668.

B. Iron:

1. Ductile iron: ASTM A536.

2. Gray cast iron: ASTM A48 (minimum 30,000 psi tensile strength).

3. Malleable iron: ASTM A47, ASTM A197.

C. Stainless Steel:

1. Stainless steel in welded applications: Low carbon 'L' type.

2. Minimum yield strength of 30,000 psi and minimum tensile strength of 75,000 psi.

a. Bars, shapes: ASTM A276, Type 304.

- b. Tubing and pipe: ASTM A269, ASTM A312 or ASTM A554, Type 304 or 316.
 - c. Strip, plate and flat bars: ASTM A666, Type 304 or 316.
 - d. Bolts and nuts: ASTM F593, Type 304 or 316.
3. Minimum yield strength of 25,000 psi and minimum tensile strength of 70,000 psi.
- a. Strip, plate and flat bar for welded connections, ASTM A666, Type 304L or 316L.
4. Welding electrodes: Low-hydrogen, in accordance with AWS for metal alloy being welded.
- D. Aluminum:
- 1. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.
 - a. ASTM B221 and ASTM B308 for shapes including beams, channels, angles, tees and zees.
 - b. Weir plates, baffles and deflector plates, ASTM B209.
 - 2. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum.
 - a. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.
 - 3. ASTM B26 for castings.
 - 4. ASTM F468, alloy 2024 T4 for bolts.
 - 5. ASTM F467, alloy 2024 T4 for nuts.
 - 6. Electrodes for welding aluminum: AWS D1.2, filler alloy 4043 or 5356.
- E. Washers: Same material and alloy as found in accompanying bolts and nuts.
- F. Embedded Anchor Bolts: Section 03 15 19.
- G. Mechanical Anchor Bolts and Adhesive Anchor Bolts: Section 03 15 19.
- H. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.
- I. Deformed Bar Anchors: ASTM A1064 with a minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.
- J. Iron and Steel Hardware: Galvanized in accordance with ASTM A153/A153M when required to be galvanized.
- K. Galvanizing Repair Paint:

1. High zinc dust content paint for regalvanizing welds and abrasions.
2. ASTM A780.
3. Zinc content: Minimum 92 percent in dry film.
4. ZRC "ZRC Cold Galvanizing" or Clearco "High Performance Zinc Spray."

L. Dissimilar Materials Protection: Section 09 96 00.

2.3 MANUFACTURED UNITS

A. Ladders:

1. General:
 - a. Fully welded type.
 - 1) All welds shall be full penetration welds, unless otherwise specified.
 - b. All ladders of a particular material shall have consistent construction and material shapes and sizes unless noted otherwise on the Drawings.
 - c. Design ladder in accordance with OSHA Standards, ANSI A14.3, ASCE 7 and applicable Building Codes.
 - d. Ladders shall be designed to support a minimum concentrated live load of 300 LBS at any point to produce the maximum stress in the member being designed.
 - 1) Apply additional 300 LB loads for each section of ladder exceeding 10 FT.
 - e. Maximum allowable stresses per AA ADM 1.
 - f. Maximum lateral deflection: Side rail span/240 when lateral load of 100 LBS is applied at any location.
2. Material:
 - a. Aluminum.
 - b. Finish: Mill.
3. Rails:
 - a. Round pipe or rectangular tubing:
 - 1) Round pipe:
 - a) 1-1/2 IN nominal diameter.
 - b) Schedule 80.
 - 2) Rectangular tubing:
 - a) Cross-section: 3 by 2 IN maximum.

- b) Thickness: 0.125 IN minimum.
 - b. Spacing:
 - 1) Minimum clear distance between rails shall be 18 IN.
 - 2) Step-through ladder extensions: 24 IN, centerline to centerline.
 - c. Provide cap at exposed top and bottom of side rails.
 - 1) Provide weep holes as necessary to prevent the accumulation of moisture within hollow members.
 - d. Extend side rails of step-through ladders a minimum of 42 IN above the landing.
4. Rungs:
- a. Minimum 1 IN DIA or 1 IN square solid bar.
 - 1) Integral non-slip finish on all sides.
 - a) Non-slip finish: Coarse knurling or extruded serrations.
 - b) Shop or field-applied grit tape and cap type non-slip finishes are not acceptable.
 - b. Rungs shall penetrate inside wall of side rails.
 - 1) Do not extend rungs beyond the outside face of the side rail.
 - 2) Provide fillet weld all around rung at inside face of side rail and plug weld at outside face of side rail.
 - c. Rung spacing:
 - 1) Uniform, 12 IN.
 - 2) Top rung shall be level with landing or platform.
 - a) Where top of ladder terminates at grating cover, floor access door, roof hatch or similar condition; locate top rung as close as practicable to, but not more than 6 IN below, adjacent walking surface.
 - 3) Spacing of bottom rung from grade or platform may vary but shall not exceed 14 IN.
5. Brackets:
- a. Angle or bent plate brackets welded to side rails:
 - 1) 3/8 IN by 2-1/2 IN by length required.
 - 2) Provide punched holes for 3/4 IN bolts or anchors.
 - 3) Minimum distance from centerline of rung to wall or any obstruction: 7 IN.
 - 4) Maximum spacing: 4 FT OC.

- b. For floor supported ladders, provide 3/8 by 2-1/2 by 4 IN rectangular bracket or 3/8 by 6 by 6 IN square plate welded to rails with punched holes for 3/4 IN bolts.
 - 1) Provide wall brackets on floor supported units if vertical run is over 4 FT.
- 6. Provide ladder cage where shown on the Drawings or required by OSHA.
 - a. Cage construction shall meet all requirements of OSHA Standards and this Specification Section:
 - 1) Hoops: Minimum 1/4 by 2 IN bar at 48 IN OC spacing.
 - 2) Vertical bars: Minimum 1/4 by 1-1/2 IN bar.
 - 3) Weld all connections.
 - 4) Construct cage of same materials as the ladder on which it is mounted.
 - 5) Mount cage on ladder by welding.
- 7. Landings:
 - a. Construct landing, railing and all supports of same material as the ladder.
 - b. Design live load for landing platform and supporting structure:
 - 1) 100 PSF, uniform load.
 - 2) 300 LBS concentrated load on 4 IN square area.
 - 3) All components shall be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
 - 4) Maximum deflection: 1/300 of span under a superimposed live load of 100 PSF.
 - c. Grating: Per this Specification Section.
 - d. Structural support: Channel or tubular sections with bracing, plates, angles, etc., shall support guardrail and grating and shall support landing from the side of the structure.
 - 1) Weld or bolt all connections using galvanized bolts, nuts and washers.
 - e. Guardrails:
 - 1) Match ladder side rails. Space intermediate rails equally between top rail and top of kickplate.
 - 2) Provide 4 IN high x 3/8 IN thick toeboard each side of landing.
- 8. Gates:
 - a. Constructed of same material and sizes as the railing system.

- b. Hinges:
 - 1) Stainless steel.
 - 2) Heavy-duty, self-closing.
- c. Gate stop: Stainless steel.
- 9. Ladder safety extension post:
 - a. Telescoping tubular galvanized steel or stainless steel section that automatically locks into place when fully extended.
 - b. Non-ferrous corrosion-resistant spring and hardware.
 - c. Factory assembled with all hardware necessary for mounting to ladder.
 - d. Bilco "LadderUp" safety post.

B. Bollards:

- 1. 8 IN DIA extra strength steel pipe, ASTM A53.
 - a. Galvanized.
 - b. See Specification Section 09 96 00 for painting requirements.

C. Abrasive Stair Nosings:

- 1. Two (2) component consisting of an embedded subchannel, installed with the concrete pour, and an abrasive tread plate with integral photoluminescent strip to be installed later.
- 2. 6063-T5 extruded aluminum, mill finished and heat treated.
- 3. Complete with concrete anchors and tread plate securing screws.
- 4. Tread plate:
 - a. Extruded aluminum.
 - b. Solid epoxy abrasive filler.
 - 1) Color: Safety yellow.
- 5. Balco "DXH-330." or "DXH-330-PL-100."
- 6. Length:
 - a. Concrete stairs:
 - 1) 4 IN less than overall stair width.
 - 2) Where tread mounted railing post occurs, hold nosing back 4 IN clear from railing centerline.

- b. Concrete landings at metal stairs: 4 IN less than clear width between stringers.

D. Metal Stairs:

1. Fabricated as indicated.
2. Treads: Grating as specified.
 - a. Provide integral corrugated non-slip nosing.
3. Risers:
 - a. Grating treads: Solid plate attached to trailing edge of tread as shown on Drawings.
 - b. Checkered plate treads: Solid checkered plate riser integral with tread.
4. Landings:
 - a. Grating as specified.
 - b. Provide integral corrugated non-slip nosing at edge acting as stair tread/nosing.
5. Design live load for landing platform and supporting structure:
 - a. 100 PSF, uniform load.
 - b. 300 LBS concentrated load on 4 IN square area.
 - c. All components shall be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
 - d. Maximum deflection: 1/300 of span under a superimposed live load of 100 PSF.
6. Design, fabricate, and install in compliance with NAAMM and applicable codes.
 - a. NAAMM AMP 510:
 - 1) Exterior at site structures and equipment: Industrial Class.
 - 2) Interior or exterior at buildings: Service Class.
7. Handrails and guardrail: Section 05 52 05.
8. Material: Aluminum.

E. Stairs, Concrete Filled Steel Pan:

1. Fabricate as indicated using ASTM A36 steel.
2. Treads: Minimum 14 GA pans with self-furring metal lath welded in pan.

3. Risers: Minimum 14 GA.
 4. Landings: minimum 10 GA pans with angle supports as required to support loading indicated and concrete.
 - a. Provide self-furring metal lath reinforcing welded in the pan.
 5. Design live load for landing platform and supporting structure:
 - a. 100 PSF, uniform load.
 - b. 300 LBS concentrated load on 4 IN square area.
 - c. All components shall be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
 - d. Maximum deflection: 1/300 of span under a superimposed live load of 100 PSF.
 6. Design, fabricate, and install in compliance with NAAMM and applicable codes.
 - a. NAAMM AMP 510: Commercial Class.
 7. Form surface of nosings with slip-resistant materials or provide separate slip-resistant nosings.
 8. Handrails and guardrails: Section 05 52 05.
 9. Galvanize entire assembly after fabrication.
- F. Steel Checkered Plate:
1. Provide galvanized checkered plate and edge supports.
 2. Conform to ASTM A786.
 - a. Diamond pattern: No. 3 (large) or No. 4 (medium).
 - b. Use one (1) pattern throughout Project.
 - c. Material: 36 ksi minimum yield strength.
 3. Design live load (unless noted otherwise on Drawings):
 - a. 100 PSF, uniform load.
 - b. 300 LBS concentrated load on 4 IN square area.
 - c. All components shall be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
 - d. Maximum deflection: 1/300 of span under a superimposed live load of 50 PSF.

4. Reinforce as necessary with steel angles welded to underside of checkered plate.
5. Plate sections:
 - a. Maximum 3 FT wide.
 - b. Minimum 1/4 IN thick.
 - c. Maximum 100 LBS per section if required to be removable.
6. Provide joints at center of all openings unless shown otherwise.
 - a. Reinforce joints and openings with additional angles to provide required load carrying capacity.
7. Unless shown otherwise, frame for opening with steel checkered plate cover:
 - a. Steel support angles:
 - 1) 3 by 2 by 1/4 IN minimum size with long leg vertical.
 - 2) 5/8 IN DIA adhesive anchor bolts spaced at maximum of 24 IN OC along each side with not less than two (2) anchor bolts per side.
 - b. Steel concrete insert seats:
 - 1) 2 by 2 by 1/4 IN minimum size.
 - 2) Auto-welded studs or strap anchors, ASTM A108 at 18 IN OC with not less than two (2) studs or anchors per side.
 - c. Drill and tap frame to receive 3/8 IN DIA fasteners at not more than 24 IN OC with not less than two (2) fasteners per side.
 - 1) Fasteners: Flat countersunk cap screws, ASTM F835.
 - a) Galvanized, ASTM A153/A153M.

G. Aluminum Checkered Plate:

1. Conform to ASTM B632.
 - a. Diamond pattern: Use one (1) pattern throughout Project.
 - b. Material: Type 6061-T6.
2. Design live load:
 - a. 100 PSF, uniform load.
 - b. 300 LBS concentrated load on 4 IN square area.
 - c. All components shall be adequate for the uniform load or the concentrated load, whichever requires the stronger component.

- d. Maximum deflection: 1/300 of span under a superimposed live load of 50 PSF.
- 3. Reinforce as necessary with aluminum angles.
- 4. Plate sections:
 - a. Maximum 3 FT wide.
 - b. Minimum 1/4 IN thick.
 - c. Maximum 100 LBS per section if required to be removable.
- 5. Provide joints at center of all openings unless shown otherwise.
 - a. Reinforce joints and openings with additional angles to provide required load carrying capacity.
- 6. Unless shown otherwise, frame for openings with aluminum checkered plate cover:
 - a. Aluminum support angles:
 - 1) 3 by 2 by 1/4 IN minimum size with long leg vertical.
 - 2) 5/8 IN DIA adhesive anchor bolts spaced at maximum of 24 IN OC along each side with not less than two (2) anchor bolts per side.
 - b. Aluminum concrete insert seats:
 - 1) 2 by 2 by 1/4 IN minimum size.
 - 2) Auto-welded studs or strap anchors at 18 IN OC with not less than two (2) studs or anchored per side.
 - c. Drill and tap frame to receive 3/8 IN DIA fasteners at not more than 24 IN OC with not less than two (2) fasteners per side.
 - 1) Fasteners: Stainless steel flat countersunk cap screws: ASTM F879.

H. Aluminum Grating:

- 1. NAAMM MBG 531.
- 2. Bearing bars: Rectangular, 1-1/2 by 3/16 IN at 1-3/16 IN OC spacing OR I-bar, 1-1/2 IN deep with minimum 1/16 IN thick bar and minimum 1/4 IN flange width at 1-3/16 IN OC spacing (unless noted otherwise on Drawings).
- 3. Cross bars:
 - a. Welded, swaged or pressure-locked to bearing bars:
 - b. Maximum 4 IN/OC spacing.
- 4. Top edges of bars: Grooved or serrated.

5. Finish: Mill, standard.
 6. Clips and bolts: Stainless steel.
 7. Seat angles: Aluminum or stainless steel
- I. Steel Grating:
1. NAAMM MBG 531.
 2. Bearing bars:
 - a. Rectangular 1-1/2 by 3/16 IN unless otherwise noted on Drawings.
 - b. Maximum 1-3/16 IN OC spacing.
 3. Cross bars:
 - a. Welded, swaged or pressure-locked to bearing bars.
 - b. Maximum 4 IN OC spacing.
 4. Top edges of bars: Serrated or grooved.
 5. Removable grating sections: Not wider than 3 FT and not more than 100 LBS.
 6. Finish:
 - a. Galvanized.
 - b. Clips and bolts: Stainless steel.
 - c. Seat angles: Galvanized steel.
 7. Ends and perimeter edges: Banded.
 8. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 IN high toe plate.
 9. Provide joints at openings between individual grating sections.
- J. Heavy-Duty Castings, Trench Covers, and Accessories:
1. Prefabricated, cast iron ASTM A48 or ductile iron ASTM A536.
 2. Design load: AASHTO HS-20 wheel loading for indicated span.
 3. Machine horizontal mating surfaces.
- K. Access Cover:
1. Tank type manhole frame and solid lid: ASTM A48 or ASTM A536, cast iron.

2. Unless shown otherwise, design of cover shall be such that top of frame extends several inches above slab to prevent surface water from entering tank.
3. Equip lid with four (4) stainless steel screws to secure lid to frame.

L. Loose Lintels:

1. Steel, ASTM A36 or ASTM A572 Grade 50, sizes as indicated on Drawings.
2. Hot-dip galvanized per ASTM A123/A123M.

M. Modular Framing System:

1. Materials:

- a. Steel: ASTM A1011, stainless steel, Grade 33.
 - 1) Hot-dipped galvanized, ASTM A123 or ASTM A153.
- b. Aluminum: ASTM B221 or ASTM B209.
- c. Stainless steel: ASTM A666.
- d. Fiberglass: Section 06 82 00.

2. Channels and inserts:

- a. Steel or stainless steel: Minimum 12 GA.
- b. Aluminum: Minimum 0.080 IN.
- c. Channels shall have one (1) side with a continuous slot with in-turned lips.
 - 1) Width: 1-5/8 IN.
 - 2) Depth and configuration as necessary for loading conditions.

3. Fittings: Same material as system major components.

4. Fasteners:

- a. Nuts: Toothed grooves in top of nuts shall engage the in-turned lips of channel.
- b. Bolts: Hex-head cap screws.
- c. Same material as system major components.

5. End caps:

- a. At each exposed end of each piece mounted on walls, or guardrails, or suspended from framing 7 FT or less above the floor or platform.
 - a) Plastic for all exposed ends 7 FT or more above floor or platform.

- b) Plastic or metallic for all other exposed ends.
- 6. Schedule:
 - a. Exterior areas: stainless steel.
 - b. All other areas not listed above: Hot-dipped galvanized steel.
- 7. Provide dissimilar materials protection in accordance with Specification Section 09 96 00.
- 8. Repair all cut ends or otherwise damaged areas of galvanized steel in accordance with ASTM A780.

2.4 FABRICATION

- A. Verify field conditions and dimensions prior to fabrication.
- B. Form materials to shapes indicated with straight lines, true angles, and smooth curves.
 - 1. Grind smooth all rough welds and sharp edges.
 - a. Round all corners to approximately 1/32 - 1/16 IN nominal radius.
- C. Provide drilled or punched holes with smooth edges.
 - 1. Punch or drill for field connections and for attachment of work by other trades.
- D. Weld Shop Connections:
 - 1. Welds shall be continuous fillet type unless indicated otherwise.
 - 2. Full penetration butt weld at bends in stair stringers and ladder side rails.
 - 3. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming to AWS A5.1/A5.1M.
 - 4. Weld aluminum in accordance with AWS D1.2.
 - 5. Weld stainless steel in accordance with AWS D1.6 and NiDI 11 007.
 - a. Treat all welded areas in accordance with ASTM A380.
 - 6. All headed studs shall be welded using automatically timed stud welding equipment.
 - 7. Grind smooth welds that will be exposed.
- E. Passivate stainless steel items and stainless steel welds after they have been ground smooth.
 - 1. ASTM A380.

- F. Conceal fastenings where practicable.
- G. Fabricate work in shop in as large assemblies as is practicable.
- H. Tolerances:
 - 1. Rolling:
 - a. ASTM A6.
 - b. When material received from the mill does not satisfy ASTM A6 tolerances for camber, profile, flatness, or sweep, the Contractor is permitted to perform corrective work by the use of controlled heating and mechanical straightening, subject to the limitations of the AISC Specification.
 - 2. Fabrication tolerance:
 - a. Member length:
 - 1) Both ends finished for contact bearing: 1/32 IN.
 - 2) Framed members:
 - a) 30 FT or less: 1/16 IN.
 - b) Over 30 FT: 1/8 IN.
 - b. Member straightness:
 - 1) Compression members: 1/1000 of axial length between points laterally supported.
 - 2) Non-compression members: ASTM A6 tolerance for wide flange shapes.
 - c. Specified member camber (except compression members):
 - 1) 50 FT or less: Minus 0/plus 1/2 IN.
 - 2) Over 50 FT: Minus 0/plus 1/2 IN (plus 1/8 IN per 10 FT over 50 FT).
 - 3) Members received from mill with 75 percent of specified camber require no further cambering.
 - 4) Beams/trusses without specified camber shall be fabricated so after erection, camber is upward.
 - 5) Camber shall be measured in fabrication shop in unstressed condition.
 - d. At bolted splices, depth deviation shall be taken up by filler plates.
 - 1) At welded joints, adjust weld profile to conform to variation in depth.
 - 2) Slope weld surface per AWS requirements.
 - e. Finished members shall be free from twists, bends and open joints.

- 1) Sharp kinks, bends and deviation from above tolerances are cause for rejection of material.
- I. Fabricate grating, checkered plate, stairs, ladders and accessories using aluminum, galvanized steel or stainless steel unless shown otherwise on Drawings.
 1. Finish:
 - a. Mill, unless noted otherwise.
 - b. Coat surfaces in contact with dissimilar materials in accordance with Section 09 96 00.
 - J. Fabricate grating in accordance with NAAMM MBG 531.
 1. Maximum tolerance for difference in depth between grating depth and seat or support angle depth: 1/8 IN.
 2. Distance between edge of grating and face of embedded seat angle or face of wall or other structural member: 1/4 IN.
 - a. Tolerance: NAAMM MBG 531.
 3. Removable sections: Not wider than 3 FT and not heavier than 100 LBS.
 4. Ends and perimeter edges: Banded, with alternate bearing bars welded to band.
 - a. Provide full depth banding unless noted otherwise.
 - b. Banding at trenches and sumps shall be 1/4 IN less than grating depth to allow for drainage.
 5. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 IN high toe plate.
 6. Provide joints at openings between individual grating sections.
 7. Fabricate grating so that bearing bars and cross bars in adjacent sections are aligned.
 - K. Fabricate checkered plate and miscellaneous metals in accordance with NAAMM AMP 555.
 1. Workmanship: Class 2 unless noted otherwise.
 - L. See Specification Section 09 96 00 for preparation and painting of ferrous metals and other surfaces.

2.5 SOURCE QUALITY CONTROL

A. Surface Preparation:

1. Refer to Specification Section 09 96 00 for surface preparation requirements.
2. All miscellaneous metal fabrication item surfaces shall be inspected and approved by NACE certified coatings inspector prior to application of shop-applied paint coating.
 - a. Inspection shall be performed to determine depth of blast profile and cleanliness of surface.
 - b. Fabricator shall reblast and or re-clean surfaces as required until acceptable.

B. Shop Applied Paint Coating Application:

1. Refer to Specification Section 09 96 00 for painting requirements.
2. After surface has been accepted in writing by NACE certified coatings inspector, fabricator may proceed with application of paint coatings.
3. Application of paint coatings shall be observed and certified by NACE certified coatings inspector.

C. Shop Inspection and Testing:

1. Owner will employ and pay for the services of a qualified independent testing agency to inspect and test all structural steel work for compliance with Contract Documents.
2. Contractor is responsible for testing to qualify shop and field welders and as needed for Contractor's own quality control to ensure compliance with Contract Documents.
3. Independent testing agency shall have a minimum of five (5) years performing similar work and shall be subject to Owner's approval.

D. Responsibilities of Testing Agency:

1. Inspect shop and field welding in accordance with AWS Code including the following non-destructive testing:
 - a. Visually inspect all welds.
 - b. In addition to visual inspection, test 50 percent of full penetration welds and 20 percent of fillet welds with liquid dye penetrant or mag particle.
 - c. Test 20 percent of liquid dye penetrant tested full penetration welds with ultrasonic or radiographic testing.
2. Inspect high-strength bolting in accordance with the RCSC Specification for Structural Joints Using High-Strength Bolts, Section 9.
 - a. Verify direct tension indicator gaps, if applicable.

3. Inspect structural steel which has been erected.
4. Inspect stud welding in accordance with AWS Code.
5. Prepare and submit inspection and test reports to Engineer.
 - a. Assist Engineer to determine corrective measures necessary for defective work.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide items to be built into other construction in time to allow their installation.
 1. If such items are not provided in time for installation, cut in and install.
- B. Prior to installation, inspect and verify condition of substrate.
- C. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.
 1. Field welding aluminum is not permitted unless approved in writing by Engineer.

3.2 INSTALLATION

- A. Set metal work level, true to line, plumb. Shim and grout as necessary.
- B. Contractor is solely responsible for safety.
 1. Construction means and methods and sequencing of work is the prerogative of the Contractor.
 2. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until slabs, decks, and diagonal bracing or rigid connections are installed.
 3. Partially complete structural members shall not be loaded without an investigation by the Contractor.
 4. Until all elements of the permanent structure and lateral bracing system are complete, temporary bracing for the partially complete structure will be required.
- C. Adequate temporary bracing shall provide safety, stability and shall resist all loads to which the partially complete structure may be subjected, including construction activities and operation of equipment is the responsibility of the Contractor.
 1. Plumb, align, and set structural steel members to specified tolerances.

2. Use temporary guys, braces, shoring, connections, etc., necessary to maintain the structural framing plumb and in proper alignment until permanent connections are made, the succeeding work is in place, and temporary work is no longer necessary.
 3. Use temporary guys, bracing, shoring, and other work to prevent injury or damage to adjacent work or construction from stresses due to erection procedures and operation of erection equipment, construction loads, and wind.
 4. Contractor shall be responsible for the design of the temporary bracing system and must consider the sequence and schedule of placement of such elements and effects of loads imposed on the structural steel members by partially or completely installed work, including work of all other trades.
 - a. If not obvious from experience or from the Drawings, the Contractor shall confer with the Engineer to identify those structural steel elements that must be complete before the temporary bracing system is removed.
 5. Remove and dispose of all temporary work and facilities off-site.
- D. Examine work-in-place on which specified work is in any way dependent to ensure that conditions are satisfactory for the installation of the work.
1. Report defects in work-in-place which may influence satisfactory completion of the work.
 2. Absence of such notification will be construed as acceptance of work-in-place.
- E. Field Measurement:
1. Take field measurements as necessary to verify or supplement dimensions indicated on the Drawings.
 2. Contractor responsible for the accurate fit of the work.
- F. Check the elevations of all finished footings or foundations and the location and alignment of all anchor bolts before starting erection.
1. Use surveyor's level.
 2. Notify Engineer of any errors or deviations found by such checking.
- G. Framing member location tolerances after erection shall not exceed the frame tolerances listed in the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.
- H. Erect plumb and level; introduce temporary bracing required to support erection loads.
- I. Use light drifting necessary to draw holes together.

1. Drifting to match unfair holes is not allowed.
- J. Welding:
1. Conform to AWS D1.1 and requirements of the FABRICATION Article in PART 2 of this Specification Section.
 2. When joining two (2) sections of steel of different ASTM designations, welding techniques shall be in accordance with a qualified AWS D1.1 procedure.
- K. Shore existing members when unbolting of common connections is required.
1. Use new bolts for rebolting connections.
- L. Clean stored material of all foreign matter accumulated prior to the completion of erection.
- M. Bolt Field Connections: Where practicable, conceal fastenings.
- N. Field Welding:
1. Follow AWS procedures.
 2. Grind welds smooth where field welding is required.
- O. Field cutting grating or checkered plate to correct fabrication errors is not acceptable.
1. Replace entire section.
- P. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing system elements, etc.
- Q. Unless noted or specified otherwise:
1. Connect steel members to steel members with 3/4 IN DIA ASTM A325 high strength bolts.
 2. Connect aluminum to aluminum with 3/4 IN DIA stainless bolts.
 3. Connect aluminum to structural steel using 3/4 IN DIA stainless steel bolts.
 - a. Provide dissimilar metals protection.
 4. Connect aluminum and steel members to concrete and masonry using stainless steel mechanical anchor bolts or adhesive anchor bolts unless shown otherwise.
 - a. Provide dissimilar materials protection.
 5. Provide washers for all bolted connections.

6. Where exposed, bolts shall extend a maximum of 3/4 IN and a minimum of 1/2 IN above the top of installed nut.
 - a. If bolts are cut off to required maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.
- R. Install and tighten ASTM A325 high-strength bolts in accordance with the AISC 325, Allowable Stress Design (ASD).
 1. Provide hardened washers for all ASTM A325 bolts.
 - a. Provide the hardened washer under the element (nut or bolt head) turned in tightening.
- S. After bolts are tightened, upset threads of ASTM A307 bolts or anchor bolts to prevent nuts from backing off.
- T. Secure metal to wood with lag screws of adequate size with appropriate washers.
- U. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing.
 1. Provide full penetration welded splices where continuity is required.
- V. Provide each fabricated item complete with attachment devices as indicated or required to install.
- W. Anchor such that work will not be distorted nor fasteners overstressed from expansion and contraction.
- X. Set beam and column base plates accurately on non-shrink grout as indicated on Drawings.
 1. See Division 03 Specification Sections for non-shrink grout and anchorage.
 2. Set and anchor each base plate to proper line and elevation.
 - a. Use metal wedges, shims, or setting nuts for leveling and plumbing columns and beams.
 - 1) Wedges, shims and setting nuts to be of same metal as base plate they support.
 - 2) Tighten nuts on anchor bolts.
 - b. Fill space between bearing surface and bottom of base plate with non-shrink grout.
 - 1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
 - c. Do not remove wedges or shims. Where they protrude, cut off flush with edge of base plate.

- d. Fill sleeves around anchor bolts solid with non-shrink grout.
- Y. Tie anchor bolts in position to embedded reinforcing steel using wire.
 - 1. Tack welding prohibited. Coat projecting bolt threads and nuts with heavy coat of clean grease.
 - 2. Anchor bolt location tolerance: Section 03 15 19.
- Z. Install bollards in concrete as detailed.
 - 1. 48 IN projection above ground.
 - 2. 48 IN embedment in concrete, unless detailed otherwise on Drawings.
 - 3. Fill pipe with concrete and round off at top.
- AA. Provide abrasive stair nosings in each tread and landing of all concrete stairs and at each concrete stair landing having metal stair structure attaching to the concrete landing.
 - 1. Center stair nosings in stair width.
 - 2. Coordinate nosings with railing vertical posts. Maintain 2 IN clear between end of nosing and edge of railing base plate.
- BB. Accurately locate and place frames for openings before casting into floor slab so top of plate is flush with surface of finished floor. Keep screw holes clean and ready to receive screws.
- CC. Attach grating to end and intermediate supports with grating saddle clips and bolts.
 - 1. Maximum spacing: 2 FT OC with minimum of two (2) per side.
 - 2. Attach individual units of aluminum grating together with clips at 2 FT OC maximum with a minimum of two (2) clips per side.
- DD. Coat aluminum surfaces in contact with dissimilar materials in accordance with Specification Section 09 96 00.
- EE. Repair damaged galvanized surfaces in accordance with ASTM A780.
 - 1. Prepare damaged surfaces by abrasive blasting or power sanding.
 - 2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.
- FF. Anchor ladder to concrete structure with minimum 3/4 IN stainless steel anchor bolts with minimum 6 IN embedment.
- GG. Anchor ladder to masonry structure with minimum 3/4 IN stainless steel anchor bolts with minimum 6 IN embedment.

1. When anchoring into masonry, fill masonry cores with grout at anchor locations and each masonry core within 8 IN of anchor
 2. When anchoring into cavity wall construction, provide minimum 6 IN embedment into concrete or masonry back-up wall.
 - a. At each anchor location, provide sleeve between back face of veneer and cavity face of concrete or masonry back-up wall.
 - b. Cut cavity insulation as required and seal around sleeve.
 - 1) Sleeve shall be 1 IN DIA schedule 40 stainless steel tubing, TP-304L, ASTM A269.
 - a) Minimum wall thickness shall be .065 IN.
 - 2) Continuously weld 4 by 4 by 1/4 IN Type 304 stainless steel, ASTM A666 flange onto each end of pipe.
 - a) Drill 1 IN hole in flange shall match pipe.
 - b) Attach sleeve to concrete or masonry back-up with 1/4 IN self-tapping concrete anchors.
 - 3) Grout solid, area around bolt where bolt penetrates veneer.
 - 4) Accurately locate sleeves to align with bolt locations on ladder.
- HH. Anchor ladder to metal stud walls using minimum 1/2 IN stainless steel bolts, nuts and washers.
1. Verify that stud wall has been provided with adequate backing to accept ladder anchors.
- II. Install ladder safety extension post in accordance with manufacturer's instructions.
1. Mount device opposite the climbing side.
 2. Provide ladder safety extension device for all ladders unless noted otherwise.
- JJ. Mount ladder fall protection system with rail offset from ladder side rail approximately 3 IN.
- KK. Install factory pre-fabricated stairs in location indicated in the Contract Documents and approved submittals.

3.3 FIELD QUALITY CONTROL

- A. Tolerances shall meet structural requirements of Specification Section 05 12 00 for erecting items of structural nature.
- B. Tolerances (unless otherwise noted on the Drawings):
 1. Frame placement, after assembly and before welding or tightening.

- a. Deviation from plumb, level and alignment: 1 in 500, maximum.
 - b. Displacement of centerlines of columns: 1/2 IN maximum, each side of centerline location shown on Drawings.
 - c. Displacement of centerlines of columns: 1/2 IN maximum, each side of centerline location shown on Drawings.
- C. Owner Pays for Field Inspection and Testing:
- 1. Owner will employ and pay for services of an independent testing agency to inspect and test structural steel shop and field work for compliance with this Specification Section.
 - 2. Contractor provides sufficient notification and access so inspection and testing can be accomplished.
 - 3. Contractor pays for retesting of failed tests and for additional testing required when defects are discovered.

3.4 CLEANING

- A. After fabrication, erection, installation or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter.
- B. All stainless steel products in addition to Paragraph A. above:
 - 1. Remove all heat tint, rusting, discoloration by passivation, ASTM A380, or other acceptable means as listed in NiDI 11 007 as approved by the Engineer.
- C. Provide surface acceptable to receive field applied paint coatings specified in Specification Section 09 96 00.

END OF SECTION

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SECTION 05 52 05
STEEL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel handrail, stair rail and guardrail.
2. Steel guardrail gates.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 05 50 00 - Metal Fabrications.
4. Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. U.S. Department of Justice, Architectural and Transportation Barriers Compliance Board (Access Board):
 - a. Americans with Disabilities Act (ADA):
 - 1) Accessibility Guidelines for Buildings and Facilities (ADAAG).
2. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - c. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - d. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - e. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
3. American Welding Society (AWS):

- a. D1.1, Structural Welding Code - Steel.
- 4. National Association of Architectural Metal Manufacturers (NAAMM):
 - a. AMP 521, Pipe Railing Systems Manual.
- 5. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
- 6. Building code:
 - a. International Code Council (ICC):
 - 1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.
- B. Qualify welding procedures and welding operators in accordance with AWS.

1.3 DEFINITIONS

- A. Hardware: As defined in ASTM A153/A153M.
- B. Galvanizing: Hot-dip galvanizing per ASTM A123/A123M or ASTM A153/A153M with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.
- C. Guardrail: A system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.
- D. Handrail: A railing provided for grasping with the hand for support.
- E. Railing: A generic term referring to guardrail, handrail and/or stair rails.
- F. Stair Rail: A guardrail, installed at the open side of stairways with either a handrail mounted to the inside face of the guardrail, or where allowed by applicable codes, with the top rail mounted at handrail height and serving the function of a handrail.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Fabrication and/or layout drawings.
 - a. Plan showing profile, location, section and details of each railing, and type and details of anchorage system.
 - b. Location and type of expansion joints.

- c. Materials of construction including shop-applied coatings.
- 3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
- B. Informational Submittals:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Certification of welders and welding procedures indicating compliance with AWS.
 - 3. Certification that railings have been designed and fabricated to meet the loading requirements specified.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver and handle railings to preclude damage.
- B. Store railings on skids, keep free of dirt and other foreign matter which will damage railings or finish and protect from corrosion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents and American Iron and Steel Act requirements, the following manufacturers are acceptable:
 - 1. Welded railing systems:
 - a. Any manufacturer meeting this Specification Section.
 - 2. Galvanizing repair paint:
 - a. ZRC Products.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

- A. Pipe: ASTM A53, Types E or S, Grade B, or ASTM A501.
- B. Steel Sheet, Bar (Pickets) and Plate: ASTM A36.
- C. Galvanizing Repair Paint:

1. High zinc dust content paint for regalvanizing welds and abrasions.
2. Dried film shall contain not less than 95 percent zinc dust by weight.
3. ZRC Products "ZRC."

D. Expansion and Adhesive Anchors: See Specification Section 05 50 00.

E. Welding Electrodes: AWS D1.1, E70 Series.

2.3 FABRICATION

A. General:

1. Verify field conditions and dimensions prior to fabrication.
2. For fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
 - a. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.
3. Form exposed work with smooth, short radius bends, accurate angles and straight edges.
 - a. Ease exposed edges to a radius of approximately 1/32 IN.
 - b. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
4. Form exposed connections with flush, smooth, hairline joints, using galvanized steel splice locks to splice sections together or by welding.
5. Provide for anchorage of type indicated on the Drawings or as required by field conditions.
 - a. Drill or punch holes with smooth edges.
6. Design railing and anchorage system in accordance with NAAMM AMP 521 to withstand loading as required by Building Code.
7. Design railings in accordance with accessibility requirements per the Building Code and ADAAG.

B. Custom fabricate pipe railings to dimensions and profiles indicated.

1. Guardrails:
 - a. 1-1/2 IN nominal diameter pipe.
 - b. Top rails and intermediate rails: Schedule 40.
 - c. Vertical posts: Schedule 80.

2. Handrails mounted to walls or guardrail vertical posts: 1-1/4 IN nominal diameter Schedule 40 pipe.
3. Where details are not indicated, space intermediate rails to requirements of the Building Code or OSHA Standards, whichever requires the more restrictive design.
4. Space vertical posts as required by loading requirements but not more than 4 FT OC.
 - a. Avoid locating vertical posts at changes in direction of railing.
 - b. Hold vertical post back from corner and provide radiused corners.
5. Space handrail brackets as required by loading requirements but not more than 4 FT OC.
6. Base plate for vertical guardrail posts mounted to top of concrete surface:
 - a. 3/8 x 6 x 6 IN square plate welded to the vertical post.
 - b. Predrilled to accept four (4) anchors.
7. Vertical guardrail post mounted to metal structure:
 - a. Weld directly to HSS tubes installed in equipment platform.
 - b. Weld directly to steel channel stringer.
8. Guardrail gates:
 - a. Constructed of same material and sizes as the guardrail system.
 - b. Width of gate as shown on Drawings.
 - c. Hinges:
 - 1) Self-closing.
 - a) Stainless steel torsion spring.
 - 2) Similar to Wagner, Model "IR100."
 - d. Gate latch and stop:
 - 1) Spring-loaded pin latch.
 - a) Stainless steel spring.
 - 2) Similar to Wagner, Model "IR101."

C. Welded Railing Fabrication:

1. All welding shall be continuous in accordance with AWS D1.1.
 - a. All welded railing joints shall have full penetration welds.

2. All exposed welds shall be ground and buffed smooth and flush to match and blend with adjoining surfaces.
 - a. NAAMM AMP 521, Type 2.
 3. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted.
 4. Fit exposed ends of guardrails and handrails with solid terminations.
 - a. Return ends of handrails to wall but do not attach to wall.
 5. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly of units at project site.
- D. Install weeps to drain moisture from hollow sections of railing at exterior locations and in high humidity areas.
1. Drill 1/4 IN weep hole in railings closed at bottom:
 - a. 1 IN above walkway surface at bottom of posts.
 - 1) 1 IN above solid rod at removable railing sections.
 - b. At low point of intermediate rails.
 - c. Drill hole prior to galvanizing.
 - d. Do not drill weep holes:
 - 1) In bottom of base plate.
- E. Expansion Joints:
1. Joints to be designed shall allow expansion and contraction of railing and still meet design loads required.
 - a. Top rail splices and expansion joints shall be located within 8 IN of post or other support.
 - b. Where railings span expansion joints; provide a railing expansion joint in the span crossing the expansion joint.
 2. Provide expansion joints in any continuous run exceeding 20 FT in length.
 - a. Space expansion joints at not more than 40 FT on center.
 3. Provide minimum 0.10 IN of expansion joint for each 20 FT length of top rail for each 25 Deg F differential between installation temperature and maximum design temperature.
 - a. Maximum expansion joint width at time of installation shall not exceed 3/8 IN.

- 1) Provide additional expansion joints as required to limit expansion joint width.
4. Provide slip-joint with internal sleeve.
 - a. Extend slip joint min 2 IN beyond joint at maximum design width.
 - b. Fasten internal sleeve securely to one side
 - 1) Provide Allen-head set screw located in bottom of rail.
 - 2) Rivets or exposed screw heads are not acceptable.
- F. Finish:
1. Hot-dip galvanize after fabrication.
 2. Powder coated:
 - a. Hot-dip galvanize after fabrication.
 - b. Prepare galvanized surfaces in accordance with ASTM D6386.
 - c. PVDF powder coating:
 - 1) Minimum 70 percent resin content.
 - 2) Meet requirements of AAMA 2605.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to installation, inspect and verify condition of substrate.
- B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.

3.2 INSTALLATION

- A. Install handrails and guardrails to meet loading requirements of the Building Code.
- B. Install products in accordance with NAAMM AMP 521 and manufacturer's instructions.
- C. Set work accurately in location, alignment and elevation; plumb, level, and true.
 1. Measure from established lines and items which are to be built into concrete, masonry or similar construction.
- D. Align railings prior to securing in place to assure proper matching at butting and expansion joints and correct alignment throughout their length.
 1. Provide shims as required.

- E. Install proper sized expansion joints based on temperature at time of installation and differential coefficient of expansion of materials in all railings as recommended by manufacturer.
 - 1. Lubricate expansion joint splice bar for smooth movement of railing sections.
- F. Provide removable railing sections where indicated on Drawings.
- G. Attach handrails to walls or guardrails with brackets designed for condition.
 - 1. Provide brackets which provide a minimum 1-1/2 IN clearance between handrail and nearest obstruction.
 - a. Handrails shall not project more than 4-1/2 IN into required stairway width.
 - 2. Anchor handrail brackets to concrete or masonry walls with 1/2 IN stainless steel adhesive anchors and stainless steel hex head bolts.
- H. Anchor railings to concrete with minimum 1/2 IN stainless steel adhesive anchors with stainless steel bolts, nuts and washers unless noted otherwise in the Contract documents.
 - 1. Where exposed, bolts shall extend minimum 1/2 IN and maximum 3/4 IN above the top nut.
 - a. If bolts are cut off to required height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nut.
 - b. Bevel the top of the bolt after cutting to provide a smooth surface.
- I. Anchor railings to metal structure with minimum 3/4 IN stainless steel bolts, nuts and washers.
- J. Install toeboards to fit tight to the walking surface.
 - 1. Attach to railing vertical post with manufacturer's standard mounting clamp:
 - a. Adjustable.
 - b. Designed to engage in extruded slot on back of toeboard.
 - 2. Provide splice bars, corner splices and brackets:
 - a. Manufacturer's standard items as required for a complete installation.
 - 3. Notch toeboards at base plates or other obstructions.
 - 4. Bottom of toeboard shall not exceed 1/4 IN above walking surface.
- K. Repair damaged galvanized surfaces in accordance with ASTM A780.

1. Properly prepare surface in accordance with galvanizing repair paint manufacturer's recommendations.
 2. Apply minimum 6 mils DFT of galvanizing repair paint in accordance with manufacturer's recommendations.
- L. Prepare and paint railings in accordance with Specification Section 09 96 00.
- M. Provide railings as required for stair construction identified in Specification Section 05 50 00.
- N. Install guardrail gate plumb and level in location shown on Drawings.
1. Center gate in opening.
 2. Top of gate shall match top of guardrail.
 3. Fasten hinges to gate and jamb post:
 - a. Minimum three (3) 1/4 IN stainless steel countersunk machine screws per leaf.
 - b. Drill and tap into railing and gate vertical posts.
 4. Provide not less than two (2) hinges per gate.
 5. Install gate latch and stop on strike side of opening.
 - a. Fasten to gate with 1/4 IN stainless steel countersunk machine screws.
 - b. Drill and tap into gate vertical post.
 - c. Drill hole in railing vertical post to receive latch pin.
 6. Adjust to provide smooth operation:
 - a. Self-closing and self-latching.

END OF SECTION

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DIVISION 06

WOOD, PLASTICS, AND COMPOSITES



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SECTION 06 82 00
FIBERGLASS REINFORCED PLASTIC FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fiberglass reinforced plastic (FRP) fabrications including but not limited to:
 - a. Solid plate.
 - b. Railings.
 - c. Grating.
 - d. Stairs.
 - e. Ladders.
 - f. Structural members.
 - g. Supporting structure design.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American National Standards Institute (ANSI):
 - a. A14.3, Ladders - Fixed - Safety Requirements.
2. ASTM International (ASTM):
 - a. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
3. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

4. Building code:
 - a. International Code Council (ICC):
 - 1) International Building Code and associated standards, 2012 Edition, including all amendments, referred to herein as Building Code.

1.3 DEFINITIONS

- A. Skid-resistant:
 1. Manufacturer's standard applied abrasive grit coating.
 2. Abrasive coated tape is not acceptable.
- B. FRP: Fiberglass Reinforced Plastic.
- C. Guardrail: A system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.
- D. Handrail: A railing provided for grasping with the hand for support.
- E. Railing: A generic term referring to guardrail, handrail and/or stair rails.
- F. Stair Rail: A guardrail, installed at the open side of stairways with either a handrail mounted to the inside face of the guardrail, or where allowed by applicable codes, with the top rail mounted at handrail height and serving the function of a handrail.

1.4 SYSTEM DESCRIPTION

- A. All fiberglass reinforced plastic support systems shall be designed by a registered professional structural engineer licensed in the State of Alaska.

1.5 SUBMITTALS

- A. Shop Drawings:
 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Manufacturer's recommendations on reinforcing field cut openings.

3. Fabrication and/or layout drawings.
 - a. Plan showing profile, location, section and details of each item including anchorage or support system(s).
 - b. Locations and type of expansion joints.
 - c. Materials of construction including shop applied coatings.
 - d. Listing of all accessory items being provided indicating material, finish, etc.
 4. Certifications:
 - a. Certification of Structural Engineer's qualifications.
 - b. Certification that all components and systems have been designed and fabricated to meet the loading requirements specified.
 5. Manufacturer's full line of colors available for each component.
- B. Informational Submittals:
1. Complete design calculations of all supporting structure and fastening conditions.
 - a. Design calculations to be for information only.
 - b. Engineer will not review or take any action on submittal.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and handle each item to preclude damage.
- B. Store all items on skids above ground.
 1. Keep free of dirt and other foreign matter which will damage items or finish and protect from corrosion and UV exposure.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Railings:
 - a. AICKIN.
 - b. American Grating.
 - c. Enduro Composite Systems.

- d. Fibergrate Composite Structures, Inc.
 - e. IKG Industries.
 - f. International Grating Inc.
 - g. Seasafe, Inc.
 - h. Strongwell.
2. Grating and solid plate:
- a. American Grating.
 - b. Enduro Composite Systems.
 - c. Fibergrate Composite Structures, Inc.
 - d. IKG Industries.
 - e. International Grating Inc.
 - f. Seasafe, Inc.
 - g. Strongwell.
3. Stairs:
- a. American Grating.
 - b. Enduro Composite Systems.
 - c. Fibergrate Composite Structures, Inc.
 - d. IKG Industries.
 - e. Seasafe, Inc.
 - f. Strongwell.
4. Ladders:
- a. American Grating.
 - b. Enduro Composite Systems.
 - c. Fibergrate Composite Structures, Inc.
 - d. IKG Industries.
 - e. Seasafe, Inc.
 - f. Strongwell.

5. Structural shapes:
 - a. American Grating.
 - b. Enduro Composite Systems.
 - c. Fibergrate Composite Structures, Inc.
 - d. Strongwell.
6. Modular framing system:
 - a. AICKIN.
 - b. Enduro Composite Systems.
 - c. Seasafe, Inc.
 - d. Unistrut.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Fiberglass Reinforced Plastic (FRP):

1. Vinyl ester with fiberglass reinforcing.
 - a. Type V.
2. Fire retardant.
 - a. Flame spread: ASTM E84, 10 or less.
3. Color: To be selected by Engineer when more than one (1) color is available for any one (1) component.

B. Fasteners, Clips, Saddles, and Miscellaneous Components:

1. Fiberglass where possible.
2. Stainless steel may be used if fiberglass component is not available.

C. Adhesive: Recommended by manufacturer.

D. Skid-resistant Surfacing: Manufacturer-applied abrasive grit coating.

2.3 FABRICATION

A. General:

1. Verify field conditions and dimensions prior to fabrication.
2. Preassemble items in shop to greatest extent possible.
3. All components shall be treated with UV inhibitor.
4. Drill or punch holes with smooth edges.

B. Railings:

1. Custom fabricate handrail and guardrail to profiles and dimensions indicated on Drawings.
2. Where not indicated on Drawings, set intermediate horizontal rails to requirements of Building Code.
3. Minimum 2 IN SQ x 0.187 IN tube.
4. Kickplate:
 - a. 4 x 1/2 IN (corrugated) x 0.125 IN thick.
 - b. Provide at all elevated platforms and where required by OSHA Standards.
5. Provide handrail supports at 4 FT maximum spacing for wall brackets and 4 FT maximum spacing for posts.
 - a. Provide vertical supports at 4 FT maximum spacing on all inclined rail sections.
 - b. Provide brackets which provide a 1-1/2 IN projection from finish wall surface or guardrail to wall or guardrail side of rail.
 - c. Handrails shall not project more than 4-1/2 IN into required stairway width.
6. Fit exposed ends of guardrails and handrails with solid terminations.
 - a. Return ends of handrail to wall but do not attach end to wall.
 - b. Where guardrail terminates at a wall or other obstruction, provide a vertical support post located 4 IN off wall or obstruction to center of post.
7. Design railings to resist loading as required by the Building Code.

8. Form connections with flush, smooth, hairline joints.
 - a. Provide concealed splice fitting at all connections.
 - b. Top rail splices and expansion joints shall be located within 8 IN of support.
9. Fabricate items free of blemishes, seam marks, roller marks, rolled trade names and roughness.
10. Provide removable railing where indicated.
11. Provide weeps to drain moisture from hollow railing sections at exterior and in high humidity areas.
 - a. 1/4 IN weep hole in railing 1 IN above walkway surface at bottom of posts set in concrete or otherwise closed at bottom, and at other low points where moisture can collect.

C. Grating and Solid Plate Material:

1. Design live load:
 - a. 100 psf uniform live load.
 - b. 300 LBS concentrated load.
 - c. Maximum deflection of $l/300$ of span under a superimposed live load.
 - d. Design for the most severe loading condition noted above.
2. Minimum grating depth: 1-1/2 IN.
3. Bar span: Maximum of 1-1/2 IN center to center.
4. Walking surface: Manufacturer's standard applied abrasive grit coating.

D. Embedded Grating Supports:

1. Fiberglass.
2. Size to suit depth of grating.
3. Provide leg or strap for embedding and anchoring into concrete.
4. Similar to Strongwell "Duradek Fiberglass Curb Angle."

E. Stairs:

1. Fabricated to profiles indicated.
2. Treads: Grating with integral 1 IN skid-resistant nosing.
 - a. Provide center reinforcing for treads over 36 IN wide.

3. Risers:
 - a. Solid plate material to match treads.
 - b. Provide center vertical reinforcing for risers over 36 IN wide.
4. Landings:
 - a. Grating with manufacturer's standard applied skid-resistant abrasive grit coating.
 - 1) Provide skid-resistant nosing on leading edge of stairs.
 - b. Provide intermediate support as required to meet loading requirements.
5. Design and fabricate stair, platforms and landings, and all connections to support a 100 psf uniform live load plus a 300 psf concentrated load.
6. Provide railing per this Specification Section.

F. Ladders:

1. Design in accordance with ANSI A14.3, OSHA Standards and Building Code requirements unless noted otherwise below.
2. Ladders shall be designed to support a minimum 300 LB concentrated vertical load with 150 LB concentrated horizontal load without failure or permanent set.
 - a. Maximum lateral deflection: Side rail span/300.
3. Rungs:
 - a. 1 IN square or diameter solid bar with skid-resistant surface on all sides.
 - b. Uniform maximum spacing of 12 IN.
 - c. Top rung level with top of platform.
 - d. Rungs shall not extend beyond the outside face of the ladder side rail.
4. Rails:
 - a. 2 IN SQ tube, minimum 0.156 IN thick.
 - b. Provide minimum 1/2 x 2-1/2 IN x length required standoff brackets on each side rail with punched holes for 3/4 IN anchors.
 - 1) Maximum vertical spacing: 5 FT OC.
 - c. The side rails of through ladder extensions shall extend 42 IN above the top rung or landing and shall flare out on each side to provide a clearance of 24 IN between the rails.

5. Minimum distance from centerline of rungs to wall or obstruction shall be 7 IN.

G. Modular Framing System:

1. Material: Heavy duty pultruded.
2. Shapes as required for condition.
3. Fasteners: Stainless steel or fiberglass.
4. Provide end caps for all exposed terminations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Set work accurately in location, alignment and elevation, plumb, level, and true.
 1. Measure from established lines and levels.
 2. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
 3. Tolerances:
 - a. Maximum variation from plumb in vertical line: 1/8 IN in 3 FT.
 - b. Maximum variation from level of horizontal line: 1/4 IN in 20 FT.
 - c. Maximum variation from plan location: 1/4 IN in 20 FT.
- C. Railings:
 1. Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length.
 - a. Plumb posts in each direction.
 2. Provide posts with floor flange, attached to post and with predrilled holes for bolting to stringer, floor or beam.
 3. Anchor handrails to walls or guardrails with brackets designed for condition.
 - a. For concrete anchorage, use stainless steel adhesive anchors with stainless steel bolts with hex nuts.
 - b. Anchor size and embedment to be designed by component fabricator.
 - 1) Provide minimum of 1/2 IN anchor bolts.

- D. Coat all exposed surfaces of stainless steel fasteners with minimum 15 mil gel coating to match component being anchored.
- E. Fasten railings to beams and stair stringers with stainless steel bolts, nuts and washers.
 - 1. Provide two washers for each bolt.
- F. Attach grating to each end and intermediate support clip or saddle with bolts, nuts and washers.
 - 1. Maximum spacing: 2 FT OC with minimum of two (2) per side.
 - 2. Attach clips or saddles to bearing bars only.
 - 3. Reinforce all field cut openings in accordance with manufacturer's recommendations.
- G. Attach stair treads at ends to stair stringer with hold-down clips, bolts, nuts, and washers.
 - 1. Minimum two clips per end.
- H. File cut ends of all fiberglass to a 1/32 IN radius.
- I. Seal cut ends of all items with catalyzed resin as recommended by manufacturer.
 - 1. Provide same resin used in fabrication of item as a minimum.
- J. Provide all modular framing components as required to suit condition.
 - 1. Install in accordance with manufacturer's recommendations.

END OF SECTION



DIVISION 07

THERMAL AND MOISTURE PROTECTION



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SECTION 07 14 00
FLUID APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fluid applied waterproofing.
2. Protection course.
3. Specific concrete finishing requirements.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Division 03 - Concrete.
4. Section 07 21 00 - Building Insulation.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. C836, Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
 - b. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
2. International Concrete Repair Institute (ICRI):
 - a. 310.2, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
3. The Society for Protective Coatings/NACE International (SSPC/NACE):
 - a. SP 6/NACE No. 3, Commercial Blast Cleaning.
 - b. SP 13/NACE No. 6, Surface Preparation of Concrete.

B. Qualifications:

1. Applicator(s) licensed or approved in writing by manufacturer.
2. Applicator(s) shall have minimum of 7 years' experience in application of cold liquid-applied elastomeric waterproofing membranes with minimum of 2 years installation of products specified or accepted for use on this Project.
 - a. Provide list of projects completed in last 2 years using products proposed for use.
 - 1) Include name of structure, area waterproofed (SF) and name of contact with phone number.

C. Miscellaneous:

1. Manufacturer's authorized representative shall review substrate preparation and provide written approval of substrate prior to installation of product.

1.3 DEFINITIONS

A. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Details showing flashing of penetrations, terminations, expansion joints, protection course attachment and other special conditions.
3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
4. Certification of Applicator qualifications.
5. Applicator's experience record.
6. Listing of projects completed in last two (2) years.

B. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Manufacturer's written approval of substrate.
3. Warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Waterproofing system:
 - a. Tremco Sealants and Waterproofing.
 - b. Carlisle Coatings and Waterproofing.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Primer: Manufacturer's recommended primer appropriate to substrate.

B. Waterproofing System:

1. One or two component, moisture curing polyurethane elastomer meeting requirements of ASTM C836.
2. Flowing type for surfaces up to 5 percent slope.
3. Non-flow type for surfaces exceeding 5 percent.
4. Carlisle "Liquiseal CCW-525" or Tremco "TREMproof 201/60."

C. Adhesive: Manufacturer's standard.

D. Flashing Reinforcement: Woven uncoated fiberglass mesh.

E. Sealant: Manufacturer's recommended sealant.

F. Protection Course:

1. Material capable of protecting cured membrane from damage caused by rocks and other debris in the backfill material.
2. Acceptable to waterproofing manufacturer.

G. Backer Rod: Closed cell polyurethane foam rod.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cure concrete and masonry in accordance with manufacturer's recommendations.
 - 1. Verify moisture content does not exceed manufacturer's maximum allowable.
 - 2. Ensure that curing agents used are compatible with coating system.
- B. Remove surface contamination by high pressure water cleaning per ASTM D4258.
- C. Verify that concrete has been troweled and broomed, free of fins, ridges or voids.
 - 1. Verify that all tie holes and honeycomb areas, holes and voids have been patched in accordance with Specification Section 03 35 00 and coating manufacturer's recommendations.
- D. Prepare substrate per manufacturer's published instructions and this Specification Section.
 - 1. Concrete surfaces:
 - a. Abrasive blast in accordance with SSPC SP 13/NACE No. 6 to provide a profiled surface.
 - 1) Profile: ICRI 310.2, CSP 3 minimum.
 - 2. Metal surfaces:
 - a. Abrasive blast in accordance with SSPC SP 6/NACE No. 3.
 - 1) Minimum one (1) mil surface profile.
 - b. Prime coat all metal surfaces.
 - 3. Flash all penetrations and other areas in accordance with manufacturer's instructions.
 - 4. Clean and seal cracks and joints in accordance with manufacturer's instructions.
- E. Protect adjacent surfaces.

3.2 APPLICATION AND INSTALLATION

- A. Apply waterproofing system in accordance with manufacturer's printed instructions and this Specification Section.
 - 1. Provide minimum 60 mil dry film thickness.
 - 2. Apply waterproofing to the exterior side of vertical concrete wall surfaces (surfaces against earth) where finished interior building space occurs on the opposite side of the wall and where indicated on the Drawings.
 - a. Terminate top of waterproofing in accordance with manufacturer's instructions approximately 4 IN below finished grade unless shown otherwise on Drawings.
- B. Extend coating over all previously flashed areas.
- C. Allow vertical applications to cure minimum of 12 HRS at 75 DegF or as recommended by manufacturer, prior to backfilling.
- D. Protection Course:
 - 1. Protection course is to be installed prior to any perimeter insulation specified in Specification Section 07 21 00.
 - a. Secure protection course to prevent displacement during backfilling.
 - 1) Adhere to cured waterproofing membrane.
 - 2) Mechanical fasteners are not acceptable.

END OF SECTION

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SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building insulation.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 09 29 00 - Gypsum Board.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. C272, Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
 - b. C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - c. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - d. C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - e. C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - f. D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - g. E96, Standard Test Methods for Water Vapor Transmission of Materials.
2. Underwriters Laboratories, Inc. (UL):
 - a. Building Materials Directory.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Manufacturer's recommendations on sealants, tapes and mastics.

B. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Certification from insulation manufacturer stating that insulation proposed is acceptable for intended use per the Drawings.

1.4 SITE CONDITIONS

- #### **A.**
- For purposes of this Specification Section, design frost line for this Project is less than the depth of the foundation footing. Perimeter foundation wall insulation shall match depth of foundation footing.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- #### **A.**
- Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Rigid extruded polystyrene board insulation:
 - a. Dow.
 - b. Diversifoam Products.
 - c. Owens Corning.
 2. Blanket or batt thermal insulation:
 - a. Owens-Corning Fiberglass Corp.
 - b. United States Gypsum Company (USG).
 - c. CertainTeed.

3. Sound control insulation:

- a. Roxul.
- b. Thermafiber.

4. Vapor retarder:

- a. Raven Industries.
- b. Reef Industries.
- c. Fortifiber Corp.
- d. Alumiseal.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Rigid Polystyrene Board Insulation:

1. Extruded: ASTM C578, Type IV.

- a. Water vapor transmission: ASTM E96, 1.1 perm-IN maximum.
- b. Water absorption: ASTM C272, 0.3 percent maximum.
- c. Thermal resistance: ASTM C518 at 75 DegF mean temperature, 5.0/IN.

2. Provide insulation designed for intended use.

a. Perimeter insulation and protection board.

- 1) Similar to Dow "Styrofoam PERIMATE."
- 2) Compressive strength: ASTM D1621, 30 psi.
- 3) Thickness:
 - a) Perimeter insulation: 2 IN.
 - b) Protection board: 1 IN.
- 4) Edges:
 - a) Long edge: Shiplap.
 - b) Short edge: Square.

b. Cavity insulation:

- 1) Similar to Dow "CAVITYMATE."
- 2) Compressive strength: ASTM D1621, 15 psi.
- 3) Thickness: 2 IN.

- 4) Edges: Square.
- B. Sealant and Mastic (for setting polystyrene and/or polyisocyanurate insulation board): Manufacturer's recommended standard.
- C. Blanket or Batt Thermal Insulation:
 - 1. Glass or other inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets.
 - 2. Unfaced:
 - a. ASTM C665, Type 1.
 - 3. Minimum thickness as noted on Drawings.
- D. Vapor Retarder:
 - 1. Fire rated, reinforced, 3 ply, Class 1 material.
 - 2. Perm rating: Not exceeding 0.035 grains/HR-FT²-IN-Hg when determined in accordance with ASTM E96.
 - 3. Griffolyn "TX-1200FR."
- E. Vapor Retarder Tape: As recommended by vapor retarder manufacturer.
- F. Sound Control Insulation:
 - 1. Mineral wool batts.
 - a. ASTM C665, Type I.
 - b. UL listed when used in fire rated construction.
 - 2. Density: Minimum 2.5 pcf.
 - 3. Sound Reduction, ASTM C423.
 - a. Minimum NRC for 3 IN thick material: 1.05.
 - 4. Thickness: As noted on Drawings.
 - 5. Thermafiber "SAFB".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. General:
 - 1. Insulate full thickness over surfaces to be insulated.
 - 2. Fit tightly around obstructions, fill voids.
 - 3. Cover all penetrations (electrical junction boxes, switch boxes, piping, conduits, etc.) with insulation, taking care not to compromise the workings of the device.
 - 4. Fit butted joints of batt or blanket insulations tightly together.
 - 5. Apply single or double layer to achieve total thickness.
 - a. If double layer is provided, stagger all joints minimum 12 IN.
 - 6. Do not use broken or torn pieces of insulation.
 - 7. Install so that completed installation is vapor tight.
 - a. Seal all joints.
 - b. Seal to abutting materials to maintain vapor retarder integrity.
 - c. Provide manufacturer's recommended vapor retarder tape for use with faced batt insulation or separate vapor retarder.
 - 1) If vapor retarder tape fails to adhere to any surface, apply sprayed-on adhesive as recommended by tape manufacturer to promote adhesion.
 - d. Provide manufacturer's recommended solvent-free sealant compatible with insulation board for rigid board insulation.
 - 1) Tape is not acceptable for use with rigid board insulation.
- C. Blanket or Batt Insulation using Separate Vapor Retarder Sheet in Exterior Stud Wall Systems:
 - 1. Verify that all piping, conduit, electrical box and other in-wall work is complete prior to installing insulation and vapor retarder.
 - 2. Install insulation friction fit between studs.
 - 3. Tightly butt ends.
 - 4. Install vapor retarder to warm side of building exterior wall.
 - a. Completely seal each wall area to surrounding construction.

5. Install vapor retarder vertically.
 - a. Use widest practical sheet.
 - b. Install in continuous sheets, floor to structure above, without horizontal joints.
 - c. Fold flaps of vapor retarder over studs.
 - d. Tape flaps together continuously.
 - e. Tape bottom and top edges to structure continuously.
 - f. After installation of any additional conduit, boxes, piping or other items within wall system, repair all tears or penetrations of vapor retarder with vapor retarder tape prior to installation of gypsum board.

D. Rigid Board Insulation in Cavity Walls:

1. Do not proceed with installation until subsequent work which conceals insulation is ready to be performed.
2. Set each piece of insulation flush with the abutting piece to eliminate ledges in the face of the insulation.
3. Install mastic on face of concrete or masonry back-up in accordance with mastic and insulation manufacturer's recommendation.
4. Press courses of insulation between wall ties (horizontal reinforcing) with edges butted tightly both ways.
5. Set units firmly into mastic.
6. Seal all horizontal and vertical joints with sealant recommended by insulation manufacturer.
7. Do not use damaged insulation.

E. Rigid Insulation at Perimeter Below Grade and Under Slab:

1. Install insulation below grade on outside face of foundation walls.
 - a. Install in mastic with tight joints.
2. Where footings are located below the design frost line, extend insulation down to the design frost line.
 - a. Where indicated on the Drawings, extend beyond the design frost line.
3. Where footings are located at the design frost line, extend insulation down to top of footing or as indicated on Drawings.

4. Protect insulation from damage and/or displacement during backfilling {and/or pouring of floor slab}.

F. Sound Control Insulation:

1. Install friction fit between studs.
2. Do not obstruct ventilation spaces.
3. Fill all miscellaneous voids unless noted otherwise on Drawings.
4. After installation of conduit, boxes, piping or other items within wall system, reposition displaced insulation and fill all voids.

3.2 FIELD QUALITY CONTROL

- A. Repair or replace damaged insulation and/or vapor retarder as directed by Engineer.

END OF SECTION

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SECTION 07 26 00
UNDER SLAB VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Application:

1. Entire concrete floor slab under climate controlled rooms shall have underslab vapor barrier on winter warm side of insulation.

B. Section Includes:

1. Under slab vapor retarder.

C. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. 302.2R, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
2. ASTM International (ASTM):
 - a. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - b. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
 - c. E96, Standard Test Methods for Water Vapor Transmission of Materials.
 - d. E1643, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - e. E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Product data sheet on vapor retarder sheet and vapor retarder tape.
 - c. All accessories proposed for use.
 - d. Manufacturer's installation instructions.

B. Samples:

1. Provide two 6 IN x 6 IN samples of vapor retarder material taped together using the vapor retarder tape proposed.
2. Provide two samples of all accessories proposed for use.

C. Informational Submittals: Manufacturer's recommendation on vapor retarder tape.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Vapor retarder:
 - a. Fortifiber Corporation.
 - b. Layfield Group
 - c. Raven Industries.
 - d. Reef Industries.
 - e. Stego Industries.
 - f. WR Meadows, Inc.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 PERFORMANCE REQUIREMENTS

- A. Vapor Retarder:
 - 1. ASTM E1745, Class A.
 - 2. Thickness: Minimum 15 mil.
 - 3. Water vapor permeance: 0.01 maximum per ASTM E96.
 - 4. Puncture resistance: ASTM D1709, Method B, 2200 grams.
 - 5. Minimum tensile strength: 45 LBS/IN, ASTM D882.

2.3 ACCESSORIES

- A. Pipe Boots: Manufacturer's standard boot fabricated to maintain the integrity of the vapor retarder system.
- B. Vapor Retarder Tape: As recommended by vapor retarder manufacturers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions, ASTM E1643 and ACI 302.2R.
- B. Provide vapor retarder where indicated on the Drawings.
 - 1. Place continuous vapor retarder above granular fill subgrade material, unless noted otherwise.
- C. Lap minimum 6 IN and seal in accordance with ASTM E1643 and manufacturer's recommendations.
- D. Extend to extremities of area and seal to adjacent elements.
- E. Seal all penetrations: Provide pipe boot for all pipes or conduit penetrating the floor slab.

3.2 FIELD QUALITY CONTROL

- A. Ensure proper precautions are implemented to prevent damage to installed vapor retarder membrane prior to and during pouring of concrete floor slab.
- B. Inspect vapor retarder immediately prior to placement of concrete.
 - 1. Patch all punctures, tears, holes, etc.
 - a. Repair with additional layer of vapor retarder and seal entire patch with vapor retarder tape or as recommended by manufacturer.

- b. Lap all repairs minimum 6 IN.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sealing all joints which will permit penetration of dust, air or moisture.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. 302.1R, Guide for Concrete Floor and Slab Construction.
2. ASTM International (ASTM):
 - a. C834, Standard Specification for Latex Sealants.
 - b. C920, Standard Specification for Elastomeric Joint Sealants.
 - c. C1521, Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
3. NSF International (NSF):
 - a. 61, Drinking Water System Components -- Health Effects.
4. Underwriters Laboratories, Inc. (UL).

- B. Qualifications: Sealant applicator shall have minimum five (5) years experience using products specified on projects with similar scope.

C. Mock-Ups:

1. Before sealant work is started, a mock-up of each type of joint shall be sealed where directed by the Engineer.
 - a. The approved mock-ups shall show the workmanship, bond, and color of sealant materials as specified or selected for the work and shall be the minimum standard of quality on the entire project.

1.3 DEFINITIONS

- A. Defect(ive): Failure of watertightness or airtightness.
- B. Finish sealant: Sealant material per this specification applied over face of compressible sealant or expanding foam sealant specified, to provide a finished, colored sealant joint.
- C. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 2. Installer and applicator are synonymous.
- D. "Seal," "sealing" and "sealant": Joint sealant work.

1.4 SUBMITTALS

- A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Manufacturer's recommendations for joint cleaner, primer, backer rod, tooling and bond breaker.
 3. Certification from sealant manufacturer stating product being used is recommended for and is best suited for joint in which it is being applied.
 4. Certification of applicator qualification.

B. Test Results:

1. Provide adhesion test results for each sealant sample including adhesion results compared to adhesion requirements.
2. Manufacturer's authorized factory representative recommended remedial measures for all failing tests.

C. Samples:

1. Cured sample of each color for Engineer's color selection.
2. Color chart not acceptable.

D. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material in manufacturer's original unopened containers with labels intact: Labels shall indicate contents and expiration date on material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Acoustical sealant:
 - a. Pecora.
 - b. BASF.
 - c. Tremco.
 2. Compressible sealant:
 - a. Polytite Manufacturing Corporation.
 - b. Emseal.
 - c. Norton.
 - d. Sandell.

3. Expanding foam sealant:
 - a. Macklanburg Duncan.
 - b. Convenience Products.
 - c. FAI International, Inc.
4. Polyether sealants:
 - a. BASF.
 - b. ChemLink, Inc.
 - c. Tremco.
5. Polysulfide rubber sealant:
 - a. Pecora.
 - b. BASF.
 - c. PolySpec.
6. Polyurea joint filler:
 - a. Dayton Superior Specialty Chemical Corporation.
 - b. Euclid Chemical Co.
 - c. L&M Construction Chemicals, Inc.
 - d. BASF.
7. Polyurethane sealants:
 - a. Pecora.
 - b. Sika Chemical Corp.
 - c. BASF.
 - d. Tremco.
8. Silicone sealants:
 - a. ChemLink.
 - b. GE Construction Sealants.
 - c. Dow Corning.
 - d. Tremco.

9. Backer rod, compressible filler, primer, joint cleaners, bond breaker: As recommended by sealant manufacturer.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Sealants - General:

1. Provide colors matching materials being sealed.
2. Where compound is not exposed to view in finished work, provide manufacturer's color which has best performance.
3. Nonsagging sealant for vertical and overhead horizontal joints.
4. Sealants for horizontal joints: Self-leveling pedestrian/traffic grade.
5. Joint cleaner, primer, bond breaker: As recommended by sealant manufacturer.
6. Sealant backer rod and/or compressible filler:
 - a. Closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, nonabsorbent, non-bituminous material recommended by sealant manufacturer to:
 - 1) Control joint depth.
 - 2) Break bond of sealant at bottom of joint.
 - 3) Provide proper shape of sealant bead.
 - 4) Serve as expansion joint filler.

B. Acoustical sealant:

1. One (1) component siliconized acrylic latex.
2. Nonstaining, nonbleeding.
3. Compatible with paints specified for adjoining materials.
 - a. See Specification Section 09 96 00.
4. Meet ASTM C834.
 - a. Pecora - AC20+.
 - b. Tremco - Tremflex 834.

C. Compressible Sealant:

1. Foamed polyurethane strip saturated with polymerized polybutylene waterproofing coated on front face with nonreactive release agent that will act as bond breaker for applied sealant.
 - a. Polytite Manufacturing Corp. "Polytite-B."
2. Fire rated where required.
3. Adhesive: As recommended by sealant manufacturer.

D. Expanding Foam Sealant:

1. One or two component fire rated moisture cured expanding urethane.
2. Shall not contain formaldehyde.
3. Density: Minimum 1.5 pcf.
4. Closed cell content: Minimum 70 percent.
5. R-value: Minimum 5.0/IN.
6. Flame spread: Less than 25.
7. Smoke developed: Less than 25.

E. Polyether Sealant:

1. Silyl-terminated polyether polymer.
2. ASTM C920, Type S, Grade NS, Class 50, Use NT, M, A, and O.
 - a. BASF MasterSeal 150.
 - b. ChemLink DuraLink.
 - c. Tremco Dymonic FC

F. Polysulfide Rubber Sealant:

1. One or two component.
2. Meet ASTM C920.
 - a. Pecora Synthacalk GC2+.
 - b. PolySpec THIOKOL 2235.

G. Polyurea Joint Filler:

1. Two component, semi-rigid material for filling formed or saw-cut control joints in interior concrete slabs.
 - a. Dayton Superior Specialty Chemical Corp. "Joint Fill, Joint Seal, Joint Saver II" as required for condition and recommended by manufacturer.
 - b. Euclid Chemical Co. "EUCO QWIK" joint.
 - c. L&M Construction Chemicals, Inc. "Joint Tite 750".
 - d. BASF MasterSeal "CR100" control joint filler.
2. Comply with ACI 302.1R performance recommendations regarding control and construction joints.
3. Color: Gray.

H. Polyurethane Sealant:

1. One or two components.
2. Paintable.
3. Meet ASTM C920 Type S or Type M, Grade NS or P, Class 25, Use NT, T, M, A and O.
 - a. Pecora Dynatrol-IXL, Dynatrol II, Urexpan NR-200, NR-201.
 - b. Sika Chemical Corporation Sikaflex-1a, Sikaflex-2C NS/SL.
 - c. BASF MasterSeal NP-1, NP-II, SL-1 SL-2.
 - d. Tremco Dymonic or Dymeric, Vulkem 116,227,45,245.

I. Silicone Sealant:

1. One component.
2. Meet ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, O.
 - a. ChemLink: DuraSil.
 - b. General Electric: Silpruf, Silglaze II.
 - c. General Electric: Sanitary 1700 sealant for sealing around plumbing fixtures.
 - d. Dow Corning: 786 for sealing around plumbing fixtures.
 - e. Dow Corning: 7565, 790, 791, 795.
 - f. Tremco: Spectrem 1, Spectrem 3, Tremsil 600.

3. Mildew resistant for sealing around plumbing fixtures.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before use of any sealant, investigate its compatibility with joint surfaces, fillers and other materials in joint system.
- B. Use only compatible materials.
- C. Where required by manufacturer, prime joint surfaces.
 1. Limit application to surfaces to receive sealant.
 2. Mask off adjacent surfaces.
- D. Provide joint depth for joints receiving polyurea joint filler in accordance with manufacturer's recommendations.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and UL requirements.
- B. Clean all joints.
- C. Make all joints water and airtight.
- D. At changes in direction of joints, joint intersections and where sealant joints interface with other construction, install continuous sealant as necessary to ensure a weather-tight seal.
- E. Make depth of sealing compounds, except expanding foam and polyurea sealant, not more than one-half width of joint, but in no case less than 1/4 IN nor more than 1/2 IN unless recommended otherwise by the manufacturer.
- F. Provide correctly sized backer rod, compressible filler or compressible sealant in all joints to depth recommended by manufacturer:
 1. Take care to not puncture backer rod and compressible filler.
 2. Provide joint backer rod as recommended by the manufacturer for polyurea joint filler.
- G. Apply bond breaker where required.
- H. Tool sealants using sufficient pressure to fill all voids.
- I. Upon completion, leave sealant with smooth, even, neat finish.
- J. Where piping, conduit, ductwork, etc., penetrate wall, seal each side of wall opening.

- K. Install compressible sealant to position at indicated depth.
 - 1. Size so that width of material is twice joint width.
 - 2. Take care to avoid contamination of sides of joint.
 - 3. Protect side walls of joint (to depth of finish sealant).
 - 4. Install with adhesive faces in contact with joint sides.
 - 5. Install finish sealant where indicated.

- L. Install expanding foam sealant to minimum 4 IN depth or thickness of wall being penetrated if less than 4 IN or as indicated on Drawings.
 - 1. Provide adequate fire rated backing material as required.
 - 2. Hold material back from exposed face of wall as necessary to allow for installation of backer rod and finish sealant.
 - a. Allow expanding foam sealant to completely cure prior to installing backer rod and finish sealant.
 - 3. Trim off excess material flush with surface of the wall if not providing finished sealant.

3.3 SEALANT WORK

A. General:

- 1. Work includes but is not limited to: Sealing all joints which will permit penetration of dust, air, or moisture.
- 2. Refer to SCHEDULE for materials to be used.

B. Concrete joints:

- 1. Flooring joints.
- 2. Isolation joints.
- 3. Joints between paving or sidewalks and building.
- 4. Construction, control and expansion joints.
- 5. Joints between precast roof units and between precast roof units and walls.
- 6. Joints between precast wall panels.
- 7. Precast panel bearing joints:
 - a. At panels bearing at or above grade, seal both sides of panel base joint.

- b. At panels bearing below grade:
 - 1) Seal exterior panel base joint prior to backfilling and/or placement of site paving.
 - 2) Provide compressible filler and sealant or backer rod and sealant as appropriate for interior slab condition.
- C. Masonry:
 - 1. Masonry control joints.
 - 2. Between masonry and other materials.
- D. Flashing, reglets and retainers.
- E. Exterior Insulation and Finish System joints.
- F. Penetrations of walls, floors and decks.
- G. Other joints where sealant, expanding foam sealant or compressible sealant is indicated.

3.4 FIELD QUALITY CONTROL

- A. Adhesion Testing:
 - 1. Perform adhesion tests in accordance with ASTM C1521 per the following criteria:
 - a. Water bearing structures: One test per every 1000 LF of joint sealed.
 - b. Exterior precast concrete wall panels: One test per every 2000 LF of joint sealed.
 - c. Building expansion joints: One test per every 500 LF of joint sealed.
 - d. All other type of joints except butt glazing joints: One test per every 3000 LF of joint sealed.
 - e. Manufacturer's authorized factory representative shall recommend, in writing, remedial measures for all failing tests.

3.5 SCHEDULE

- A. Furnish sealant as indicated for the following areas:
 - 1. Exterior areas:
 - a. Above grade: Polyether.
 - b. Below grade: Polyurethane.

2. Immersion:
 - a. Prolonged contact with or immersion in:
 - 1) Potable water:
 - a) Polysulfide.
 - b) NSF 61 approved.
 - 2) Nonpotable water, wastewater or sewage: Polysulfide.
3. Compressible sealant: Where indicated.
4. Exterior wall penetrations: Expanding urethane foam, with finish sealant.
 - a. Finish sealant:
 - 1) Exterior side:
 - a) Above grade: Polyether.
 - b) Below grade: Polyurethane.
 - 2) Interior side:
 - a) Noncorrosive area:
 - (1) Wet exposure: Polyether
 - (2) Dry exposure: Polyether unless noted otherwise.
5. Interior concrete slab formed or saw-cut control joints: Polyurea joint filler.

END OF SECTION

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DIVISION 08

OPENINGS



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SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Floor access doors.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Specification Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO).
 - 2. ASTM International (ASTM):
 - a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - b. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - c. A240, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - d. A480, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - e. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - f. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - g. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - h. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 DEFINITIONS

- A. Standard Duty: Will support live load of 150 psf.
- B. Heavy Duty: Will support live load of 300 psf.
- C. H-20 loading: As defined in AASHTO Guidelines.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.

- b. Manufacturer's installation instructions.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Floor access doors:
 - a. Bilco Company.
 - b. Babcock Davis Associates.
 - c. Dur-Red Products.
 - d. Halliday Products.
 - e. USF Fabrication Inc.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

- A. Aluminum:
 - 1. Sheet and Plate: ASTM B209.
 - 2. Extruded shapes: ASTM B221.
- B. Steel:
 - 1. Sheet Metal: G90 Galvanized, ASTM A653.
 - 2. Fabrications: Hot-Dip Galvanized, ASTM A123.
 - 3. Hardware: Hot-Dip Galvanized, ASTM A153.
- C. Stainless Steel: ASTM A240 or A666.

2.3 MANUFACTURED UNITS

- A. General:
 - 1. Acceptable products shall be subject to compliance with the Contract Documents and American Iron and Steel Act requirements.
 - 2. All access doors shall be provided by the same manufacturer when possible.
 - 3. Coat all aluminum components in contact with concrete or masonry with manufacturer's standard bituminous coating.
- B. Heavy Duty Floor Access Doors:
 - 1. Frame: 1/4 IN mill finish aluminum channel with anchor tabs.
 - a. 1-1/2 IN DIA drain coupling. Position drain as shown on the Drawings.
 - 2. Cover:
 - a. 1/4 IN mill finished diamond plate aluminum.
 - b. Reinforce cover with aluminum stiffeners.
 - 1) Live load: 300 psf.
 - 2) Deflection: Maximum 1/150 of span.

- c. Cover Insulation: Shall be 2" thick polyisocyanurate with an R-value of 12, fully covered and protected by an 18 gauge aluminum liner.
- 3. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" gusset support plate.
- 4. Hardware:
 - a. All hardware to be stainless steel.
 - b. Positive hold open arm that engages automatically when door reaches full 90 degree open position.
 - c. Slam lock and removable key handle.
- 5. Bilco Company, Type "J-AL" or "JD-AL."

C. Sizes: As shown on the Drawings.

2.4 ACCESSORIES

- A. Secondary Fall Protection System:
 - 1. Design and install system such that when in the open position, no part of the system obstructs the clear opening size listed in the SCHEDULES Article in PART 3 of this Specification Section.
 - 2. Platform: Design grating to meet OSHA 29 CFR 1910.23 requirements for protection for floor openings.
 - 3. Finish:
 - a. Powder coated.
 - b. Color: Safety Orange or Safety Yellow.
 - 4. Hardware:
 - a. Stainless steel Type 316.
 - b. Tamper proof Type 316 stainless steel bolts.
 - 5. Provide positive latch to hold grating in upright position.
 - 6. Size: Allow 6 IN clear space on each unhinged side for visual observation.
 - 7. Provide padlock hasp for Owner provided padlock.
 - 8. Double leaf openings:
 - a. Provide two (2) individual grating platforms hinged on the same side of the hatch frame but independent from one another.
 - 1) Provide each platform with a padlock hasp and positive latch to hold grating in upright position.
 - 9. Install secondary fall protection system at the factory.
- B. Load Rating Plates:
 - 1. Minimum 18 GA Type 316 stainless steel, ASTM A666.
 - 2. Engraved with maximum design live load allowed for unit on which it will be mounted.
 - 3. Display load in English units as well as metric units.
 - 4. Size as required for text as needed.
 - 5. Text:
 - a. Font: Helvetica Narrow, all caps.

- b. Size: 1/4 IN height.
- c. Depth of engraving: 3 mils.
- 6. Finish:
 - a. Text:
 - 1) Black epoxy baked on paint.
 - 2) Plate to have finish conducive to paint application.
 - b. Coat entire plate with baked on clear coat on front and back side.
- 7. Attach to top of all access doors using stainless steel screws in location determined by manufacturer.
 - a. Provide a neoprene gasket under the plate to separate the stainless steel from the aluminum cover or frame.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

END OF SECTION



DIVISION 09

FINISHES



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SECTION 09 96 00
HIGH PERFORMANCE INDUSTRIAL COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. High performance industrial coatings (HPIC).
2. Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Specification Section.
3. Minimum surface preparation requirements.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 01 61 03 - Equipment: Basic Requirements.
4. Section 01 74 13 - Cleaning.
5. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.
6. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC).
7. Division 26 - Electrical.
8. Division 40 - Process Interconnections.
9. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. D3359, Standard Test Methods for Measuring Adhesion by Tape Test.
 - b. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
 - c. D4259, Standard Practice for Abrading Concrete.

- d. D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
 - e. D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
 - f. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 - g. D4414, Standard Practice for Measurement of Wet Film Thickness by Notch Gages.
 - h. D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - i. D6677, Standard Test Method for Evaluating Adhesion by Knife.
 - j. D7091, Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
 - k. F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - l. F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
2. International Concrete Repair Institute (ICRI):
 - a. 310.2, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair
 3. National Association of Pipe Fabricators (NAPF):
 - a. 500-03, Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings:
 - 1) 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe.
 - 2) 500-03-05, Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
 4. NSF International (NSF).
 - a. 61, Drinking Water System Components - Health Effects.
 5. Steel Door Institute/American National Standards Institute (SDI/ANSI):
 - a. A250.10, Test Procedure and Acceptance Criteria For Prime Painted Steel Surfaces for Steel Doors and Frames.
 6. The Society for Protective Coatings (SSPC):
 - a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.

- b. SP 1, Solvent Cleaning.
 - c. SP 16, Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
7. The Society for Protective Coatings/NACE International (SSPC/NACE):
- a. SP 5/NACE No. 1, White Metal Blast Cleaning
 - b. SP 6/NACE No. 3, Commercial Blast Cleaning.
 - c. SP 7/NACE No. 4, Brush-off Blast Cleaning.
 - d. SP 10/NACE No. 2, Near-White Blast Cleaning.
 - e. SP 13/NACE No. 6, Surface Preparation of Concrete.

B. Qualifications:

- 1. Coating manufacturer's authorized representative shall provide written statement attesting that applicator has been instructed on proper preparation, mixing and application procedures for coatings specified.
- 2. Applicators shall have minimum of 10 years' experience in application of similar products on similar project.
 - a. Provide references for minimum of three different projects completed in last 5 years with similar scope of work.
 - b. Include name and address of project, size of project in value (painting) and contact person.

C. Miscellaneous:

- 1. Furnish coating through one manufacturer unless noted otherwise.

D. Deviation from specified mil thickness or product type is not allowed without written authorization of Engineer.

E. Material shall not be thinned unless approved, in writing, by coating manufacturer's authorized representative.

1.3 DEFINITIONS

A. Installer or Applicator:

- 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
- 2. Installer and applicator are synonymous.

- B. Approved Factory Finish: Finish on a product in compliance with the finish specified in the Specification Section where the product is specified or in Specification Section 01 61 03.
- C. Corrosive Environment:
1. Immersion in or subject to:
 - a. Condensation, spillage or splash of a corrosive material such as water, wastewater or chemical solution.
 - b. Exposure to corrosive caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions.
 - c. For purposes of this Specification Section, corrosive environments include:
 - 1) Exterior areas not otherwise identified as highly corrosive.
 - 2) Piping galleries.
 - 3) Surfaces within 2 FT of high water level.
 - 4) Chemicals storage and feed areas:
- D. Highly Corrosive Environment:
1. Immersion in or subject to:
 - a. Condensation, spillage or splash of a highly corrosive material such as wastewater, or chemical solution.
 - b. Exposure to highly corrosive caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions.
 - c. For purposes of this Specification Section, highly corrosive environments include:
 - a) Secondary Clarifiers.
- E. Holiday:
1. A void, crack, thin spot, foreign inclusion, or contamination in the coating film that significantly lowers the dielectric strength of the coating.
 2. May also be identified as a discontinuity or pinhole.
- F. Exposed Exterior Surface:
1. Exterior surface which is exposed to view.
 2. Exterior surface which is exposed to weather but not necessarily exposed to view.
- G. Finished Area: An area that is listed in or has finish called for on Room Finish Schedule or is indicated on Drawings to be coated.

H. Immersion Service:

1. Any surface immersed in water or some other liquid.
2. Surface of any pipe, valve, or any other component of the piping system subject to frequent wetting.
3. Surfaces within two feet above high water level in water bearing structures.

I. Surface Hidden from View:

1. Within pipe chases.
2. Between top side of ceilings and underside of floor or roof structures above.

J. HPIC: High performance industrial coatings.

1. Epoxies, urethanes, vinyl ester, waterborne vinyl acrylic emulsions, acrylates, silicones, alkyds, acrylic emulsions and any other coating listed as a HPIC.

K. Water level for purposes of coating: See Drawings.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Applicator experience qualifications.
 - a. No submittal information will be reviewed until Engineer has received and approved applicator qualifications.
3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's application instructions.
 - c. Manufacturer's surface preparation instructions.
 - d. If products being used are manufactured by Company other than listed in the MATERIALS Article of this Specification Section, provide complete individual data sheet comparison of proposed products with specified products including application procedure, coverage rates and verification that product is designed for intended use.
 - e. Contractor's written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.

- f. Coating manufacturer's recommendation on abrasive blasting.
 - g. Manufacturer's recommendation for universal barrier coat.
 - h. Manufacturer's recommendation for providing temporary or supplemental heat or dehumidification or other environmental control measures.
- 4. Manufacturer's statement regarding applicator instruction on product use.
 - 5. Certification that High Performance Coating Systems proposed for use have been reviewed and approved by Senior Corrosion Specification Specialist employed by the coating manufacturer.
- B. Samples:
- 1. Manufacturer's full line of colors for Engineer's preliminary color selection.
 - 2. After preliminary color selection by Engineer provide two (2) 3 x 5 IN samples of each final color selected.
- C. Informational Submittals:
- 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Approval of application equipment.
 - 3. Applicator's daily records:
 - a. Submit daily records at end of each week in which coating work is performed unless requested otherwise by Engineer's on-site representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in original containers, labeled as follows:
- 1. Name or type number of material.
 - 2. Manufacturer's name and item stock number.
 - 3. Contents, by volume, of major constituents.
 - 4. Warning labels.
 - 5. VOC content.
- B. Store materials in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 DegF.

1.6 PROJECT CONDITIONS

- A. Verify that atmosphere in area where coating is to take place is within coating manufacturer's acceptable temperature, humidity and sun exposure limits.
 - 1. Provide temporary heating, shade and/or dehumidification as required to bring area within acceptable limits.
 - a. Provide temporary dehumidification equipment properly sized to maintain humidity levels required by coating manufacturer.
 - b. Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 HR basis.
 - 1) Vent exhaust gases to exterior environment.
 - 2) No exhaust gases shall be allowed to vent into the space being coated or any adjacent space.
 - 2. Do not apply coatings in snow, rain, fog or mist.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. High Performance Industrial Coatings:
 - a. Carboline Protective Coatings.
 - b. PPG Industries.
 - c. Sherwin Williams.
 - d. Tnemec.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

- A. Coatings used for interior finishes shall meet the requirements of the Building Code and NFPA 101.
- B. General:
 - 1. High Performance Industrial Coatings: Products listed are manufactured by Tnemec.
 - 2. High Temperature Coatings: Products listed are manufactured by Dampney.

3. Products of other manufacturers will be considered for use provided that the product:
 - a. Is of the same generic resin.
 - b. Requires comparable surface preparation.
 - c. Has comparable application requirements.
 - d. Meets the same VOC levels or better.
 - e. Provides the same finish and color options.
 - f. Will withstand the atmospheric or immersion conditions of the location where it is to be applied.
4. Where manufacturer's product data sheet indicates a minimum mil thickness per coat that is greater than specified herein, mil thickness for entire coating system shall be increased proportionately.

C. Coatings shall comply with the VOC limits of EPA.

D. For unspecified materials such as thinner, provide manufacturer's recommended products.

E. High Performance Industrial Coatings:

| GENERIC DESCRIPTION | PRODUCT |
|--|---------------------------------------|
| Modified Aromatic Polyurethane Primer | Series 1 Omnithane |
| Modified Polyamine Epoxy (NSF 61) | Series 22 Pota-Pox 100 |
| Polyamidoamine Epoxy | Series L69 Hi-Build Epoxoline II |
| Zinc-Rich Urethane | Series 94-H ₂ O Hydro-Zinc |
| Modified Polyamidoamine Epoxy | Series 135 Chembuild |
| Acrylic Emulsion | Series 180 WB Tneme-Crete |
| Polyamidoamine Epoxy (NSF 61) | Series L140 Pota-Pox Plus |
| Modified Polyamine Epoxy | Series 201 Epoxoprime |
| Modified Flexible Polyamine Epoxy | Series 206SC Chembloc |
| Modified Polyamine Epoxy Surfacer/Filler | Series 215 Surfacing Epoxy |
| Epoxy Modified Cementitious Mortar | Series 218 MortarClad |
| Modified Polyamine Epoxy | Series 237 Power-Tread |
| Modified Polyamine Epoxy (Secondary Containment) | Series 237SC Chembloc |
| Novolac Vinyl Ester (Primer) | Series 251SC Chembloc |
| Novolac Vinyl Ester (Secondary Containment) | Series 252SC Chembloc |
| Polyamine Novolac Epoxy | Series 282 Tneme-Glaze |

| GENERIC DESCRIPTION | PRODUCT |
|---|----------------------------|
| Aliphatic Polyester Polyurethane | Series 290 CRU |
| Modified Polyamine Epoxy | Series 435 Perma-Glaze |
| Fiber-Reinforced Modified Polyamine Epoxy | Series 436 Perma-Shield FR |
| Polyfunctional Hybrid Urethane (Gloss) | Series 740 UVX |
| Polyfunctional Hybrid Urethane (Semi-Gloss) | Series 750 UVX |
| Inorganic Hybrid Water-Based Epoxy | Series 1254 Epoxoblock WB |

2.3 COATING SYSTEMS:

| Environment | Surface Preparation | Prime Coat | Intermediate Coats | Finish Coat |
|---|---|--|-------------------------------|----------------------------------|
| Ferrous Metals (Structural & Miscellaneous Metals) | | | | |
| Interior atmospheric | SSPC SP-6/ NACE No. 3 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 |
| Interior atmospheric (corrosive environment) | SSPC SP-10/ NACE No. 2 min. 2 mil anchor profile | 2.5 to 3.5 mil Series 94-H ₂ O | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 |
| Interior atmospheric (highly corrosive environment) | SSPC SP-10/ NACE No. 2 min. 2 mil anchor profile | 2.5 to 3.5 mil Series 94-H ₂ O | 3.0 to 4.0 mil Series L69 | 2.0 to 3.0 mil Series 290 CRU |
| Immersion – Wastewater | SSPC SP-10/ NACE No. 2 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 |
| Immersion – Wastewater (abrasion resistant) | SSPC SP-10/ NACE No. 2 min. 3 mil anchor profile | 15 to 20 mil Series 435 | | 15 to 20 mil Series 435 |
| Immersion – non NSF | SSPC SP-10/ NACE No. 2 | mil Series 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 |
| Immersion – NSF | SSPC SP-5/ NACE No. 1 | 4.0 to 5.0 mil Series L140 | 4.0 to 5.0 mil Series L140 | 4.0 to 5.0 mil Series L140 |
| Exterior atmospheric | SSPC SP-6/ NACE No. 3 | 2.5 to 3.5 mil Series 94-H ₂ O | 3.0 to 5.0 mil Series L69 | 2.5 to 3.5 mil Series 740 |
| Hollow Metal Doors | SSPC SP-3 | 2.5 to 3.5 mil Series 135 | | 2.5 to 3.5 mil Series 750 |
| Bar Joists | SSPC SP-3 | 2.5 to 3.5 mil Series 1 | | 3.0 to 4.0 mil Series L69 |

| Environment | Surface Preparation | Prime Coat | Intermediate Coats | Finish Coat |
|---|--|--|-------------------------------|-------------------------------|
| Galvanized Steel | | | | |
| Interior atmospheric | SSPC SP-16 | 4.0 to 6.0 mil Series 135 | | 2.0 to 3.0 mil Series L69 |
| Immersion – non NSF | SSPC SP-16 | 4.0 to 6.0 mil Series 135 | 2.0 to 3.0 mil Series L69 | 2.0 to 3.0 mil Series L69 |
| Immersion – NSF | SSPC SP-16 | 3.0 to 4.0 mil Series L140 | | 3.0 to 4.0 mil Series L140 |
| Exterior atmospheric | SSPC SP-16 | 4.0 to 6.0 mil Series 135 | | 2.5 to 3.5 mil Series 740 |
| Field cut pipe threads | SSPC SP-3 | 4.0 to 6.0 mil Series 135 | Coat per exposure above | Coat per exposure above |
| Non Ferrous Metals, including piping | | | | |
| Dissimilar Materials Protection | SSPC SP-2 | 4.5 to 5.5 mil Series L69 | | |
| Interior atmospheric | SSPC SP-2 | 3.0 to 4.0 mil Series L69 | | 3.0 to 4.0 mil Series L69 |
| Immersion - Wastewater | SSPC SP-16 | 3.0 to 4.0 mil Series L69 | | 5.0 to 6.0 mil Series L69 |
| Immersion – non NSF | SSPC SP-16 | 3.0 to 4.0 mil Series L69 | | 5.0 to 6.0 mil Series L69 |
| Immersion – NSF | SSPC SP-16 | 4.0 to 5.0 mil Series L140 | 4.0 to 5.0 mil Series L140 | 4.0 to 5.0 mil Series L140 |
| Exterior atmospheric | SSPC SP-2 | 4.0 to 6.0 mil Series L69 | | 2.5 to 3.5 mil Series 750 |
| Ferrous Piping | | | | |
| Interior atmospheric | SSPC SP-6/ NACE No. 3 | 2.5 to 3.5 mil Series 94-H ₂ O | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 |
| Immersion – Wastewater | SSPC SP-10/ NACE No. 2 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 |
| Immersion – Wastewater (abrasion resistant) | SSPC SP-10/ NACE No. 2 min. 3 mil anchor profile | 15 to 20 mil Series 435 | | 15 to 20 mil Series 435 |
| Immersion – non NSF | SSPC SP-5/ NACE No. 1 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 |
| Immersion – NSF | SSPC SP-5/ NACE No. 1 | 4.0 to 5.0 mil Series L69 | 4.0 to 5.0 mil Series L69 | 4.0 to 5.0 mil Series L69 |
| Exterior atmospheric | SSPC SP-10/ NACE No. 2 | 2.5 to 3.5 mil Series 94-H ₂ O | 3.0 to 4.0 mil Series L69 | 2.5 to 3.5 mil Series 750 |

| Environment | Surface Preparation | Prime Coat | Intermediate Coats | Finish Coat |
|----------------------------|--|-------------------------------|------------------------------|-------------------------------|
| Ductile Iron Piping | | | | |
| Interior atmospheric | Pipe: NAPF 500-03-04 Fittings: NAPF 500-03-05 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 |
| Immersion – Wastewater | Pipe: NAPF 500-03-04 Fittings: NAPF 500-03-05 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 |
| Immersion – non NSF | Pipe: NAPF 500-03-04 Fittings: NAPF 500-03-05 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 |
| Immersion – NSF | Pipe: NAPF 500-03-04 Fittings: NAPF 500-03-05 | 3.0 to 4.0 mil Series L140 | | 20.0 to 25.0 mil Series 22 |
| Exterior atmospheric | Pipe: NAPF 500-03-04 Fittings: NAPF 500-03-05 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 | 2.5 to 3.5 mil Series 750 |
| Cast Iron Piping | | | | |
| Interior atmospheric | SSPC SP-1 | 4.0 to 6.0 mil Series 135 | 2.0 to 3.0 mil Series L69 | 2.0 to 3.0 mil Series L69 |
| Exterior atmospheric | SSPC SP-1 | 4.0 to 6.0 mil Series 135 | 2.0 to 3.0 mil Series L69 | 2.5 to 3.5 mil Series 750 |
| PVC Piping | | | | |
| Interior atmospheric | Hand Sanding/ SSPC SP-1 | 3.0 to 4.0 mil Series L69 | | 3.0 to 4.0 mil Series L69 |
| Exterior atmospheric | Hand Sanding/ SSPC SP-1 | 3.0 to 4.0 mil Series L69 | | 2.5 to 3.5 mil Series 750 |

| Environment | Surface Preparation | Filler/ Surfacer | Prime Coat | Intermediate Coat | Finish Coat |
|--|---|--|---------------------------------------|---|---|
| Concrete | | | | | |
| Interior walls, ceilings, etc. atmospheric | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | Series 218 and/or 215 as necessary to fill holes and depressions | 250 to 300 SF/GAL Series L69 | | 250 to 300 SF/GAL Series L69 |
| Interior floors | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | Series 215 as necessary to fill holes and depressions | 175 to 225 SF/GAL Series 237 clear | 200 to 250 SF/GAL Series 237 pigmented | 200 to 250 SF/GAL Series 237 pigmented |

| Environment | Surface Preparation | Filler/ Surfacer | Prime Coat | Intermediate Coat | Finish Coat |
|---|---|--|------------------------------------|--|------------------------------------|
| Interior – Secondary Containment | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | Series 218 and/or 215 as necessary to fill holes and depressions | 50 to 60 mil Series 206SC | 211-0215 Fiberglass mat Saturated with 8.0 to 12 mils Series 237SC | 10 to 12 mil Series 237SC |
| Interior – Secondary Containment (Highly Corrosive) | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | Series 218 and/or 215 as necessary to fill holes and depressions | 6.0 to 8.0 mil Series 251SC | 211-0215 Fiberglass mat Saturated with 8.0 to 12 mils Series 252SC | 6.0 to 8.0 mil Series 252SC |
| Immersion – Wastewater (Abrasion Resistant) | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | 1/16 to 1/4 IN Series 218 | 1/8 IN Series 434 | | 15 to 25 mil Series 435 |
| Immersion - Wastewater – Clarifier Launderers | SSPC SP-13 NACE No. 6 ICRI CSP 5 | 1/16 to 1/4 IN Series 218 | 8.0 to 10 mil Series 446 | | 30 to 45 mil Series 435 |
| Immersion – non NSF | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | 1/16 to 1/4 IN Series 218 | | | 16 to 20 mil Series 22 |
| Immersion – NSF | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | 1/16 to 1/4 IN Series 218 | | | 16 to 20 mil Series 22 |
| Vapor space at covered clarifiers, digesters and similar structures | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | 1/16 to 1/4 IN Series 218 | | | 30 to 45 mil Series 435 |
| Exterior atmospheric Corrosive Environment | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | Series 218 and/or 215 as necessary to fill holes and depressions | 150 to 175 SF/GAL Series 180 | | 150 to 175 SF/GAL Series 180 |
| Exterior atmospheric Highly Corrosive Environment | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | 1/16 IN Series 218 | 3.0 to 4.0 mil Series L69 | 3.0 to 4.0 mil Series L69 | 2.5 to 3.5 mil Series 750 |
| Secondary Containment (Horizontal Surface) | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | 1/16 to 1/4 IN Series 218 | 10.0 to 12.0 mil Series 282 | | 10.0 to 12.0 mil Series 282 |
| Secondary Containment (Vertical Surface) | SSPC SP-13/ NACE No. 6 ICRI CSP 5 | 1/16 to 1/4 IN Series 218 | 8.0 to 10.0 mil Series 282 | | 8.0 to 10.0 mil Series 282 |
| CMU* | | | | | |
| Interior atmospheric | Refer to PART 3 | 100 to 150 SF/Gal Series 1254 | 175 to 200 SF/Gal Series L69 | | 175 to 200 SF/Gal Series L69 |
| Exterior atmospheric Corrosive Environment | Refer to PART 3 | 100 to 150 SF/Gal Series 1254 | 175 to 200 SF/Gal Series L69 | | 275 to 300 SF/Gal Series 750 |
| Exterior atmospheric Highly Corrosive Environment | Refer to PART 3 | 100 to 150 SF/Gal Series 1254 | 175 to 200 SF/Gal Series L69 | 175 to 200 SF/Gal Series L69 | 275 to 300 SF/Gal Series 750 |

* Coverage rates indicated are based on smooth-face normal weight CMU. Provide increased coverage rates in accordance with manufacturer's recommendations for more porous surfaces.

PART 3 - EXECUTION

3.1 ITEMS TO BE COATED

- A. Exterior Surfaces, including but not limited to:
 - 1. Concrete:
 - a. Components of concrete tankage:
 - 1) Walls, columns, beams:
 - a) Coat from 1 foot below low water level to top of component.
 - 2) Troughs, launders, weirs.
 - b. Secondary containment enclosures.
 - c. Chemical fill stations.
 - 1) Paving where indicated on Drawings.
 - 2) Spill containment sumps.
 - 2. Piping, valves, fittings, hydrants and supports:
 - a. As scheduled in Specification Section 40 05 00.
 - 3. Pumps and motors.
 - 4. Ferrous metal tankage.
 - 5. Ferrous metal process equipment.
 - a. Clarifier mechanisms.
 - b. Equipment bridges.
 - c. Gates and operators.
 - 6. Structural steel (Clarifier):
 - a. Columns, beams and bracing.
 - b. Field welded connections of factory painted structural steel.
 - 7. Miscellaneous ferrous metal surfaces:
 - a. Pipe Bollards.
 - b. Embed Plates.
 - c. Items specifically noted on Drawings to be painted.

8. Miscellaneous galvanized steel surfaces:
 - a. Pipe Bollards.
 - b. Embed Plates.
 - c. Loose lintels.
 - d. Steel components of concrete lintels.
 - e. Items specifically noted on Drawings to be painted.
9. Appurtenant surfaces attached to or adjacent to a surface indicated to be painted:
 - a. Conduit, boxes, covers and supports.

B. Interior Areas:

1. Refer to Room Finish Schedule on Drawings.
 - a. If space is scheduled to be painted, paint all appurtenant surfaces within the space unless specifically noted otherwise. Appurtenant surfaces include but are not limited to:
 - 1) Columns.
 - 2) Equipment pads.
 - 3) Equipment supports.
 - 4) Underside of roof or floor decks above:
 - a) Including semi-exposed or concealed from view unless noted otherwise.
 - 5) Conduit, boxes, covers and supports.
 - 6) Miscellaneous ferrous metal surfaces.
2. Concrete:
 - a. Components of concrete tankage:
 - 1) Walls, columns, beams:
 - a) Paint from 1 foot below low water level to top of component.
 - 2) Troughs, launders, weirs.
 - 3) Underside of concrete walkways within 2 feet of high water level.
 - b. Chemical storage areas:
 - 1) Flooring where scheduled or indicated on Drawings.
 - 2) Secondary containment enclosures.
3. Piping, valves, fittings, hydrants and supports:

- a. Do not paint piping scheduled to be insulated.
- 4. Pumps and motors.
- 5. Ferrous metal tankage.
- 6. Ferrous metal process equipment.
 - a. Clarifier mechanisms.
 - b. Equipment bridges.
 - c. Gates and operators.
 - d. Embed Plates.
 - e. Items specifically noted on Drawings to be painted.
- 7. Miscellaneous galvanized steel surfaces:
 - a. Pipe Bollards.
 - b. Embed Plates.
 - c. Loose lintels.
 - d. Steel components of concrete lintels.
 - e. Seismic angles at masonry partitions.
 - f. Items specifically noted on Drawings to be painted.

3.2 ITEMS NOT TO BE PAINTED

- A. General: Do not paint items listed in this Article, unless noted otherwise.
- B. Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.
- C. Electrical Equipment.
- D. Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.
- E. Code labels, equipment identification or rating plates and similar labels, tagging and identification.
- F. Contact surfaces of friction-type structural connections.
- G. Stainless Steel Surfaces, except:
 - 1. Piping where specifically noted to be painted.
 - 2. Banding as required to identify piping.

- H. Aluminum Surfaces, except:
 - 1. Where specifically shown in the Contract Documents.
 - 2. Where in contact with concrete.
 - 3. Where in contact with dissimilar metals.
 - 4. Appurtenant surfaces as described in the ITEMS TO BE PAINTED article.
- I. Fiberglass Surfaces, except:
 - 1. Fiberglass piping where specifically noted to be painted.
 - 2. Piping supports where specifically noted to be painted.
 - 3. Appurtenant surfaces as described in the ITEMS TO BE PAINTED article.
- J. Mechanical piping scheduled to be insulated.
- K. Interior of Pipe, Ductwork, and Conduits.
 - 1. See Division 23 for ductwork.
 - 2. See Division 40 for pipe linings.
- L. Galvanized Steel Items, unless specifically noted to be painted.
- M. Architectural Finishes:
 - 1. Exterior concrete indicated to receive another finish.
 - 2. Precast concrete surfaces, unless specifically indicated to be painted.
 - 3. Prefinished masonry surfaces:
 - a. Pre-colored masonry (exterior face).
 - 1) Interior face shall be painted where scheduled.
 - b. Burnished (ground face) concrete masonry.
 - c. Prefaced masonry.
 - d. Face brick.
 - e. Glass masonry.
 - 4. Plastic laminate.
 - 5. Solid surface material.
 - 6. Standing and running trim.
 - 7. Fiberglass fabrications.

8. Anodized aluminum.
9. PVDF coated metals.
10. Factory finished doors and frames.
11. Aluminum windows, curtainwall and storefront framing systems.
12. Finish hardware.
13. Glass and glazing.
14. Ceramic, porcelain, quarry tile or natural stone.
15. Acoustical materials.
16. Building specialties.
17. Louvers.
18. Casework and countertops.
19. Pipe insulation and jacketing.
20. Standing seam metal roof, fascia, trim, soffit and accessories.

3.3 EXAMINATION

A. Concrete:

1. Test pH of surface to be painted in accordance with ASTM D4262.
 - a. If surface pH is not within coating manufacturer's required acceptable range, use methods acceptable to coating manufacturer as required to bring pH within acceptable range.
 - b. Retest pH until acceptable results are obtained.
2. Verify that moisture content of surface to be painted is within coating manufacturer's recommended acceptable limits.
 - a. Test surface to be coated in accordance with ASTM D4263 to determine the presence of moisture.
 - 1) If moisture is detected, test moisture content of surface to be coated in accordance with ASTM F1869 or ASTM F2170.
 - 2) Provide remedial measures as necessary to bring moisture content within coating manufacturer's recommended acceptable limits.
 - 3) Retest surface until acceptable results are obtained.

3.4 PREPARATION

A. General:

1. Prepare surfaces to be painted in accordance with coating manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.
 - a. Where discrepancy between coating manufacturer's instructions and this Specification Section exists, the more stringent preparation shall be provided unless approved otherwise, in writing, by the Engineer.
 2. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.
 3. Adhere to manufacturer's recoat time surface preparation requirements.
 - a. Surfaces that have exceeded coating manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional coating in accordance with manufacturer's published recommendations.
 - 1) Minimum SSPC SP 7/NACE No. 4 unless otherwise approved by Engineer.
- B. Protection:
1. Protect surrounding surfaces not to be coated.
 2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
 3. Protect code labels, equipment identification or rating plates and similar labels, tagging and identification.
- C. Prepare and paint before assembly all surfaces which are inaccessible after assembly.
- D. Ferrous Metal:
1. Prepare ductile iron pipe in accordance with pipe manufacturer's recommendations and NAPF.
 - a. All piping, pumps, valves, fittings and any other component used in the water piping system that requires preparation for painting shall be prepared in accordance with requirements for immersion service.
 - b. Prepare all areas requiring patch painting in accordance with recommendations of manufacturer and NAPF.
 - c. Remove bituminous coating per piping manufacturer, paint manufacturer and NAPF recommendations.
 - 1) The most stringent recommendations shall apply.
 2. Complete fabrication, welding or burning before beginning surface preparation.

- a. Chip or grind off flux, spatter, slag or other laminations left from welding.
 - b. Remove mill scale.
 - c. Grind smooth rough welds and other sharp projections.
3. Solvent clean in accordance with SSPC SP 1.
 4. Restore surface of field welds and adjacent areas to original surface preparation.
- E. Galvanized Steel and Non-ferrous Metals:
1. Solvent clean in accordance with SSPC SP 1 followed by brush-off blast clean in accordance with SSPC SP 16 to remove zinc oxide and other foreign contaminants.
 - a. Provide uniform 1 mil profile surface.
- F. Concrete:
1. Cure for minimum of 28 days.
 2. Concrete surfaces shall be cleaned in accordance with ASTM D4258.
 3. Abrasive blast concrete surfaces in accordance with ASTM D4259 and SSPC SP 13/NACE No. 6.
 - a. Provide profile per ICRI 301.2 as listed in MATERIALS article of this Specification Section.
 4. Test pH and moisture content in accordance with EXAMINATION article in this Specification Section.
- G. Preparation by Abrasive Blasting:
1. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before painting.
 2. Provide compressed air for blasting that is free of water and oil.
 - a. Provide accessible separators and traps.
 3. Protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from blasting.
 4. All abrasive-blasted ferrous metal surfaces shall be inspected immediately prior to application of paint coatings.
 - a. Inspection shall be performed to determine cleanliness and profile depth of blasted surfaces and to certify that surface has been prepared in accordance with these Specifications.

5. Perform additional blasting and cleaning as required to achieve surface preparation required.
 - a. Re-blast surfaces not meeting requirements of these Specifications.
 - b. Prior to painting, re-blast surfaces allowed to set overnight and surfaces that show rust bloom.
 - c. Surfaces allowed to set overnight or surfaces which show rust bloom prior to painting shall be re-inspected prior to paint application.
6. Profile depth of blasted surface: Not less than 1 mil or greater than 2 mils unless required otherwise by coating manufacturer.
7. Ensure abrasive blasting operation does not result in embedment of abrasive particles in paint film.
8. Confine blast abrasives to area being blasted.
 - a. Provide shields of polyethylene sheeting or other such barriers to confine blast material.
 - b. Plug pipes, holes, or openings before blasting and keep plugged until blast operation is complete and residue is removed.
9. Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Engineer's review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process.
10. Properly dispose of blasting material contaminated with debris from blasting operation.

H. All Plastic Surfaces:

1. Sand using 80-100 grit sandpaper to scarify surfaces.

3.5 APPLICATION

A. General:

1. Thin, mix and apply coatings by brush, roller, or spray in accordance with manufacturer's installation instructions.
 - a. Application equipment must be inspected and approved in writing by coating manufacturer.
 - b. Hollow metal shall be spray applied only.
2. Temperature and weather conditions:
 - a. Do not paint surfaces when surface temperature is below 50 DegF unless product has been formulated specifically for low temperature

application and application is approved in writing by Engineer and paint manufacturer's authorized representative.

- b. Avoid painting surfaces exposed to hot sun.
- c. Do not paint on damp surfaces.
3. Apply materials under adequate illumination.
4. Provide complete coverage to mil thickness specified.
 - a. Thickness specified is dry mil thickness.
5. Evenly spread to provide full, smooth coverage.
 - a. All paint systems are "to cover."
 - 1) In situations of discrepancy between manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern.
 - b. When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.
 - c. Finished paint system shall be uniform and without voids, bug holes, holidays, laps, brush marks, roller marks, runs, sags or other imperfections.
6. If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.
7. Work each application of material into corners, crevices, joints, and other difficult to work areas.
8. Avoid degradation and contamination of blasted surfaces and avoid inter-coat contamination.
 - a. Clean contaminated surfaces before applying next coat.
9. Smooth out runs or sags immediately, or remove and recoat entire surface.
10. Allow preceding coats to dry before recoating.
 - a. Recoat within time limits specified by coating manufacturer.
 - b. If recoat time limits have expired re-prepare surface in accordance with coating manufacturer's printed recommendations.
11. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.
12. Coat all aluminum in contact with dissimilar materials.

13. When coating rough surfaces which cannot be backrolled sufficiently, hand brush coating to work into all recesses.
 14. Backroll surfaces if paint coatings are spray applied.
- B. Employ services of coating manufacturer's qualified technical representative to ensure that field-applied coatings are compatible with factory-applied or existing coatings.
1. Certify through material data sheets.
 2. Perform test patch.
 - a. Prepare existing coating surface to receive specified coating system.
 - b. Apply coating to a minimum 1 SF area and allow to cure in accordance with manufacturer's recommendations.
 - c. Evaluate adhesion to existing coating:
 - 1) Concrete or Masonry substrates: ASTM D4541.
 - 2) All other substrates: ASTM D6677 and ASTM D3359 (X-cut method).
 3. If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.
 - a. Perform test patch as described above.
 4. At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate paint system listed in the MATERIALS Article, Paint Systems paragraph of this Specification Section.
 - a. All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.
- C. Prime Coat Application:
1. Apply structural steel and miscellaneous steel prime coat in the factory.
 - a. Finish coats shall be applied in the field.
 - b. Prime coat referred to here is prime coat as indicated in this Specification.
 - 1) Prime coating applied in factory (shop) as part of Fabricator's standard rust inhibiting and protection coating is not acceptable as replacement for specified prime coating.

2. Prime all surfaces indicated to be painted.
 - a. Apply prime coat in accordance with coating manufacturer's written instructions and as written in this Specification Section.
3. Prime ferrous metals embedded in concrete to minimum of 1 IN below exposed surfaces.
4. Apply zinc-rich primers while under continuous agitation.
5. Brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over entire surface.
6. Touch up damaged primer coats prior to applying finish coats.
 - a. Restore primed surface equal to surface before damage.
7. All surfaces of steel lintels and steel components of concrete lintels used in wall construction shall be completely painted with both prime and finish coats prior to placing in wall.

D. Finish Coat Application:

1. Apply finish coats in accordance with coating manufacturer's written instructions and in accordance with this Specification Section; manufacturer instructions take precedent over these Specifications.
2. Touch up damaged finish coats using same application method and same material specified for finish coat.
 - a. Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.

3.6 COLOR CODING

- A. Color code piping in accordance with the SCHEDULE Article of this Specification Section.

3.7 FIELD QUALITY CONTROL

A. Application Deficiencies:

1. Surfaces showing runs, laps, brush marks, telegraphing of surface imperfections or other defects will not be accepted.
2. Surfaces showing evidence of fading, chalking, blistering, delamination or other defects due to improper surface preparation, environmental controls or application will not be accepted.
 - a. Epoxy surfaces showing evidence of chalking or amine blush shall be prepared and recoated as follows:
 - 1) Solvent clean surfaces in accordance with SSPC SP1 and abrasive blast in accordance with SSPC SP7/NACE No. 4.

- 2) Recoat with intermediate and finish coats in accordance with coating system specified herein.

B. Provide protection for painted surfaces.

1. Surfaces showing soiling, staining, streaking, chipping, scratches, or other defects will not be accepted.

C. Contractor Performed Testing:

1. The Contractor shall provide ongoing testing and inspection, including but not limited to the following:
 - a. Measurement and recording of environmental conditions as specified herein.
 - b. Measurement and recording of substrate conditions as specified herein.
 - c. Thickness Testing:
 - 1) Wet film thickness during application in accordance with ASTM D4414.
 - 2) Dry Film Thickness (DFT) in accordance with SSPC PA 2 and ASTM D7091.

D. Instrumentation:

1. Provide instrumentation as necessary to measure and record atmospheric and substrate conditions, including but not limited to:
 - a. Dry Film Thickness Gauge.
 - b. Wet Film Thickness Gauge.
 - c. Sling Psychrometer.
 - d. Surface Temperature Gauge.
 - e. Anemometer.
 - f. Moisture Meter.

E. Maintain Daily Records:

1. Record the following information during application:
 - a. Date, starting time, end time, and all breaks taken by painters.
 - b. Air temperature.
 - c. Relative humidity.
 - d. Dew point.

- e. Moisture content and pH level of concrete or masonry substrates prior to coating.
 - f. Surface temperature of substrate.
 - g. Provisions utilized to maintain work area within manufacturer's recommended application parameters including temporary heating, ventilation, cooling, dehumidification and provisions utilized to mitigate windblown dust and debris from contaminating the wet paint film.
 - h. For exterior painting:
 - 1) Sky condition.
 - 2) Wind speed and direction.
 - i. Record environmental conditions, substrate moisture content and surface temperature information not less than once every 4 HRS during application.
 - 1) Record hourly when temperatures are below 50 DegF or above 100 DegF.
2. Record the following information daily for the paint manufacturer's recommended curing period:
- a. Date and start time of cure period for each item or area.
 - b. For exterior painting:
 - 1) Sky conditions.
 - 2) Wind speed and direction.
 - 3) Air temperature.
 - a) Dry Bulb.
 - b) Wet Bulb.
 - 4) Relative humidity.
 - 5) Dew point.
 - 6) Surface temperatures.
 - c. Record environmental conditions not less than once every 4 HRS.
 - 1) Record hourly when temperatures are below 50 DegF or above 100 DegF.
 - d. Provisions utilized to protect each item or area and to maintain areas within manufacturer's recommended curing parameters.
3. Format for daily record to be computer generated.
- F. Measure wet coating with wet film thickness gages in accordance with ASTM D4414.

- G. Measure coating dry film thickness in accordance with SSPC PA 2.
 - 1. Engineer may measure coating thickness at any time during project to assure conformance with these Specifications.
- H. Measure surface temperature of items to be painted with surface temperature gage specifically designed for such.
- I. Measure substrate humidity with humidity gage specifically designed for such.
- J. Provide wet paint signs.

3.8 CLEANING

- A. Clean paint spattered surfaces.
 - 1. Use care not to damage finished surfaces.
- B. Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.
- C. Remove surplus materials, scaffolding, and debris.

3.9 COLOR SCHEDULE

- A. Pipe Bollards: 02SF Safety Yellow.
- B. Piping and Pipe Banding Color Schedule (Colors based on Tnemec):
 - 1. Match existing piping and banding colors.
 - 2. Piping systems shown in italics with no paint color shown for the pipe but having paint colors shown for the banding color are systems that will be banded using material other than paint.
 - a. Refer to Specification Section 10 14 00 for the piping system and banding material and refer to this Specification Section and this Schedule for the banding colors.

3. Wastewater Treatment Plant Piping Color Schedule:

| SERVICE | PIPE COLOR | BANDING COLOR |
|---------------------------|------------|--|
| Wastewater Piping: | | |
| Plant influent | 32GR-Gray | 35GR-Black |
| Settled primary | 32GR-Gray | YB24-Brown |
| Settled final | 32GR-Gray | 07SF-Red |
| Filtered | 32GR-Gray | 05SF/35GR-International Orange/Black |
| Final effluent | 32GR-Gray | 05SF/YB24-International Orange/Brown |
| Plumbing drains | 32GR-Gray | 11SF-Safety Blue |
| Supernatant | 32GR-Gray | 08SF-Safety Green filtrate or centrate |

| SERVICE | PIPE COLOR | BANDING COLOR |
|---|---------------------------|---|
| Filter backwash | 32GR-Gray | 02SF-Safety Yellow |
| Sump | 32GR-Gray | 11WH-White |
| Steam Piping - High Pressure: | | |
| Saturated | 05SF-International Orange | 11WH-White |
| Super heated | 05SF-International Orange | 11WH/32GR-White/Gray |
| Steam Piping - Low Pressure: | | |
| Saturated | 05SF-International Orange | 11WH/32GR-White/Gray |
| Super heated | 05SF-International Orange | -- |
| Sludge Piping: | | |
| Waste activated | YB24-Brown | 32GR/35GR-Gray/Black |
| Recirculated | YB24-Brown | 32GR/07SF-Gray/Red waste activated |
| Wasted | YB24-Brown | 11SF/32GR-Safety Blue/Gray |
| Miscellaneous Sludge Piping: | | |
| Scum | YB23-Dk. Brown | 32GR-Gray |
| Grit | YB23-Dk. Brown | 07SF-Red |
| Water Piping: | | |
| Fire | 06SF-Safety Red | -- |
| Service | 08SF-Safety Green | 35GR-Black |
| Nonpotable | 08SF-Safety Green | 32GR-Gray |
| Make-up | 08SF-Safety Green | YB24-Brown |
| Potable water hot | -- | 05SF-International Orange |
| Cooling | 08SF-Safety Green | 11SF-Safety Blue |
| Condensate | 08SF-Safety Green | 35GR/32GR-Black/Gray |
| Potable water cold | -- | 35GR/07SF-Black/Red |
| Gas and Fuel Piping: | | |
| L-P or natural | 02SF-Safety Yellow | 06SF/35GR-Safety Red/Black |
| Exhaust | 02SF-Safety Yellow | 11WH/35GR-White/Black |
| Air | 02SF-Safety Yellow | 11WH/32GR-White/Gray |
| Chemical Piping: | | |
| Alum | 11WH-White | 35GR/32GR-Black/Gray |
| Neutralization Piping: | | |
| Caustic | 11WH-White | 32GR/07SF-Gray/Red |
| Odor Control and Sulfide Destruction Piping: | | |
| Defoaming | 11WH-White | 11SF-Safety Blue |
| Polymer Piping: | | |
| Anionic coagulant | 11WH-White | 08SF/35GR/32GR-Safety Green/Black/Gray |
| Cationic coagulant | 11WH-White | 08SF/35GR/YB24-Safety Green/Black/Brown |
| Nonionic coagulant | 11WH-White | 08SF/35GR/07SF-Safety Green/Black/Red |
| Coagulant aid | 11WH-White | 08SF/YB24-Safety Green/Brown |
| Anionic flocculent | 11WH-White | 08SF/07SF/32GR-Safety |

| SERVICE | PIPE COLOR | BANDING COLOR |
|-----------------------------|---------------------------|---|
| | | Green/Red/Gray |
| Cationic flocculent | 11WH-White | 08SF/07SF/05SF-Safety Green/Red/International Orange |
| Nonionic flocculent | 11WH-White | 08SF/07SF/11SF-Safety Green/Red/Safety Blue |
| Dechlorination | 11WH-White | 02SF-Safety Yellow |
| Dual Purpose Piping: | | |
| | Aluminum-GR04 Lt. Gray | Colors of Pipe color above |

END OF SECTION



DIVISION 10

SPECIALTIES



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SECTION 10 14 00
IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tag, tape and stenciling systems for equipment, piping, valves, pumps, ductwork and similar items, and hazard and safety signs.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
 - a. A13.1, Scheme for the Identification of Piping Systems.
2. The International Society of Automation (ISA).
3. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
 - a. Z535.1, Safety Color Code.
 - b. Z535.2, Environmental and Facility Safety Signs.
 - c. Z535.3, Criteria for Safety Symbols.
 - d. Z535.4, Product Safety Signs and Labels.
4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
5. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910.145, Specification for Accident Prevention Signs and Tags.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Catalog information for all identification systems.
 - b. Acknowledgement that products submitted meet requirements of standards referenced.
3. Identification register, listing all items in PART 3 of this Specification Section to be identified, type of identification system to be used, lettering, location and color.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents and American Iron and Steel regulations, the following manufacturers are acceptable:
 1. W.H. Brady Co.
 2. Panduit.
 3. Seton.
 4. National Band and Tag Co.
 5. Carlton Industries, Inc.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MANUFACTURED UNITS

A. Type A1 - Round Metal Tags:

1. Materials:
 - a. Aluminum or stainless steel.
 - b. Stainless steel shall be used in corrosive environments.
2. Size:
 - a. Diameter: 1-1/2 IN minimum.
 - b. Thickness: 0.035 IN (20 GA) minimum.

3. Fabrication:
 - a. 3/16 IN minimum mounting hole.
 - b. Legend: Stamped and filled with black coloring.
 4. Color: Natural.
- B. Type A2 - Rectangle Metal Tags:
1. Materials: Stainless steel.
 2. Size:
 - a. 3-1/2 IN x 1-1/2 IN minimum.
 - b. Thickness: 0.036 IN (20 GA) minimum.
 3. Fabrication:
 - a. 3/16 IN minimum mounting hole.
 - b. Legend: Stamped and filled with black coloring.
 4. Color: Natural.
- C. Type A3 - Metal Tape Tags:
1. Materials: Aluminum or stainless steel.
 2. Size:
 - a. Width 1/2 IN minimum.
 - b. Length as required by text.
 3. Fabrication:
 - a. 3/16 IN minimum mounting hole.
 - b. Legend: Embossed.
 4. Color: Natural.
- D. Type B1- Square Nonmetallic Tags:
1. Materials: Fiberglass reinforced plastic.
 2. Size:
 - a. Surface: 2 x 2 IN minimum.
 - b. Thickness: 100 mils.

3. Fabrication:
 - a. 3/16 IN mounting hole with metal eyelet.
 - b. Legend: Preprinted and permanently embedded and fade resistant.
 4. Color:
 - a. Background: Manufacturer standard or as specified.
 - b. Lettering: Black.
- E. Type B2 - Nonmetallic Signs:
1. Materials: Fiberglass reinforced or durable plastic.
 2. Size:
 - a. Surface: As required by text.
 - b. Thickness: 60 mils minimum.
 3. Fabrication:
 - a. Rounded corners.
 - b. Drilled holes in corners with grommets.
 - c. Legend: Preprinted, permanently embedded and fade resistant for a 10 year minimum outdoor durability.
 4. Color:
 - a. Background: Manufacturer standard or as specified.
 - b. Lettering: Black.
 5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.
- F. Type C - Laminated Name Plates:
1. Materials: Phenolic or DR (high impact) acrylic.
 2. Size:
 - a. Surface: As required by text.
 - b. Thickness: 1/16 IN.
 3. Fabrication:
 - a. Outdoor rated and UV resistant when installed outdoors.

- b. Two layers laminated.
 - c. Legend: Engraved through top lamination into bottom lamination.
 - d. Two drilled side holes, for screw mounting.
4. Color: Black top surface, white core, unless otherwise indicated.

G. Type D - Self-Adhesive Tape Tags and Signs:

- 1. Materials: Vinyl tape or vinyl cloth.
- 2. Size:
 - a. Surface: As required by text.
 - b. Thickness: 5 mils minimum.
- 3. Fabrication:
 - a. Indoor/Outdoor grade.
 - b. Weather and UV resistant inks.
 - c. Permanent adhesive.
 - d. Legend: Preprinted.
 - e. Wire markers to be self-laminating.
- 4. Color: White with black lettering or as specified.
- 5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.

H. Type E - Heat Shrinkable Tape Tags:

- 1. Materials: Polyolefin.
- 2. Size: As required by text.
- 3. Fabrication:
 - a. Legend: Preprinted.
- 4. Color: White background, black printing.

I. Type F - Underground Warning Tape:

- 1. Materials: Polyethylene.
- 2. Size:
 - a. 6 IN wide (minimum).

- b. Thickness: 3.5 mils.
 - 3. Fabrication:
 - a. Legend: Preprinted and permanently imbedded.
 - b. Message continuous printed.
 - c. Tensile strength: 1750 psi.
 - 4. Color: As specified.
- J. Type G - Stenciling System:
 - 1. Materials:
 - a. Exterior type stenciling enamel.
 - 2. Size: As required.
 - 3. Fabrication:
 - a. Legend: As required.
 - 4. Color: Meet ANSI guidelines
- K. Type H- Snap Around Labeling System:
 - 1. Materials:
 - a. Interior/Exterior Conditions
 - b. Pipe temperature range - 40°F to 248°F
 - 2. Over-laminated polyester construction
 - 3. Size: As required.
 - 4. Fabrication:
 - a. Legend: As required.
 - 5. Color: Color: Meet ANSI guidelines
 - 6. Manufacturer: Seton, or equal
- L. Underground Tracer Wire:
 - 1. Materials:
 - a. Wire:
 - 1) 12 GA AWG.
 - 2) Solid.

- b. Wire nuts: Waterproof type.
- c. Split bolts: Brass.

2.3 ACCESSORIES

- A. Fasteners:
 - 1. Bead chain: #6 brass, aluminum or stainless steel.
 - 2. Plastic strap: Nylon, urethane or polypropylene.
 - 3. Screws: Self-tapping, stainless steel.
 - 4. Adhesive, solvent activated.

2.4 MAINTENANCE MATERIALS

- A. Where stenciled markers are provided, clean and retain stencils after completion and include in extra stock, along with required stock of paints and applicators.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Install identification devices at specified locations.
- B. All identification devices to be printed by mechanical process, hand printing is not acceptable.
- C. Attach tags to equipment with sufficient surface or body area with solvent activated adhesive applied to back of each tag.
- D. Attach tags with 1/8 IN round or flat head screws to equipment without sufficient surface or body area, or porous surfaces.
 - 1. Where attachment with screws should not or cannot penetrate substrate, attach with plastic strap.
- E. Single items of equipment enclosed in a housing or compartment to be tagged on outside of housing.
 - 1. Several items of equipment mounted in housing to be individually tagged inside the compartment.
- F. Tracer Wire:
 - 1. Attach to pipe at a maximum of 10 FT intervals with tape or tie-wraps.
 - 2. Continuous pass from each valve box and above grade at each structure.

3. Coil enough wire at each valve box to extend wire a foot above the ground surface.
4. 1,000 FT maximum spacing between valve boxes.
5. If split bolts are used for splicing, wrap with electrical tape.
6. If wire nuts are used for splicing, knot wire at each splice point leaving 6 IN of wire for splicing.
7. Use continuous strand of wire between valve box where possible.
 - a. Continuous length shall be no shorter than 100 FT.

3.2 SCHEDULES

A. Process Systems:

1. General:
 - a. Provide arrows and markers on piping.
 - 1) At 20 FT maximum centers along continuous lines.
 - 2) At changes in direction (route) or obstructions.
 - 3) At valves, risers, "T" joints, machinery or equipment.
 - 4) Where pipes pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.
 - b. Position markers on both sides of pipe with arrow markers pointing in flow direction.
 - 1) If flow is in both directions use double headed arrow markers.
 - c. Apply tapes and stenciling in uniform manner parallel to piping.
2. Trenches with piping:
 - a. Tag type: Type F - Underground Warning Tape
 - b. Location: Halfway between top of piping and finished grade.
 - c. Letter height: 1-1/4 IN minimum.
 - d. Natural gas or digester gas:
 - 1) Color: Yellow with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION"
 - b) Second line: "BURIED GAS LINE BELOW"

- e. Potable water:
 - 1) Color: Blue with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION"
 - b) Second line: "BURIED WATER LINE BELOW"
 - f. Storm and sanitary sewer lines:
 - 1) Color: Green with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION"
 - b) Second line: "BURIED SEWER LINE BELOW"
 - g. (Nonpotable) water piping, except 3 IN and smaller irrigation pipe:
 - 1) Color: Green with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION"
 - b) Second line: "BURIED NONPOTABLE WATER LINE BELOW"
 - h. Chemical feed piping (e.g., chlorine solution, polymer solution, caustic solution, etc.):
 - 1) Color: Yellow with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION"
 - b) Second line: "BURIED CHEMICAL LINE BELOW"
 - i. Other piping (e.g., compressed air, irrigation, refrigerant, heating water, etc.):
 - 1) Color: Yellow with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION"
 - b) Second line: "BURIED PIPE LINE BELOW"
3. Yard valves, buried, with valve box and concrete pad:
- a. Tag type: Type A2 - Rectangle Metal Tags.
 - b. Fastener: 3/16 IN x 7/8 IN plastic screw anchor with 1 IN #6 stainless steel pan head screw.
 - c. Legend:
 - 1) Letter height: 1/4 IN minimum.

- 2) Valve designation as indicated on the Drawings (e.g., "V-xxx").
4. Valves and slide gates:
 - a. Tag type:
 - 1) Outdoor locations: Type B1 - Square Nonmetallic Tags.
 - 2) Indoor noncorrosive:
 - a) Type A1 - Round Metal Tags.
 - b) Type B1 - Square Nonmetallic Tags.
 - 3) Indoor corrosive:
 - a) Stainless steel Type A1 - Round Metal Tags.
 - b) Type B1 - Square Nonmetallic Tags.
 - b. Fastener:
 - 1) Type A1: Chain of the same material.
 - 2) Type B1: Stainless steel chain.
 - c. Color: Per ASME A13.1 corresponding to the piping system.
 - d. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) Valve designation as indicated on the Drawings (e.g., "V-xxx").
 5. Process equipment (e.g., pumps, pump motors, blowers, air compressors, bar screens, clarifier drive mechanism, etc.):
 - a. Tag type:
 - 1) Type B2 - Nonmetallic Signs.
 - 2) Type D - Self-Adhesive Tape Tags and Signs.
 - b. Fastener:
 - 1) Self.
 - 2) Screws.
 - 3) Adhesive.
 - c. Legend:
 - 1) Letter height: 1/2 IN minimum.
 - 2) Equipment designation as indicated on the Drawings (e.g., "Primary Sludge Pump P-xxx").

6. Piping systems:
 - a. Tag type:
 - 1) Outdoor locations: Type H – Snap-Around System.
 - 2) Indoor locations: Type H – Snap-Around System.
 - 3) Fastener: Self.
 - b. Color: Per ASME A13.1.
 - c. Legend:
 - 1) Letter height: Manufacturers standard for the pipe diameter.
 - 2) Mark piping in accordance with ASME A13.1.
 - 3) Use piping designation as indicated on the Drawings.
 - 4) Arrow: Single arrow.
7. Process tanks (over 1000 GAL) and basins, (e.g., chemical storage, clarifiers, trickling filters, digesters, etc.):
 - a. Tag type:
 - 1) Type B2 - Nonmetallic Signs.
 - b. Fastener:
 - 1) Screw.
 - 2) Self.
 - c. Location as directed by Owner.
 - d. Legend:
 - 1) Letter height: 4 IN minimum.
 - 2) Equipment designation as indicated on the Drawings (e.g., “Clarifier CL-xxx”).
8. Tanks (less than 1000 GAL) (e.g., break tanks, chemical tanks, hydro-pneumatic tanks, air receivers, etc.):
 - a. Tag type:
 - 1) Type D - Self-Adhesive Tape Tags and Signs.
 - 2) Fastener: Self.
 - b. Legend:
 - 1) Letter height: 2 IN minimum.
 - 2) Equipment designation as indicated on the Drawings (e.g., “Polymer Storage Tank Txxx”)

9. Equipment that starts automatically:
 - a. Tag type:
 - 1) Type B2 - Nonmetallic Signs.
 - 2) Type D - Self-Adhesive Tape Tags and Signs.
 - b. Fastener:
 - 1) Type B2 - Screw or adhesive.
 - 2) Type D - Self.
 - c. Size: 5 IN x 7 IN
 - d. Location: Equipment name.
 - e. Legend:
 - 1) OSHA Warning Sign.
 - 2) Description of Warning: "THIS MACHINE STARTS AUTOMATICALLY".

B. Instrumentation Systems:

1. Instrumentation Equipment (e.g., flow control valves, primary elements, etc.):
 - a. Tag type:
 - 1) Outdoor locations: Type B1 - Square Nonmetallic Tags.
 - 2) Indoor noncorrosive:
 - a) Type A1 - Round Metal Tags.
 - b) Type B1 - Square Nonmetallic Tags.
 - 3) Indoor corrosive:
 - a) Stainless steel Type A1 - Round Metal Tags.
 - b) Type B1 - Square Nonmetallic Tags.
 - b. Fastener:
 - 1) Type A1: Chain of the same material.
 - 2) Type B1: Stainless steel chain.
 - c. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) Equipment ISA designation as indicated on the Drawings (e.g., "FIT-xxx").

2. Enclosure for instrumentation and control equipment, (e.g., PLC control panels, etc.):
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/2 IN minimum.
 - 2) Equipment name (e.g., "PLC CONTROL PANEL PCP-xxx").
3. Components inside equipment enclosure, (e.g., PLC's, control relays, contactors, and timers):
 - a. Tag type: Type D - Self-Adhesive Tape Tags.
 - b. Fastener: Self.
 - c. Legend:
 - 1) Letter height: 3/16 IN minimum.
 - 2) Description or function of component (e.g., "PLC-xxx" or "CR-xxx").
4. Through enclosure door mounted components (e.g., selector switches, controller digital displays, etc.):
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) Component ISA tag number as indicated on the Drawings (e.g., "HS-xxx").

C. HVAC Systems:

1. General:
 - a. Provide arrows and markers on ducts.
 - 1) At 20 FT maximum centers along continuous lines.
 - 2) At changes in direction (route) or obstructions.
 - 3) At dampers, risers, branches, machinery or equipment.
 - 4) Where ducts pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.

- b. Position markers on both sides of duct with arrow markers pointing in flow direction.
 - 1) If flow is in both directions use double headed arrow markers.
 - c. Apply tapes and stenciling in uniform manner parallel to ducts.
2. HVAC Equipment (e.g., unit heaters, exhaust fans, air handlers, etc.):
- a. Tag type:
 - 1) Type B2 - Nonmetallic Signs.
 - 2) Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1 IN minimum.
 - 2) Equipment designation as indicated on the Drawings (e.g., "EF-xxx").
3. Ductwork:
- a. Tag type:
 - 1) Type D - Self-Adhesive Tape Tags and Signs.
 - 2) Type G - Stenciling System.
 - b. Fastener: Self.
 - c. Legend:
 - 1) Letter height: 1 IN minimum.
 - 2) Description of ductwork, (e.g., "AIR SUPPLY").
 - 3) Arrows: Single arrow.
4. Enclosure for instrumentation and control equipment, (e.g., fan control panels, etc.):
- a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/2 IN minimum.
 - 2) Equipment designation as indicated on the Drawings (e.g., "FAN CONTROL PANEL FCP-xxx").

5. Wall mounted thermostats:
 - a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
 - b. Fastener: Self.
 - c. Legend:
 - 1) Letter height: 3/16 IN minimum.
 - 2) Description of equipment controlled (e.g., "UH-xxx" or AHU-xxx").
6. Components inside equipment enclosure, (e.g., controller's, control relays, contactors, and timers):
 - a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
 - b. Fastener: Self.
 - c. Legend:
 - 1) Letter height: 3/16 IN minimum.
 - 2) Description or function of component (e.g., "CR-xxx").
7. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., "HS-xxx").

D. Electrical Systems:

1. Trenches with ductbanks, direct-buried conduit, or direct-buried wire and cable.
 - a. Tag type: Type F - Underground Warning Tape.
 - b. Letter height: 1-1/4 IN minimum.
 - c. Location:
 - 1) Where trench is 12 IN or more below finished grade: In trench 6 IN below finished grade.
 - 2) Where trench is less than 12 IN below finished grade: In trench 3 IN below finished grade.

- d. Electrical power (e.g., low and medium voltage):
 - 1) Color: Red with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION".
 - b) Second line: "BURIED ELECTRIC LINE BELOW".
 - e. Communications (e.g., telephone, instrumentation, LAN, SCADA):
 - 1) Color: Orange with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION".
 - b) Second line: "BURIED COMMUNICATION LINE BELOW".
2. Switchgear, switchboards and motor control centers:
- a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Main equipment legend:
 - 1) Letter height:
 - a) First line: 1 IN minimum.
 - b) Subsequent lines: 3/8 IN minimum.
 - 2) First line: Equipment name (e.g., "MAIN SWITCHBOARD MSBxxx").
 - 3) Second line:
 - a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").
 - b) Include the building name or number if the source is in another building.
 - 4) Third line: System voltage and phase (e.g., "480/277 V, 3PH").
 - 5) Fourth line: Date installed (e.g., "INSTALLED JULY 20xx").
 - d. Main and feeder device legend:
 - 1) Letter height: 3/8 IN minimum.
 - 2) Description of load (e.g., "MAIN DISCONNECT", "PUMP Pxxx" or "PANELBOARD HPxxx").
3. Panelboards and transformers:
- a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.

- c. Legend:
 - 1) Letter height:
 - a) First line: 3/8 IN minimum.
 - b) Subsequent lines: 3/16 IN minimum.
 - 2) First line: Equipment name (e.g., "PANELBOARD LPxxx" or "TRANSFORMER Txxx").
 - 3) Second line (panelboards only): System voltage and phase (e.g., "208/120V, 3PH").
 - 4) Third line:
 - a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").
 - b) Include the building name or number if the source is in another building.
 - 5) Fourth line: Date installed (e.g., "INSTALLED JULY 20xx").

4. Transfer switches:

- a. Tag type: Type C - Phenolic Name Plates.
- b. Fastener: Screws.

c. Legend:

- 1) Letter height:
 - a) First line: 3/8 IN minimum.
 - b) Subsequent lines: 3/16 IN minimum.
- 2) First line: Equipment name (e.g., "AUTOMATIC TRANSFER SWITCH ATSxxx").
- 3) Second line: Normal source of power (e.g., "NORMAL SOURCE FED FROM MCCxxx").
- 4) Third line: Emergency source of power (e.g., "EMERGENCY SOURCE FED FROM SGENxxx").
- 5) Fourth line: Date installed (e.g., "INSTALLED JULY 20xx").

5. Safety switches, separately mounted circuit breakers and motor starters, VFD's, etc.:

- a. Tag type: Type C - Phenolic Name Plates.
- b. Fastener: Screws.

- c. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) First line: Description of load equipment is connected to (e.g., "PUMP Pxxx").
- 6. Enclosure for instrumentation and control equipment, (e.g., lighting control panels, etc.):
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/2 IN minimum.
 - 2) Equipment name (e.g., "LIGHTING CONTROL PANEL LCPxxx").
- 7. Components inside equipment enclosures (e.g., circuit breakers, fuses, control power transformers, control relays, contactors, timers, etc.):
 - a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
 - b. Fastener: Self.
 - c. Legend:
 - 1) Letter height: 3/16 IN minimum.
 - 2) Description or function of component (e.g., "M-xxx", "CR-xxx" or "TR-xxx").
- 8. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., "HS-xxx").
- 9. Conductors in control panels and in pull or junction boxes where multiple circuits exist.
 - a. Tag type: Type D - Self-Adhesive Tape Tags.
 - b. Fastener: Self.
 - c. Tag conductor at both ends.

- d. Legend:
 - 1) Letter height: 1/8 IN minimum.
 - 2) Circuit number or wire number as scheduled on the Drawings or as furnished with the equipment.
- 10. Conductors in handholes and manholes.
 - a. Tag type: Type A3 - Metal Tape Tags.
 - b. Fastener: Nylon strap.
 - c. Tag conductor at both ends.
 - d. Legend:
 - 1) Letter height: 1/8 IN minimum.
 - 2) Circuit number or wire number as scheduled on the Drawings.
- 11. Grounding conductors associated with grounding electrode system in accordance with the following:
 - a. Tag type: Type D - Self-Adhesive Tape Tags.
 - b. Fastener: Self.
 - c. Legend:
 - 1) Letter height: 1/8 IN minimum.
 - 2) Function of conductor (e.g., "MAIN BONDING JUMPER", "TO GROUND RING", "TO MAIN WATER PIPE").
- 12. Conduit: Provide tagging of all interior conduit at entrance to control Panels or
Power Panels, at wall, ceiling and floor penetrations.
 - a. Tag type: Type D - Self-Adhesive Tape Tags.
 - b. Fastener: Self.
 - c. Legend:
 - 1) Letter height: 1/8 IN minimum.
 - 2) To and From Description of conduit (e.g., "From LCP –XXX to Eq Tag PMP-XXX)
- 13. Flash protection for switchboards, panelboards, industrial control panels and motor control centers:
 - a. Tag type: Type D - Self-Adhesive Tape Signs.
 - b. Fastener: Self.

- c. Legend: Per NFPA 70.
14. Entrances to electrical rooms:
- a. Tag type: Type B2 - Nonmetallic Signs.
 - b. Fastener: Screw or adhesive.
 - c. Size: 5 IN x 7 IN.
 - d. Location: Each door to room.
 - e. Legend:
 - 1) OSHA Danger Sign.
 - 2) Description of Danger: "HIGH VOLTAGE, AUTHORIZED PERSONNEL ONLY".
15. Equipment where more than one voltage source is present:
- a. Tag type:
 - 1) Type B2 - Nonmetallic Signs.
 - 2) Type D - Self-Adhesive Tape Signs.
 - b. Fastener:
 - 1) Screw or adhesive.
 - 2) Self.
 - c. Size: 1-3/4 IN x 2-1/2 IN.
 - d. Location: Exterior face of enclosure or cubical.
 - e. Legend:
 - 1) OSHA Danger Sign.
 - 2) Description of Danger: "MULTIPLE VOLTAGE SOURCES".

3.3 HAZARD AND SAFETY SIGNS

- A. Provide 10 Hazard and Safety Signs:
- 1. Type B2.
 - 2. Inscription as directed by Owner.

END OF SECTION



DIVISION 23

HEATING, VENTILATING, AND AIR
CONDITIONING (HVAC)



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SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING AND HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment furnished for plumbing and HVAC systems.
2. Single phase motors for plumbing and HVAC equipment.
3. Three-phase motors for plumbing and HVAC equipment.
4. Motors shipped loose for installation in plumbing and HVAC equipment.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 07 92 00 - Joint Sealants.
4. Section 09 96 00 - High Performance Industrial Coatings.
5. Section 10 14 00 - Identification Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Bearing Manufacturers Association (ABMA).
2. International Electrotechnical Commission (IEC).
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
4. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. ICS 6, Enclosures for Industrial Control and System.
 - c. MG 1, Motors and Generators.
5. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC):
 - 1) Article 430, Motors, Motor Circuits, and Controllers.

6. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
7. Underwriters Laboratories, Inc. (UL):
 - a. 508a, Standard for Industrial Control Panels.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Equipment technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Data sheets that include manufacturer's name and complete product model number.
 - 1) Clearly identify all optional accessories that are included.
 - c. Equipment identification utilizing numbering system and name utilized in Drawings.
 - d. Equipment installation details:
 - 1) Location of anchorage.
 - 2) Type, size, and materials of construction of anchorage.
 - 3) Anchorage setting templates.
 - 4) Manufacturer's installation instructions.
 - e. Equipment physical characteristics:
 - 1) Dimensions (both horizontal and vertical).
 - 2) Materials of construction and construction details.
 - 3) Shipping and operating weight.
 - 4) Duct and piping connection sizes, type and location.
 - f. Equipment lining and coatings:
 - 1) Equipment factory primer and paint data.
 - g. Operating characteristics:
 - 1) Utility requirements, natural gas, electric and other.
 - 2) Performance curves.

3) Equipment capacity and efficiency.

B. Contract Closeout Information:

1. Operation and Maintenance Data:

- a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to individual equipment Specification Sections for acceptable manufacturers.

B. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Motors:

- a. Baldor.
- b. General Electric.
- c. Marathon Electric.
- d. Reliance Electric.
- e. Siemens.
- f. Teco-Westinghouse.
- g. U.S. Motors.
- h. WEG.

C. Submit request for substitution in accordance with Specification Section 01 25 13.

D. MANUFACTURED UNITS

1. Electric Motors:

- a. Design for frequent starting duty equivalent to duty service required by driven equipment.
- b. Design for full voltage starting.
- c. Design bearing life based upon actual operating load conditions imposed by driven equipment.

- d. Size for altitude of Project.
- e. Furnish with stainless steel nameplates which include all data required by NFPA 70 (NEC), Article 430.
- f. Use of manufacturer's standard motor will be permitted on integrally constructed motor driven equipment specified by model number in which a redesign of the complete unit would be required in order to provide a motor with features specified.
- g. AC electric motors less than 1/3 HP:
 - 1) Single phase, 60 Hz, designed for the supply voltage shown on the Drawings.
 - 2) Permanently lubricated sealed bearings conforming to ABMA standards.
 - 3) Built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element with stainless steel enclosure.
- h. AC electric motors 1/3 to 1 HP:
 - 1) Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
 - 2) Permanently lubricated sealed bearings conforming to ABMA standards.
 - a) For single phase motors, provide built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element.
- 2. AC electric motors 1-1/2 to 10 HP:
 - a. 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
 - b. Permanently lubricated sealed bearings conforming to ABMA standards.
 - c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
- 3. AC electric motors greater than 10 HP:
 - a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
 - b. Oil or grease lubricated antifriction bearings conforming to ABMA standards.
 - 1) Design bearing life for 90 percent survival rating at 50,000 HRS of operation for motors up to and including 100 HP.
 - 2) For motors greater than 100 HP, design bearing life for 90 percent survival rating at 100,000 HRS of operation.

- c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
- 4. Severe duty motor to have the following minimum features:
 - a. All cast iron construction.
 - b. Gasketed conduit box.
 - c. Epoxy finish for corrosion protection.
 - d. Hydrosopic varnish on windings for corrosion protection.
 - e. Drain plug and breather.
- E. NEMA Design Squirrel Cage Induction Motors:
 - 1. Provide motors designed and applied in compliance with NEMA and IEEE for the specific duty imposed by the driven equipment.
 - 2. Motors to meet NEMA MG 1 NEMA Premium efficiencies.
 - 3. Do not provide motors having a locked rotor kVA per HP exceeding the NEMA standard for the assigned NEMA code letter.
 - 4. For use on variable frequency type adjustable speed drives, provide:
 - a. Induction motors that are in compliance with NEMA MG 1, Part 31.
 - b. Nameplate identification meeting NEMA MG 1, Part 31 requirements.
 - c. Insulated drive end bearing on all motors.
 - d. Shaft grounding ring on all motors:
 - 1) Factory installed, maintenance free, circumferential, bearing protection ring with conductive microfiber shaft contacting material.
 - 2) Electro Static Technology AEGIS SGR Bearing Protection Ring or approved equal.
 - 5. Design motor insulation in accordance with NEMA standards for Class F insulation with Class B temperature rise above a 40 DegC ambient.
 - 6. Design motors for continuous duty.
 - 7. Size motors having a 1.0 service factor so that nameplate HP is a minimum of 15 percent greater than the maximum HP requirements of the driven equipment over its entire operating range.
 - a. As an alternative, furnish motors with a 1.15 service factor and size so that nameplate HP is at least equal to the maximum HP requirements of the driven equipment over its entire operating range.

8. Motor enclosure and winding insulation application:

- a. The following shall apply unless modified by specific Specification Sections:

| MOTOR LOCATION | MOTOR ENCLOSURE / WINDING INSULATION |
|---------------------------------------|---|
| Unclassified Indoor Areas | TEFC, Standard Insulation |
| Wet indoor Areas | TEFC, Encapsulated Windings |
| Corrosive Areas | TEFC, Severe/ Chemical Duty |
| Class I, Division 1 Areas | Explosion Proof, Approved for Class I Division 1 Locations |
| Class II, Division 1 Areas | Explosion Proof, Approved for Class II Division 1 Locations |
| Class I or Class II, Division 2 Areas | Explosion Proof, Approved for Division 1 Locations or TEFC with maximum external frame temperature compatible with the gas or dust in the area, Encapsulated Windings |

NOTE: Provide TENV motors in the smaller horsepower ratings where TEFC is not available.

9. Provide oversize conduit box complete with clamp type grounding terminals inside the conduit box.

F. Submersible Motors: Refer to individual narrow-scope Specification Sections for submersible motor requirements.

G. V-Belt Drive:

1. Provide each V-belt drive with sliding base or other suitable tension adjustment.
2. Provide V-belt drives with a service factor of at least 1.6 at maximum speed.
3. Provide staticproof belts.

2.2 ACCESSORIES

A. Guards:

1. Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
2. Interior applications:
 - a. Construct from expanded galvanized steel rolled to conform to shaft or coupling surface.
 - b. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 IN spacing.
 - c. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.

3. Exterior applications:
 - a. Construct from 16 GA stainless steel or aluminum.
 - b. Construct to preclude entrance of rain, snow, or moisture.
 - c. Roll to conform to shaft or coupling surface.
 - d. Connect to equipment frame with stainless steel bolts and wing nuts.
- B. Equipment: Refer to individual equipment Specification Sections for product requirements.
- C. Data Plate:
 1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
 2. Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.
- D. Lifting Eye Bolts or Lugs:
 1. Provide on all equipment 50 LBS or greater.
 2. Provide on other equipment or products as specified in the narrow-scope Specification Sections.
- E. Platforms and Ladders:
 1. Design and fabricate in accordance with OSHA Standards.
 2. Fabricate components from stainless steel grade 316 .
 3. Provide platform surface: Non-skid grating, unless specified in narrow-scope Specification Sections.

2.3 FABRICATION

- A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.
- B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.
- C. Furnish like parts of duplicate units to be interchangeable.
- D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.

- E. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.
 - 1. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.
- F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.
 - 1. Provide drain connection for 3/4 IN PVC tubing.
- G. Machine the mounting feet of rotating equipment.
- H. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that can not be properly prepared and painted.
 - 1. When such back to back fabrication can not be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.
 - 2. Where continuous welds are not practical, after painting seal the back to back surfaces from the environment in accordance with Specification Section 07 92 00.
- I. Critical Speed:
 - 1. All rotating parts accurately machined and in as near perfect rotational balance as practicable.
 - 2. Excessive vibration is sufficient cause for equipment rejection.
 - 3. Ratio of all rotative speeds to critical speed of a unit or components: Greater than 1.2.
- J. Control Panels Engineered and Provided with the Equipment by the Manufacturer:
 - 1. Manufacturer's standard design for components and control logic unless specific requirements are specified in the specific equipment Specification Section.
 - 2. NEMA or IEC rated components are acceptable, whichever is used in the manufacturer's standard engineered design, unless specific requirements are required in the specific equipment Specification Section.
 - 3. Affix entire assembly with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to delivery.
 - a. Control panels without an affixed UL 508A label shall be rejected.

2.4 SHOP OR FACTORY PAINT FINISHES

A. Electrical Equipment:

1. Provide factory-applied paint coating system(s) for all electrical equipment components except those specified in Specification Section 09 96 00 to receive field painting.
 - a. Field painted equipment: See Specification Section 09 96 00 for factory applied primer/field paint compatibility requirements.

B. Field paint other equipment in accordance with Specification Section 09 96 00.

1. See Specification Section 09 96 00 for factory applied primer/field paint compatibility requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment as shown on Drawings and in accordance with manufacturer's directions.

B. Utilize templates for anchorage placement for slab-mounted equipment.

C. For equipment having drainage requirements such as condensate, provide 3/4 IN PVC or clear plastic tubing from equipment base to nearest floor or equipment drain.

1. Route clear of major traffic areas and as approved by Engineer.

D. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings from closest operating floor level.

E. Equipment Base:

1. Construct level in both directions.
2. Take particular care at anchor bolt locations so these areas are flat and level.

F. Machine Base:

1. Mount machine base of rotating equipment on equipment base.
 - a. Level in both directions, using a machinist level, according to machined surfaces on base.

2. Level machine base on equipment base and align couplings between driver and driven unit using steel blocks and shims.
 - a. Size blocks and shims to provide solid support at each mounting bolt location.
 - 1) Provide area size of blocks and shims approximately 1-1/2 times area support surface at each mounting bolt point.
 - b. Provide blocks and shims at each mounting bolt.
 - 1) Furnish blocks and shims that are square shape with "U" cut out to allow blocks and shims to be centered on mounting bolts.
 - c. After all leveling and alignment has been completed and before grouting, tighten mounting bolts to proper torque value.

G. Couplings:

1. Align in the annular and parallel positions.
 - a. For equipment rotating at 1200 rpm or less, align both annular and parallel within 0.001 IN tolerance for couplings 4 IN size and smaller.
 - 1) Couplings larger than 4 IN size: Increase tolerance 0.0005 IN per inches of coupling diameter, i.e., allow 6 IN coupling 0.002 IN tolerance, and allow a 10 IN coupling 0.004 IN tolerance.
 - b. For equipment rotating at speeds greater than 1200 rpm allow both annular and parallel positions within a tolerance rate of 0.00025 IN per inch coupling diameter.
2. If equipment is delivered as a mounted unit from factory, verify factory alignment on site after installation and realigned if necessary.
3. Check surfaces for runout before attempting to trim or align units.

H. Grouting:

1. After machine base has been shimmed, leveled onto equipment base, couplings aligned and mounting bolts tightened to correct torque value, place a dam or formwork around base to contain grouting between equipment base and equipment support pad.
 - a. Extend dam or formwork to cover leveling shims and blocks.
 - b. Do not use nuts below the machine base to level the unit.
2. Saturate top of roughened concrete subbase with water before grouting.
 - a. Add grout until entire space under machine base is filled to the top of the base underside.

- b. Puddle grout by working a stiff wire through the grout and vent holes to work grout in place and release any entrained air in the grout or base cavity.
- 3. When the grout has sufficiently hardened, remove dam or formwork and finish the exposed grout surface to fine, smooth surface.
 - a. Cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too rapid evaporation of water from the grout.
 - b. When the grout has fully hardened (after a minimum of seven (7) days) tighten all anchor bolts to engage equipment base to grout, shims, and equipment support pad.
 - c. Recheck driver-driven unit for proper alignment.

3.2 INSTALLATION CHECKS

- A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.
 - 1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.
- B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
 - 1. Has been properly installed and lubricated.
 - 2. Is in accurate alignment.
 - 3. Is free from any undue stress imposed by connecting piping or anchor bolts.
 - 4. Has been operated under full load conditions and that it operated satisfactorily.
 - a. Secure and deliver a field written report to Owner immediately prior to leaving jobsite.
- C. No separate payment shall be made for installation checks.
 - 1. All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

3.3 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS

- A. Identify equipment and install hazard warning signs in accordance with Specification Section 10 14 00.

3.4 FIELD HIGH PERFORMANCE INDUSTRIAL COATINGS

- A. For required field High Performance Industrial Coatings, comply with Specification Section 09 96 00.

3.5 WIRING CONNECTIONS AND TERMINATION

- A. Clean wires before installing lugs and connectors.
- B. Coat connection with oxidation eliminating compound for aluminum wire.
- C. Terminate motor circuit conductors with copper lugs bolted to motor leads.
- D. Tape stripped ends of conductors and associated connectors with electrical tape.
 - 1. Wrapping thickness shall be 150 percent of the conductor insulation thickness.
- E. Connections to carry full ampacity of conductors without temperature rise.
- F. Terminate spare conductors with electrical tape.

END OF SECTION

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SECTION 23 80 00
HVAC: EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heating, ventilating, and cooling equipment.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 01 61 03 - Equipment: Basic Requirements.
4. Section 23 05 13 - Common Motor Requirements for Plumbing and HVAC Equipment.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Air Movement and Control Association (AMCA).
2. Air Conditioning and Refrigeration Institute (ARI).
3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - a. HVAC Applications Handbook, Chapter entitled "Sound and Vibration Control."
 - b. 20, Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.
 - c. 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
4. Canadian Standards Association (CSA).
5. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
6. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).

7. National Roofing Contractors Association (NRCA).
8. Underwriters Laboratories, Inc. (UL):
 - a. 507, Standard for Electric Fans.
9. Building code:
 - a. International Code Council (ICC):
 - 1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.

B. Miscellaneous:

1. Gage thickness specified herein shall be manufacturer's standard gage for steel and Brown and Sharpe gage for non-ferrous metals.
2. Corrosion protection of equipment to be as specified herein.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Fabrication and/or layout drawings.
3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Wiring diagrams.
 - d. Control diagrams.
 - e. Manufacturer's catalog cuts and technical data.
 - f. Corrosion-protection information.
 - g. Fan curves.
 - h. Sound data.
 - i. Vibration isolation.
 - j. Control description.
 - k. Performance data on all equipment.

4. Certifications:
 - a. Provide certification of thickness of corrosion-protection coating.
- B. Contract Closeout Information:
 1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Vibration isolation assemblies:
 - a. Mason.
 - b. Vibration Mounting and Controls Co.
 - c. Vibro-Acoustics.
 2. Corrosion-protective coatings:
 - a. Heresite and Chemical Co.; "Heresite."
 - b. Aero-Marine Engineering, Inc.
 - c. Luvata ElectroFin.
 3. Unit heater - electric:
 - a. Brasch.
 - b. Chromalox.
 - c. QMark.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 GENERAL

- A. All Manufactured Units:
 1. Comply with Specification Section 01 61 03.
 2. Factory wired and assembled.

3. Use fasteners made of same material as unit.
 4. Fabricate motor assemblies and unit housings with vibration isolation assemblies:
 - a. Type: As per Table 47, Chapter 48, ASHRAE HVAC Applications Handbook.
- B. All manufactured units shall be constructed with corrosion-resistant materials or have corrosion-resistant coating.
1. Type:
 - a. Corrosion-resistant materials:
 - 1) Aluminum.
 - 2) Stainless steel.
 - 3) FRP.
 - b. Corrosion-resistant coating:
 - 1) Phenolic-based coating:
 - 2) 3 mil minimum dry thickness, air-dried coating, for surfaces exposed to temperatures less than 150 DegF.
 - 3) 5 mil baked-on coating for heat transfer surfaces and surfaces exposed to temperatures greater than 150 DegF.
 - 4) Factory applied.
 - 5) Provide factory certification of application.

2.3 MANUFACTURED UNITS

- A. Unit Heater - Electric:
1. Type: Vertical.
 2. UL listed for non-rated areas.
 3. Material:
 - a. Cabinet: 18 GA steel.
 - b. Heating elements: Copper-clad steel.
 4. Fan motors:
 - a. See Specification Section 01 61 03.
 - b. Built-in automatic reset overload protection.
 5. Dynamically balanced fan.

6. Built-in automatic reset cutout protection.
 7. Accessories:
 - a. Mounting bracket.
 - b. 40 to 90 DegF, 5 DegF differential internal thermostat.
 8. Electrical, fan motor, and airflow data as scheduled on Drawings.
- B. Unit Heater - Electric:
1. UL listed for Class 1, Group D, Division 1 areas.
 2. Material:
 - a. Fan and heater case: Non-sparking aluminum.
 - b. Heating bank: Cast aluminum.
 - c. Junction box: Cast aluminum.
 3. Fan motor:
 - a. See Specification Section 23 05 13.
 - b. Built-in overload protection.
 4. Built-in over temperature protection.
 5. Integral line voltage terminal block.
 6. Accessories: Mounting bracket.
 7. Electrical, fan motor and airflow data as scheduled on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with Specification Section 01 61 03.
- B. Install fixed pitched drive sheave after sheave has been sized based on accepted test and balance report.

3.2 ADJUSTING

- A. Install new filters on units which have been running prior to acceptance of Project.

END OF SECTION

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DIVISION 25

INTEGRATED AUTOMATION



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SECTION 25 14 05

LOCAL CONTROL STATIONS AND MISCELLANEOUS ELECTRICAL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide complete local control stations, relays, detectors, and switches as indicated on the electrical drawings, control diagram, herein, or in other Sections of the Specifications.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Local control panels shall comply with the requirements of NEC, NEMA, and shall be built to UL-508 standards, or equal as approved by the State of Alaska Department of Labor Inspections Division.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with 26 05 00 – Electrical Work, General.
 - 1. Include panel schematics and layout drawings, and catalog cuts of all control equipment including enclosures, relays, pilot devices, terminations, and wire troughs.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Contractor shall provide the stations to satisfy the functional requirements in the relevant mechanical equipment and Instrumentation & Control specifications and the Electrical Schematics. Each station shall be fabricated with UL-labeled components. Stations not specifically indicated as being WORK of other Sections shall be provided under this Section. All stations shall be wired under this Section.
- B. The controls shall be 120-volt maximum. Where the electrical power supply is 240-volt, single-phase or 480-volt, 3-phase, the station shall be provided with a fused control power transformer. Control conductors shall be provided in accordance with Section 26 05 00 – Electrical Work, General.
- C. Each station shall be provided with identified terminal strips for the connection of external conductors. The Contractor shall provide sufficient terminal blocks to connect 25 percent additional conductors for future use. Termination points shall be identified in accordance with Shop Drawings. The stations shall be the source of power for all 24 VDC/120 VAC solenoid valves interconnected with the stations. All equipment associated with the stations shall be ready for service after connection of conductors to equipment, controls, and stations.

D. Wiring to door-mounted devices shall be extra flexible and anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals.

E. Enclosures

1. In indoor rooms, enclosures shall be NEMA 12 steel enclosures painted with ANSI 61 exterior and white interior.
2. In outdoor areas and underground locations, enclosures shall be NEMA 4X stainless steel (prior to modifications) with brushed finish. Where possible, penetrations shall be made in such a manner as to maintain the NEMA 4X rating. If this is not possible, the penetrations shall be made in such a manner as to minimize entry of foreign materials into the enclosure.
3. Through the door disconnects are not permitted.
4. Enclosures shall be freestanding, pedestal-mounted, or equipment skid-mounted, as indicated. Internal control components shall be mounted on a removable mounting pan. Mounting pan shall be finished white.
5. Enclosures shall have non-locking handles.

F. Disconnect Switches

1. Heavy duty, non-fusible, single throw.
2. Horsepower rated.
3. UL listed.
4. Padlockable in "Off" position and door interlock without having the operator mounted on the door.
5. Enclosure per area classification in Section 26 05 00 – Electrical Work, General.
6. 600-volt, 3-phase, 3-pole.
7. Auxiliary control contact as applicable and as indicated.
8. As manufactured by **G.E., Cutler-Hammer, or Square D.**

G. Identification of panel-mounted devices, conductors, and electrical components shall be in accordance with Section 26 05 00 – Electrical Work, General.

H. Panel-mounted devices shall be mounted a minimum of 3 feet above finished floor elevation.

I. Combination Motor Starters: Provide NEMA combination motor starters not furnished in a new MCC, **Allen-Bradley Bulletin 513**, or equal.

1. Provide circuit breakers. Fuses are not acceptable.
2. Provide overload relay. Overload relay shall be electronic, **Allen-Bradley E3 Plus**, or equal, or thermal overload, as noted on the drawings.
3. Provide terminal strips for field terminations.
4. Provide green run lights.
5. "Through the door" type disconnects are not permitted.
6. Assembly shall be Listed as "Self Protected" under UL 508 Type F
7. Provide status contact as required by control wiring diagrams.

2.2 STATION COMPONENTS

- A. Pushbuttons, selector switches, and pilot lights shall be the heavy-duty, oil-tight type, sized to 30 mm. Miniature style devices are not acceptable. Devices shall be as manufactured by **Square D, G.E., Cutler-Hammer**, or equal. Switches shall be UL listed for use in existing motor starters, MCCs, or LCPs, as required.
 1. Lens colors shall be green for "run," "open," or "on;" red for "stopped," "closed," or "off;" and amber for alarm.
 2. Pilot lights shall be LED type.
- B. Relays shall be 1, 2, or 3 PDT, as required, with 10-amp contacts, plug-in type utilizing rectangular blades and provided with sockets for screw-type termination and hold-down clips or DIN rail mounted. Relays shall be as manufactured by **Square D, Potter Brumfield**, or equal.
- C. Magnetic starters shall be:
 1. NEMA rated. IEC or dual NEMA/IEC rated type are not acceptable.
 2. FVNR type unless indicated otherwise.
 3. Combination starters with magnetic only instantaneous trip circuit breakers such as **Cutler-Hammer "MCP," G.E., "Mag-Break,"** or equal.
 4. Control transformers shall be provided with primary and secondary fuses, 120-volt maximum control voltage.
- D. Terminal strips shall be provided for all panels and shall be the flanged fork or ring lug type suitable for No. 12 AWG stranded wire minimum, or shall be DIN rail-mounted terminals, **Phoenix model KDKS**, or equal. Provide 25 percent spare terminals in each panel.
- E. Time delay relays shall be combination on delay and off delay (selectable) with adjustable timing ranges. Provide socket with screw terminal connections and retaining strap. Time delay relays shall be Square D JCK70, or equal.

2.3 FACTORY TESTING

- A. Each LCS shall be factory-assembled and tested for sequence of operation prior to delivery.

2.4 MISCELLANEOUS DEVICES

- A. Intrusion Detection Switches:
 - 1. Industrial limit switch and lever arm, **Allen-Bradley 802T-HP switch with 802MC-W2B lever arm**, or equal.
 - 2. Provide intrusion detection switches as shown on the plans.
- B. Smoke Detectors: Smoke detectors are to be **GE Interlogix ESL 500N Series, Model 541NCRXT**, or equal.
- C. Flood Detectors: Flood detection is to be accomplished utilizing single-level liquid level sensors that employ hermetically sealed magnetic reed switch technology. The detector is to have a float made from Burna-N that rides up and down a brass stem. The 'normally closed' switching contact is to be rated at 24 VDC, 0.5 A. Flood detectors are to be **Madison M Series model M4300**, or equal.
- D. High Wet Well Float Switch: The float switch shall be a simple level switch that provides a contact on high level. The float body shall be high-density polypropylene and the cable shall be flexible PVC, rated 120 VAC and use in corrosive environments at a temperature range of -20 degrees F to 100 degrees F. The contact shall be a single Form C-type mercury or mercury-free switch. The float switch shall include a Kevlar Cable grip and 20 meters of cable. The switch shall be **Flygt Model ENM-10**, or equal.
- E. Pump Protection Relays: The pump protection relay shall monitor the pump for high temperature and leakage. The relay for Flygt pumps shall plug into an 11-pin socket, operate on 24V AC or DC, and shall provide a single 2-pole contact for high temperature and a single 2-pole contact for leakage. The relay for ABS pumps shall be a UL 508 listed control panel with ABS solid state seal minder relay, motor protection relay, and seal in relay.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Stations shall be installed in accordance with in Section 26 05 00 – Electrical Work, General, and in accordance with the manufacturer's recommendations.
- B. Stations shall be protected at the Site from loss, damage, and the effects of weather. Stations shall be stored in an indoor, dry location. Heating shall be provided in areas subject to corrosion and humidity.
- C. Station interiors and exteriors shall be cleaned, and coatings shall be touched up to match original finish upon completion of the Work.

- D. Conduit, conductors, and terminations shall be installed in accordance with Section 26 05 00 – Electrical Work, General.

3.2 FIELD TESTING

- A. Each station shall be tested again for functional operation in the field after the connection of external conductors and prior to equipment startup.
- B. Deficient stations shall be corrected, to the Engineer's satisfaction, at the Contractor's expense.

END OF SECTION

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DIVISION 26

ELECTRICAL



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SECTION 26 01 26
ELECTRICAL TESTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies the Work necessary to test, commission, and demonstrate that the electrical Work satisfies the criteria of these Specifications and functions as required by the Contract Documents.
- B. The requirements of Section 26 05 00 – Electrical Work, General, apply to the Work of this Section.

1.2 TESTING

- A. The following test requirements supplement test and acceptance criteria that may be stated elsewhere.
 - 1. Lighting: Switching, including remote control, if indicated. Circuitry is in accordance with panel schedules.
 - 2. Power Instrumentation: Demonstrate that power monitor, power monitoring, current monitoring, and voltage monitoring is functional.
 - 3. Demonstrate mechanical and/or electrical interlocking by attempting to subvert the intended sequence.
 - 4. Activate ground fault tripping by operating test features provided with ground current protective systems and by injecting a known and reasonable current in the ground current sensor circuit. In general, ground fault tripping should occur at a ground current equivalent to 20 percent of phase current. Current injection is not required of circuit 400 amps or less.
 - 5. Cable Testing: 480-volt circuits shall be tested for insulation resistance with a 1000-volt megohm meter. Testing shall be done after the 480-volt equipment is terminated. Control and signal wires shall be tested for continuity and resistance to ground.
 - 6. Test Ground Fault Interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle manufacturer.
 - 7. A functional test and check of all electrical components is required prior to performing subsystem testing and commissioning. Compartments and equipment shall be cleaned as required by other provisions of these Specifications before commencement of functional testing. Functional testing shall comprise:
 - a. Visual and physical check of cables, circuit breakers, transformers and connections associated with each item of new and modified equipment.

- b. Shunt trip breakers shall be operated and able to be manually reset.
 - c. Circuit breakers that have adjustable time or pick-up settings for ground current, instantaneous overcurrent, short-time overcurrent, or long-time overcurrent, shall be field-adjusted by a representative of the circuit breaker manufacturer. Setting shall be tabulated and proven for each circuit breaker in its installed position. Test results shall be certified by the person performing the tests and be transmitted to the ENGINEER.
8. Complete ground testing of grounding electrodes per requirements prior to operating the equipment.
- B. Subsystem testing shall occur after the proper operation of alarm and status contacts has been demonstrated or otherwise accepted by the ENGINEER and after process control devices have been adjusted as accurately as possible. It is intended that the Contractor will adjust limit switches and level switches to their operating points prior to testing and will set pressure switches, flow switches, and timing relays as dictated by operating results.
 - C. After initial settings have been completed, each subsystem shall be operated in the manual mode and it shall be demonstrated that operation is in compliance with the Contract Documents. Once the manual mode of operation has been proven, automatic operation shall be demonstrated to verify such items as proper start and stop sequence of pumps, proper operation of valves, proper speed control, etc.
 - D. Motor operated valves shall be tested after having been phased and tested for correct motor rotation and after travel and torque limit switches have been adjusted by a representative of the valve manufacturer. Tests shall verify status indication, proper valve travel, and correct command control from local and remote devices.
 - E. Provide ground resistance tests on the main grounding bars in all control panels in the presence of the ENGINEER and submit results.
 - F. Subsystems shall be defined as individual and groups of pumps, conveyor systems, chemical feeders, air conditioning units, ventilation fans, air compressors, etc.
 - G. General: Carry out tests indicated herein for individual items of materials and equipment in other Sections.
 - H. Megger each complete phase wire, cable, termination, and submersible pump winding to ground.
 - I. Perform Fiber Optic cable tests as required

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 26 05 00
ELECTRICAL WORK, GENERAL

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide electrical work, complete and operable, in accordance with the Contract Documents.
- B. The provisions of this Section apply to all sections in Division 25, 26, and 40 except as indicated otherwise.
- C. The Work of this Section is required for operation of electrically-driven equipment provided under specifications in other Divisions. The Contractor's attention is directed to the requirement for proper coordination of the Work of this Section with the WORK of equipment specifications, and the Work of instrumentation sections.
- D. Concrete, excavation, backfill, and steel reinforcement required for encasement, installation, or construction of the Work of the various sections of Division 26 is included as a part of the Work under the respective sections, including duct banks, manholes, handholes, equipment housekeeping pads, and light pole bases.

1.2 REFERENCE STANDARDS

- A. The WORK of this Section and all sections in Division 26 shall comply with the following, as applicable:
 - NEC (NFPA 70) National Electrical Code
 - NETA International Electrical Testing Association
 - NEMA 250 Enclosure for Electrical Equipment (1000 Volts
Maximum)Anchorage Electrical Code amendments to the NEC.
- B. Electrical equipment shall be listed by and shall bear the label of Underwriters' Laboratories, Inc. (UL).
- C. Installation of electrical equipment and materials shall comply with OSHA Safety and Health Standards, state building standards, and applicable local codes and regulations.
- D. Where the requirements of the specifications conflict with UL, NEMA, NFPA, or other applicable standards, the more stringent requirements shall govern.

1.3 SIGNAGE

A. Local Disconnect Switches:

1. Each local disconnect switch for motors and equipment shall be legibly marked to indicate its purpose, unless the purpose is indicated by the location and arrangement.

B. Warning Signs:

1. 600 volts nominal, or less. – Entrances to rooms and other guarded locations that contain live parts shall be marked with conspicuous signs prohibiting entry by unqualified persons.

C. Isolating Switches: Isolating switches not interlocked with an approved circuit interrupting device shall be provided with a sign warning against opening them under load.

1.4 PUBLIC UTILITIES REQUIREMENTS

A. Electrical service is existing and Utility is the Matanuska Electric Association.

B. The Contractor will be responsible for coordinating outages as needed with the serving utility when working on the ATS which is also serves portions of the existing WWTP.

1.5 PERMITS AND INSPECTION

A. All electrical permits shall be obtained and inspection fees shall be paid by the Contractor.

B. All electrical permits shall be obtained by the Contractor. The Owner has paid for the inspection fees.

C. The Contractor shall pay all connection and turn-on service charges required by the utility company.

1.6 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Specification Section 01 33 00 - Submittals.

B. Shop Drawings: Include the following:

1. Complete material lists stating manufacturer and brand name of each item or class of material.
2. Shop Drawings for all grounding WORK not specifically indicated.
3. Front, side, rear elevations, and top views with dimensional data.
4. Location of conduit entrances and access plates.

5. Component data.
 6. Connection diagrams, terminal numbers, internal wiring diagrams, conductor size, and cable numbers.
 7. Method of anchoring, seismic requirements, weight.
 8. Types of materials and finish.
 9. Nameplates.
 10. Temperature limitations, as applicable.
 11. Voltage requirement, phase, and current, as applicable.
 12. Front and rear access requirements.
 13. Test reports.
 14. Grounding requirements.
 15. Catalog cuts of applicable pages of bulletins or brochures for mass produced, non-custom manufactured material. Catalog data sheets shall be stamped to indicate the project name, applicable Section and paragraph, model number, and options. This information shall be marked in spaces designated for such data in the Engineer's stamp.
- C. Shop Drawings shall be custom prepared. Drawings or data indicating "optional" or "as required" equipment are not acceptable. Options not proposed shall be crossed out or deleted from Shop Drawings.
- D. Materials and Equipment Schedules: The Contractor shall deliver to the Engineer within 30 days of the commencement date in the Notice to Proceed, a complete list of all materials, equipment, apparatus, and fixtures proposed for use. The list shall include type, sizes, names of manufacturers, catalog numbers, and other such information required to identify the items.
- E. Owner's Manuals: Complete information in accordance with Specification Section 01 33 04 - Operation and Maintenance Manuals.
- F. Record Drawings: The Contractor shall show invert and top elevations and routing of all duct banks and concealed below-grade electrical installations. Record Drawings shall be prepared, be available to the ENGINEER, and be submitted according to Specification Section 01 77 23 – Contract Closeout.

1.7 AREA DESIGNATIONS

A. General:

1. Raceway system enclosures shall comply with Section 26 05 33 – Electrical Raceway Systems.
2. Electrical WORK specifically indicated in sections within any of the Specifications shall comply with those requirements.
3. Electrical WORK in above ground indoor facilities shall be NEMA 12.
4. Electrical WORK in below ground facilities and outdoors shall be NEMA 4X.
5. Installations in hazardous locations shall conform strictly to the requirements of the Class, Group, and Division indicated.

B. Material Requirements:

1. NEMA 4X enclosures shall be stainless steel.
2. NEMA 12 enclosures shall be steel, coated with ANSI 61 grey paint.

1.8 TESTS

- A. The Contractor shall be responsible for factory and field tests required by specifications in Division 26 and by the Engineer or other authorities having jurisdiction. The Contractor shall furnish necessary testing equipment and pay costs of tests, including all replacement parts and labor, due to damage resulting from damaged equipment or from testing and correction of faulty installation.
- B. Where test reports are indicated, proof of design test reports for mass-produced equipment shall be submitted with the Shop Drawings, and factory performance test reports for custom-manufactured equipment shall be submitted and be approved prior to shipment. Field test reports shall be submitted for review prior to Substantial Completion.
- C. Equipment or material which fails a test shall be removed and replaced.

1.9 CONSTRUCTION SEQUENCING

- A. Continuance of facility operation during demolition and the installation process is critical at some facilities. Therefore, the Contractor shall carefully examine all work to be done in, on, or adjacent to existing equipment. Work shall be scheduled, subject to the Owner's approval, to minimize required process or equipment shutdown time. The Contractor shall submit a written request including sequence and duration of activities to be performed during plant shutdown.
- B. All switching, safety tagging, etc., required for process or equipment shutdown or to isolate EXISTING equipment shall be performed by the Contractor. In no case shall the CONTRACTOR begin any work in, on, or adjacent to existing

equipment without written authorization by the AWWU plant supervisor and the Engineer. The Contractor shall remove the lock within 4 hours upon request of AWWU, in an emergency, and if the equipment is operable.

- C. The Contractor shall make all modifications or alterations to existing electrical facilities required to successfully install and integrate the new electrical equipment as indicated on the electrical drawing. Modifications to existing equipment, panels, or cabinets shall be made in a professional manner with all coatings repaired to match existing. The Contractor is responsible for ensuring all panels and equipment are UL-listed. The costs for modifications (including UL listing) to existing electrical facilities required for a complete and operating system shall be included in the Contractor's original Bid amount and no additional payment for this Work will be authorized. Extreme caution shall be exercised by the Contractor in digging trenches in order not to damage existing underground utilities. Cost of repairs of damages caused during construction shall be the Contractor's responsibility without any additional compensation from the Owner.
- D. The Contractor shall be responsible for identifying available existing circuit breakers in lighting panels for the intended use as required by the Drawings. The CONTRACTOR shall also be responsible for field-verifying the available space in substation switchboards to integrate new power circuit breakers. Costs for this WORK shall be included in the Contractor's original Bid amount.
- E. The Contractor is advised to visit the Site before submitting a Bid to better acquaint itself with the Work of this Contract. Lack of knowledge will not be accepted as a reason for granting extra compensation to perform the WORK.
- F. Installation of New Equipment:
 - 1. The Contractor will install and terminate the new switchboards, motor starters, control panels, wireways, cables, and instruments in accordance with the agreed schedule. The CONTRACTOR shall provide a list, daily, of the points that are ready for service as they are connected, calibrated, and tested. The Contractor shall only connect to equipment that is new or is out of service.
 - a. Warranty: The warranty shall start from the date of final acceptance of the completed project, and shall extend for 1 year.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Equipment and materials shall be new and shall be listed by an Agency acceptable to the State of Alaska Department of Labor Mechanical Inspections Division. Equipment and materials shall be the products of experienced and reputable manufacturers in the industry. Similar items in the WORK shall be products of the same manufacturer. Equipment and materials shall be of industrial grade standard of construction.

- B. Where a NEMA enclosure type is indicated in a non-hazardous location, the CONTRACTOR shall utilize that type of enclosure, despite the fact that certain modifications, such as cutouts for control devices, may negate the NEMA rating.
- C. On devices indicated to display dates, the year shall be displayed as 4 digits.

2.2 MOUNTING HARDWARE

- A. Miscellaneous Hardware:
 - 1. Nuts, bolts, and washers shall be stainless steel.
 - 2. Strut for mounting of raceways and equipment shall be galvanized or stainless steel as required by the area classification. Where contact with concrete or dissimilar metals may cause galvanic corrosion, suitable non-metallic insulators shall be utilized to prevent such corrosion. Strut shall be as manufactured by **Unistrut, B-Line**, or equal.
 - 3. Anchors for attaching equipment to concrete walls, floors and ceilings shall be stainless steel expansion anchors, such as "**Rawl-Bolt**," "**Rawl-Stud**" or "**Lok-Bolt**" as manufactured by **Rawl**; similar by **Star**, or equal. Wood plugs shall not be permitted.

2.3 ELECTRICAL IDENTIFICATION

- A. Nameplates: Nameplates shall be fabricated from black-letter, white-face laminated plastic engraving stock, **Formica type ES-1**, or equal. Each shall be fastened securely, using fasteners of brass, cadmium-plated steel, or stainless steel, screwed into inserts or tapped holes, as required. Engraved characters shall be block style, with no characters smaller than 1/8-inch in height.
- B. Conductor and Equipment Identification: Conductor and equipment identification devices shall be heat-shrink plastic tubing with machine printing. Lettering shall read from left to right and shall face toward the front of the panel.

PART 3 - EXECUTION

3.1 GENERAL

- A. Incidentals: The CONTRACTOR shall provide all materials and incidentals required for a complete and operable system, even if not required explicitly by the Specifications or the Drawings. Typical incidentals are terminal lugs not furnished with vendor-supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and control wiring required by vendor-furnished equipment to connect with other equipment indicated in the Contract Documents.
- B. Field Control of Location and Arrangement: The Drawings diagrammatically indicate the desired location and arrangement of outlets, conduit runs, equipment, and other items. Exact locations shall be determined by the Contractor in the field, based on the physical size and arrangement of

equipment, finished elevations, and other obstructions. Locations on the Drawings, however, shall be followed as closely as possible.

1. Where raceway development drawings, or "home runs," are shown, the Contractor shall route the raceways in accordance with the indicated installation requirements. Routings shall be exposed.
 2. Conduit and equipment shall be installed in such a manner as to avoid all obstructions and to preserve headroom and keep openings and passageways clear. Lighting fixtures, switches, convenience outlets, and similar items shall be located within finished rooms as indicated. Where the Drawings do not indicate exact locations, the Engineer shall determine such locations. If equipment is installed without instruction and must be moved, it shall be moved without additional cost to the Owner. Lighting fixture locations shall be adjusted slightly to avoid obstructions and to minimize shadows.
 3. Wherever raceways and wiring for lighting and receptacles are not indicated, it shall be the Contractor's responsibility to provide all lighting and receptacle-related conduits and wiring as required, based on the actual installed fixture layout and the circuit designations as indicated. Wiring shall be #12 AWG minimum, and conduits shall be 3/4-inch minimum. Where circuits are combined in the same raceway, the Contractor shall derate conductor ampacities in accordance with NEC requirements.
 4. Where complete raceway systems are not shown on the plans, Contractor shall submit a raceway plan for approval. Intent is to minimize number of raceway systems.
- C. Workmanship: Materials and equipment shall be installed in strict accordance with printed recommendations of the manufacturer. Installation shall be accomplished by workers skilled in the work. Installation shall be coordinated in the field with other trades to avoid interferences.
- D. Protection of Equipment and Materials: The Contractor shall fully protect materials and equipment against damage from any cause. Materials and equipment, both in storage and during construction, shall be covered in such a manner that no finished surfaces will be damaged, marred, or splattered with water, foam, plaster, or paint. Moving parts shall be kept clean and dry. The Contractor shall replace or refinish damaged materials or equipment, including faceplates of panels and switchboard sections, as part of the WORK.
- E. Incoming utility power equipment shall be provided in conformance with the utility's requirements.
- F. The Contractor shall provide power wiring in raceways for the motor starters in accordance with Section 25 14 05 – Local Control Stations and Miscellaneous Electrical Devices, for starters not in MCC's.

3.2 CORE DRILLING

- A. The Contractor shall perform core drilling required for installation of raceways through concrete walls and floors. Locations of floor penetrations, as may be required, shall be based on field conditions. Verify all exact core drilling locations based on equipment actually furnished, as well as exact field placement. To the extent possible, identify the existence and locations of encased raceways and other piping in existing walls and floors with the Owner prior to any core drilling activities. Damage to any encased conduits, wiring, and piping shall be repaired as part of the Work.
- B. All penetrations required to extend raceways through concrete walls, roofs, and floors or masonry walls shall be core drilled.

3.3 CONCRETE HOUSEKEEPING PADS

- A. Concrete housekeeping pads shall be provided for indoor floor standing electrical equipment, and the standby Generator. Housekeeping pads for equipment, including future units, shall be 3-1/2 inches above surrounding finished floor or grade, and 2 inches larger in both dimensions than the equipment, unless otherwise indicated.
- B. Concrete housekeeping curbs shall be provided for all conduit stub-ups in indoor locations that are not concealed by equipment enclosures. Such curbing shall be 3 inches above finished floor or grade.

3.4 EQUIPMENT ANCHORING

- A. Floor supported, wall-, or ceiling-hung equipment and conductors shall be anchored in place by methods that will meet seismic requirements in the area where the project is located. Wall-mounted panels that weigh more than 500 pounds, or which are within 18 inches of the floor, shall be provided with fabricated steel support pedestals. If the supported equipment is a panel or cabinet enclosed within removable side plates, it shall match supported equipment in physical appearance and dimensions. Transformers hung from 4-inch stud walls and weighing more than 300 pounds shall have auxiliary floor supports.
- B. Anchoring methods and leveling criteria in the printed recommendations of the equipment manufacturers are a part of the WORK of this Contract.
- C. Panels, raceways, and other equipment shall be anchored and supported for Seismic requirements.

3.5 EQUIPMENT IDENTIFICATION

- A. General: Equipment and devices shall be identified as follows:
 - 1. Nameplates shall be provided for all panelboards, control and instrumentation panels, starters, switches, and pushbutton stations. In addition to nameplates, control devices shall be equipped with standard collar-type legend plates.

2. Control devices within enclosures shall be identified as indicated. Identification shall be similar to the subparagraph above.
3. Equipment names and tag numbers, where indicated on the Drawings, shall be utilized on all nameplates.
4. The Contractor shall furnish typewritten circuit directories for panelboards; circuit directory shall accurately reflect the equipment connected to each circuit.
5. Generator receptacles shall be identified with the incoming service voltage with 1" lettering.
6. Generator transfer switches shall be labeled "Main" and "Generator" with ½" lettering.

3.6 CLEANING

- A. Before final acceptance, the electrical WORK shall be thoroughly cleaned. Exposed parts shall be thoroughly clean of cement, plaster, and other materials. Oil and grease spots shall be removed with a non-flammable cleaning solvent. Such surfaces shall be carefully wiped and all cracks and corners cleaned out. Touch-up paint shall be applied to scratches on panels and cabinets. Electrical cabinets or enclosures shall be vacuum-cleaned.
- B. Contractor shall group, coil, and tie wrap all spare cables at the bottom of the Local Control Panels. The wires shall be grouped according to the device, control panel, or MCC section they originate from. Cable groups shall be tagged according to their point of origin.
- C. All debris shall be removed from the void below the panels.

3.7 CONTROL PANEL WIRING

- A. The Contractor shall ensure all panels are listed as assemblies upon completion of the Work.

END OF SECTION

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SECTION 26 05 05
ELECTRIC MOTORS

PART 1 - GENERAL

1.1 SUMMARY

- A. General: The Contractor shall provide electric motors, accessories, and appurtenances complete and operable, in conformance with the specifications and the Contract Documents.
- B. The provisions of this Section apply to constant torque AC squirrel cage induction motors throughout the Contract Documents, except as indicated otherwise.
- C. The Contractor shall assign to the equipment supplier the responsibility to select suitable electric motors for the equipment. The choice of motor manufacturer shall be subject to review by the ENGINEER. Such review will consider future availability of replacement parts and compatibility with driven equipment.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Specification Section 01 33 00.
- B. Complete motor data shall be submitted. Motor data shall include:
 - 1. Motor manufacturer.
 - 2. Motor type or model and dimension drawing. Include motor weight.
 - 3. Nominal horsepower.
 - 4. NEMA design.
 - 5. Enclosure.
 - 6. Frame size.
 - 7. Winding insulation class and temperature rise class.
 - 8. Voltage, phase, and frequency ratings.
 - 9. Service factor.
 - 10. Full load current at rated horsepower for application voltage.
 - 11. Full load speed.
 - 12. Torque characteristics.

13. Guaranteed minimum full load efficiency. Also nominal efficiencies at 1/2 and 3/4 load.
14. Type of thermal protection or over-temperature protection, if included.
15. Wiring diagram for devices such as motor leak detection, temperature, or zero speed switches, as applicable.
16. Bearing data. Include recommendation for lubricants of re-lubricatable type bearings.
17. Power factor at 1/2, 3/4 and full load.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

- A. General: Electric motors shall comply with NEMA MG-1 - Motor and Generator.
- B. NEMA Design: Electric motors shall be NEMA Design B unless otherwise indicated. In no case shall starting torque or breakdown torque be less than the value in NEMA MG 1. Motors shall be suitable for the indicated starting method.
- C. Insulation: Three phase motors shall be provided with Class F insulation, rated to operate at a maximum ambient temperature of 40 degrees C and at the altitudes where the motors will be installed and operated, without exceeding Class B temperature rise limits stated in NEMA MG 1-12.44. Motors shall be provided with insulation systems to withstand 1600 volt spikes, with dV/dt as defined in NEMA MG 1-31.
- D. Motors shall be totally enclosed, fan-cooled (TEFC) with a Service Factor of 1.15, unless otherwise indicated.

2.2 ACCESSORY REQUIREMENTS

- A. General: Motors shall have split-type cast metal conduit boxes.
- B. Lifting Devices: Motors weighing 265 lb (120 Kg) or more shall have suitable lifting eyes for installation and removal.
- C. Grounding Lugs: Provide motor grounding lug suitable to terminate ground wire, sized as indicated.
- D. Nameplate: Motors shall be fitted with permanent stainless steel nameplates indelibly stamped or engraved with NEMA Standard motor data, in conformance with NEMA MG-1-10.40.

2.3 MOTOR THERMAL PROTECTION

- A. Thermostats: Winding thermostats shall be snap action, bi-metallic, temperature-actuated switch. Thermostats shall be provided with one normally

closed contact for each phase. The thermostat switch point shall be precalibrated by the manufacturer.

2.4 MOTOR BEARINGS

- A. Motors shall have bearings designed for 100,000 hours (coupled) L-10 life.
- B. Motors that are indirectly coupled and are controlled by VFD's shall have provisions to limit bearing currents.

2.5 MANUFACTURERS

- A. **U.S. Motors, Reliance Electric**, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Motor installation shall be performed in accordance with the motor manufacturer's written recommendations and the written requirements of the manufacturer of the driven equipment.
- B. Motors shall be installed as required by the existing field conditions, including coupling and shims.
- C. Related electrical WORK involving connections, controls, switches, and disconnects shall be performed in accordance with the applicable sections of Division 26.

3.2 FIELD TESTING

- A. The Contractor shall perform the following field tests:
 - 1. Inspect each motor installation for any deviation from rated voltage, phase, frequency, and improper installation.
 - 2. Visually check for proper phase and ground connections. Verify that multi-voltage motors are connected for proper voltage.
 - 3. Check winding and bearing temperature detectors and space heaters for functional operation.
 - 4. Test for proper rotation prior to connection to the driven equipment.
 - 5. Test insulation (megger test) of new and re-used motors in accordance with NEMA MG-1. Test voltage shall be 1000 VAC plus twice the rated voltage of the motor.

END OF SECTION

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SECTION 26 05 19
WIRE AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide wires and cable, complete and operable, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit Shop Drawings in accordance with 26 05 00 – Electrical Work, General.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Conductors, include grounding conductors, shall be copper. Aluminum conductor wire and cable will not be permitted. Insulation shall bear the label of Underwriters' Laboratories, Inc. (UL), the manufacturer's trademark, and identify the type, voltage, and conductor size. All conductors except flexible cords and cables, fixture wires, and conductors that form an integral part of equipment, such as motors and controllers, shall conform to the requirements of Article 310 of the National Electric Code, latest edition, for current carrying capacity. Flexible cords and cables shall conform to Article 400, and fixture wires shall conform to Article 402. Wiring shall have wire markers at each end.

2.2 LOW VOLTAGE WIRE AND CABLE

A. Power and Lighting Wire

1. Power and lighting wire shall be No. 12 copper AWG minimum size.
2. Wire rated for 600 volts in duct or conduit for all power shall be
 - a. In above grade interior locations: Class B Type THWN-2
 - b. In underground and below grade installations XHHW-2
3. Wiring for 600 volt class power and lighting shall be as manufactured by General Cable, Okonite, or Rome Cable.

B. Control Wire

1. Control wire in duct or conduit shall be the same type as power and lighting wire indicated above.
2. Control wiring shall be No. 14 19-strand copper AWG.

C. Instrumentation Cable

1. Instrumentation cable shall be rated at 600 volts.
2. Individual conductors shall be No. 18 AWG stranded, tinned copper. Insulation shall be color-coded polyethylene: black-red for two-conductor cable, and black-red-white for three-conductor cable.
3. Instrumentation cables shall be composed of the individual conductors, an aluminum polyester foil shield, a No. 18 AWG stranded, tinned copper drain wire, and a PVC outer jacket with a thickness of 0.048-inches.
4. Single pair, No. 18 AWG, twisted, shielded cable shall be Belden Part No. 9341, or equal.
5. Single triad, No. 16 AWG, twisted, shielded cable shall be Belden Part No. 1119A, or equal.

D. Tray Cable - Tray cable is not to be used.

E. Cat 6 Cable: Cat 6 patch cable shall be 4-pair 24-gauge twisted pair rated to TIA/EIA 568-B Cat. SE and UL-listed. The Contractor shall install RJ-45 connectors as required.

F. Submersible Pump Power Cable: Submersible pumps shall be wired with submersible multi-conductor cable as required by the Drawings. The cable shall be Type W Portable Power Cable rated at 600V and 70C temperature with (2) #14 control cables. The insulation shall be EPR, and conduction shall be rope-lay-stranded copper per UL-62. The cabling shall be round with round or flat fillers as needed, with an extra-hard usage, oil resistant, thermoset, CPE jacket, per UL-1581. Cable shall be **Flygt SubCab**, or equal.

G. VFD motor branch cable: Motors circuits operated under VFD control shall be run with shielded cable. Cable shall be **Belden 295xx** (where xx= wire gauge) or VFD Manufacturer recommended equal. Twisted shielded THHN is not permitted.

2.3 FIBER OPTIC CABLE

A. Multimode fiber optic backbone cable:

1. Corning Altos All-Dielectric Gel-Free Cables
2. Fiber count: 12.
3. Shall meet the requirements of TIA/EIA 568A and ICEA S-83-596.
4. Loose tube with a dry gel water blocking agent.
5. For cable installations outside of building envelopes.
6. Type: OSP (outside plant installations).

7. Fibers and water-blocking elements inside gel-free buffer tubes.
8. Core consists of stranded buffer tubes around a central member and wrapped with strength members covered with water-blocking tape.
9. Installation tensile load: 600 LBS.
10. Minimum bending radius:
 - a. Install: 6.2 IN.
 - b. Long term: 4.1 IN.
11. Black, UV resistant outer jacket.
12. Fiber strands:
 - a. Glass fiber core: 62.5/125 micrometer (core diameter/cladding diameter).
 - b. Multimode fiber.
 - c. Individual fibers shall be color coded for identification.
 - d. Maximum attenuation:
 - 1) At 850 nm: 3.4 dB/km.
 - 2) At 1300 nm: 1.0 dB/km.
 - e. Minimum bandwidth:
 - 1) At 850 nm: 200 MHz-km.
 - 2) At 1300 nm: 500 MHz/km.
 - f. Cables shall be listed and marked in accordance with the requirements of NFPA 70.
 - g. Cables shall be imprinted with fiber count and aggregate length at regular intervals.
 - h. Optical fiber cable type utilized shall be in accordance with NFPA 70.
 - 1) Utilize LC type connectors:
 - 2) Tip material: Ceramic or ceramic/glass composite.
 - 3) Utilize connectors which do not require adhesive, epoxy, or polish.
 - 4) Connector maximum insertion loss of 0.5 dB.
 - 5) Connectors shall meet performance requirements of TIA/EIA 568A.
 - 6) Connectors shall be field installable.
 - i. Cable jacket material: medium-density polyethylene.

- j. UL Listed.

2.4 CABLE TERMINATIONS

- A. Compression connectors shall be **Burndy "Hi Lug", Thomas & Betts "Sta-Kon,"** or equal. Threaded connectors shall be split bolt type of high strength copper alloy. Pressure type, twist-on connectors will not be acceptable.
- B. Pre-insulated fork tongue lugs shall be **Thomas & Betts, Burndy,** or equal.
- C. General purpose insulating tape shall be **Scotch No. 33, Plymouth "Slip-knot,"** or equal. High temperature tape shall be polyvinyl as manufactured by **Plymouth, 3M,** or equal.
- D. Labels for coding 600-volt wiring shall be heat-shrink plastic tubing type with machine print. Lettering shall read from left to right, and face the front of the panel. Field wires terminating at a Control Panel shall be labeled with the wire number shown on the LCP Panel wiring diagrams. The Contractor shall mark all as-built drawings with wire labels.
- E. See Section 25 14 05 – Local Control Stations and Miscellaneous Electrical Devices, paragraph 2.4, for a list of pump types.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall provide and terminate all power, control, and instrumentation conductors, except where indicated.

3.2 INSTALLATION

- A. Conductors for feeders as defined in Article 100 of the NEC shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.
- B. Conductors for branch circuits as defined in Article 100 of the NEC, shall be sized to prevent a voltage drop exceeding 3 percent at the farthest connected load or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.
- C. Conductors shall not be pulled into raceway until raceway has been cleared of moisture and debris.
- D. Pulling tensions on raceway cables shall be within the limits recommended by the cable manufacturer. Wire pulling lubricant, where needed, shall be UL-approved.
- E. The following wiring shall be run in separate raceways:

1. 24 VDC discrete signal and instrument power supply.
 2. 4-20 mA analog signal.
 3. All AC circuits.
- F. Wire in panels, cabinets, and wireways shall be neatly grouped using nylon tie straps, and shall be fanned out to terminals.
- G. Wet Well Conduit Seals: Conduit entering wet wells shall be sealed with duct seal at the end of the conduit where the conduit enters the wet well. Provide cloth rag backing and 1" of duct seal so duct seal can be removed in the future.

3.3 SPLICES AND TERMINATIONS

A. General

1. Wire taps and splices are not to be used unless the Contractor can convince the ENGINEER that they are essential and the ENGINEER gives written permission.
2. There shall be no cable splices in underground manholes or pullboxes.
3. Stranded conductors shall be terminated directly on equipment box lugs, making sure that all conductor strands are confined within the lug. Use forked-tongue lugs where equipment box lugs have not been provided.
4. Excess control and instrumentation wire shall be properly taped and terminated as spares.

B. Control Wire and Cable

1. Control conductors shall be spliced or terminated only on terminal strips in panels or vendor-furnished equipment.
2. In terminal cabinets, junction boxes, motor control centers, and control panels, control wire and spare wire shall be terminated to terminal strips.

C. Instrumentation Wire and Cable

1. Shielded instrumentation cables shall be grounded at one end only, the receiving end (i.e., in the LCP/NODE panels) on a 4-20 mA system.

D. Power Wire and Cable

1. No 120/208-volt, 120/240-volt, and 480/277-volt branch circuit conductors may be spliced unless the Contractor can convince the ENGINEER that they are essential and the ENGINEER gives written permission.
2. Shielded power cable shall be terminated with pre-assembled stress cones in a manner approved by the cable and terminal manufacturer. The Contractor shall submit the proposed termination procedure as a Shop Drawing.

3.4 CABLE IDENTIFICATION

- A. General: Wires and cables shall be identified for proper control of circuits and equipment and to reduce maintenance effort.
- B. Identification Numbers: The Contractor shall assign to each control and instrumentation wire and cable a unique identification number. Numbers shall be assigned to all conductors having common terminals and shall be shown on "as built" drawings. Identification numbers shall appear within 3 inches of conductor terminals. "Control Conductor" shall be defined as any conductor used for alarm, annunciator, or signal purposes.
 - 1. Multiconductor cable:
 - a. Assign a number that shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath freestanding equipment.
 - b. Cable number shall form a part of the individual wire number.
 - c. Individual control conductors and instrumentation cable shall be identified at pull points as described above.
 - d. The instrumentation cable numbers shall incorporate the loop numbers assigned in the Contract Documents.
 - 2. All 120/208-volt system feeder cables and branch circuit conductors shall be color-coded as follows:
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Blue
 - d. Neutral - White
 - 3. The 120/240-volt system conductors shall be color-coded as follows:
 - a. Line 1 - Black
 - b. Line 2 - Red
 - c. Neutral - White
 - 4. The 480/277-volt system conductors shall be color-coded as follows:
 - a. Phase A - Brown
 - b. Phase B - Orange
 - c. Phase C - Yellow
 - d. Neutral - Gray

5. Color-coding tape shall be used where colored insulation is not available.
 - a. Branch circuit switch shall be Yellow.
 - b. Insulated ground wire shall be Green.
 - c. Neutral shall be Gray.
6. Color coding and phasing shall be consistent throughout the Site, but bars at panelboards, switchboards, and motor control centers shall be connected Phase A-B-C, top to bottom, or left to right, facing connecting lugs.
7. General purpose AC control cables shall be Red.
8. General purpose DC control cables shall be Blue.
9. Spare cable shall be terminated on terminal screws and shall be identified with a unique number as well as with destination.
10. Terminal strips shall be identified by computer-printable, cloth, self-sticking marker strips attached under the terminal strip.

3.5 TESTING

- A. Cable Assembly and Testing: Cable assembly and testing shall comply with applicable requirements of ICEA Publication No. S-68-516 - Ethylene-Propylene-Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy. Factory test results shall be submitted in accordance with Section 01 33 00 Submittals, prior to shipment of cable. The following field tests shall be the minimum requirements:
 1. Power cable rated at 600 volts shall be tested for insulation resistance between phases and from each phase to a ground using a megohmmeter.
 2. Field testing shall be done after cables are installed in the raceways.
 3. Field tests shall be performed by a certified test organization acceptable to the cable manufacturer. Test results shall be submitted to the ENGINEER for review and acceptance.
 4. Cables failing the tests shall be replaced with a new cable or be repaired. Repair methods shall be as recommended by the cable manufacturer and shall be performed by persons certified by the industry.
- B. Continuity Test: Control and instrumentation cables shall be tested for continuity, polarity, undesirable ground, and origination. Such tests shall be performed after installation and prior to placing all wires and cables in service.

3.6 FIBER OPTIC CABLE INSTALLATION

- A. The fiber optic cable shall be routed as shown on the drawings. Minor variations to the routing may be made to avoid underground utilities or other obstructions with prior approval from the Engineer and at no additional cost to the Owner.

- B. Follow cable manufacturer's specifications regarding handling methods, bend radius, and maximum pulling tension limitations. Fiber optic cable is subject to damage if the cable's specified maximum tensile force is exceeded. Except for short runs (under twenty (20) meters) or hand pulls, tension in the cable must be monitored. A dynamometer or in-line tensiometer shall be used to monitor tension in the pull-line near the winch. This device must be visible to the winch operator, and record of the maximum tension during pulls shall be documented and submitted to the engineer.
- C. Fiber optic cable shall not be installed if outside temperatures are below 0°F.
- D. All underground optical fiber cable shall be run in continuous schedule 80 HDPE conduit provided with a pre-installed pull tape. Transition to GRC, EMT, and/or LTF wherever the cable is routed above grade. HDPE shall not extend above grade. Provide heat shrink tubing extending 6" beyond all under ground transition couplings.
1. In no case shall HDPE conduit ends be terminated in handholes or manholes below grade. The intent is to avoid the possibility of water intrusion into the underground conduit system.
- E. Pulling lubricant shall be used to minimize pulling tension and prevent sheath damage when pulling cables into ducts and conduits. Lubricant shall be applied to the cable sheath with a lubricator. When pulling has been completed, the exposed cable ends shall be wiped clean of lubricant. Lubricants shall be compatible with and intended for use with the fiber optic cables being installed. Soap and grease type lubricants are not allowed.
1. Pulling lines shall be attached to both cable ends when cable is destined for bi- directional pull, and fitted with factory-installed pulling eyes where possible. Cables not equipped with a pulling eye shall have the pulling line attached to the cable end by means of a cable grip. Core hitches shall not be used.
 2. Set up winches, monitoring devices, lubrication points, bend radius devices (sheaves, capstans, bending shoes, etc.), and means of communications along the route prescribed in the pull plan.
 3. Locate the cable reels at the appropriate points of the route.
 4. Remove reel lagging and retrieve the cable data sheets from each reel for as- built records.
 5. Inspect the reels and equipment on which they are mounted for any bolts, nails, or other protrusions that could damage the cable as it is paid off.
 6. Ensure that the reel trailer or jack stands are stable, and that the reel may turn freely without binding. The reel must be level to allow proper pay off of cable.
 7. Align the reel at the feed hole so that the cable can be routed from the top of the reel into the duct bank in as straight a path as possible in a long,

smooth bend without twisting. Cable shall not be paid out from the bottom of the reel or by pulling. Use bending shoes, sheaves, secured sections of innerduct, or other devices to control cable feed into the duct bank.

8. Rigging shall be set up at the pulling end so that the pulling line and cable exit on a line parallel with the duct or conduit to prevent either from rubbing against the edge or mouth. Cable ends shall not be pulled around sheave wheels. When the sheave or pulley cannot be positioned to obtain sufficient cable end slack for proper racking and splicing with the pulling line attached to the end of the cable, a split cable grip may be used to obtain the necessary slack.
9. If not previously installed, attach the pulling grip to the cable, and attach the grip to a swivel. The swivel should be securely fastened to the pull-line. See the pull- line manufacturer's recommendations for appropriate knots.
10. A warning marker (colored tape or similar material) may be attached to the pull- line several feet in front of the pulling grip to alert observers at manholes that the cable is approaching.
11. Apply cable lubricant as required.
12. Verify that communication lines are functional and crews are in place at feed, pull, and intermediate pull points.
13. Start the pull at a slow speed, passing the pull-line and cable over and around the capstans, sheaves, and other devices required to maintain the minimum bend radius. Begin tension monitoring with a calibrated device as soon as tension is applied to the cable. If necessary, aid the cable feed by turning the reel by hand. Ensure that the cable is fed only as fast as the pull-line is moving. Back tension on the reel will prevent too much cable being fed off.
14. Pulling tension shall not exceed 500 lbs or cable manufacturer's recommendation, whichever is less. Contractor shall replace cable if cable manufacturer's maximum pulling tension is exceeded at any time during a pull.
15. Once the cable has moved a minimum of 1.3 m (5 ft) into the innerduct, accelerate the pull smoothly to its intended speed (5.2-30.4 m [50-100 ft] per minute is desirable)
16. Continue the pull at a steady rate. If it is necessary to stop the pull at any point, the winch operator should stop the pull, but NOT release the tension unless instructed to do so. Pulls can be easily resumed if tension is maintained on the pull-line and cable.
17. The cable should be visually observed during the following situations:
 - a. When it passes through any intermediate pull point

- b. Where use of a radius-maintaining device is required due to a bend or offset of entrance and exit ducts
 - c. At intermediate-assist winches
18. Cable shall be carefully inspected for sheath defects or other irregularities as it is payed out from the reel. When defects are detected, pulling shall stop immediately and the cable section shall be replaced. A system of communications shall be maintained between pulling and feed locations so that pulling can be stopped instantly, when required.
 19. Ensure that the bend radius is maintained, and that the cable is properly routed through the sheaves, capstans, bending shoes, etc. Stop the pull if the cable is misrouted, and correct the problem before resuming.
 20. When the cable end reaches a backfeed point or splice point manhole, put the cable out of the hole using a setup similar to that at the feed hole to maintain bend radius.
 21. After passing around the winch, the cable slack should be "figure-eighted" in an area where it will not be subject to damage by personnel or traffic. Flip the "figure-eight" so that the pulling grip end of the cable will be on top before the pull is resumed.
 22. Pulls which have a large number of intermediate Distribution Panels will require a large quantity of cable slack. This slack must be pulled from the two end points and backfed to provide racking slack.
 23. Verify and record the distance markings printed on the cable for as-built documentation.

3.7 FIBER OPTIC TESTING

- A. Perform in-place testing of all installed, terminated fibers in accordance with TIA/EIA-526-7 (OFSTP-7) methods. Document and submit all test results in accordance with the Specifications.
- B. Perform OTDR testing at 1550nm on all fibers in accordance with tester manufacturers procedures and examine traces for events indicating faults or flaws which may affect network performance.
- C. Use an Optical Loss Test Set (OLTS) with hard-copy and disk/CD output capability to test each installed single-mode permanent link fiber from both directions at 1310 and 1550 nm fibers in accordance with TIA/EIA-526-7 (OFSTP-7). T). For spans greater than 90 meters, each tested span must test to a value less than or equal to the value determined by calculating a link loss budget. For horizontal spans less than or equal to 90 meters, each tested span must be < 2.0 dB.
- D. The insertion loss for each mated fiber optic connector pair shall be ≤ 0.75 dB.

- E. Reflectance for single-mode single fiber UPC cable assemblies shall be ≤ -55 dB. Mated connector pair loss testing shall be based on one unidirectional OTDR inspection in accordance with the OTDR operating manual for systems greater than 100 meters.
- F. Calculate and document test results in accordance with TIA/EIA Standard OFSTP-7.
- G. Output a graph which indicates the attenuation and distance of each optical fiber for each test performed. Note on each page of test output:
 - H. 1. Date and Time
 - I. 2. Test Location
 - J. 3. Test Technician's Name
 - K. 4. Test Equipment Used
 - L. 5. Cable number
 - M. 6. Strand number
 - N. 7. Strand Color
 - O. 8. Direction of Test
 - P. 9. Wavelength
 - Q. 10. Attenuation
 - R. 11. Length
- S. Test jumpers shall be of the same fiber core size and connector type as the cable system.
- T. The power meter and the light source shall be set to the same wavelength.
- U. The light sources, OTDR or OLTS shall operate within the ranges of operation specified for 1310 nm or 1550 nm, in accordance with TIA/EIA-526-7, or the manufacturer's recommendation, whichever is the more stringent. Power meters shall be calibrated and traceable to the National Bureau of Standards.
- V. All system connectors, sleeves, and jumpers shall be properly cleaned before measurements are taken.
- W. All testing shall be certified as passing testing standards established by TIA/EIA specification for fiber optic cable.
- X. Final Documentation
- Y. 1. Contractor shall submit optical fiber test results for each fiber installed.

- Z. Optical Time Domain Reflectometer (OTDR) and Optical Loss Test Set (OLTS) output test result graphs shall be provided for each fiber installed with one hardcopy and one electronic copy. If special software is required to read the electronic test results, a copy of the software, licensed to the Owner, shall be delivered to the Owner upon completion of the project.
- AA.2. As-built drawings of the installed fiber optic distribution system shall be provided in hardcopy and electronic AutoCAD format. The As-built drawings shall show:
- BB. Location of all underground cables and final routing of above grade cables.
- CC. Location of all distribution panels, patch panels, terminations and splices.
c. Installed lengths of all fibers, their type and manufacturer, identifying label
- DD. number and color, and their termination points.
- EE. Location and description of all interconnects and cross-connections.
- FF. Calculated loss budgets with transmitter and receiver power, attenuation values, wavelength used and measured optical loss.
- GG.

END OF SECTION 26 05 19

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SECTION 26 05 26
GROUNDING

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide the electrical grounding system, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 26 05 00 – Electrical Work, General apply to this Section.
- C. Single Manufacturer: Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts and manufacturer's services.
- D. Grounding system shall be bonded to the existing system ground via the feeder serving the clarifiers

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Specification Section 01 33 00 and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings: Manufacturer's product information for connections, clamps, and grounding system components, showing compliance with the requirements of this Section.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Components of the grounding electrode system shall be manufactured in accordance with ANSI/UL 467 - Standard for Safety Grounding and Bonding Equipment, and shall conform to the applicable requirements of National Electrical Code Article 250 and local codes.

2.2 GROUNDING SYSTEM

- A. Grounding loop conductors shall be bare annealed copper conductors suitable for direct burial. Conductors shall be No. 4 for 100A services, or No. 4/0, unless indicated otherwise.
- B. Ground Rods
 - 1. Unless indicated otherwise, the ground rod shall be a minimum of 3/4-inch in diameter, 8 feet long, and have a uniform covering of electrolytic copper metallically bonded to a rigid steel core. The copper to steel bond shall be corrosion resistant.

2. Conform to ANSI/UL 467.
 3. Sectional type joined by threaded copper alloy couplings.
- C. Buried cable-to-cable and cable-to-ground rod connections shall be made using exothermic welds by **Cadweld, Enrico Products**, or equal.
 - D. Exposed grounding connectors shall be of the compression type (connector to cable), made of high copper alloy, and be manufactured specifically for the particular grounding application. The connectors shall be **Burndy, O.Z. Gedney**, or equal.
 - E. Grounding clamps shall be used to bond each separately derived system to the grounding electrode conductors.
 - F. Equipment Grounding Circuit Conductors
 1. These conductors shall be the same type and insulation as the load circuit conductors. The minimum size shall be as outlined in Table 250.122 of the National Electrical Code, unless indicated otherwise.
 2. Metallic conduit systems shall have equipment grounding wires as well as being equipment grounding conductors themselves.
 - G. Ground clamps in concrete shall be rated for use with rebar and embedded in concrete.
 - H. Manufacturers of grounding materials shall be **Copperweld, Blackburn, Burndy**, or equal.

PART 3 - EXECUTION

3.1 GROUNDING

- A. Provide a separate grounding conductor, securely grounded in each raceway independent of raceway material.
- B. Provide a separate grounding conductor for each motor and connect at motor box. Do not use bolts securing motor box to frame or cover for grounding connectors.
- C. Size in accordance with the NEC-Article 250 and local amendments.
- D. Route conductors inside raceway.
- E. Provide a grounding type bushing for secondary feeder conduits which originate from the secondary section of each switchboard or panelboard.
- F. Individually bond these raceways to the ground bus in the secondary section.
- G. Provide a green insulated wire as grounding jumper from the ground screw to a box grounding screw and, for grounding type devices, to equipment grounding conductor.

- H. Provide a separate grounding conductor in each individual raceway for parallel feeders.
- I. Interconnect the secondary switchgear neutral bus to the ground bus in the secondary switchgear compartment only at service entrance point or after a transformer.
- J. Bond cold water pipe systems and metallic building structure per NEC. Bond ALL water pipe penetrations.
- K. Measure ground impedance in accordance with IEEE STD 81 after installation but before connecting the electrode to the remaining grounding system.
- L. Low Voltage Grounded System (600-volt or less): A low voltage grounded system is a system where the local power supply is a transformer with the transformer secondary grounded.
 - 1. Grounding system connections for a premises wired system supplied by a grounded AC service shall have a grounding electrode connector connected to the grounded service conductor at each service, in accordance with the NEC.
 - 2. The grounded circuit conductor shall not be used for grounding non-current carrying parts of equipment, raceways, and other enclosures except where specifically listed and permitted by the NEC.
- M. Embedded Ground Connections
 - 1. Underground and grounding connections embedded in concrete shall be UL listed compression type ground grid connectors.
 - 2. The connection shall be made in accordance with the manufacturer's instructions.
 - 3. The Contractor shall not conceal or cover any ground connections until the ENGINEER or authorized representative has established that every grounding connection conforms to the Contract Documents and has given the Contractor written confirmation.
- N. Ground Rods
 - 1. Locations shall be as determined in the field.
 - 2. Rods forming an individual ground array shall be equal in length.
 - 3. Rod spacing shall be a minimum of the rod length.
- O. Shield Grounding
 - 1. Shielded instrumentation cable shall have its shield grounded at one end only unless Shop Drawings indicate the shield will be grounded at both ends.

2. The grounding point shall be at the control panel or otherwise at the receiving end of the signal carried by the cable.
3. Termination of shield drain wire shall be on its own terminal screw.
4. Terminal screws shall be jumpered together using manufactured terminal block jumpers.
5. Connection to the ground bus shall be via a green No. 12 conductor to the main ground bus for the panel.

END OF SECTION

SECTION 26 05 33
ELECTRICAL RACEWAY SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide electrical raceway systems, complete and in place, in accordance with the Contract Documents.
- B. Local amendments to NEC require:
 - 1. The equipment grounding conductor run with or enclosing the circuit conductors shall be of the following:
 - a. A copper conductor.
 - b. This conductor shall be solid or stranded; insulated, covered, or bare; and in the form of a wire or a bus bar of any shape.

1.2 DEFINITIONS

- A. Raceway System – raceway system consist of conduits, wireways, fittings, junction and pull boxes, supports, labels complete and ready for conductors.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Conduits, wireways, fittings, supports, labels, junction and pull boxes, and other indicated enclosures which are dedicated to the raceway system, shall comply with the requirements of this Section.

2.2 CONDUIT

- A. Galvanized Rigid Steel Conduit (GRC)
 - 1. Rigid steel conduit shall be mild steel, hot-dip galvanized inside and out.
 - 2. Rigid steel conduit shall be manufactured in accordance with ANSI C80.1 - Rigid Steel Conduit, Zinc Coated, and UL-6.
 - 3. Manufacturers, or Equal
 - a. LTV Steel;
 - b. Triangle;
 - c. Wheatland Tube.

B. PVC-Coated Galvanized Rigid Steel Conduit (PVC-coated GRC)

1. The conduit, prior to PVC coating, shall meet the requirements for GRC conduit above.
2. A PVC coating shall be bonded to the outer surface of the galvanized conduit. The bond between the coating and the conduit surface shall be greater than the tensile strength of the coating.
3. PVC coating thickness shall be not less than 40 mils.
4. PVC-coated GRC shall be manufactured in accordance with the following standards:
 - a. UL-6
 - b. ANSI C80.1
 - c. NEMA RN1 - PVC Externally Coated Galvanized Rigid Steel Conduit, Intermediate Metal Conduit, and where shown on the plans
5. Manufacturers, or Equal
 - a. Robroy;
 - b. Ocal.

C. Liquidtight Flexible Conduit (LFMC)

1. Liquidtight flexible conduit (LFMC) shall be constructed of a flexible galvanized metal core with a sunlight-resistant thermoplastic outer jacket.
2. LFMC shall be manufactured in accordance with UL-360 - Steel Conduits, Liquid-Tight Flexible.
3. Manufacturers, or Equal
 - a. Anaconda, "Sealtite";
 - b. Electriflex, "Liquatite".

D. Electrical Metallic Tubing (EMT) or Intermediate conduit (IMC) will not be accepted.

2.3 FITTINGS AND BOXES

A. General:

1. Cast and malleable iron fittings for use with metallic conduit shall be the threaded type with 5 full threads.
2. Fittings and boxes shall have neoprene gaskets and non-magnetic stainless steel screws. All covers shall be attached by means of holes tapped into

the body of the fitting. Covers for fittings attached by means of clips or clamps will not be acceptable.

3. Non-explosion-proof boxes larger than standard cast or malleable types shall be 304 stainless steel, NEMA 4X.
4. Boxes larger than standard cast or malleable types shall be 304 stainless steel, NEMA 4X.
5. In outdoor areas, raceways shall be terminated in raintight hubs as manufactured by Myers, O.Z. Gedney, or equal. In other than outdoor areas, sealed locknuts and bushings shall be used.
6. Fittings and boxes in hazardous locations shall be suitable for the Class and Division indicated or required by code.

B. Cast Aluminum Fittings and Boxes

1. Cast aluminum boxes and fittings shall have less than 0.40 percent copper content.
2. Manufacturers, or Equal
 - a. O.Z. Gedney;
 - b. Appleton;
 - c. Crouse-Hinds.

C. Malleable Iron Fittings and Boxes

1. Fittings and boxes for use with galvanized steel conduit shall be of malleable iron or gray-iron alloy with zinc plating.
2. Manufacturers, or Equal
 - a. O.Z. Gedney;
 - b. Crouse-Hinds;
 - c. Appleton.

D. PVC-Coated Fittings and Boxes

1. Fittings and boxes for use with PVC-coated GRC shall be PVC-coated and shall be products of the same manufacturer as the conduit.
2. Fittings used for LFMC and PVC-coated systems are to be PVC-coated.

E. Stainless Steel Boxes

1. Stainless steel boxes shall be used with PVC-coated GRC raceway systems and where indicated on the Drawings.

2. Stainless steel boxes shall be NEMA 4X, Type 304.
3. Stainless steel shall be a minimum 14-gauge thickness, with a brushed finish.
4. Doors shall have full-length stainless steel piano hinges. Non-hinged boxes are not acceptable.
5. Manufacturers, or Equal
 - a. Hoffman;
 - b. Rohn;
 - c. Hammond.

2.4 WIREWAYS

- A. All wireways shall be painted ANSI 61 gray, galvanized 14-gauge steel with screw covers and a steel divider to separate the discrete signals from the analog signals. Wireways shall be Hoffman, or equal.
- B. Wireway shall be NEMA 12 and used only in above ground indoor locations.
- C. Wireway systems not shown on the plans shall be submitted for approval.

2.5 NONMETALLIC CONDUIT

- A. Manufacturers:
 1. Carlon Electrical Products.
 2. EGS/Appleton Electric.
 3. Hubbell Premise Wiring..
 4. Substitutions: Section 01 25 13.
- B. Product Description: NEMA TC 2; Schedule 40 or 80 PVC as indicated on plans. If not indicated than SCH 80 is to be used.
- C. Fittings and Conduit Bodies: NEMA TC 3.

2.6 IDENTIFICATION TAPE

- A. Continuous lengths of warning tapes shall be installed 12 inches above and parallel to all underground conduits. Tape shall be 6-inch-wide polyethylene film imprinted, "CAUTION – ELECTRIC UTILITIES BELOW." Tape shall be as manufactured by Brady, or equal.

2.7 CONDUIT SEALING

- A. Service and above grade sealant

1. Non- Hardening Duct Compound
 2. Asbestos Free
 3. Thomas and Betts COMPOUND SEAL DUCT or Equal
- B. Below Grade
1. Seals to 22' H2O pressure
 2. Re-enterable
 3. Chemical resistant
 4. POLYWATER FST Duct Sealant or Equal
- C. Explosion Proof Sealant
1. Sealant and fiber filler shall be listed for use with the fitting.

2.8 EXPLOSION-PROOF BOXES

- A. Explosion-proof boxes shall be used to house control stations, switches, any arc producing device, and terminal for splicing in hazardous locations. The boxes shall be made from copper-free aluminum with stainless steel hardware, have a hinged cover, and use O-ring gaskets for watertight integrity. The boxes shall be factory painted with epoxy gray paint. Boxes 12" x 12" and larger shall have (1) 2" hole and (2) 1.5" holes, and (2) 1" holes drilled, tapped, and plugged on the bottom of the box. The boxes shall be Appleton Electric AJBEW, or equal.

2.9 EXPLOSION-PROOF CONDUIT FITTINGS AND UNIONS

- A. Explosion-proof conduit fittings and unions shall be made from zinc electroplated malleable iron. Fittings shall include gasketed water-tight connections, be UL-listed for use in Class 1 Division 1 areas. Fittings shall be Appleton Electric, or equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. All wiring shall be run in raceway unless indicated otherwise.
- B. Raceways shall be installed between equipment as indicated. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends and offsets shall be smooth and symmetrical, and shall be accomplished with tools designed for this purpose. Field bends are required on conduits up to 2". Factory elbows may be utilized on raceways over 2". All fittings and connections shall be made tight.

C. Separate raceway systems shall be provided for:

1. Analog signals
2. 24 VDC discrete signals and instrument power supply conductors
3. 120 VAC and higher wiring

When non-loop powered instruments have only one raceway port, the Contractor may run both the analog and 24 VDC wiring in a short length of 1/2" LFMC to a splitter box where the wiring must then be separated into the required raceway system. The length of LFMC must be kept to the absolute minimum and must not exceed 3 feet unless written approval has been given by the ENGINEER.

- D. Where raceway routings are indicated on plan views, follow those routings to the extent possible. See SECTION 26 05 00 – ELECTRICAL WORK, GENERAL for additional installation requirements.
- E. Routings shall be adjusted to avoid obstructions. Coordinate between trades prior to installation of raceways. Lack of such coordination shall not be justification for extra compensation, and removal and re-installation to resolve conflicts shall be by the Contractor as part of the WORK.
- F. Support rod attachment for ceiling-hung trapeze installations shall meet the seismic requirements.
- G. Exposed raceways shall be installed parallel or perpendicular to structural beams.
- H. Install expansion fittings with bonding jumpers wherever raceways cross building expansion joints.
- I. Exposed raceways shall be installed at least 1/2-inch from walls or ceilings except that at locations above finished grade where damp conditions do not prevail, exposed raceways shall be installed 1/4-inch minimum from the face of walls or ceilings by the use of clamp backs or struts.
- J. In underground facilities or NEMA 4X areas, all raceway penetrations in panels shall be bottom entry.
- K. Wherever contact with concrete or dissimilar metals can produce galvanic corrosion of equipment, suitable insulating means shall be provided to prevent such corrosion.
- L. To facilitate future expansion, boxes and fittings are to be installed when indicated on the drawings. Unused hubs are to be plugged with proprietary devices. Raceways that include future expansion provision are to be sized to accommodate any such specified wiring without exceeding the requirements of this specification.

- M. The maximum allowable conduit fill for instrumentation and control wiring is given by the following table:

| Conduit Diameter | No. of 14-Gauge Wires | No. of 18-Gauge TWS |
|-------------------------|------------------------------|----------------------------|
| 3/4" | 8 | 2 |
| 1" | 16 | 4 |
| 1-1/4" | 32 | 7 |
| 1-1/2" | 48 | 10 |
| 2" | 72 | 17 |

Note: No instrumentation or control wiring conduit is to be larger than 2 inches in diameter.

3.2 RACEWAYS

- A. Exposed raceway systems shall be rigid galvanized steel except as follows, unless indicated otherwise:
1. In outdoor areas, all underground vaults, and NEMA 4X areas, PVC-coated GRC shall be utilized.
- B. Raceways concealed, buried, or encased in concrete, shall be PVC-coated GRC. Where conduit emerges from concrete encasement, a PVC-coated RGS elbow shall be utilized for transition from the concrete. Conduit shall emerge from the concrete perpendicular to the surface whenever possible.
- C. Exposed conduit shall be 3/4-inch minimum trade size. Supports shall be installed at distances required by the NEC.
- D. Conduit shall not be encased in the bottom floor slab below grade.
- E. Concrete cover for conduit and fittings shall not be less than 1-1/2 inches for concrete exposed to earth or weather, or less than 3/4-inch for concrete not exposed to weather or in contact with the ground.
- F. Raceways passing through a slab, wall, or beam shall not impair significantly the strength of the construction.
- G. Raceways embedded within a slab, wall, or beam (other than those merely passing through) shall satisfy the following:
1. Conduits with their fittings embedded within a column shall not displace more than 4 percent of the gross area of cross section.
 2. Conduits shall not be larger in outside dimension than one third the overall thickness of slab, wall, or beam in which embedded.
 3. Raceways shall not be spaced closer than 3 outside diameters on centers.

- H. Raceways shall be placed so that cutting, bending, or displacing reinforcement from its proper location will not be required.
- I. Threads shall be coated with a conductive lubricant before assembly.
- J. Joints shall be tight, thoroughly grounded, secure, and free of obstructions in the pipe. Conduit shall be adequately reamed to prevent damage to the wires and cables inside. Strap wrenches and vises shall be used to install conduit to prevent wrench marks on conduit. Conduit with wrench marks shall be replaced.
- K. Wherever raceways enter substructures below grade, the raceways shall be sloped to drain water away from the structure. Extreme care shall be taken to avoid pockets or depressions in raceways. In addition raceways entering from outside the vault may only enter enclosures and equipment through the bottom. Side entry is permitted only if the raceway is provided with a continuous means to drain water before entry into the box.
- L. Raceways that enter vaults below grade shall be sealed at their origin where water intrusion is possible. Sealant shall be water tight to 22' H₂O.
- M. Connections to lay-in type grid lighting fixtures shall be made using LFMC not exceeding 4-feet in length. Connections to motors and other equipment subject to vibration shall be made with LFMC not exceeding 3-feet in length. Equipment subject to vibration that is normally provided with wiring leads shall be provided with a cast junction box for the make-up of connections. The junction box is to be independently supported and not left free to hang from the equipment.
- N. Raceways passing through walls or floors shall have plastic sleeves. Core drilling shall be performed in accordance with Section 26 05 00.
- O. Provide raceway seal fittings at the following locations:
 - 1. In hazardous classified locations, in strict accordance with the NEC.
- P. Conduit, fittings, and boxes required in hazardous classified areas shall be suitably rated for the area and shall be provided in strict accordance with NEC requirements.
- Q. Empty raceways shall be tagged at both ends to indicate the final destination. Where it is not possible to tag the raceway, destination shall be identified by a durable marking on an adjacent surface. A pull-cord shall also be installed in each empty conduit. This shall apply to conduits in floors, panels, manholes, equipment, etc.
- R. Where an underground raceway enters a structure through a concrete roof or a membrane waterproofed wall or floor, core-drill the entrance and provide a Link-Seal, or equal, sealing device. The sealing device shall be utilized with rigid steel conduit.

- S. Final connections to heaters, instruments, motors, limit switches, and any equipment subject to vibration shall be made with LFMC and approved fittings. Maximum length of LFMC shall be 3 feet.
- T. Connections to solenoid valves, pilot actuators, and flood sensors shall be made with LFMC and approved fittings to a cast box with screw cover (GUA type), independently and securely supported. In no case is the device to support the cast box.

3.3 CABLE TRAYS

- A. Cable trays are not to be used.

END OF SECTION

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SECTION 26 05 43
UNDERGROUND RACEWAY SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide underground raceway systems, including trenching, backfill, compaction, and restoration, complete and in place, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 26 05 00.
- B. Shop Drawings
 - 1. Complete catalog cuts of all conduit, fittings, and pullboxes, marked where applicable to show proposed materials and finishes.
- C. Record Drawings
 - 1. Show routings, burial depths, and pullbox locations and sizes.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pullboxes, and fittings that are dedicated to the underground raceway system shall comply with the requirements of this Section.

2.2 PULLBOXES

- A. Shall be precast with construction and H20 or load rating as indicated.
 - 1. Covers shall be traffic type, cast iron with LOGO, except as indicated otherwise.
 - 2. Pullbox covers shall be identified as "Electric" by raised letters cast into the covers.
- B. Shall have frost-proof and water-tight grey iron frames and covers with solid lids and inner lids with 28-inch clear openings. Covers and lids shall be bolted to cast-in-place steel frames with corrosion resistant hardware. Frames shall be factory-primed; covers shall be cast-iron and shall have pick-holes.
- C. Shall be equipped with pulling-in irons opposite and below each raceway entrance.
- D. Unless noted otherwise, pull boxes shall have closed bottoms. Open bottom pullboxes will not be accepted.

- E. Precast pullboxes shall be **Jensen Precast, Mack, Quikset, U.S. Precast**, or equal. Cast-iron covers shall be by **U.S. Foundry**, or equal.

2.3 UNDERGROUND CONDUITS

- A. High Density Polyethelene Conduit (HDPE)
 - 1. Compliant with NEC articles 300 and 353 and,
 - 2. Listed to UL 651 A&B.
- B. PVC Coated Rigid Steel shall be per Section 26 05 33 para. 2.2 B.
- C. Transition Fitting
 - 1. For transition from/to HDPE, Plastic, or Steel
 - 2. ETL listed to UL-514B,
 - 3. Listed for underground applications,
 - 4. Withstands water head pressure to 20+ feet
 - 5. **Dura-line** Shur-Lock II Coupler or equal
- D. Identification Tape: Continuous lengths of underground warning tapes shall be installed 12-inches above and parallel to conduits. Tape shall be 6-inches wide polyethylene film imprinted "CAUTION - ELECTRIC UTILITIES BELOW." Tape shall have non-ferrous metal foil conductor sandwiched in the tape for detection purposes. Tape shall be as manufactured by **Brady**, or equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Underground raceways shall be installed between structures and pullboxes as indicated. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends and offsets shall be smooth and symmetrical, and shall be fabricated with tools designed for this purpose. Factory elbows shall be utilized wherever possible. Unless otherwise noted provide plastic coated RSC for vertical sweeps and risers.
- B. Raceway routing shall be adjusted to avoid obstructions.

3.2 INSTALLATION

- A. Unless otherwise noted on the plans or specifications, the buried horizontal sections shall be HDPE with PVC coated rigid steel sweeps and risers.
 - 1. Provide a heat shrink sleeve with heat activated adhesive to all transition fittings that extends at least 6" in each direction from the fitting.
- B. Raceways shall be installed in accordance with the criteria below:

1. Raceway shall be laid on a grade line of at least 3-inches per 100-feet, sloping towards pullboxes or buried structures. Conduit shall be installed and pullbox depths adjusted so that the top of the conduit is a minimum of 24-inches below grade.
 2. Changes in horizontal direction shall have a minimum radius of 3x the published minimum of the conduit.
 3. Conduits shall be run continuous without couplings except at risers.
 4. Raceway shall be installed in accordance with the Manufacturer's requirements and recommendations. The bottom of trench shall be of select backfill or sand.
 5. Each of the completed raceways shall be cleaned by drawing through it a standard flexible mandrel one foot long and 1/4-inch smaller than the nominal size of the duct. After passing of the mandrel, a wire brush and swab shall be drawn through.
- C. Sections of pre-fabricated pullboxes shall be assembled with waterproof mastic and shall be set on a 6-inch bed of gravel or as recommended by the manufacturer.
- D. Raceway penetration through walls of structures and pullboxes (with floors) below grade shall be watertight.
- E. Where an underground raceway enters a below grade structure through a concrete wall,
1. provide a **Link-Seal**, or equal sealing device.
 2. The sealing device shall be utilized with plastic coated rigid steel conduit.
 3. Transition from PVC or HDPE to plastic coated RSC prior to building entry.
 4. Provide an alternate route for condensation prior to entering any enclosure.
 5. Enclosures shall be entered through the bottom unless acceptable justification and means to mitigate water entry warrants a side entry. Side entry shall be on the lower end of enclosures, below the level of any components, including terminals. Enclosures with side entry shall be provided with an approved conduit drain fitting.

3.3 RESTORATION

- A. The Contractor shall restore all disturbed areas.
- B. Grassed areas shall be backfilled, compacted, and topsoiled and reseeded as specified in 31 23 33 Trenching and Backfill, 32 91 13 Topsoiling and Finished Grading and 32 92 00 Seeding, Sodding and Sediment Control.

- C. Asphalt concrete driveways, bike trails, and roadways and curb and gutter shall be cut and patched to match existing, including backfill and compaction to 95 percent density.

END OF SECTION

SECTION 26 05 48
SEISMIC BRACING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The design and installation of seismic bracing and anchorage required for electrical equipment, conduit, cable tray, and bus ducts.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A307, Standard Specification Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - c. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.3 SYSTEM DESCRIPTION

A. Contractor is responsible for design and installation of seismic bracing and anchorage systems.

B. Description of Systems:

1. Transverse and longitudinal bracing for seismic forces on suspended electrical systems including conduit, cable tray, bus duct, and equipment.
2. Anchorage of floor and roof mounted electrical equipment.

C. Seismic Design Requirements:

1. Seismic design criteria: Provide bracing and anchoring for equipment, conduit, cable tray, bust duct, designed, constructed, and installed to resist stresses produced by lateral forces.

- D. Design and install seismic anchorage and bracing for all floor or roof mounted equipment weighing 400 LBS or more and all suspended or wall mounted equipment weighing 20 LBS or more.
- E. The following components are exempt from the requirements of this Specification Section:
 - 1. Electrical components in structures assigned to Seismic Design Category C provided that the importance factor (I_p) is equal to 1.0.
 - 2. Electrical components in Seismic Design Categories D, E, and F where $I_p = 1.0$ and flexible connections between the components and associated ductwork, piping, and conduit are provided and that are mounted at 4 FT (1.22 m) or less above a floor level and weigh 400 LBS (1780 N) or less.
 - 3. Electrical components in Seismic Design Categories D, E, and F weighing 20 LBS (95 N) or less where $I_p = 1.0$ and flexible connections between the components and conduit are provided, or for distribution systems, weighing 5 LBS/FT (7 N/m) or less.
- F. Seismic forces shall be presumed to act through the center of mass of the equipment in a direction that will produce the largest single anchor force.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:
 - a. Seismic control devices.
 - 3. Fabrication and/or layout drawings:
 - a. Layout and mounting detail drawings showing system and proposed brace locations for all systems including pre-engineered systems.
 - b. The specific detail for each type of brace or anchor must be referenced on a plan that identifies the required location.
 - 1) Supplying a book of details without referencing the proper detail to a specific location on a plan is not acceptable.
 - c. Structural calculations for required lateral force level for each component.
 - d. All submittals, including pre-approved systems, shall be signed and sealed by a licensed engineer, licensed in the state in which the project is located.

1.5 PROJECT CONDITIONS

- A. Seismic (Earthquake) Loads:
- B. Seismic use group: III.
- C. S_s : 1.5.
- D. S_1 : 0.701.
- E. Site Class: D.
- F. Seismic design category: D

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Pre-engineered suspended bracing systems:
 - a. International Seismic Application Technology (ISAT) "Engineered Seismic Bracing of Suspended Utilities".
 - b. Unistrut.
 - c. Tolco.
 - d. B-Line.
 - 2. Custom engineered systems designed using specified criteria and common building materials.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 EQUIPMENT ANCHORS AND SUPPORTS

- A. Drilled-in-place concrete anchors shall have an approved ICBO Evaluation Services Report.
- B. Cast-in-place anchors shall comply with ASTM A36, ASTM A307, or ASTM F1554, 36 ksi.
- C. Anchors permanently exposed to weather or corrosive environments shall be stainless steel or hot-dipped galvanized.
- D. Structural steel for supports: ASTM A36.
- E. Cold formed metal and connection material: Unistrut.
- F. Any details provided are based on assumed equipment and arrangement.

1. Contractor shall be responsible for design and acquiring approval for support and anchorage of equipment and arrangement which varies from equipment and arrangement assumed in detail provided.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Every run which requires bracing shall have a minimum of two (2) transverse braces and one (1) longitudinal brace.
 1. A "run" is defined as suspended pipe, conduit, cable tray, bus duct or trapeze rack having a minimum 5 FT straight run length.
- B. Brace spacing shall not exceed the maximum allowable brace spacing as engineered by the manufacturer or custom bracing designer.
- C. Bracing may be omitted from conduit, cable tray and bus duct runs less than 5 FT in length.
- D. Bracing may be omitted from conduit, cable tray and bus duct runs where rod hung supports of less than 12 IN in length are required.
 1. All unbraced suspended utility systems having 2 IN conduit and larger or systems weighing more than 5 LBS/FT shall be installed with a minimum 6 IN clearance to suspended ceiling vertical hanger wires.
 2. The conduit, cable tray, or bus duct shall be installed such that the lateral motion of the members will not cause damaging impact with other systems or structural members or loss of vertical support.
- E. A longitudinal brace at a 90 degree change in direction may act as a transverse brace if it is located within 2 FT of the change in direction.
- F. A transverse brace may act as a longitudinal brace if it is located within 2 FT of a change in direction and if the brace arm and anchorage have been sized to meet or exceed the requirements of the longitudinal brace.
- G. When bracing equipment or a utility system that is suspended from an overhead deck, brace back to the overhead deck or to the supporting structure supporting the deck.
 1. Do not brace to another element of the structure which may respond differently during a seismic event.
- H. Obtain approval from the Structural Engineer prior to attaching any brace elements to structural steel or wood framing.
- I. When utilizing cable bracing, tension the cable to remove slack without inducing uplift of the suspended element.

1. Tension seismic bracing system prior to system start-up and adjust if necessary after equipment start-up.
- J. As a general rule, do not mix rigid bracing with cable bracing in the same run.
1. However, once bracing has transitioned a 90 degree change in run direction, the bracing may switch from rigid to cable or vice versa if required due to a significant change in overhead deck elevation or to provide an implementable bracing scheme in a congested area.
- K. Install brace members at an angle of 45 degrees from horizontal within a tolerance of plus 2 1/2 degrees or minus 45 degrees provided the brace length is accounted for in design.
1. Brace angle may be increased to 60 degrees provided the brace spacing is reduced to 1/2 that required for a 45 degree brace.
- L. Seismic bracing may not pass through a building separation joint.
1. Utility systems that pass through a separation joint must be seismically restrained no greater than 5 FT from the point of connection.
 2. Any hardware designed to accommodate seismic movement across the span of the separation joint shall be installed per manufacturer's installation and listing instructions.
- M. With approval of the Structural Engineer, utility systems that are suspended from the overhead deck may be braced to load bearing concrete or CMU (concrete masonry) walls provided that the walls and the overhead decks will respond similarly during a seismic event.
- N. Each layer of a multiple layer trapeze rack shall be braced individually based on the weight of the individual layer.
- O. Conduit, cable tray, or bus duct constructed of non ductile material (plastic or fiberglass), shall have brace spacing reduced to 1/2 of the spacing allowed for ductile materials.
- P. Where brace elements are through-bolted, the mounting hole in the element is to be no more than 1/16 IN in diameter larger than the bolt or threaded rod.
- Q. Seismic braces shall directly brace the system and not the hanger.

3.2 SUSPENDED ELECTRICAL SYSTEMS

- A. Install seismic bracing for all conduit 2-1/2 IN trade size or greater.
- B. All trapeze assemblies supporting conduits, cable trays or bus ducts shall be braced considering the total weight of the elements on the trapeze.
1. For the purposes of calculating weight, all conduits are to be treated as full.
- C. Brace all trapeze racks which support conduit 2-1/2 IN trade size or larger.

1. Brace all other conduit rack, cable tray or bus duct trapezes having a minimum weight in excess of 10 LBS/LF.
 2. Include a minimum 10 percent additional capacity for future additions.
- D. Seismic bracing may be omitted from cable trays, conduit and bus ducts suspended by rod hung supports 12 IN or less in length from the top of the element to the bottom of the structural attachment of the hanger provided lateral motion will not cause damaging impacts to other systems or loss of system vertical support.
- E. All vertical risers involving conduit 2-1/2 IN in diameter or larger shall include lateral restraint at maximum 30 FT intervals and at the top and bottom of the riser.

3.3 FLOOR- OR ROOF-MOUNTED EQUIPMENT

- A. Provide one anchor on each leg or corner.
1. Support with a minimum of three 3/8-inch-diameter anchors.
- B. Friction shall be neglected when designing anchors for shear.
- C. Vertical seismic forces, when required, shall be presumed to act concurrently with horizontal seismic forces.

END OF SECTION

SECTION 26 09 16
CONTROL EQUIPMENT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Operator control devices (selector switches, pushbuttons, indicator lights, etc.).
2. Control devices (timers, relays, contactors, etc.).
3. Industrial Control Panels.
4. Operator Control Stations.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 26 05 00 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. ICS 2, Industrial Control and System Controllers, Contactors and Overload Relays Rated 600 Volts.
 - c. ICS 5, Control Circuit and Pilot Devices.
2. Underwriters Laboratories, Inc. (UL):
 - a. 508, Standard for Safety Industrial Control Equipment.
 - b. 508A, Standard for Safety Industrial Control Panels.

1.3 SYSTEM DESCRIPTION

- A. This Specification specifies components used within other equipment as referenced in other technical specifications.

- B. This Specification is used to specify the components and construction of following Operator Control Stations:
 - 1. HAND SWITCH with control logic per diagram on the Drawings.
- C. This Specification is used to specify the components and construction of following Industrial Control Panels.
 - 1. Lighting Control Panel – LCPxxx, with control logic per diagram on the Drawings.
 - 2. HEAT TRACE Control Panel – HTCW with control logic per diagram on the Drawings.
 - 3. All other MISC Local Control Panels (LCP-XXX).

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification:
 - 1) When components are used within equipment specified in another Section, submittal data for components specified herein shall be included with the submittal for the equipment the components are used in.
 - b. Industrial Control Panel bill of material.
 - c. Control Station bill of material.
 - d. See Specification Section 26 05 00 for additional requirements.
 - 3. Fabrication and/or layout drawings.
 - a. Industrial Control Panel:
 - 1) Interior and exterior layout.
 - 2) Wiring/connection diagrams.
 - 3) Short circuit rating.
 - 4) Copy of the UL 508A label.
 - b. Operator Control Station:
 - 1) Interior (if applicable) and exterior layout.
 - 2) Wiring/connection diagrams.

- c. Associate Industrial Control Panel and Operator Control Stations with associated equipment name and tagging.

B. Informational Submittals:

- 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- 2. Functional Test Plan.

C. Contract Closeout Information:

- 1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
 - b. Content of Operation and Maintenance Manual:
 - 1) Product technical data of components used within Industrial Control Panels and Operator Control Stations.
 - 2) As-constructed wiring/connection diagrams for Industrial Control Panels and Operator Control Stations.
 - 3) Functional Test Report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Pilot devices, relays, contactors, and termination equipment:
 - a. Allen-Bradley.
 - b. ATC Diversified Electronics.
 - c. Automatic Switch Company (ASCO).
 - d. c3controls.
 - e. Eaton.
 - f. General Electric Company.
 - g. Idec.
 - h. Phoenix Contact.
 - i. Potter & Brumsfield.

- j. Schneider Electric.
 - k. Siemens.
 - l. Time Mark.
2. Photocells and time clocks:
- a. Grasslin.
 - b. Tork.
 - c. Intermatic.
 - d. Paragon.
3. Alarm devices:
- a. Edwards Signaling.
 - b. Federal Signal Corp.
4. Enclosures:
- a. Hoffman Engineering Co.
 - b. Wiegmann.
 - c. Eaton B-Line.
 - d. Adalet.
 - e. Stahlin.

2.2 PILOT DEVICES

A. General Requirements:

- 1. Standards: NEMA ICS 5, UL 508.
- 2. Heavy-duty NEMA 4/13 watertight/oiltight.
- 3. Heavy-duty NEMA 4/4X corrosion resistant.
- 4. Heavy-duty factory sealed, explosion-proof and dust ignition-proof (Class I and II).
- 5. Mounting hole: 30.5 mm.
- 6. Contact blocks: 10 amp, NEMA A600 rated, number as required to fulfill functions shown or specified.
- 7. Legend plate marked as indicated on Drawings or specified.

B. Selector Switches:

1. Two, three- or four-position rotary switch as required to fulfill functions shown or specified.
2. Maintained contact type.
3. Knob or lever type operators.

C. Pushbuttons:

1. Non-illuminated type:
 - a. Protective boot.
 - b. Momentary contact.
 - c. Standard flush and mushroom operators.
 - d. Green colored buttons for START or ON and red color for STOP or OFF.
 - e. Emergency stop pushbuttons: Mushroom head operator and maintained contact.
2. Illuminating type:
 - a. Protective boot.
 - b. Momentary contact.
 - c. Standard flush operator.
 - d. Serves as both pushbutton control and indicating light.
 - e. Green colored lenses: START or ON.
 - f. Red colored lense: STOP or OFF.
 - g. Resistor-type full voltage light unit with lens and panel gasket.

D. Indicating Lights:

1. Allowing replacement of bulb without removal from control panel.
2. Lamp: LED, 120 V or 24 V as required.
3. Full voltage type.
4. Push-to-test indicating lights.
5. Glass lens.
6. Color code lights as follows:

- a. Green: ON or running;
- b. Blue: valve open.
- c. Amber: Standby; auto mode; ready.
- d. Red: OFF or stopped; valve closed.

2.3 RELAYS

A. General Requirements:

- 1. Standards: NEMA ICS 5, UL 508.

B. Control Relays:

1. General purpose (ice cube) type:

- a. Plug-in housing.
- b. Clear polycarbonate dust cover with clip fastener.
- c. Coil voltage: 120 Vac or as required.
- d. Contacts:
 - 1) 10 amp continuous.
 - 2) Silver cadmium oxide.
 - 3) Minimum of 3 SPDT contacts.
- e. Sockets: DIN rail mounted.
- f. Internal neon or LED indicator is lit when coil is energized.
- g. Manual operator switch.

2. Industrial type:

- a. Coil voltage: 120 Vac or as required.
- b. Contacts:
 - 1) 10 amp, NEMA A600 rated.
 - 2) Double break, silver alloy.
 - 3) Convertible from normally open to normally closed or vice versa, without removing any wiring.
 - 4) Expandable from 2 poles to 12 poles.
- c. Provide contacts for all required control plus two spares.

C. Time Delay Relays:

1. General purpose type:
 - a. Timing modes: On and Off delay, interval, one shot and repeat cycle.
 - b. Plug-in housing.
 - c. Polycarbonate dust cover with clip fastener.
 - d. Coil voltage: 120 Vac or as required.
 - e. Contacts:
 - 1) 10 amp continuous.
 - 2) Silver cadmium oxide.
 - 3) Two normally open and two normally closed DPDT contacts.
 - f. Sockets: DIN rail mounted.
 - g. External timing adjustment knob.
 - h. Timing ranges: 0.05 seconds to 16.65 HRS.
 - i. Repeat accuracy: +1 percent.
2. Solid State industrial type:
 - a. Timing modes: On and Off delay and repeat cycle.
 - b. Industrial housing.
 - c. Coil voltage: 120 Vac or as required.
 - d. Contacts:
 - 1) 5 amp, NEMA B150 rated.
 - 2) Silver alloy.
 - 3) Convertible On Delay and Off Delay contacts.
 - 4) One normally open and one normally closed timed contacts.
 - 5) One normally open and one normally closed instantaneous contacts.
 - e. Furnish with "on" and "timing out" indicators.
 - f. External timing adjustment knob.
 - g. Timing ranges: 0.05 seconds to 10 HRS.
 - h. Repeat accuracy: +1 percent.
3. Mechanical industrial type:
 - a. Timing modes: On and Off delay.

- b. Coil voltage: 120 Vac or as required.
- c. Contacts:
 - 1) 10 amp, NEMA A600 rated.
 - 2) Double break, silver alloy.
 - 3) Convertible On Delay and Off Delay contacts.
 - 4) Convertible normally open and normally closed timed contacts.
 - 5) Convertible normally open instantaneous contacts.
- d. External timing adjustment knob.
- e. Timing ranges: 0.2 - 60 sec or 5 - 180 sec.
- f. Repeat accuracy: Greater than +10 percent.

2.4 CONTACTORS

A. General Requirements:

- 1. Standards: NEMA ICS 2, UL 508.

B. Lighting and Remote Control Switches:

- 1. Electrically operated, electrically held.
- 2. Coil voltage: 120 Vac or as required.
- 3. Contacts: Totally enclosed, double-break silver-cadmium-oxide.
- 4. Rated for ballasted lighting, tungsten and general use loads.
- 5. Number of poles, continuous ampere rating and voltage, as indicated on Drawings or as specified.
- 6. Auxiliary control relays, as indicated on Drawings or as specified.
- 7. Auxiliary contacts, as indicated on Drawings or as specified.

C. Definite Purpose:

- 1. Coil voltage: 120 Vac or as required.
- 2. Contacts: Totally enclosed, double-break silver-cadmium-oxide.
- 3. Resistive load and horsepower rated.
- 4. Number of poles, continuous ampere rating and voltage, as indicated on Drawings or as specified.
- 5. Auxiliary contacts, as indicated on Drawings or as specified.

2.5 MISCELLANEOUS DEVICES

A. Run Time Meters:

1. Six-digit wheels including a 1/10 digit.
2. Non-reset type.
3. Time range in hours.
4. Automatic recycle at zero.
5. Accuracy: 1 percent.
6. Sealed against dirt and moisture.
7. Tamperproof.

2.6 TERMINATION EQUIPMENT

A. General Requirements:

1. Modular type with screw compression clamp.
2. Screws: Stainless steel.
3. Current bar: Nickel-plated copper alloy.
4. Thermoplastic insulation rated for -40 to +90 DegC.
5. Wire insertion area: Funnel-shaped to guide all conductor strands into terminal.
6. End sections and end stops at each end of terminal strip.
7. Machine-printed terminal markers on both sides of block.
8. Spacing: 6 mm.
9. Wire size: 22-12 AWG.
10. Rated voltage: 600 V.
11. DIN rail mounting.

B. Standard-type block:

1. Rated current: 30 A.
2. Color: Gray body.

C. Bladed-type disconnect block:

1. Terminal block with knife blade disconnect which connects or isolated the two sides of the block.
 2. Rated current: 10 A.
 3. Color:
 - a. Panel control voltage leaves enclosure - normal: Gray body, orange switch.
 - b. Foreign voltage entering enclosure: Orange body, orange switch.
- D. Grounded-type block:
1. Electrically grounded to mounting rail.
 2. Terminal ground wires and analog cable shields.
 3. Color: Green and yellow body.
- E. Fuse Holders:
1. Blocks can be ganged for multi-pole operation.
 2. Spacing: 9.1 mm.
 3. Wire size: 30-12 AWG.
 4. Rated voltage: 300 V.
 5. Rated current: 12 A.
 6. Fuse size: 1/4 x 1-1/4.
 7. Blown fuse indication.
 8. DIN rail mounting.

2.7 ENCLOSURES

- A. Industrial Control Panels:
1. NEMA 4 rated:
 - a. Seams continuously welded and ground smooth.
 - b. No knockouts.
 - c. External mounting flanges.
 - d. Hinged or non-hinged cover held closed with stainless steel screws and clamps.
 - e. Cover with oil resistant gasket.

2. NEMA 4X rated:
 - a. Body and cover: 14 GA Type 304 or 316 stainless steel.
 - b. Seams continuously welded and ground smooth.
 - c. No knockouts.
 - d. External mounting flanges.
 - e. Hinged door and stainless steel screws and clamps.
 - f. Door with oil-resistant gasket.
3. NEMA 7 and 9 rated:
 - a. Cast gray iron alloy or copper-free aluminum.
 - b. Drilled and tapped openings or tapered threaded hub.
 - c. Cover bolted-down with stainless steel bolts or threaded cover with neoprene gasket.
 - d. External mounting flanges.
 - e. Grounding lug.
 - f. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.
4. NEMA 12 enclosure:
 - a. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
 - b. No knockouts.
 - c. External mounting flanges.
 - d. Non-hinged stainless steel cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
 - e. Flat door with oil resistant gasket.
5. Control panel miscellaneous accessories:
 - a. Back plane mounting panels: Steel with white enamel finish or Type 304 stainless steel.
 - b. Interiors shall be white or light gray in color.
 - c. Wire management duct:

- 1) Bodies: PVC with side holes.
 - 2) Cover: PVC snap-on.
 - 3) Size as required.
 - d. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
 - e. Split covers when heavier than 25 LBS.
 - f. Floor stand kits made of same material as the enclosure.
 - g. Weldnuts for mounting optional panels and terminal kits.
 - h. Ground bonding jumper from door, across hinge, to enclosure body.
6. Standards: NEMA 250, UL 508.
- B. Operator Control Stations:
- 1. NEMA 4/13 rated:
 - a. Die cast aluminum body with manufacturers standard finish.
 - b. Gasketed die cast aluminum cover with manufacturers standard finish.
 - c. Number of device mounting holes as required.
 - 2. NEMA 4X rated:
 - a. Type 304 or 316 stainless steel body.
 - b. Gasketed Type 304 or 316 stainless steel cover.
 - c. Number of device mounting holes as required.
 - 3. NEMA 7 and 9 rated:
 - a. Zinc plated cast iron or die-cast copper free aluminum, with threaded hubs, grounding screw and with manufacturers standard finish.
 - b. "EDS" or "EFS" style.
 - c. Single or multiple gang or tandem.
 - d. Accessories: 40 mil PVC exterior coating and two (2) mil urethane interior coating.

2.8 FABRICATION

- A. Supplier of Industrial Control Panels shall build control panel under the provisions of UL 508A.
 - 1. Entire assembly shall be affixed with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated and in accordance with manufacturer's recommendations and instructions.
- B. Control Panels:
 - 1. Size as required to mount the equipment.
 - 2. Permitted uses of NEMA 4 enclosure:
 - a. Surface mounted in areas designated as wet.
 - 3. Permitted uses of NEMA 4X enclosure:
 - a. Surface mounted in areas designated as wet and/or corrosive or highly corrosive.
 - 4. Permitted uses of NEMA 7 enclosure:
 - a. Surface mounted in areas designated as Class I hazardous.
 - 5. Permitted uses of NEMA 12 enclosure:
 - a. Surface mounted in areas designated as dry and/or dusty architecturally or non-architecturally finished areas.
- C. Operator Control Stations:
 - 1. Permitted uses of NEMA 4/13 enclosure:
 - a. Surface mounted in areas designated as dry and/or dusty architecturally or non-architecturally finished areas and wet.
 - 2. Permitted uses of NEMA 4X enclosure:
 - a. Surface mounted in areas designated as wet and/or corrosive or highly corrosive.
 - 3. Permitted uses of NEMA 7 enclosure:
 - a. Surface mounted in areas designated as Class I hazardous with PVC coating in corrosive and highly corrosive areas when PVC coated conduit is used.

3.2 FIELD QUALITY CONTROL

- A. See Section 26 05 00.
- B. Industrial Control Panel(s) and Operator Control Station Functional Test:

1. The test is to prove the correct interaction of all sensing, processing and action devices.
2. Develop a test plan and parameters for the purpose of evaluating the performance of the system.
 - a. Plan shall have witness signature lines for the contractor and owner and submitted when system pass the test.
3. Perform the following tests:
 - a. Verify functionality of all control states.
 - b. Verify the correct operation of all interlock safety devices for fail-safe functions
 - c. Verify the correct operation of all sensing devices, alarms and indicating devices.

3.3 TRAINING

- A. A qualified supplier representative shall provide the Owner with on-site training in the operation and maintenance of the Industrial Control Panel(s) and its components.

END OF SECTION

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SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide panelboards complete and operable, in accordance with the Contract Documents.
- B. Single Manufacturer: Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.

1.2 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be in accordance with Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings
 - 1. Breaker layout drawings with dimensions and nameplate designations
 - 2. Component list
 - 3. Drawings of conduit entry/exit locations
 - 4. Assembly ratings including:
 - a. Short circuit rating
 - b. Voltage
 - c. Continuous current
 - 5. Cable terminal sizes
 - 6. Descriptive bulletins
 - 7. Product sheets
 - 8. Installation information
 - 9. Seismic certification and equipment anchorage details

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Panelboards shall be dead front factory assembled. Panelboards shall comply with NEMA PB-1-Panelboards, as well as the provisions of UL 50 – Safety

Enclosures for Electrical Equipment and UL 67 – Safety Panelboards. Panelboards used for service equipment shall be UL labeled for such use. Lighting panelboards shall be rated for 120/208-volt, 3-phase operation or 120/240-volt for single phase operation as indicated. Power panelboards shall be rated for 480 volts, 3-phase, 4-wire operation.

B. The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers.

C. Ratings

1. Panelboards rated 240 VAC or less shall have short circuit ratings not less than 10,000 amps RMS symmetrical or as indicated by the Short Circuit Study, whichever is greater.
2. Panelboards rated 480 VAC shall have short circuit ratings not less than 42,000 amps RMS symmetrical or as indicated by the Short Circuit Study, whichever is greater.
3. Panelboards shall be labeled with a UL short circuit rating. Series ratings are not acceptable.

D. Construction

1. Panelboard enclosures shall be NEMA rated based on their location as specified in Section 26 05 00.
2. All lighting and power distribution panels shall have copper bus bars.
3. Breakers shall be one, two, or three pole as indicated, with ampere trip ratings as required by the equipment. Breakers shall be quick-make and quick-break, inverse time trip characteristics, to trip free on overload or short circuit, and to indicate trip condition by the handle position.
4. The panels shall have hinged doors with combination catch and latch. The front panels shall be so arranged that when the plates are removed, the gutters, terminals and wiring will be exposed and accessible. The doors shall have inner doors within the plates to have only the breaker operating mechanism exposed when they are opened. Live conductors and terminals shall be concealed behind the plates.
5. All panelboards shall be rated for the intended voltage.
6. All circuit breakers shall be interchangeable and capable of being operated in any position as well as being removable from the front of the panelboard without disturbing adjacent units. No plug-in circuit breakers will be acceptable.
7. Lighting and power distribution panels which are not part of a motor control center shall be constructed in accordance with Section 26 05 00 – Electrical Work, General. Panels shall have the necessary barriers, supports, and liberal wiring gutters. Trim screws shall be stainless steel. All panelboard

parts of metal other than copper, aluminum, or stainless steel shall be cadmium plated. Panelboards shall be as manufactured by **Allen-Bradley**, **General Electric**, or **Cutler-Hammer**.

8. Panelboards shall be suitable for use as service entrance as indicated or as otherwise required by the N.E.C.

PART 3 - EXECUTION

3.1 GENERAL

- A. All Work of this Section shall be installed as indicated in Section 26 05 00 – Electrical Work, General.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide all wiring devices, plates, and nameplates in accordance with the Contract Documents.
- B. The requirements of Section 26 05 00 – Electrical Work, General apply to this Section.
- C. Single Manufacturer: Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00.
- B. Shop Drawings
 - 1. Complete catalog cuts of switches, receptacles, enclosures, covers, and appurtenances, marked to clearly identify proposed materials.
 - 2. Documentation showing that proposed materials comply with the requirements of NEC and UL.
 - 3. Documentation of the manufacturer's qualifications.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All devices shall carry the UL label.
- B. General purpose duplex receptacles and toggle switch handles shall be brown everywhere except in finished rooms where they shall be ivory. Special purpose receptacles shall have a body color as indicated. Receptacles and switches shall conform to Federal Specifications W-C-596E and W-S-896E, respectively.

2.2 LIGHTING SWITCHES

- A. Local branch switches shall be toggle type, rated at 20 amps, 120-277 VAC, and shall be **General Electric Cat. No. GE-5951-1** for single pole, **GE-5953-1** for 3-way and **GE-5954-1** for 4-way, or similar types as manufactured by **Hubbell**, or equal.

2.3 GENERAL PURPOSE RECEPTACLES

- A. Duplex receptacles rated 120-volt, 20 amps shall be polarized 3-wire type for use with 3-wire cord with grounded lead and 1 designated stud shall be permanently grounded to the conduit system (NEMA 5-20R). Duplex 120-volt receptacles shall be **G.E. 5362, Hubbell 5362**, or equal. Single receptacles shall be **G.E. 4102, Hubbell 4102**, or equal.
- B. Ground-fault circuit interrupting receptacles (GFCI's) shall be installed at the locations indicated. GFCI's shall be rated 125-volt, 20 amps and shall be **Hubbell GF-5362**, or equal.
- C. Receptacles for hazardous locations shall be single gang receptacles with spring door. Receptacles shall have a factory sealed chamber. The receptacles shall have a delayed action feature requiring the plug to be inserted in the receptacle and rotated before the electrical connection is made. The receptacle shall not work with non-hazardous rated plugs. One plug shall be furnished with each receptacle. The receptacles shall be rated for 20 amps at 125 VAC. Hazardous location receptacles shall be **Appleton EFSB, Crouse-Hinds ENR**, or equal.
- D. Where indicated, hazardous location receptacles shall be provided with ground fault protection. Ground fault protection shall be **Appleton EFSR-GFI, Crouse-Hinds GFS 1**, or equal.

2.4 LOCKING RECEPTACLES

- A. Receptacles for all existing chemical feed pumps and all new sump pumps shall be locking receptacles. Provide matching plugs.
 - 1. Single-phase locking receptacles shall be **Pass & Seymour Turnlok L630-R receptacle** and **CRL630-P plug**, or equal.
 - 2. Three-phase locking receptacles shall be 250-volt, 20-amp, 4-wire, **Pass & Seymour Turnlok L1520-R receptacle** and **L1520-P plug**, or equal.

2.5 ENCLOSURES AND COVERS

- A. Surface mounted switches and receptacles shall be in FS or FD type cast device boxes.
- B. In finished areas, switch and receptacle boxes shall be provided with SUPER STAINLESS STEEL COVERS as manufactured by **Harvey Hubbell, Arrow Hart, Bryant**, or equal.
- C. In areas where cast boxes are used, switch and receptacle covers shall be **Crouse-Hinds Catalogue No. DS185 and WLRD-1, or Adalet No. WSL and WRD**, or equal.
- D. Receptacles in exterior locations and where used with chemical dosing pumps shall be with s-hinged cover/enclosure marked "Suitable for Wet Locations when in use" and "UL Listed." There shall be a gasket between the enclosure

and the mounting surface and between the hinged cover and mounting plate/base. The cover shall be **TayMac Specification Grade**, or equal.

2.6 NAMEPLATES

- A. Provide nameplates or equivalent markings on switch enclosures to indicate ON and OFF positions of each switch. ON and OFF for 3-way or 4-way switches is not acceptable. Provide receptacles for special purposes with nameplates indicating their use. Conform to requirements of Section 26 05 00 – Electrical Work, General.

PART 3 - EXECUTION

3.1 CONNECTION

- A. Securely fasten nameplates using screws, bolts, or rivets centered under or on the device, unless otherwise indicated.

3.2 GROUNDING

- A. Ground all devices, including switches and receptacles, in accordance with NEC, ART 250, and Section 26 05 26 – Grounding.
- B. Ground switches and associated metal plates through switch mounting yoke, outlet box, and raceway system.
- C. Ground flush receptacles and their metal plates through positive ground connections to outlet box and grounding system. Maintain ground to each receptacle by spring-loaded grounding contact to mounting screw or by grounding jumper, each making positive connection to outlet box and grounding system at all times.

3.3 FIELD TESTING

- A. Provide checkout, field, and functional testing of wiring devices in accordance with Section 26 05 00 – Electrical Work, General.
- B. Test each receptacle for polarity and ground integrity with a standard receptacle tester.

END OF SECTION

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SECTION 26 28 00
OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Low voltage circuit breakers.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 26 05 00 - Electrical: Work, General.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C37.13, Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures.
 - b. C37.16, Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations.
 - c. C37.17, Trip Devices for AC and General Purpose DC Low Voltage Power Circuit Breakers.
2. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
3. Underwriters Laboratories, Inc. (UL):
 - a. 489, Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
 - b. 943, Standard for Safety for Ground-Fault Circuit-Interrupters.
 - c. 1066, Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - b. See Specification Section 26 05 00 for additional requirements.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

C. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Reports:
 - a. As-left condition of all circuit breakers that have adjustable settings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Circuit breakers:
 - a. Eaton.
 - b. General Electric Company.
 - c. Square D Company.
 - d. Siemens.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 CIRCUIT BREAKERS

A. Molded Case Type:

1. General:

- a. Standards: UL 489.
- b. Unit construction.
- c. Over-center, toggle handle operated.
- d. Quick-make, quick-break, independent of toggle handle operation.
- e. Manual and automatic operation.
- f. All poles open and close simultaneously.
- g. Three (3) position handle: On, off and tripped.
- h. Molded-in ON and OFF markings on breaker cover.
- i. One-, two- or three-pole as indicated on the Drawings.
- j. Current and interrupting ratings as indicated on the Drawings.
- k. Bolt on type.

2. Thermal magnetic type:

- a. Inverse time overload and instantaneous short circuit protection by means of a thermal magnetic element.
- b. Frame size 150 amp and below:
 - 1) Non-interchangeable, non-adjustable thermal magnetic trip units.
- c. Frame sizes 225 to 400 amp (trip settings less than 400A):
 - 1) Interchangeable and adjustable instantaneous thermal magnetic trip units.
- d. Ground Fault Circuit Interrupter (GFCI) Listed:
 - 1) Standard: UL 943.
 - 2) One- or two-pole as indicated on the Drawings.
 - 3) Class A ground fault circuit.
 - 4) Trip on 5 mA ground fault (4-6 mA range).
- e. Ground Fault Circuit Interrupter (GFCI) Listed:
 - 1) Standard: UL 943.
 - 2) One- or two-pole as indicated on the Drawings.

- 3) Class B ground fault circuit.
 - 4) Trip on 5 mA ground fault (4-6 mA range).
 - 5) For use on Electric Heat Trace circuits only.
3. Solid state trip type:
- a. Inverse time overload, instantaneous short circuit and ground fault protection by means of a solid state trip element, associated current monitors and flux shunt trip mechanism.
 - b. Frame size 400 amp to 1200 amp (trip settings between 400 and 1200A:
 - 1) Standard rating.
 - 2) Interchangeable current sensor or rating plug.
 - 3) Adjustable long time pick-up setting.
 - a) Adjustable from 50 to 100 percent of the current sensor or rating plug.
 - 4) Adjustable short time pick-up setting.
 - 5) Adjustable instantaneous pick-up.
 - 6) Fixed ground fault pick-up, when indicated on the Drawings.
4. Motor circuit protector:
- a. Adjustable instantaneous short circuit protection by means of a magnetic or solid state trip element.
 - b. Sized for the connected motor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Current and interrupting ratings as indicated on the Drawings.
- B. Series rated systems not acceptable.
- C. Devices shall be ambient temperature compensated.
- D. Circuit Breakers:
 1. Molded case circuit breakers shall incorporate the following, unless indicated otherwise on the Drawings:
 - a. Frame sizes 400 amp and less with trip setting less than 400A shall be thermal magnetic type.
 - b. Frame sizes 1000 amp and above shall include integral ground fault protection.

- c. Motor circuit protectors sized for the connected motor.
- 2. Insulated case circuit breakers shall incorporate the following, unless indicated otherwise on the Drawings:
 - a. Set current sensor or rating plugs long time pick-up setting so that the indicated trip level is near the 75 percent trip point.
 - b. Frame sizes 1000 amp and above shall include integral ground fault protection, when indicated on the Drawings.

3.2 FIELD QUALITY CONTROL

A. Adjustable Circuit Breakers:

- 1. Set all circuit breaker adjustable taps as defined on the Drawings, except adjust motor circuit protectors per the motor nameplate and NFPA 70 requirements.

B. Ground Fault Protection System:

- 1. Single source system:
 - a. Main breaker using the residual sensing method system coordinated with individual feeder breakers using the residual sensing method.
 - b. Main and feeder breakers: Utilize four (4) individual current sensors; the phase sensors are integral to the circuit breaker and the neutral sensor is external to the circuit breaker.

END OF SECTION

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SECTION 26 32 14
ENGINE GENERATOR: DIESEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Engine generator set and accessories.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 26 05 00 - Electrical: Basic Requirements.
4. Section 26 05 48 - Seismic Bracing Systems}

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Environmental Protection Agency (EPA):
 - a. 40 CFR Part 60, Subpart IIII, Protection of Environment, Standards of Performance for New Stationary Sources, Standards for Performance for Stationary Compression Ignition Internal Combustion Engines.
2. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. MG 1, Motors and Generators.
3. National Fire Protection association (NFPA):
 - a. 70, National Electrical Code (NEC):
 - 1) Article 700, Emergency Systems.
 - 2) Article 701, Legally Required Standby Systems.
 - 3) Article 702, Optional Standby Systems.
4. Underwriters Laboratories, Inc. (UL):
 - a. 2200, Standard for Stationary Engine Generator Assemblies.

- B. The engine generator set manufacturer or authorized supplier is designated to have single source responsibility for the supply of all components and installation of the unit.

1.3 SYSTEM DESCRIPTION

- A. The engine generators will be used and rated for:
 - 1. Standby power during a power outage, NFPA 70, Article 700.
 - 2. Optional standby power during a utility power outage, NFPA 70, Article 702.
- B. The engine generator system shall be housed in an environmentally controlled arctic duty rated non-walk-in enclosure. Enclosure to contain all required accessories including battery, battery charger and thermostatically controlled louvers.
- C. Fuel supply shall be stored in a belly tank located beneath the generator enclosure. Fuel supply shall allow operation at 50% load for 5 days.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - b. See Specification Section 26 05 00 for additional requirements.
 - c. Engine/generator performance curves.
 - 3. Fabrication and/or layout drawings.
 - a. Dimensional plan and elevation drawings.
 - b. Wire interconnection drawings.
 - 4. Test reports:
 - a. Factory test reports.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

- C. Informational Submittals:
 - 1. Unit installation, startup and operational statement.
 - 2. Field Quality Control test reports.

1.5 SITE CONDITIONS

- A. Ambient air temperature:
 - 1. Minimum: -40 DegF.
 - 2. Maximum: 90 DegF.
- B. Altitude: 100 FT above sea level.
- C. Seismic (Earthquake) forces:
 - 1. See 26 05 48 Seismic Bracing Systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Engine generator unit:
 - a. Caterpillar.
 - b. Cummins Onan.
 - c. Kohler.
 - d. Generac.
 - e. Waukesha.
 - 2. Silencers:
 - a. Maxim.
 - b. GT Exhaust Systems.
 - c. Nelson.
 - d. Cowl.
 - e. Hapco.
 - 3. Battery charger:
 - a. Manufacturer's standard.

4. Governor:
 - a. Manufacturer's standard.
5. Radiator:
 - a. Manufacturer's standard.
6. Vibration isolators:
 - a. Caldyne.
 - b. Mason Inds.
 - c. Ace.
 - d. Korfund Dynamics.
7. Day tank:
 - a. Pryco.
 - b. Simplex Access Controls.
 - c. Tramont.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 EQUIPMENT

A. Emissions Requirements:

1. A single units emissions shall meet all Federal, State and Local government requirements, including but not limited too:
 - a. Environmental Protection Agencies (EPA) New Source Performance Standards (NSPS), 40 CFR Part 60, Subpart IIII.

2.3 COMPONENTS

A. Engine Generator Unit General:

1. Diesel engine direct-connected to alternating current generator mounted on suitable rigid steel skid supports.
2. Mount unit on skid suitable for installation on concrete foundation.
3. Base rating on operation at rated RPM when equipped with all operating accessories.
4. Standards: UL 2200.

B. Engine:

1. Four-cycle, full compression ignition, single acting, solid-injection unit, either vertical or V-type pistons naturally aspirated or turbo charged with inter and after cooling.
2. Fuel supply: No. 2 Diesel.
3. Removable full wet-type cylinder liners of close grained alloy iron, heat treated for proper hardness to obtain maximum life.
4. Capable of operating at idle or light loads for extended periods of time.

C. Injection Pumps and Valves:

1. Type not requiring adjustment in service, which may be individually removed and replaced.
2. Individual injection pump and valve for each cylinder.
3. Fuel injection pumps: Positive action, constant-stroke, actuated by cam driven by gears from engine crankshaft.
4. Fuel lines between injection pumps and valves: Heavy seamless steel tubing.
5. Flexible fuel line connectors for supply and return connections at pump.

D. Oil Pump:

1. Gear-type lubricating oil pump to supply oil under pressure to main bearings, crank pin bearings, pistons, timing gears, camshaft bearings and valve rocker mechanism.
2. Spray cool and lubricate pistons.
3. Oil filters so located that lubricating oil is continuously filtered, except during periods when oil is automatically by-passed to protect vital parts when filters are clogged.
4. Filter elements accessible and easily removable.
5. Filter elements: Effective full flow, replaceable resin-impregnated cellulose type.
6. Equip filter system with spring-loaded by-pass valve.
7. Oil cooler: Water-cooled, engine-mounted.

E. Fuel System:

1. Fuel pump: Built-in gear-type, engine-driven fuel transfer pump, capable of supplying fuel at constant pressure against head of 3 FT.

2. Equip fuel system with replaceable fuel filter elements arranged for easy removal without breaking any fuel line connections or disturbing fuel pumps or any other part of engine.
 3. Locate all fuel filters in an accessible housing, ahead of injection pumps to thoroughly filter fuel before it reaches the pump.
 4. Use no screens or filters requiring cleaning or replacement of injection pumps or valve assemblies.
- F. Governor: Fully enclosed electronic type governor with actuator capable of providing accurate speed control within 1 percent of rated speed, complete with panel-mounted electronic assembly with ramp generator and speed-sensing modules.
- G. Air Cleaners: Engine-mounted, dry type air cleaners of sufficient capacity.
- H. Electric Starting System:
1. Sufficient capacity to crank at speed which will start engine under normal operating conditions.
 2. Controls to provide automatic cranking of engine when generator is called to start.
 3. Prevent excessive cranking which could damage cranking motor.
 4. Automatic stop controls.
 5. Starter motors with positive-engagement feature.
- I. Cooling System:
1. Capacity for cooling engine at the specified operating conditions.
 2. Engine driven, centrifugal type water circulating pump and thermostatic valve to maintain the engine at recommended temperature level.
 3. Unit mounted radiator.
 - a. Core guard flexible duct adapter.
 - b. Site glass at top of unit.
 - c. Engine driven blower fan.
 - d. Low water level cutoff switch.
 4. Provide fan guards.
- J. Heater:

1. Thermostatically controlled jacket water heater(s) to maintain cooling jacket at the manufacturer's recommended temperature at the specified low ambient temperature.
2. 208 V, single phase.

K. Silencer:

1. Suitable type for critical silencing.
2. Seamless, stainless steel, flexible, exhaust adapter for exhaust outlet to silencer.

L. Engine Instruments and Controls:

1. Engine-mounted instruments:
 - a. Oil pressure gage.
 - b. Water temperature gage.
 - c. Run time meter.
 - d. Battery voltage meter.
2. Automatic cycle cranking and over-crank protection.
3. Safety controls: Equip engine with automatic safety controls to shut down engine in event of low lubricating oil pressure, high jacket water temperature, overspeed or overcrank.
4. Auxiliary control devices: Either integral with specified engine instruments, control, and safety devices or as separate devices as required to operate various signal circuits specified for remote annunciator panel.
5. Three (3) NO auxiliary contacts for interface with louvers, fans or other miscellaneous equipment.
 - a. Contacts shall close when generator is started.

M. Fuel Day Tank:

1. Double wall sub-base day tank mounted underneath engine generator unit.
2. Steel construction, top and bottom baffles, steel channel side supports, weatherproof secondary containment, rust preventive interior coating, rust proofed and finish painted exterior.
3. Tank connections: Fuel level gauge, fuel lines to generator, fill, vent, drain and pressure relief.
4. Manual overflow protection.

5. Low level warning with contacts for remote alarm.
 - a. Set to alarm at 50 percent of capacity.
6. Critical low level shutoff with contacts for remote alarm.
7. Leak detection alarm with contacts for remote alarm.
8. Capacity: 24 HRS at full load.

N. Batteries:

1. Lead acid type.
2. Furnish electrolyte separately for use when installation is complete and unit is ready for testing.

O. Battery Charger:

1. Output current rating of at least 1/20th of ampere hour capacity of battery and capable of automatically switching between low rate (float) mode and high rate (equalize) mode.
2. Solid state rectifiers, DC voltmeter and ammeter, fuse input and output, and 115 Vac input.
3. Malfunction alarm contacts (minimum): low and high battery voltage, weak battery and charger failure.

P. Generator:

1. Brushless, 4-pole drip-proof revolving field type with permanent magnet, 2/3 pitch stator, direct-coupled rotor, Class H insulation.
2. Minimum continuous standby ratings:
 - a. 400kW @ 0.8pf , 480Y277V, 4-wire, three phase substantiated by manufacturer's standard published curves and conform to NEMA MG 1 specification.
 - b. Special ratings or maximum ratings are not acceptable.
3. Rated to serve up to 50 percent non-linear load without exceeding rated temperature rise.
4. Minimum efficiency: 92 percent at 50 to 110 percent of nominal standby rating, less than 30 percent instantaneous voltage dip at full load and rated power factor and suitable for simultaneous operation with other future units connected in parallel.
5. Stator and rotor: 130 DegC temperature rise with minimum Class H insulated with 100 percent epoxy impregnation and overcoat of resilient insulating material to reduce possible fungus and/or abrasive deterioration.

6. Directly connect stator to engine flywheel housing.
7. Drive rotor through semiflexible driving flange to ensure permanent alignment.
8. Self ventilating with suitable blower, air inlet and outlet openings.
9. Provide terminal box of adequate size for entrance of conduit and termination of conductors.
10. Generator drive free from critical torsional vibration within operating range.
11. Provide generator mounted main circuit breaker:
 - a. Solid state molded case type.
 - b. Ratings as indicated.

Q. Voltage Regulator:

1. SCR type, to maintain 2 percent voltage regulation from 0 to full load with steady state modulation not exceeding plus 1/2 percent including cross-current compensation to provide maximum of 5 percent unbalance in kVA load sharing between this unit and possible future generators.
2. Automatic protection against short circuits on system.
3. Permit unit to operate at no load below rated frequency for engine start up and shut down procedures.
4. Provide voltage level and gain controls for normal operating adjustments.
5. Provide voltage level control with minimum range of plus or minus 5 percent from rated voltage.
6. Mount regulator, volts per hertz type, in generator housing on suitable vibration isolators.

R. Generator Instruments and Controls:

1. Generator mounted NEMA 1 type, illuminated vibration isolated instrument and control panel(s).
2. AC voltmeter and phase selector switch.
3. AC ammeter and phase selector switch.
4. Frequency meter.
5. Run-off-auto engine, start-stop control switch.
6. Emergency stop.
7. Run time meter.

8. Governor control rheostat.
9. Voltage level adjustment rheostat.
10. Cool down time delay 0-15 minute adjustable.
11. Cycle cranking control.
12. Minimum red shut down indicating lights as follows:
 - a. Overcrank.
 - b. Overspeed.
 - c. Low lubricating oil pressure.
 - d. High engine water temperature.
13. Minimum amber alarm indicator lights as follows:
 - a. Control switch not in auto position.
 - b. Low engine water temperature (less than 70 DegF).
 - c. Low fuel in day tank.
 - d. Day tank leak.
 - e. Battery charger malfunctioning.
 - f. Low battery voltage.
14. Minimum amber prealarm indicator lights as follows:
 - a. High engine water temperature.
 - b. Low lubricating oil pressure.
15. Dry, relay contact outputs for each of the following conditions for monitoring by the Plant Control System:
 - a. Not in Auto.
 - b. Running.
 - c. Warning.
 - d. Common Alarm.
 - e. Battery Fault
 - f. Diesel Fuel Level Low.
 - g. Diesel Fuel Tank Leak.

- S. Vibration Isolators: Vibration system shall consist of engine and generator mount isolators with or without additional mechanical spring isolators rubber pads to control both high and low frequency vibrations between major components, sub-base and structural foundation and to provide required vibration isolation for the seismic zone of the Project.

2.4 ACCESSORIES

- A. Provide interposing relays (24 Vdc to 120 Vac) as required for interfacing with customer's 120 Vac monitoring system.
- B. Generator remote annunciator panel:
 - 1. Surface mounted NEMA 1 enclosure.
 - 2. Circuits:
 - a. 24 Vdc powered from starting batteries.
 - b. Verify circuit voltage to match battery voltage.
 - 3. Provide red and green signal lamps, buzzer, silencing switch, lamp test switch, relays, solid-state components, and engraved function identifications.
 - 4. Annunciator functions:
 - a. Green light "ON" to indicate generator is operating to supply power to load.
 - b. Separate red light for each shutdown or alarm condition and amber light for each prealarm condition and common buzzer with silence/acknowledge switch.
 - c. Shut down indicating lights as follows:
 - 1) Overcrank.
 - 2) Overspeed.
 - 3) Low lubricating oil pressure.
 - 4) High engine water temperature.
 - d. Alarm indicator lights as follows:
 - 1) Control switch not in auto position.
 - 2) Low engine water temperature (less than 70 DegF).
 - 3) Low fuel in day tank.
 - 4) Fuel in day tank rupture basin.
 - 5) Battery charger malfunctioning.
 - 6) Low battery voltage.

e. Prealarm indicator lights as follows:

- 1) High engine water temperature.
- 2) Low lubricating oil pressure.

C. Generator set non-walk-in weather protective enclosure:

1. Sheet steel with side servicing panels, air intake louvers and rear control panel access door.
2. Side servicing panels shall have two (2) locking points; all panels and doors are key lockable.
3. Pitched roof with silencing exhaust muffler mounted inside or outside the enclosure.
4. Completely install enclosure on generator set mounting base.

2.5 SOURCE QUALITY CONTROL

A. Individually test each prime mover.

1. Apply derating factors for the proposed site to test data.
2. Continuously test for a period no less than 2 HRS.
3. Test procedure shall be as follows:
 - a. Start prime mover and upon reaching rated RPM, pick up 100 percent of nameplate KW rating at rated power factor in one (1) step.
 - b. Observe and record the cranking time(s) required to start and run for each prime mover.
 - c. Observe and record the time required to come up to operating speed for each prime mover.
 - d. Record voltage and frequency overshoot for each prime mover.
 - e. Record voltage, frequency and amperes.
 - f. Record oil pressure, water temperature where applicable and battery charge rate at first load acceptance and at 15 minute intervals thereafter for each prime mover.

2.6 MAINTENANCE MATERIALS

A. Spare Parts:

1. Provide manufacturer's recommended spare parts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all components as indicated and in accordance with manufacturer's recommendations and instructions and Specification Section 26 05 48.
- B. Fill cooling system with solution of 50-50 water and ethylene glycol anti-freeze to prevent freezing at temperatures as low as minus 30 DegF.
- C. Provide fuel for a full tank.
- D. Install all wiring to engine in conduit.
 - 1. Control wiring on engine may be factory installed in high temperature loom.
- E. Provide control wiring in conduit between generator control panel, remote annunciator panel(s), and remote devices as described under generator instrument and controls paragraph and remote annunciator paragraph of this Specification.
- F. Mount on concrete pad utilizing vibration/seismic isolators, see structural drawings for pad detail.

3.2 FIELD QUALITY CONTROL

- A. Employ and pay for services of equipment manufacturer's field service representative(s) to:
 - 1. Inspect equipment covered by this Specification Section.
 - 2. Supervise pre-startup adjustments and installation checks.
 - 3. Conduct initial startup of equipment and perform operational checks.
 - 4. Provide Owner written statement that manufacturer's equipment has been installed properly, started up, tested, and is ready for operation by Owner's personnel.
 - 5. Provide 4 HRS of the manufacturer's technical representative's time for on-site training of Owner's personnel.
- B. Provide two (2) load tests and one (1) cycle crank test.
 - 1. Tests one (1) and two (2) shall be for continuous period of no less than 2 HRS each.
 - 2. Engineer and Owner shall be notified seven (7) days prior to testing.
 - 3. Test number one:

- a. With prime mover(s) in a "cold start" condition and load at normal operating level, initiate a normal power failure by opening all switches or breakers supplying normal power to facility.
 - b. Observe and record the time delay on engine start.
 - c. Observe and record the cranking time(s) required to start and run for each prime mover.
 - d. Observe and record the time required to come up to operating speed for each prime mover.
 - e. Record voltage and frequency overshoot for each prime mover.
 - f. Observe and record time required to achieve steady-state condition with all switches transferred to emergency position.
 - g. Record voltage, frequency and amperes.
 - h. Record oil pressure, water temperature where applicable and battery charge rate at 5-minute intervals for the first 15 minutes and at 15 minute intervals thereafter for each prime mover.
 - i. Return normal power to facility, record time delay on retransfer to normal for each switch and cool down time delay for each prime mover.
4. Test number two:
- a. Immediately after completion of test number one, start prime mover and upon reaching rated RPM, pick up 100 percent of nameplate KW rating in one (1) step.
 - 1) Unity power factor is acceptable for on-site testing
 - b. Observe and record the cranking time(s) required to start and run for each prime mover.
 - c. Observe and record the time required to come up to operating speed for each prime mover.
 - d. Record voltage and frequency overshoot for each prime mover.
 - e. Observe and record time required to achieve steady-state condition.
 - f. Record voltage, frequency and amperes.
 - g. Record oil pressure, water temperature where applicable and battery charge rate at first load acceptance and at 15 minute intervals thereafter for each prime mover.
5. Cycle crank test:
- a. Perform test for each prime mover.

- 1) Utilize any method recommended by manufacturer to prevent prime mover(s) from running.
 - 2) Put control switch into "run" position to cause prime mover to crank.
- b. A complete cranking cycle shall consist of an automatic crank period of approximately 15 seconds duration followed by a rest period of approximately 15 seconds duration.
- 1) Upon starting and running of the prime mover, further cranking shall cease.
 - 2) Two (2) means of cranking termination shall be utilized so that one (1) will act as a backup to the other to prevent inadvertent starter engagement.
 - 3) Cranking limiter time shall be 75 seconds for cycle crank.
6. Furnish load banks of required ratings necessary for tests.
 7. Record engine fuel consumption by means of test equipment.
 8. Test all safeties specified for generator instruments and controls and generator remote annunciator panel as recommended by manufacturer and as required to verify proper operation.
 9. Contractor shall be responsible for fuel and all consumables use during the test.

END OF SECTION

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SECTION 26 36 05
HEAVY-DUTY SAFETY SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install heavy-duty, double-throw safety switches for manual transfer of loads between alternate sources of supply and single-throw safety switches for motor disconnect.

1.2 CODES AND STANDARDS

- A. The heavy-duty safety switches shall conform to the requirements of:
 - 1. UL 98 – Enclosed Switches

1.3 SUBMITTALS

- A. Provide outline drawings with dimensions, and equipment ratings for voltage, amperage and short circuit in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 SAFETY SWITCH

- A. The safety switches used as transfer switches shall be heavy-duty, manually operated, single-throw or double-throw switches, full load make or break rated. Switches shall include a NO contact that is made in the A and B position.
- B. Switch shall be UL listed for use as service equipment and is to be labeled for this application.
- C. Switch shall have switch blades which are visible when the switch is OFF and the cover is open.
- D. Lugs shall be front removable and UL listed for aluminum or copper.
- E. All current carrying parts shall be plated to resist corrosion.
- F. The UL listed short circuit current rating of the double throw switch shall be 10,000 rms symmetrical amperes.
- G. Provisions for padlocking the switch in the OFF position shall be provided.
- H. Motor disconnect switches installed in control panels shall be rotary disconnect switches **Allen-Bradley Bulletin 194RF**, or equal.

2.2 ENCLOSURE

- A. The safety switch shall be furnished in a NEMA enclosure, type determined by location as specified.
- B. The enclosure shall be supplied with a metal nameplate which includes ON-OFF-ON markings.

2.3 MANUFACTURERS

- A. Safety switches shall be manufactured by **Square D, Allen-Bradley**, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The safety switch shall be installed in accordance with the Manufacturer's requirements and recommendations.

END OF SECTION

SECTION 26 50 00
LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide lighting fixtures, supports, and lamps, and accessories, complete and operable, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

- A. If the Contractor proposes to install equivalent equipment to that suggested, then he shall furnish the following product information in accordance with Section 01 33 00.

1. Interior luminaires

- a. Catalog data sheets and pictures.
- b. Luminaire finish and metal gauge.
- c. Lens material, pattern, and thickness.
- d. Candle power distribution curves in two or more planes.
- e. Candle power chart 0 to 90 degrees.
- f. Lumen output chart.
- g. Average maximum brightness data in foot lamberts.
- h. Coefficients of utilization for zonal cavity calculations.
- i. Mounting or suspension details.
- j. Heat exchange and air handling data.

2. Exterior luminaires

- a. Catalog data sheets and pictures.
- b. Luminaire finish and metal gauge.
- c. Lens material, pattern, and thickness.
- d. IES lighting classification and isolux diagram.
- e. Fastening details to wall or pole.
- f. For light poles, submit wind loading, complete dimensions, and finish.

3. Lamps
 - a. Voltages .
 - b. Colors.
 - c. Approximate life (in hours).
 - d. Approximate initial lumens.
 - e. Lumen maintenance curve.
 - f. Lamp type and base.

PART 2 - PRODUCTS

2.1 FIXTURES - GENERAL

- A. Luminaires: Specific requirements relative to execution of WORK of this Section are located in the Luminaire Schedule on Contract Drawings.
- B. All fixtures shall be pre-wired with leads of 18-AWG, minimum, for connection to building circuits.
- C. Fixtures shall be LED.

2.2 EXTERIOR FIXTURES

- A. Exterior fixtures in combination with their mounting pole and bracket shall be capable of withstanding 100 MPH winds without damage. Exterior fixtures shall have corrosion-resistant hardware and hinged doors or lens retainer. Fixtures specified to be furnished with integral photo-electrical control shall be of the fixture manufacturer's standard design.

2.3 INTERIOR FIXTURES

- A. Interior fluorescent fixtures without diffusers shall be furnished with end plates. Where diffusers are required, they shall be of high molecular strength acrylic. Minimum thickness of the acrylic shall be 0.125 inches for all diffusers, except that those on 4-foot square fixtures shall be 0.187 inches thick.

2.4 LAMPS

- A. Lamps shall be first-line **General Electric, Cutler-Hammer, Sylvania**, or equal.
- B. Fluorescent lamps shall be cool/white unless otherwise indicated. Incandescent lamps shall be frosted unless a specified fixture lighting control system requires clear globe lamps. High-pressure sodium lamps shall be "color corrected." Unless otherwise indicated in the Contract Documents, lamps shall be suitable for operation in any burning position.

2.5 PHOTO-ELECTRIC CELLS

- A. Photoelectric cells for control of multiple fixtures shall be self-contained, weatherproof type, rated for 1800 va 120-volt, single pole, single throw, and shall be provided with time-delay features. Photoelectric cell shall be **Tork Model 2101**, or equal.

2.6 FIXTURE TYPES

- A. Specific requirements are located in the Lighting Fixture Schedule on the Contract Drawings.

PART 3 - EXECUTION

3.1 LUMINAIRES

- A. Install in accordance with manufacturer's recommendations.
- B. Provide necessary hangers, pendants, and canopies.
- C. Provide additional ceiling bracing, hanger supports, and other structural reinforcements to building required to safely mount.
- D. Install plumb and level.
- E. Locate luminaires to avoid both conflict with other building systems and blockage of luminaire light output.

3.2 LAMPS

- A. Provide in each fixture, the number and type for which the fixture is designed, unless otherwise indicated.

3.3 CLEANING FOLLOWING INSTALLATION

- A. Remove all labels and other markings, except UL listing mark.
- B. Wipe luminaires inside and out to remove construction dust.
- C. Clean luminaire plastic lenses with antistatic cleaners only.
- D. Touch up all painted surfaces of luminaires and poles with matching paint ordered from manufacturer.
- E. Replace all defective fixtures at time of Substantial Completion.

END OF SECTION

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DIVISION 31

EARTHWORK



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SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Site clearing, tree protection, stripping topsoil and demolition.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 31 23 00 - Earthwork.
4. Section 31 25 00 - Soil Erosion and Sediment Control.
5. Section 32 91 13 - Topsoiling and Finished Grading.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing trees and other vegetation to remain against damage.

1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
3. Provide temporary protection as required.

B. Repair or replace trees and vegetation damaged by construction operations.

1. Repair to be performed by a qualified tree surgeon/licensed arborist.
2. Remove trees which cannot be repaired and restored to full-growth status.
3. Replace with new trees of minimum 4 IN caliper or as required by local tree ordinance.

C. Owner will obtain authority for removal and alteration work on adjoining property, as applicable.

3.2 SITE CLEARING

A. Topsoil Removal:

1. Strip topsoil to depths encountered or as specified within the soils report, 4" minimum.
 - a. Remove heavy growths of grass before stripping.
 - b. Stop topsoil stripping sufficient distance from such trees to prevent damage to main root system.
 - c. Separate from underlying subsoil or objectionable material.
2. Stockpile topsoil where directed by Engineer.
 - a. Construct storage piles to freely drain surface water.
 - b. Seed or cover storage piles to prevent erosion.
3. Do not strip topsoil in wooded areas where no change in grade occurs.
4. Borrow topsoil: Reasonably free of subsoil, objects over 2 IN DIA, weeds and roots.

B. Clearing and Grubbing:

1. Clear from within limits of construction all trees not marked to remain.
 - a. Include shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, structures and debris.
2. Grub (remove) from within limits of construction all stumps, roots, root mats, logs and debris encountered.

C. Disposal of Waste Materials:

1. Do not burn combustible materials on site.
2. Remove all waste materials from site.
3. Do not bury organic matter on site.

3.3 ACCEPTANCE

- A. Upon completion of the site clearing, obtain Engineer's acceptance of the extent of clearing, depth of stripping, and rough grade.

END OF SECTION

SECTION 31 23 00
EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Earthwork - excavation, backfilling, grading, compaction, disposal of waste and surplus materials, placing crushed stone, construction of berms, sheeting, bracing, dewatering and other Earthwork related work.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 07 26 00 - Under Slab Vapor Retarder.
4. Section 31 25 00 - Soil Erosion and Sediment Control.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
 - c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³(2,700 kN-m/m)).
 - d. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - e. D3786, Standard Test Method for Bursting Strength of Textile Fabrics-- Diaphragm Bursting Strength Tester Method.
 - f. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - g. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

- h. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- 2. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR Part 1926.650, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
- 3. Alaska Department of Environmental Conservation:
 - a. Lagoon Construction Guidelines, Revised July, 2013.

1.3 DEFINITIONS

- A. Excavation:
 - 1. Consists of removal of material encountered to subgrade elevations required or indicated.
 - 2. Includes excavation of soils; pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; boulders; and rock.
- B. Foundations: Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.
- C. Geotechnical Engineer: Independent geotechnical specialist providing field quality control for the project.
- D. Non-Structural Fill/Backfill: Soil materials placed and compacted to achieve finish grade elevations that do NOT support foundations, slabs, paving, or other flatwork.
- E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.
- F. Subgrade: The earth or soil layer immediately below foundation bearing elevation, subbase material, fill material, backfill material, or topsoil materials.
- G. Unauthorized Excavation:
 - 1. Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer.
 - a. Unauthorized excavation, as well as associated remedial work as directed by Engineer or Geotechnical Engineer, shall be at Contractor's expense.
 - 2. Unsuitable Soil Materials: Soil materials encountered at or below subgrade elevation of insufficient strength and stiffness to support construction as determined by the Geotechnical Engineer.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
3. Certifications.

B. Samples:

1. Coordinate samples and testing for approval of off-site materials with the Geotechnical Engineer.
2. Test reports.

1.5 PROJECT CONDITIONS

- A. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.
- B. Dispose of waste materials, legally, off site.
 1. Burning, as a means of waste disposal, is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Classified Fill and Backfill:

1. Selected material approved by Geotechnical Engineer from site excavation or from off site borrow.
2. Structural Fill:
 - a. Classified fill and backfill shall contain no lumps, frozen material, organic matter or other deleterious matter. It shall have plasticity index not greater than six (6) as determined by ASTM D-424 and shall conform to one of the following types, as required by the drawings.
 - 1) Type II Classified Fill: Materials furnished by the Contractor for use as Type II classified fill and/or backfill shall be graded within the limitation of Table I.

TABLE I

| <u>U.S. Std Sieve</u> | <u>Cumulative % Passing</u> |
|-----------------------|-----------------------------|
| <u>8"</u> | <u>100</u> |
| <u>3"</u> | <u>70-100</u> |
| <u>1-1/2"</u> | <u>55-100</u> |
| <u>3/4"</u> | <u>45-85</u> |
| <u>#4</u> | <u>20-60</u> |
| <u>#10</u> | <u>12-50</u> |
| <u>#40</u> | <u>4-30</u> |
| <u>#200</u> | <u>2-6*</u> |

*- The fraction passing the No. 200 sieve shall not exceed 15 percent of the fraction passing the No. 4 sieve.

- 2) Type II-A Classified Fill: Materials furnished by the Contractor for use as Type II-A classified fill and/or backfill shall be graded within the limitation of Table II.

TABLE II

| <u>U.S. Std Sieve</u> | <u>Cumulative % Passing</u> |
|-----------------------|-----------------------------|
| <u>3"</u> | <u>100</u> |
| <u>3/4"</u> | <u>50-100</u> |
| <u>#4</u> | <u>25-60</u> |
| <u>#10</u> | <u>15-50</u> |
| <u>#40</u> | <u>4-30</u> |
| <u>#200</u> | <u>2-6**</u> |

** - The fraction passing the No. 200 sieve shall not exceed 20 percent of the fraction passing the No. 4 sieve.

B. Leveling Course:

- a. The leveling course shall consist of crushed gravel, rock, sand, or other approved material. The aggregate shall be free from lumps, balls of clay, or other objectionable matter, and shall be durable and sound. The portion of the material retained on a No. 4 sieve shall be known as coarse aggregate. Both coarse and fine aggregates shall conform to the quality requirements of AASHTO M-147.

- b. Coarse Aggregate: The coarse aggregate material conforming to the requirements specified above shall have a percentage of wear not to exceed 50 after 500 revolutions, as determined by the current requirements of ASTM C-131. It shall consist of angular fragments reasonably uniform in density and quality, and reasonably free from thin and elongated pieces, dirt, and other objectionable material. At least fifty (50) percent of the coarse aggregate particles shall have two or more mechanically fractured faces.
- c. Fine Aggregate: The fine aggregate shall consist of material free of organic or other objectionable matter. The fine aggregate, either naturally combined with the coarse aggregate or separately obtained and mixed therewith, shall be of such character that the composite material will conform to the gradation and other requirements specified.
- d. Gradation: The composite mixture of coarse aggregate and fine aggregate, processed as hereinafter specified, shall conform to the following gradation limits as required by the Drawings:

| <u>U.S. Std Sieve</u> | <u>Cumulative % Passing</u> |
|-----------------------|-----------------------------|
| <u>1"</u> | <u>100</u> |
| <u>3/4"</u> | <u>70-100</u> |
| <u>3/8"</u> | <u>50-80</u> |
| <u>#4</u> | <u>35-65</u> |
| <u>#8</u> | <u>20-50</u> |
| <u>#50</u> | <u>8-28</u> |
| <u>#200</u> | <u>0-6***</u> |

***- The fraction passing the No. 200 sieve shall not exceed 75 percent of the fraction passing the No. 4 sieve.

- C. Granular Fill Under Base Slabs with Pressure Relief Valves:
 - 1. Drainage material: Conform to ASTM C33, Size No. 67.
 - 2. Filter material: Conform to ASTM C33 requirements for fine aggregate.
- D. Structural Fill Beneath Clarifiers, Splitter Box and WAS Vault Structures: Provide a 4-inch thickness of compacted Leveling Course overlying a minimum 8 inch thickness of compacted Type IIA Classified Fill. Subgrade below this structural fill shall be compacted non-frost susceptible gravel soil, free of organics.
- E. Granular Fill Under Electrical Equipment Pads, Manholes and Handholes: Clean, crushed, nonporous rock, crushed or uncrushed gravel complying with ASTM C33 gradation size No. 67, 3/4 IN to No. 4.

F. Geotextile Filter Fabric:

1. Nonwoven type.
2. Equivalent opening size: 50 - 100 (U.S. Standard Sieve).
3. Permeability coefficient (cm/second): 0.07 minimum, 0.30 maximum.
4. Grab strength: 90 LBS minimum in either direction in accordance with ASTM D4632 requirements.
5. Mullen burst strength: 125 psi minimum in accordance with ASTM D3786 requirements.

G. Vapor Retarder: Refer to Specification Section 07 26 00.

H. Lagoon Liner Backfill:

1. Bentonite and sand admix liners are to be mixed with native sands or silts.
2. Bentonite shall be high-swelling
3. Minimum thickness after compaction: 4 IN

I. Control Low Strength Material (CLSM): See Section 03 31 30.

PART 3 - EXECUTION

3.1 PROTECTION

A. Erosion Control:

1. See Specification Section 31 25 00.
2. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
3. Conduct work to minimize erosion of site. Remove eroded material washed off site.
 - a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.

B. Protect existing surface and subsurface features on-site and adjacent to site as follows:

1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
2. Protect and maintain bench marks, monuments or other established reference points and property corners.

- a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
3. Verify location of utilities.
 - a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
 - b. Secure and examine local utility records for location data.
 - c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
 - 1) If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
 - 2) Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
 - 3) Obtain Owner's approval prior to disconnecting any utility service
 - d. Repair damages to utility items at own expense.
 - e. In case of damage, notify Engineer at once so required protective measures may be taken.
 4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
 - a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
 - c. All repairs to be made and paid for by Contractor.
 5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
 6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
 7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

3.2 SITE EXCAVATION AND GRADING

- A. The site excavation and grading work includes the offsite disposition of all material:
 - 1. That exceed quantities required for earthwork on the project.
 - 2. That the Geotechnical engineer classifies as unclassified excavation.
 - 3. That the Geotechnical engineer classifies as unacceptable.
 - 4. That the Geotechnical engineer classifies as potentially contaminated.
- B. Excavation and Grading:
 - 1. Perform as required by the Contract Drawings.
 - 2. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
 - a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
 - b. Perform other layout work required.
 - c. Replace property corner markers to original location if disturbed or destroyed.
 - 3. Preparation of ground surface for embankments or fills:
 - a. Before fill is started, scarify to a minimum depth of 6 IN in all proposed embankment and fill areas.
 - b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
 - 4. Protection of finish grade:
 - a. During construction, shape and drain embankment and excavations.
 - b. Maintain ditches and drains to provide drainage at all times.
 - c. Protect graded areas against action of elements prior to acceptance of work.
 - d. Reestablish grade where settlement or erosion occurs.
- C. Borrow:
 - 1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
 - 2. Include cost of all borrow material in original proposal.

3. Fill material to be approved by Geotechnical Engineer prior to placement.
- D. Construct embankments and fills as required by the Contract Drawings:
1. Construct embankments and fills at locations and to lines of grade indicated.
 - a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
 2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.
 - a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of fill or embankment.
 - b. Do not place material in layers greater than 8 IN loose thickness.
 - c. Place layers horizontally and compact each layer prior to placing additional fill.
 3. Compact soils as required to obtain specified density. Selection of appropriate equipment is the Contractor's responsibility.
 - a. In general, compact cohesive soils by sheepsfoot, and granular soils by pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
 - b. Control moisture for each layer necessary to meet requirements of compaction.

3.3 USE OF EXPLOSIVES

- A. Blasting with any type of explosive is prohibited.

3.4 COMPACTION DENSITY REQUIREMENTS

- A. Obtain approval from Geotechnical Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.
- B. Provide dewatering system necessary to successfully complete compaction and construction requirements.
- C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Geotechnical Engineer.
- D. Stabilize subgrade with well graded granular materials as directed by Geotechnical Engineer.
- E. Assure by results of testing that compaction densities comply with the following requirements:

1. Sitework:

| LOCATION | COMPACTION DENSITY | MOISTURE CONTENT |
|--|---|-----------------------------|
| Under Paved Areas, Sidewalks and Piping: | | |
| Cohesive soils | 95 percent per ASTM D698 | -2 to +3 percent of optimum |
| Cohesionless soils | 75 percent relative density per ASTM D4253 and ASTM D4254 | |
| Unpaved Areas: | | |
| Cohesive soils | 90 percent of ASTM D698 | -2 to +3 percent of optimum |
| Cohesionless soils | 65 percent relative density per ASTM D4253 and ASTM D4254 | |

2. Structures:

| LOCATION | COMPACTION DENSITY | MOISTURE CONTENT |
|--|--------------------------|-----------------------------|
| Inside of structures under foundations, under equipment support pads, under slabs-on-grade | 98 percent per ASTM D698 | -2 to +3 percent of optimum |
| Outside structures next to walls, piers, columns and any other structure exterior member | 92 percent per ASTM D698 | -2 to +3 percent of optimum |

3. Specific areas:

| LOCATION | COMPACTION DENSITY | MOISTURE CONTENT |
|--|--|-----------------------------|
| Outside structures under equipment support foundations | 98 percent per ASTM D698 | -2 to +3 percent of optimum |
| Under void | 85 percent per ASTM D1557 | -2 to +3 percent of optimum |
| Granular fill under base slabs with pressure relief valves | 75 percent relative density per ASTM D4253 and ASTM D4254 or 98 percent of ASTM D698 | |
| Granular fill under building floor slabs-on-grade | 60 percent relative density per ASTM D4253 and ASTM D4254 | |

3.5 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. General:

1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
2. Obtain fill and backfill material necessary to produce grades required.

- a. Materials and source to be approved by Geotechnical Engineer.
 - b. Excavated material approved by Geotechnical Engineer may also be used for fill and backfill.
3. In the paragraphs of this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation Requirements for Structures:

1. General:

- a. Do not commence excavation for foundations for structures until Geotechnical Engineer approves:
 - 1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
 - 2) Density and moisture content of site area compacted fill material meets requirements of specifications.
 - 3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
 - 4) Surcharge or mass fill material has been removed from construction area or portions thereof.
- b. Engineer grants approval to begin excavations.

2. Dimensions:

- a. Excavate to elevations and dimensions indicated or specified.
 - b. Allow additional space as required for construction operations and inspection of foundations.
 - c. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
 - d. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
- a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Geotechnical Engineer.
 - b. Remove unsuitable subgrade soils located below foundations. The bottom of the overexcavation shall be located outside the exterior limits

of foundations around the perimeter of structure the following horizontal distance, whichever is greater:

- 1) Distance equal to depth of overexcavation below bottom of foundations.
 - 2) 5 FT.
 - 3) As directed by Geotechnical Engineer.
- c. When excavation has reached required subgrade elevations, notify Geotechnical Engineer, who will make an inspection of conditions.
- 1) If Geotechnical Engineer determines that bearing materials at required subgrade elevations are unsuitable, provide Subgrade Stabilization as specified herein.
4. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill.
- a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
 - b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6 IN and then compact to density stated in this Specification Section before fill material can be placed thereon.
 - c. Do not carry excavations lower than shown for foundations except as directed by Geotechnical Engineer or Engineer.
 - d. If any part of excavations is carried below required depth without authorization, notify Engineer and correct unauthorized excavation as directed. Corrections may include:
 - 1) Under soil supported footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
 - a) Concrete fill may be used to bring elevations to proper position.
 - 2) In locations other than those above, including slabs on grade and pile supported foundations, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Geotechnical Engineer.
 - 3) No extra compensation will be made to Contractor for correcting unauthorized excavations.
5. Make excavations large enough for working space, forms, dampproofing, waterproofing, and inspection.
6. Notify Geotechnical Engineer and Engineer as soon as excavation is completed in order that subgrades may be inspected.

- a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under equipment support pads, and under retaining wall footings has been inspected and approved by the Geotechnical Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.
- b. Geotechnical Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.
- c. Place fill material, foundations, retaining wall footings, floor slabs-on-grade, and equipment support pads as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.
- d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.

7. Dewatering:

- a. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
- b. Groundwater shall be maintained at least 3 FT below the bottom of any excavation.
- c. Review Geotechnical investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
- d. Employ dewatering specialist for selecting and operating dewatering system.
- e. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
- f. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
 - 1) Install groundwater monitoring wells as necessary.
- g. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.

8. Subgrade stabilization:

- a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Geotechnical Engineer.
 - b. Provide compaction density of replacement material as stated in this Specification Section.
 - c. Loose, wet, or soft materials, when approved by Geotechnical Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
 - d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.
 - e. Remove and replace frozen materials as directed by Geotechnical Engineer.
 - f. Method of stabilization shall be performed as directed by Geotechnical Engineer.
 - g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Geotechnical Engineer.
9. Do not place floor slabs-on-grade including equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence slab construction.
- a. Do not place building floor slabs-on-grade including equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40 DegF before structure is completed and heated to a temperature of at least 50 DegF.

10. Protection of structures:

- a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
- b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.

11. Shoring:

- a. Shore, slope, or brace excavations as required to prevent them from collapsing.
- b. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.

- c. Construct shoring that is required to retain water as part of the dewatering system, using non-permeable details such as interlock sealant for sheet piles.

12. Drainage:

- a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
- b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.
- c. Provide pumping required to keep excavated spaces clear of water during construction.
- d. Should any water be encountered in the excavation, notify Engineer and Geotechnical Engineer.
- e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.

13. Frost protection:

- a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
- b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.
- c. Protect excavation from frost if placing of concrete or fill is delayed.
- d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.
- e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 DegF.

C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs, Floor Slabs, Equipment Support Pads and Piping:

1. General:

- a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Geotechnical Engineer and scarified to a depth of 6 IN and compacted to density specified herein.

- b. Surface may be stepped by at not more than 12 IN per step or may be sloped at not more than 2 percent.
 - c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Geotechnical Engineer as being free of undesirable material and compacted to specified density.
- 2. Obtain approval of fill and backfill material and source from Geotechnical Engineer prior to placing the material.
- 3. Granular fill under floor slabs-on-grade: Place all floor slabs-on-grade on a minimum of 6 IN of granular fill unless otherwise indicated.
- 4. Vapor barrier: Install a continuous vapor barrier under floor slabs-on-grade as required by Specification Section 07 26 00 and shown on Contract Drawings.
- 5. Fill and backfill placement:
 - a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Geotechnical Engineer.
 - b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
 - c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
 - d. Use hand operated equipment for filling and backfilling within 5 FT of walls and less than 3 FT above pipes
 - 1) Compaction equipment exceeding 3000 LBS dead weight shall not be used within 5 FT of the wall as a minimum
 - 2) Contractor is responsible for method of compaction so as not to damage wall.
 - e. Use hand operated equipment for filling and backfilling next to walls.
 - f. Do not place fill and backfill when the temperature is less than 40 DegF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
 - g. Use vibratory equipment to compact granular material; do not use water.
- 6. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content as required to fill the specified overexcavation to bottom of foundation.

D. Filling and Backfilling Outside of Structures.

1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
2. Provide material as approved by Geotechnical Engineer for filling and backfilling outside of structures.
3. Fill and backfill placement:
 - a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Geotechnical Engineer.
 - b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
 - c. Compact material with equipment of proper type and size to obtain density specified.
 - d. Use hand operated equipment for filling and backfilling within 5 FT of walls and less than 3 FT above pipes
 - 1) Compaction equipment exceeding 3000 LBS dead weight shall not be used within 5 FT of the wall as a minimum
 - 2) Contractor is responsible for method of compaction so as not to damage wall.
 - e. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
 - f. Do not place fill or backfill material when temperature is less than 40 DegF and when subgrade to receive material is frozen, wet, loose, or soft.
 - g. Use vibratory equipment for compacting granular material; do not use water.
4. Backfilling against walls:
 - a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.
 - b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, dampproofing and waterproofing have been completed.
 - c. Do not place fills against walls until floor slabs at top, bottom, and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.

- 1) See Contract Drawings for specific exceptions.
 - d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.
- E. Backfilling Outside of Structures Under Piping or Paving:
1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Specification Section.
 2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.
 3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Specification Sections for the Project.

3.6 FIELD QUALITY CONTROL

- A. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA standards 29 CFR Part 1926.650 Subpart P, and state requirements. Where conflict between OSHA and state regulations exists, the more stringent requirements shall apply.
- B. Special Inspection and testing:
1. See Section 01 45 33.
- C. Responsibilities of Special Inspector:
1. Review proposed materials for fill and backfill around structures.
 2. All testing, observation and work indicated as being performed by the Geotechnical Engineer in Article 3.5 of this Specification Section.
 3. Services will include verification and documentation of satisfactory soil materials, subgrade quality, sampling, placement, moisture conditioning, compaction and testing of proposed soil materials, and field testing for quality control.
 4. Moisture density relations, to be established by the Geotechnical Engineer required for all materials to be compacted.
 5. Extent of compaction testing will be as necessary to assure compliance with specifications.
 6. Prepare and submit inspection and test reports to Engineer.
 - a. Coordinate such work with other Special Inspectors.

7. Test reports to include the following:
 - a. Report and certification of aggregate fill and drainage fill.
 - b. Test reports on borrow material.
 - c. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
 - d. Field reports; in-place soil density and moisture tests.
 - e. One optimum moisture-maximum density curve for each type of soil encountered.
 - f. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.
 - g. Other documentation necessary for Geotechnical Engineer to approve earthwork.
 - h. Assist Engineer to determine corrective measures necessary for defective work.

D. Responsibilities of Testing Agency for Site Excavation and Grading:

1. All testing, observation and work indicated as being performed by the Geotechnical Engineer in other than Article 3.5 of this Specification Section.
2. Services will include verification and documentation of satisfactory soil materials, subgrade quality, sampling, placement, moisture conditioning, compaction and testing of proposed soil materials, and field testing for quality control.
3. Moisture density relations, to be established by the Geotechnical Engineer required for all materials to be compacted.
4. Extent of compaction testing will be as necessary to assure compliance with specifications.

END OF SECTION

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SECTION 31 23 33

TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation, trenching, backfilling and compacting for all underground utilities.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
4. Division 26 - Electrical.
5. Section 31 23 00 - Earthwork.
6. Section 33 05 16 - Precast Concrete Manhole Structures.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):

- a. C33, Standard Specification for Concrete Aggregates.
- b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- c. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- d. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
- e. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

- B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

- A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

- A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
4. Submit sieve analysis reports on all granular materials.

- B. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Trench shield (trench box) certification if employed:
 - a. Specific to Project conditions.
 - b. Re-certified if members become distressed.
 - c. Certification by registered professional structural engineer, registered in the state where the Project is located.
 - d. Engineer is not responsible to, and will not, review and approve.

1.5 SITE CONDITIONS

- A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
 1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.
- B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

- C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.
- D. Verify location of existing underground utilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Material:

- 1. As approved by Engineer.
 - a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
 - b. Moisture content at time of placement: 3 percent plus/minus of optimum moisture content as specified in accordance with ASTM D698.
- 2. Gravel trench backfill materials:
 - a. Uniformly graded pea gravel defined below:

| Sieve Size | 1 IN | 3/4 IN | 3/8 IN | No. 4 | No. 20 |
|---------------------------|------|--------|--------|-------|--------|
| Percent Passing by Weight | 100 | 90-100 | 20-55 | 0-10 | 0 |

B. Bedding Materials:

- 1. As approved by the Geotechnical Engineer.
- 2. Granular bedding materials:
 - a. Coarse aggregate material conforming to the requirements specified below shall have a percentage of wear not to exceed thirty (30) after five hundred (500) revolutions, as determined by the current requirements of ASTM C-131. Adapted from Municipality of Anchorage Standard Specifications, 2015 for Class "E" Bedding:

| Sieve Size | 1/2 IN | 3/8 IN | No. 4 | No. 10 | No. 40 | No. 200 |
|---------------------------|--------|--------|-------|--------|--------|---------|
| Percent Passing by Weight | 100 | 80-100 | 20-75 | 12-60 | 2-30 | 0-6 |

- 1) Well graded gravel.
- 3. Flowable fill:
 - a. Description: Flowable fill shall be a mixture of cement, fly ash, fine sand, water, and air having a consistency which will flow under a very low head.

- b. Material characteristics:
 - 1) The approximate quantities of each component per cubic yard of mixed material shall be as follows:
 - a) Cement (Type I or II): 50 LBS.
 - b) Fly ash: 200 LBS.
 - c) Fine sand: 2,700 LBS.
 - d) Water: 420 LBS.
 - e) Air content: 10 percent.
 - 2) Actual quantities shall be adjusted to provide a yield of 1 cubic yard with the materials used.
 - 3) Approximate compressive strength should be 85 to 175 psi.
 - 4) Fine sand shall be an evenly graded material having not less than 95 percent passing the No. 4 sieve and not more than 5 percent passing the No. 200 sieve.
 - 5) Mixing and handling of the material shall be in accordance with Specification Section 03 31 31.

C. Insulation: Install rigid foam insulation board as indicated on Contract Drawings. Manufacturer shall be Dow or other approved equivalent. Insulation thickness shall be as per Contract Drawings.

D. Install a utility locating wire and a utility marker ribbon in trench as indicated on Contract Drawings.

- 1. Polyethylene plastic and metallic core or metallic-faced, acid-and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

| | |
|---------|-----------------------------------|
| Yellow: | Gas, Oil, and Dangerous Materials |
| Blue: | Water |
| Green: | Sewer |

- 2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi otherwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection. Color coded tape shall be installed flat with color side up 12 inches to 24 inches over all installed utility lines including main line and service lateral or service connection.

PART 3 - EXECUTION

3.1 GENERAL

- A. Remove and dispose of unsuitable materials as directed by Geotechnical Engineer to site provided by Contractor.

3.2 EXCAVATION

- A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Geotechnical Engineer.
- B. Excavation for Appurtenances:
 1. 12 IN (minimum) clear distance between outer surface and embankment.
 2. See Specification Section 31 23 00 for applicable requirements.
 3. See Specification Section 33 05 16 for applicable requirements.
- C. Groundwater Dewatering:
 1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade to allow subgrade stabilization, pipe, bedding and backfill material to be placed in the dry, and to maintain a stable trench wall or side slope.
 2. Groundwater shall be drawn down and maintained at least 3 FT below the bottom of any trench or manhole excavation prior to excavation.
 3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
 - a. Employ dewatering specialist for selecting and operating dewatering system.
 4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.

5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
6. Install groundwater monitoring wells as necessary.
7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Cost of groundwater dewatering shall be included in the lineal foot unit price of the pipe installation.

D. Trench Excavation:

1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
 - a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
 - 1) Stabilize excavation to prevent undermining of existing utility and yard piping.
2. Open trench outside buildings, units, and structures:
 - a. No more than the distance between two manholes, structures, units, or 300 LF, whichever is less.
 - b. Field adjust limitations as weather conditions dictate.
3. Trenching within buildings, units, or structures:
 - a. No more than 100 LF at any one time.
4. Any trench or portion of trench, which is opened and remains idle for seven (7) calendar days, or longer, as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
 - a. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.
5. Observe following trenching criteria:
 - a. Trench size:
 - 1) Excavate width to accommodate free working space.
 - 2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

| OVERALL DIAMETER OF UTILITY SERVICE | EXCESS DIMENSION |
|-------------------------------------|------------------|
| 33 IN and less | 24 IN |

| | |
|-----------------|-------|
| more than 33 IN | 36 IN |
|-----------------|-------|

- 3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.
- 4) Keep trenches free of surface water runoff.
 - a) Include cost in Bid.
 - b) No separate payment for surface water runoff pumping will be made.

E. Trenching for Electrical Installations:

- 1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification Section.
- 2. Modify for electrical installations as follows:
 - a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN but not more than 30 IN wide.
 - b. Any length of trench may be opened in exterior locations for trenches which are 12 IN wide or less.
 - c. Do not over excavate trench.
 - d. Cut trenches for electrical runs with minimum 30 IN cover, unless otherwise specified or shown on Drawings.
 - e. See Division 26 for additional requirements.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Over-Excavation:

- 1. Backfill and compact to 90 percent of maximum dry density per ASTM D698.
- 2. Backfill with granular bedding material as option.

B. Rock Excavation:

- 1. Excavate minimum of 6 IN below bottom exterior surface of the pipe or conduit.
- 2. Backfill to grade with suitable earth or granular material.
- 3. Form bell holes in trench bottom.

C. Subgrade Stabilization:

- 1. Stabilize the subgrade when directed by the Owner.

2. Observe the following requirements when unstable trench bottom materials are encountered.
 - a. Notify Owner when unstable materials are encountered.
 - 1) Define by drawing station locations and limits.
 - b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
 - 1) Replace with subgrade stabilization with no additional compensation.

3.4 BACKFILLING METHODS

- A. Do not backfill until tests to be performed on system show system is in full compliance with specified requirements.
- B. Carefully Compacted Backfill:
 1. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 IN above top of pipe or conduit.
 2. Comply with the following:
 - a. Place backfill in lifts not exceeding 8 IN (loose thickness).
 - b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
 - c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - d. Compact each lift to specified requirements.
- C. Common Trench Backfill:
 1. Perform in accordance with the following:
 - a. Place backfill in lift thicknesses capable of being compacted to densities specified.
 - b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.
- D. Water flushing for consolidation is not permitted.
- E. Backfilling for Electrical Installations:

1. Observe the preceding Carefully Compacted Backfill paragraph or Common Trench Backfill paragraph in PART 3 of this Specification Section or when approved by the Engineer.
2. Modify for electrical installation as follows:
 - a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.5 COMPACTION

A. General:

1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. Compaction Requirements:

1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.

a. Bedding material:

| LOCATION | SOIL TYPE | COMPACTION DENSITY |
|---------------|--------------------|--|
| All locations | Cohesionless soils | 75 percent relative density by ASTM D4253 and ASTM D4254 |

b. Carefully compacted backfill:

| LOCATION | SOIL TYPE | COMPACTION DENSITY |
|----------------------|----------------|--|
| All applicable areas | Cohesive soils | 95 percent of maximum dry density by ASTM D698 |

c. Toe drain bedding and backfill:

| LOCATION | SOIL TYPE | COMPACTION DENSITY |
|---------------|--------------------|--|
| All locations | Cohesionless soils | 60 percent relative density by ASTM D4253 and ASTM D4254 |

d. Common trench backfill:

| LOCATION | SOIL TYPE | COMPACTION DENSITY |
|--|----------------|--|
| Under pavements, roadways, surfaces within highway right-of-ways | Cohesive soils | 95 percent of maximum dry density by ASTM D-1557 |
| Under turfed, sodded, plant seeded, nontraffic areas | Cohesive soils | 90 percent of maximum dry density by ASTM D-1557 |

3.6 FIELD QUALITY CONTROL

A. Testing:

1. Perform in-place moisture-density tests as directed by the Owner.
2. Perform tests through recognized testing laboratory approved by Owner.
3. Costs of "Passing" tests paid by Owner.
4. Perform additional tests as directed until compaction meets or exceeds requirements.
5. Cost associated with "Failing" tests shall be paid by Contractor.
6. Reference to Engineer in this Specification Section will imply Geotechnical Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
7. Assure Owner has immediate access for testing of all soils related work.
8. Ensure excavations are safe for testing personnel.

END OF SECTION

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SECTION 31 25 00
SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil erosion and sediment control.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Erosion control standards: Standards and Specifications for Soil Erosion and Sediment Control in Developing Areas by the United States Department of Agriculture (USDA), Soil Conservation Service, College Park, Maryland.
2. "Alaska Storm Water Pollution Prevention Plan Guide" January 14, 2005 by the State of Alaska Department of Transportation & Public Facilities
3. For general reference only: Section 641 of "Standard Specifications For Highway Construction - 2004" by the State of Alaska Department of Transportation & Public Facilities. (Note: Engineer will not be providing an Erosion and Sediment Control Plan (ESCP) for this project.)

1.3 SUBMITTALS

- A. Copy of a Storm Water Pollution Prevention Plan (SWPPP) meeting U.S. Environmental Protection Agency (EPA) and Alaska Department of Environmental Conservation (ADEC) requirements and with ADEC approval.
- B. Copy of a Hazardous Material Control Plan (HMCP) if applicable meeting EPA and ADEC requirements and with ADEC approval.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Straw bales, twine tied.
- B. Pipe Riser and Barrel: 16 GA corrugated metal pipe (CMP) of size indicated.
- C. Stone for Stone Filter: 2 IN graded gravel or crushed stone.

- D. Grass Seed: Annual ryegrass.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with all EPA and ADEC requirements for erosion, sediment, and pollution control and maintain the best management practices (BMPs) through the life of the project.
- B. Ensure that all necessary federal and state permits have been secured prior to construction. Refer to the ADEC website (http://www.dec.state.ak.us/water/wnpssc/stormwater/sw_construction.htm) for information regarding construction permits and SWPPP requirements.
- C. BMPs for erosion, sediment, and pollution control shall be in accordance with the most current revision of "Alaska Storm Water Pollution Prevention Plan Guide" by the State of Alaska Department of Transportation & Public Facilities.

3.2 PREPARATION

- A. Prior to General Stripping Topsoil and Excavating:
 - 1. Install perimeter dikes and swales.
 - 2. Install straw bales where indicated.
 - a. Provide two stakes per bale.
 - b. First stake angled toward previously installed bale to keep ends tight against each other.
- B. Construct sediment traps/infiltration basins where indicated on Drawings during rough grading as grading progresses.
- C. Temporarily seed basin slopes and topsoil stockpiles:
 - 1. Rate: 1/2 LB/1000 SF.
 - 2. Reseed as required until good stand of grass is achieved.

3.3 DURING CONSTRUCTION PERIOD

- A. Maintain Basins, Dikes, Traps, Stone Filters, Straw Bales, etc.:
 - 1. Inspect regularly especially after rainstorms.
 - 2. Repair or replace damaged or missing items.
- B. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment basin or trap.
- C. Construct inlets as soon as possible.

1. Excavate and tightly secure straw bales completely around inlets as detailed on Drawings.
- D. Provide necessary swales and dikes to direct all water towards and into sediment basins and traps.
- E. Do not disturb existing vegetation (grass and trees).
- F. Excavate sediment out of basins and traps when capacity has been reduced by 50 percent.
 1. Remove sediment from behind bales to prevent overtopping.
- G. Topsoil and Fine Grade Slopes and Swales, etc.: Seed and mulch as soon as areas become ready.

3.4 NEAR COMPLETION OF CONSTRUCTION

- A. Eliminate basins, dikes, traps, etc.
- B. Grade to finished or existing grades.
- C. Fine grade all remaining earth areas, then seed and mulch.

END OF SECTION

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DIVISION 32

EXTERIOR IMPROVEMENTS



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SECTION 32 91 13
TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Topsoiling and finished grading.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 31 10 00 - Site Clearing.
 - 4. Section 31 23 00 - Earthwork.
 - 5. Section 31 25 00 - Soil Erosion and Sediment Control.
 - 6. Section 32 92 00 - Seeding, Sodding and Landscaping.
- C. Location of Work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Project Data: Test reports for furnished topsoil.

1.3 SITE CONDITIONS

- A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil:
 - 1. Original surface soil typical of the area.

2. Existing topsoil stockpiled under Specification Section 31 10 00.
3. Capable of supporting native plant growth.

2.2 TOLERANCES

- A. Finish Grading Tolerance: 0.1 FT plus/minus from required elevations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Correct, adjust and/or repair rough graded areas.
 1. Cut off mounds and ridges.
 2. Fill gullies and depressions.
 3. Perform other necessary repairs.
 4. Bring all sub-grades to specified contours, even and properly compacted.
- B. Loosen surface to depth of 2 IN, minimum.
- C. Remove all stones and debris over 2 IN in any dimension.

3.2 ROUGH GRADE REVIEW

- A. Reviewed by Engineer in Specification Section 31 10 00.

3.3 PLACING TOPSOIL

- A. Do not place when subgrade is wet or frozen enough to cause clodding.
- B. Spread to compacted depth of 4 IN for all disturbed earth areas.
- C. If topsoil stockpiled is less than amount required for work, furnish additional topsoil at no cost to Owner.
- D. Provide finished surface free of stones, sticks, or other material 1 IN or more in any dimension.
- E. Provide finished surface smooth and true to required grades.
- F. Restore stockpile area to condition of rest of finished work.

3.4 ACCEPTANCE

- A. Upon completion of topsoiling, obtain Engineer's acceptance of grade and surface.
- B. Make test holes where directed to verify proper placement and thickness of topsoil.

END OF SECTION

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SECTION 32 92 00
SEEDING, SODDING AND LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding, sodding and landscape planting:

a. Soil preparation.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 - General Requirements.

3. Section 32 91 13 - Topsoiling and Finished Grading.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Nursery and Landscape Association/American National Standards Institute (ANLA/ANSI):

a. Z60.1, American Standard for Nursery Stock.

2. AOAC International (AOAC).

3. ASTM International (ASTM):

a. D2028, Standard Specification for Cutback Asphalt (Rapid-Curing Type).

b. D5276, Standard Test Method for Drop Test of Loaded Containers by Free Fall.

B. Quality Control:

1. Fertilizer:

a. If Engineer determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of the AOAC.

b. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.

- c. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Layout drawings:
 - a. Scaled site plan (scale 1 IN = 20 FT or equal to scale of Project site plan Drawing) on reproducible Drawing to show:
 - 1) Structures, sidewalks, pavement, and fences.
 - 2) Limits of seeded, sodded, and mulched areas.
3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.
 - d. Type of herbicide to be used during first growing season to contain annual weeds and application rate.
 - e. Source and location of sod, plants, and plant material, as per Paragraph 3.2C.1. and Paragraph 3.3A.
4. Certification that each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.

B. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty.

1.4 SEQUENCING AND SCHEDULING

A. Installation Schedule:

1. Provide schedule showing when groundcovers and other plant materials are anticipated to be planted.
 2. Show schedule of when lawn type and other grass areas are anticipated to be planted.
 3. Indicate planting schedules in relation to schedule for irrigation system installation, finish grading and topsoiling.
 4. Indicate anticipated dates Engineer will be required to review installation for initial acceptance and final acceptance.
- B. Pre-installation Meeting:
1. Meet with Engineer and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Engineer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND SUPPLIERS

- A. Subject to compliance with the Contract Documents, the manufacturers and suppliers listed in the applicable Articles below are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

- A. Native Grass Seeding: Certified seed of locally adapted strains.
- B. Soil Amendments:
- C. Asphalt Binder: Emulsified asphalt per State specifications.
- D. Water:
 1. Water free from substances harmful to grass or sod growth.
 2. Provide water from source approved prior to use.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

- A. General:
 1. Limit preparation to areas which will be planted soon after.
 2. Provide facilities to protect and safeguard all persons on or about premises.
 3. Protect existing trees designated to remain.

4. Verify location and existence of all underground utilities.
 - a. Take necessary precaution to protect existing utilities from damage due to construction activity.
 - b. Repair all damages to utility items at sole expense.
 5. Provide facilities such as protective fences and/or watchmen to protect work from vandalism.
 - a. Contractor to be responsible for vandalism until acceptance of work in whole or in part.
- B. Preparation for Lawn-Type Seeding, Sprigging, Plugging or Sodding:
1. Loosen surface to minimum depth of 4 IN.
 2. Remove stones over 1 IN in any dimension and sticks, roots, rubbish, and other extraneous matter.
 3. Prior to applying fertilizer, loosen areas to be seeded with a double disc or other suitable device if the soil has become hard or compacted.
 4. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
 5. Distribute fertilizer uniformly over areas to be seeded:
 - a. For lawn-type seeding: 30 LBS per 1000 SF.
 - b. For pasture seeding: 200 LBS per acre.
 6. Incorporate fertilizer into soil to a depth of at least 2 IN by disking, harrowing, or other approved methods.
 7. Remove stones or other substances from surface which will interfere with turf development or subsequent mowing operations.
 8. Grade lawn areas to a smooth, even surface with a loose, uniformly fine texture.
 - a. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
 - b. Limit fine grading to areas which can be planted soon after preparation.
 9. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.

3.2 INSTALLATION

- A. Lawn-Type and Pasture Seeding:

1. Do not use seed which is wet, moldy, or otherwise damaged.
2. Perform seeding work from April 20 to May 15 for spring planting, and August 1 to September 15 for fall planting, unless otherwise approved by Engineer.
3. Employ satisfactory methods of sowing using mechanical power-driven drills or seeders, or mechanical hand seeders, or other approved equipment.
4. Distribute seed evenly over entire area at rate of application not less than 4 LBS (PLS) of seed per 1000 SF, 50 percent sown in one direction, remainder at right angles to first sowing.
5. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
 - a. Resume work only when favorable conditions develop.
6. Lightly rake seed into soil followed by light rolling or cultipacking.
7. Immediately protect seeded areas against erosion by mulching.
 - a. Spread mulch in continuous blanket using 1-1/2 tons per acre to a depth of 4 or 5 straws.
8. Protect seeded slopes against erosion with erosion netting or other methods approved by Engineer.
 - a. Protect seeded areas against traffic or other use by erecting barricades and placing warning signs.
9. Immediately following spreading mulch, anchor mulch using a rolling coulter or a wheatland land packer having wheels with V-shaped edges to force mulch into soil surface, or apply evenly distributed emulsified asphalt at rate of 10-13 GAL/1000 SF.
 - a. SS-1 emulsion in accordance with ASTM D5276 or RC-1 cutback asphalt in accordance with ASTM D2028 are acceptable.
 - b. If mulch and asphalt are applied in one treatment, use SS-1 emulsion with penetration test range between 150-200.
 - c. Use appropriate shields to protect adjacent site improvements.

3.3 MAINTENANCE AND REPLACEMENT

A. General:

1. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated below, whichever is the longer.

2. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.
3. Protection of new materials:
 - a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain.
 - b. Repair and pay for all damaged items.
4. Replace unacceptable materials with materials and methods identical to the original specifications unless otherwise approved by the Engineer.

B. Seeded or Sodded Lawns:

1. Maintain seeded lawns: 90 days, minimum, after installation and review of entire project area to be planted.
2. Maintenance period begins at completion of planting or installation of entire area to be seeded or sodded.
3. Engineer will review seeded or sodded lawn area after installation for initial acceptance.
4. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, uniform lawn, free of weeds and eroded or bare areas.
5. Lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas.
 - a. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch.
6. Mow lawns as soon as there is enough top growth to cut with mower set at recommended height for principal species planted.
 - a. Repeat mowing as required to maintain height.
 - b. Do not delay mowing until grass blades bend over and become matted.
 - c. Do not mow when grass is wet.
 - d. Time initial and subsequent mowings as required to maintain a height of 1-1/2 to 2 IN.
 - e. Do not mow lower than 1-1/2 IN.
7. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose.
 - a. Anchor as required to prevent displacement.

8. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.
9. Replant bare areas using same materials specified.
10. Engineer will review final acceptability of installed areas at end of maintenance period.
11. Maintain repaired areas until remainder of maintenance period or approved by Engineer, whichever is the longer period.

END OF SECTION

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DIVISION 33

UTILITIES



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SECTION 33 05 16
PRECAST CONCRETE MANHOLE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast concrete manhole structures and appurtenant items.
 - a. Sanitary sewer manholes and appurtenances.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
4. Section 03 21 00 - Reinforcement.
5. Section 03 31 30 - Concrete Materials and Proportioning.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. A48/A48M, Standard Specification for Gray Iron Castings.
 - b. C150/C150M, Standard Specification for Portland Cement.
 - c. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - d. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
 - e. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
 - f. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 3. Fabrication and/or layout drawings:
 - a. Include detailed diagrams of manholes showing typical components and dimensions, reinforcements and other details.
 - b. Itemize, on separate schedule, sectional breakdown of each manhole structure with all components and refer to drawing identification number or notation.
 - c. Indicate knockout elevations for all piping entering each manhole.
- B. Unless approved prior to submittal, submit all products from this Specification Section in one complete submittal package. Include all products and accessories together.

1.4 SITE CONDITIONS

- A. For this project, the established high groundwater elevation is 100 FT MSL (Mean Sea Level).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Manhole rings, covers and frames:
 - a. Neenah Foundry and Neenah Enterprises, Inc.
 - b. Deeter Foundry.
 2. Black mastic joint compound:
 - a. Kalktite 340.
 - b. Tufflex.
 - c. Plastico.
 3. Premolded joint compound:

- a. RAM-NEK.
- b. Kent Seal.
- 4. Emulsified fibrated asphalt compound:
 - a. Sonneborn Hydrocide 700B.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 SANITARY SEWER, STORM AND DRAIN MANHOLE STRUCTURE COMPONENTS

- A. Manhole Components:
 - 1. Reinforcement: ASTM C478.
 - 2. Minimum wall thickness: 5 IN.
 - 3. Minimum base thickness: 12 IN.
 - 4. Provide the following components for each manhole structure:
 - a. Base (precast) with integral bottom section or (cast-in-place).
 - b. Precast bottom section(s).
 - c. Precast barrel section(s).
 - d. Precast eccentric transition section.
 - e. Precast adjuster ring(s).
 - f. Precast concrete transition section.
 - g. Precast flat top.
 - 5. Unless dimensioned or specifically noted on Drawings, provide manhole section with minimum 48 IN inside dimensions.
- B. Nonpressure Type Frames and Cover:
 - 1. Cast iron frame and covers: ASTM A48/A48M, Class 35 (minimum).
 - 2. Use only cast iron of best quality, free from imperfections and blow holes.
 - 3. Furnish frame and cover of heavy-duty construction a minimum total weight of 450 LBS.
 - 4. Machine all horizontal surfaces.
 - 5. Furnish unit with solid nonventilated lid with concealed pickholes.

- a. Letter covers "SEWER" for all collection system and treatment plant manholes.
 6. Ensure minimum clear opening of 24 IN DIA.
- C. Pressure Type Frame and Cover:
1. Provide covers meeting the requirements of the Nonpressure Type Frames and Cover paragraph above and as modified below.
 2. Furnish frame and bolted cover of heavy-duty construction.
 - a. Equip unit with six (6) stainless steel countersunk 3/8 IN DIA by 1-1/2 IN long bolts with stainless steel washers.
 3. Provide solid lid and minimum 1/8 IN thick x 1/2 IN wide continuous strip neoprene gasket.
 4. Furnish unit with a minimum of six (6) anchorage holes and six (6) 6 IN long x 3/4 IN DIA stainless steel anchor bolts.
- D. Special Coatings and Joint Treatment:
1. Joints of precast sections:
 - a. Black mastic compound: ASTM D4586.
 2. Vertical wall surfaces:
 - a. Emulsified fibrated asphalt compound meeting ASTM D1227 Type II for all exterior vertical wall surfaces.
- E. Sanitary Sewer Manhole Concrete:
1. Provide all sanitary manholes constructed with Portland ASTM C150/C150M, Type I or II cement with a tricalcium aluminate content not to exceed 8 percent.
 2. Mix aggregate shall be a minimum of 50 percent crushed limestone.
 3. Provide 3000 psi nonshrink grout.

PART 3 - EXECUTION

3.1 MANHOLE CONSTRUCTION

A. General:

1. Construct cast-in-place concrete base slabs.
2. Make inverts with a semi-circular bottom conforming to the inside contour of the adjacent sewer sections.

3. On all straight runs, lay pipe through manhole and cut out top half of pipe.
 - a. See detail on Drawings.
 - b. If pipes deflect at manhole, shape as specified in Paragraphs 2 and 4 in this General Paragraph.
4. Shape inverts accurately and steel trowel finish.
 - a. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert using as large a radius as manhole inside diameter will permit.
 - b. Pour base slab integral with bottom barrel section.
- B. Build each manhole to dimensions shown on plans and at such elevation that pipe sections built into wall of manhole will be true extensions of line of pipe.
- C. For all horizontal mating surfaces between concrete and concrete or concrete and metal, above established high groundwater elevation shown trowel apply to clean surface black mastic joint compound to a minimum wet thickness of 1/4 IN immediately prior to mating the surfaces.
- D. For horizontal joints that fall below established high groundwater elevation shown, install a resilient O-ring type gasket or pre-molded joint compound.
- E. Seal all pipe penetrations in manhole.
 1. Form pipe openings smooth and well shaped.
 2. After installation, seal cracks with, non shrink grout.
 3. After grout cures, wire brush smooth and apply two coats emulsified fibrated asphalt compound to minimum wet thickness of 1/8 IN to ensure complete seal.
- F. Set and adjust frame and cover final 6 IN (minimum) to 18 IN (maximum) to match finished pavement or finished grade elevation using precast adjuster rings.

END OF SECTION

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DIVISION 40

PROCESS INTERCONNECTIONS



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SECTION 40 05 00
PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Process piping systems.
 2. Utility piping systems.
 3. Plumbing piping systems.
- B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 2. Division 01 - General Requirements.
 3. Section 31 23 33 – Trenching, Backfilling, and Compacting for Utilities.
 4. Section 09 96 00 – High Performance Industrial Coatings.
 5. Section 10 14 00 – Identification Devices.
 6. Section 40 05 07- Pipe Support Systems
 7. Section 40 05 23- Pipe Stainless Steel.
 8. Section 40 05 51 – Valves: Basic Requirements.
 9. Section 40 42 00 – Pipe, Duct, and Equipment Insulation
 10. Section 40 90 00 – Instrumentation for Process Control: Basic Requirements.
 11. Section 40 91 10 – Primary Meters And Transmitters.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M36, Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains (Equivalent ASTM A760).

- b. M190, Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
 - c. M252, Standard Specification for Corrugated Polyethylene Drainage Tubing.
 - d. M294, Interim Specification for Corrugated Polyethylene Pipe 12 to 24 Inch Diameter.
2. American Iron and Steel Institute (AISI).
 3. American Society of Mechanical Engineers (ASME):
 - a. B16.3, Malleable Iron Threaded Fittings.
 - b. B16.5, Pipe Flanges and Flanged Fittings.
 - c. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.
 - d. B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.
 - e. B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - f. B36.19, Stainless Steel Pipe.
 - g. B40.100, Pressure Gauges and Gauge Attachments.
 4. ASTM International (ASTM):
 - a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - b. A74, Standard Specification for Cast Iron Soil Pipe and Fittings.
 - c. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
 - d. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - e. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - f. A197, Standard Specification for Cupola Malleable Iron.
 - g. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - h. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

- i. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- j. A518, Standard Specification for Corrosion-Resistant High-Silicon Iron Castings.
- k. A536, Standard Specification for Ductile Iron Castings.
- l. A587, Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.
- m. A760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
- n. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
- o. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
- p. B88, Standard Specification for Seamless Copper Water Tube.
- q. C14, Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
- r. C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- s. C425, Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
- t. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- u. C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- v. C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
- w. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- x. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- y. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- z. D4101, Standard Specification for Polypropylene Plastic Injection and Extrusion Materials.

- aa. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
 - bb. F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
 - cc. B300, Standard for Hypochlorites.
 - dd. C200, Standard for Steel Water Pipe - 6 IN and Larger.
 - ee. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
 - ff. C208, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
 - gg. C606, Standard for Grooved and Shouldered Joints.
 - hh. C651, Standard for Disinfecting Water Mains.
 - ii. C800, Standard for Underground Service Line Valves and Fittings.
5. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
 - b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - c. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - d. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - e. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.
 6. Chlorine Institute, Inc. (CI):
 - a. Pamphlet 6, Piping Systems for Dry Chlorine.
 7. Cast Iron Soil Pipe Institute (CISPI):
 - a. 301, Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 8. International Plumbing Code (IPC).
 9. National Fire Protection Association (NFPA):
 - a. 54, National Fuel Gas Code.
 - b. 69, Standard on Explosion Prevention Systems.

10. Underwriters Laboratories, Inc. (UL).
- B. Coordinate flange dimensions and drillings between piping, valves, and equipment.

1.3 DEFINITIONS

- A. HPIC: High performance industrial coating.
- B. PVDF: Polyvinylidene fluoride.

1.4 SYSTEM DESCRIPTION

- A. Piping Systems Organization and Definition:
 1. Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.
 2. See PIPING SPECIFICATION SCHEDULES in PART 3.

1.5 SUBMITTALS

- A. Shop Drawings:
 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
 - c. Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.
 - 1) Attach technical product data on gaskets, pipe, fittings, and other components.
 3. Fabrication and/or Layout Drawings:
 - a. Exterior yard piping drawings (minimum scale 1 IN equals 10 FT) with information including:
 - 1) Dimensions of piping lengths.
 - 2) Invert or centerline elevations of piping crossings.
 - 3) Acknowledgement of bury depth requirements.
 - 4) Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.

- 5) Acknowledge designated valve or gate tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
 - 6) Line slopes and vents.
- b. Interior piping drawings (minimum scale 1/8 IN equals 1 FT) with information including:
- 1) Dimensions of piping from column lines or wall surfaces.
 - 2) Centerline dimensions of piping.
 - 3) Centerline elevation and size of intersecting ductwork, conduit/conduit racks, or other potential interferences requiring coordination.
 - 4) Location and type of pipe supports and anchors.
 - 5) Locations of valves and valve actuator type.
 - 6) Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.
 - 7) Acknowledgement of valve, equipment and instrument tag numbers.
 - 8) Provisions for expansion and contraction.
 - 9) Line slopes and air release vents.
 - 10) Rough-in data for plumbing fixtures.
- c. Schedule of interconnections to existing piping and method of connection.
- B. Contract Closeout Information:
1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
- C. Informational Submittals:
1. Qualifications of lab performing disinfection analysis on water systems.
 2. Test reports:
 - a. Copies of pressure test results on all piping systems.
 - b. Reports defining results of dielectric testing and corrective action taken.
 - c. Disinfection test report.
 - d. Notification of time and date of piping pressure tests.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect pipe coating during handling using methods recommended by manufacturer.
 - 1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.
- B. Prevent damage to pipe during transit.
 - 1. Repair abrasions, scars, and blemishes.
 - 2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Dirt strainers (Y type):
 - a. Armstrong.
 - b. Or approved equal
 - 2. Chemical strainers (Y type):
 - a. Chemtrol.
 - b. Asahi.
 - 3. Dielectric flange kit:
 - a. Maloney.
 - b. Central Plastics.
 - 4. Pipe saddles (for gage installation):
 - a. Dresser Style 91 (steel and ductile iron systems).
 - b. Dresser Style 194 (nonmetallic systems).
 - 5. Expansion joint at FRP and poly tanks:
 - a. Or approved equal
 - 6. Hose bibs:
 - a. Elkhart

- b. Croker
- 7. Hydrants:

- a. Wade.
- b. Smith

- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 PIPING SPECIFICATION SCHEDULES

- A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Specification Section.

2.3 COUPLINGS:

- A. General:

1. Couplings shall be rated for the working pressure of the pipe as described in the Pipe Schedules and not less than 150 psig.
2. Potable Water Service Couplings shall conform to the requirements of NSF 61.
3. Couplings shall be lined and coated with fusion-bonded epoxy requirements to meet AWWA C213.
4. Thrust restraint shall be provided in accordance with AWWA Manual M11, with a ring welded to the pipe end of pipe or retainer, or as shown on the drawings.

- B. Flexible Sleeve Type Couplings:

1. ALP SST Pipe Flexible Coupling to be Dresser Style 38 or Smith Blair Style 411 with EPDM gaskets rated to 350 degrees.
2. Steel Pipe Flexible Coupling Manufacturers:
 - a. Dresser: Style 38
3. Ductile Iron Pipe Flexible Coupling Manufacturers:
 - a. Dresser: Style 253

- C. Flanged Coupling Adapter:

1. Steel Pipe:
 - a. Steel Pipe:

- 1) Dresser: Style 128
- 2. Ductile Iron Pipe:
 - a. Dresser: Style 128
- D. Restrained Flange Adapter:
 - 1. Pressure Rating:
 - a. Minimum working pressure shall not be less than 150 psi
 - b. Provide a safety factor of two times the working pressure, validated by Manufacturer Test Results.
 - 2. Thrust Restraint:
 - a. Hardened Steel Wedges shall allow for articulation of the pipe joint after assembly with wedges remaining in place in the original position
 - b. Products that employ set screws that directly bear on pipe shall not be accepted.
 - 3. Manufacturer: EBAA Iron; Mega-Flange
- E. Transition Couplings:
 - a. Steel Pipe
 - b. Manufacturers:
 - a) Romac: Style RC 400
 - b) Dresser: Style 162
- F. Dismantling Joints:
 - 1. Pressure Rating:
 - 1) Pressure rating shall exceed the rating of the connecting flange.
 - 2) Shall conform to AWWA C219
 - 2. Manufacturers:
 - a) Romac: Style DJ 400
 - b) Dresser: Style 131

2.4 PIPE SLEEVES

- A. Insulated or Encased Pipe Sleeves
 - 1. Manufacturer:

- a. Pipe Shields, Inc; Model WFB, WFB-CS and CW Series, as according to the applications.

2. Modular Mechanical Seal

- a. Type: Interconnected rubber links in accordance with ASTM A276, with 316 SST bolts and nuts.
- b. Size: Shall be according to the Manufacturer's requirements for the pipe type and size shown on the drawings.
- c. Watertight seal shall be provided to withstand a hydrostatic pressure of 40 feet minimum.
- d. Pressure plates shall be reinforced nylon polymer
- e. Manufacturer shall be Thunderline Corp: Link Seal Division

B. High Density Polyethylene (HDPE) Pipe Sleeve:

1. Molded HDPE with integral water stop ring not less than 3-inches larger than HDPE sleeve.
2. Continuously welded seep ring
3. Provide with end cap for concrete placement
4. Manufacturer: Century Link by Thunderline-: Link Seal Division

2.5 WALL, FLOOR AND SLAB PENETRATIONS

A. General:

1. Refer to the area classification table for the Project for selection of pipe materials.
2. Thickness shall be greater to or equal to the connecting pipe.

B. Stainless Steel:

1. Thrust Collar:
 - a. Shall be no less than 3-inches in diameter greater than the outside diameter of the pipe.
 - b. Continuous Fillet welds around pipe on both sides.

C. Ductile Iron Pipe:

1. Fittings in accordance with the Pipe Schedules:
2. Manufacturers:
 - a. US Pipe and Foundry

b. American Cast Iron Pipe

2.6 SPRAY NOZZLES:

A. Secondary Clarifier Sprays:

1. Material: 316 Stainless Steel
2. Orifice Diameter: 0.0109 inch
3. Swivel Type
4. Capacity: 3.2 gpm at 100 psig
5. Size: ¼ inch NPT
6. Spray Pattern and Angle: Standard 65 degrees at 40 psig.
7. Provide an adjustable stainless steel ball fitting, male inlet and outlet
8. Number of Sprays as shown on the drawings.
9. Manufacturer: Spraying Systems Co: Model Series Veejet, H ¼ U-316 SS 65 20, or equal

B. Scum Pump Station Sprays:

1. Material: 316 Stainless Steel
2. Orifice Diameter: 0.25 inch
3. Swivel Type
4. Capacity: 16 gpm at 100 psig
5. Size: 3/8 inch NPT
6. Spray Pattern and Angle: Narrow Angle @ 34 degrees at 100 psig.
7. Provide an adjustable stainless steel ball fitting, male inlet and outlet
8. Number of Sprays as shown on the drawings.
9. Manufacturer: Spraying Systems Co: Model Series Spiraljet, 3/8HHSJX-120 53, or equal

2.7 COMPONENTS AND ACCESSORIES

A. Insulating Components:

1. Dielectric flange kits:
 - a. Flat faced.

- b. 1/8 IN thick dielectric gasket, phenolic, non-asbestos.
 - c. Suitable for 175 psi, 210 DegF.
 - d. 1/32 IN wall thickness bolt sleeves.
 - e. 1/8 IN thick phenolic insulating washers.
2. Dielectric unions:
- a. Screwed end connections.
 - b. Rated at 175 psi, 210 DegF.
 - c. Provide dielectric gaskets suitable for continuous operation at union rated temperature and pressure.
- B. Reducers:
- 1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
 - 2. Connection size requirements may change from those shown on Drawings depending on equipment furnished.
- C. Dry Disconnect Couplings:
- 1. Adapters:
 - a. Male adapters: Size shown on Drawings.
 - b. Adapters:
 - 1) Female NPT end connection for sludge and flush applications.
 - 2) Male NPT end connection for chemical applications.
 - c. Construct adapters for sludge applications from cast iron or steel.
 - d. Construct adapters for chemical and PVC system applications 3 IN and below from polypropylene.
 - 1) Above 3 IN size, provide stainless steel units.
 - 2. Couplers:
 - a. Built-in valve and spring loaded poppet which close automatically when disconnected.
 - b. Designed to remain with only one (1) arm locked in closed position.
 - c. Construct couplers for sludge applications fabricated from material utilized for adapters.

- d. Construct couplers for chemical and PVC system applications 3 IN and less from polypropylene with stainless steel arms and pins.
 - 1) Above 3 IN, provide stainless steel units.
 - e. Gasket: Compatible with conveyed liquid.
3. Dust caps: For all adapters.
- D. Sacrificial Anode Cathodic Protection:
- 1. 3 LB magnesium sacrificial anodes, prepackaged in a cloth bag containing 75 percent hydrated gypsum, 20 percent bentonite and 5 percent anhydrous sodium sulphate.
 - 2. TW 600 V or an HMWPE insulated copper lead attached to the anode.
- E. Valves:
- 1. See schematics and details for definition of manual valves used in each system under 4 IN in size.
 - a. See Specification Section 40 05 51 schedule for valve types 4 IN and above and for automatic valves used in each system.
 - 2. See Specification Section 40 05 51.
- F. Expansion Joints at FRP and Poly Tanks:
- 1. Materials:
 - a. Bellows: PTFE-62.
 - b. Flanges: PVC, ductile iron.
 - c. Limit bolts and nuts: 316 stainless steel, Epoxy coated carbon steel.
 - d. Reinforcing rings: Stainless steel.
 - 2. Pressure rating at 70 DegF: 70 psig.
 - 3. Minimum axial movement: 3/8 IN.
- G. Hose Bib (HB-1):
- 1. 1 1/2 IN brass, satin finish, nozzles with adjustable fog, straight stream, and shut-off feature, and rubber bumper at each hose bib station. Provide nozzles with female NST hose thread..
 - 2. Vacuum breaker: Non-removable, manual draining, meeting the requirements of the ASSE 1011.
- H. Water Hose:

1. Provide 50-ft lengths of 1 1/2 IN rubber hose at each hose bib station. EPDM black copver and EPDM Tube, reinforced with two textile braids. Provide each length with brass male and female NST hose thread couplings to fit hose bib and nozzle.
2. Rated pressure 200 psi
3. Manufacturer:
 - a. Goodyear
 - b. Boston
- I. Hydrants (YH):
 1. Yard hydrant (YH):
 - a. Non-freeze.
 - b. Galvanized casing.
 - c. Bury depth per Specification Section 40 05 00.
 - d. Brass mechanism.
 - e. Type: YH-1 (post type, aluminum housing wheel operating handle, 1-1/2 IN inlet and 1-1/2 IN hose connection) Wade W-8610.
 - f. Casing guard.

PART 3 - EXECUTION

3.1 EXTERIOR BURIED PIPING INSTALLATION

- A. Unless otherwise shown on the Drawings, provide a minimum of 10 FT earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.
- B. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals specified in Specification Section 01 73 20 and as shown on Drawings.
- C. When entering or leaving structures with buried mechanical joint piping, install joint within 2 FT of point where pipe enters or leaves structure.
 1. Install second joint not more than 6 FT nor less than 4 FT from first joint.
- D. Install expansion devices as necessary to allow expansion and contraction movement.
- E. Laying Pipe In Trench:
 1. Excavate and backfill trench in accordance with Specification Section 31 23 33.
 2. Clean each pipe length thoroughly and inspect for compliance to specifications.

3. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
4. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
5. Lay pipe in only suitable weather with good trench conditions.
 - a. Never lay pipe in water except where approved by Engineer.
6. Seal open end of line with watertight plug if pipe laying stopped.
7. Remove water in trench before removal of plug.

F. Lining Up Push-On Joint Piping:

1. Lay piping on route lines shown on Drawings.
2. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
3. Observe maximum deflection values stated in manufacturer's written literature.
4. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.
5. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.

G. Anchorage and Blocking:

1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces in or on buried piping tees, wye branches, plugs, or bends.
2. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall.
 - a. Concrete blocks shall not cover pipe joints.
3. Provide bearing area of concrete in accordance with drawing detail.

H. Install underground hazard warning tape per Specification Section 10 14 00.

I. Install insulating components where dissimilar metals are joined together.

3.2 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

A. Install piping in vertical and horizontal alignment as shown on Drawings.

- B. Alignment of piping smaller than 4 IN may not be shown; however, install according to Drawing intent and with clearance and allowance for:
 - 1. Expansion and contraction.
 - 2. Operation and access to equipment, doors, windows, hoists, moving equipment.
 - 3. Headroom and walking space for working areas and aisles.
 - 4. System drainage and air removal.
- C. Enter and exit through structure walls, floor and ceilings using penetrations and seals specified in Specification Section 01 73 20 and as shown on the Drawings.
- D. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.
- E. Pipe Support:
 - 1. Use methods of piping support as shown on Drawings and as required in Specification Section 40 05 07.
 - 2. Where pipes run parallel and at same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight.
 - a. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.
 - 3. Size pipe supports with consideration to specific gravity of liquid being piped.
- F. Locate and size sleeves and castings required for piping system.
 - 1. Arrange for chases, recesses, inserts or anchors at proper elevation and location.
- G. Use reducing fittings throughout piping systems.
 - 1. Bushings will not be allowed unless specifically approved.
- H. Equipment Drainage and Miscellaneous Piping:
 - 1. Provide drip pans and piping at equipment where condensation may occur.
 - 2. Hard pipe stuffing box leakage to nearest floor drain.
 - 3. Avoid piping over electrical components such as motor control centers, panelboards, etc.

- a. If piping must be so routed, utilize 16 GA, 316 stainless steel drip pan under piping and over full length of electrical equipment.
 - b. Hard pipe drainage to nearest floor drain.
- 4. Collect system condensate at drip pockets, traps and blowoff valves.
- 5. Provide drainage for process piping at locations shown on Drawings in accordance with Drawing details.
- 6. For applications defined above and for other miscellaneous piping which is not addressed by a specific piping service category in PART 1, provide 304 stainless steel piping and fittings.
 - a. Size to handle application with 3/4 IN being minimum size provided.
- I. Unions:
 - 1. Install in position which will permit valve or equipment to be removed without dismantling adjacent piping.
 - 2. Mechanical type couplings may serve as unions.
 - 3. Additional flange unions are not required at flanged connections.
- J. Install expansion devices as necessary to allow expansion/contraction movement.
- K. Provide full face gaskets on all systems.
- L. Anchorage and Blocking:
 - 1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.
- M. Equipment Pipe Connections:
 - 1. Equipment - General:
 - a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.
 - b. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.
 - c. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint.
 - 1) Provide tightening torque in accordance with manufacturer's recommendations.

- d. Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.
 - e. Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
 - f. Align, level, and wedge equipment into place during fitting and alignment of connecting piping.
 - g. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
 - h. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
 - 1) Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
 - 2) Realign as necessary, install flange bolts and make equipment connection.
 - i. Provide utility connections to equipment shown on Drawings, scheduled or specified.
2. Plumbing and HVAC equipment:
- a. Make piping connections to plumbing and HVAC equipment, including but not limited to installation of fittings, strainers, pressure reducing valves, flow control valves and relief valves provided with or as integral part of equipment.
 - b. Furnish and install sinks, fittings, strainers, pressure reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or as integral part of equipment.
 - c. For each water supply piping connection to equipment, furnish and install union and gate or angle valve.
 - 1) Provide wheel handle stop valve at each laboratory sink water supply.
 - 2) Minimum size: 1/2 IN.
 - d. Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly to building sewer system.
 - 1) Size trap as required by IPC.
 - e. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P" traps, miscellaneous traps and miscellaneous brass

through wall or floor and cap and protect until such time when later installation is performed.

N. Provide insulating components where dissimilar metals are joined together.

O. Instrument Connections:

1. See drawing details.

P. Hose Bibbs:

1. Install 3/6 IN above finished floor.

Q. Yard Hydrants:

1. Install plumb.

2. Provide concrete around pipe as shown on Drawing.

3. For buried applications, install Schedule 80 PVC drainage nipple sized to match drain port as provided by manufacturer.

a. Extend nipple into crushed rock.

4. For applications at elevated slabs, provide 1/2 IN Schedule 80 PVC from drain port to drain.

3.3 CONNECTIONS WITH EXISTING PIPING

A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered.

B. Perform connections with existing piping at time and under conditions which will least interfere with service to customers affected by such operation.

C. Undertake connections in fashion which will disturb system as little as possible.

D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to adjacent property.

E. Where connections to existing systems necessitate employment of past installation methods not currently part of trade practice, utilize necessary special piping components.

F. Where connection involves potable water systems, provide disinfection methods as prescribed in this Specification Section.

G. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made and tested.

3.4 HEAT TRACING

A. See Specification Section 40 41 13 - Heat Tracing Cable.

3.5 PRESSURE GAGES

- A. Provide at locations shown on the Drawings and specified.
- B. See Specification Section 01 61 03.

3.6 FIELD QUALITY CONTROL

- A. Provide accessibility for maintenance to all piping specialties such as sprays and other specified accessories.
- B. Pipe Testing - General:
 - 1. Test piping systems as follows:
 - a. Test exposed, non-insulated piping systems upon completion of system.
 - b. Test exposed, insulated piping systems upon completion of system but prior to application of insulation.
 - c. Test concealed interior piping systems prior to concealment and, if system is insulated, prior to application of insulation.
 - d. Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated, prior to application of insulation.
 - 2. Utilize pressures, media and pressure test durations as specified in the PIPING SPECIFICATION SCHEDULES.
 - 3. Isolate equipment which may be damaged by the specified pressure test conditions.
 - 4. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.
 - a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.
 - b. Notify the Engineer 24 HRS prior to each test.
 - 5. Completely assemble and test new piping systems prior to connection to existing pipe systems.
 - 6. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.
 - 7. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

C. Pressure Testing:

1. Testing medium: Unless otherwise specified in the PIPING SPECIFICATION SCHEDULES, utilize the following test media.

- a. Process and plant air systems:

| PIPE LINE SIZE | SPECIFIED TEST PRESSURE | TESTING MEDIUM |
|-------------------|-------------------------|----------------|
| 2 IN and smaller | 75 psi or less | Air or water |
| 2 IN and smaller | Greater than 75 psi | Water |
| Greater than 2 IN | 3 psi or less | Air or water |
| Greater than 2 IN | Greater than 3 psi | Water |

- b. Laboratory gases and natural gas systems: Cylinder nitrogen.

- c. Liquid systems:

| PIPE LINE SIZE (DIA) | GRAVITY OR PUMPED | SPECIFIED TEST PRESSURE | TESTING MEDIUM |
|---------------------------|-------------------|-------------------------|----------------|
| Up to and including 48 IN | Gravity | 25 psig or less | Air or water |
| Above 48 IN | Gravity | 25 psig or less | Water |
| All sizes | Pumped | 250 psig or less | Water |

2. Allowable leakage rates:

- a. Hazardous gas systems, all exposed piping systems, all pressure piping systems and all buried, insulated piping systems which are hydrostatically pressure tested shall have zero leakage at the specified test pressure throughout the duration of the test.
- b. Hydrostatic exfiltration and infiltration for sanitary and stormwater sewers (groundwater level is below the top of pipe):
 - 1) Leakage rate: 200 GAL per inch diameter per mile of pipe per day at average head on test section of 3 FT.
 - 2) Average head is defined from groundwater elevation to average pipe crown.
 - 3) Acceptable test head leakage rate for heads greater than 3 FT: Acceptable leakage rate (gallons per inch diameter per mile per day) equals 115 by (actual test head to the 1/2 power).
- c. Hydrostatic infiltration test for sanitary and stormwater sewers (groundwater level is above the top of pipe):
 - 1) Allowable leakage rate: 200 GAL per inch diameter per mile of pipe per day when depth of groundwater over top of pipe is 2 to 6 FT.

- 2) Leakage rate at heads greater than 6 FT: Allowable leakage rate (gallons per inch diameter per mile of pipe per day) equals 82 by (actual head to the 1/2 power).
- d. Large diameter (above 48 IN) gravity plant piping systems shall have a maximum exfiltration of 25 gpd per inch-mile.
- e. Non-hazardous gas and air systems which are tested with air shall have a maximum pressure drop of 5 percent of the specified test pressure throughout the duration of the test.
- f. For low pressure (less than 25 psig) air testing, the acceptable time for loss of 1 psig of air pressure shall be:

| PIPE SIZE (IN DIA) | TIME, MINUTES/100 FT |
|--------------------|----------------------|
| 4 | 0.3 |
| 6 | 0.7 |
| 8 | 1.2 |
| 10 | 1.5 |
| 12 | 1.8 |

3. Hydrostatic pressure testing methodology:

- a. General:
 - 1) All joints, including welds, are to be left exposed for examination during the test.
 - 2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.
 - 3) Provide temporary restraints for expansion joints for additional pressure load under test.
 - 4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.
 - 5) Do not coat or insulate exposed piping until successful performance of pressure test.
- b. Soil, waste, drain and vent systems:
 - 1) Test at completion of installation of each stack or section of piping by filling system with water and checking joints and fittings for leaks.
 - 2) Eliminate leaks before proceeding with work or concealing piping.
 - 3) Minimum test heights shall be 10 FT above highest stack inlet.
- c. Larger diameter (above 36 IN) gravity plant piping:
 - 1) Plug downstream end of segment to be tested.
 - a) Provide bracing as required.

- 2) Fill segment and upstream structure to normal operating level as per hydraulic profile.
 - 3) Allow 24 HRS for absorption losses.
 - a) Refill to original level.
 - 4) Provide reservoir to maintain constant head over duration of test.
 - 5) Record reservoir water volume at beginning and end of test.
4. Natural gas systems - testing methodology:
- a. Maintain specified test pressure until each joint has been thoroughly examined for leaks by means of soap suds and glycerine.
 - b. Wipe joints clean after test.
5. Air testing methodology:
- a. General:
 - 1) Assure air is ambient temperature.
 - b. Low pressure air testing:
 - 1) Place plugs in line and inflate to 25 psig.
 - 2) Check pneumatic plugs for proper sealing.
 - 3) Introduce low pressure air into sealed line segment until air pressure reaches 4 psig greater than ground water that may be over the pipe.
 - a) Use test gage conforming to ASME B40.100 with 0 to 15 psi scale and accuracy of 1 percent of full range.
 - 4) Allow 2 minutes for air pressure to stabilize.
 - 5) After stabilization period (3.5 psig minimum pressure in pipe) discontinue air supply to line segment.
 - 6) Record pressure at beginning and end of test.

D. Dielectric Testing Methods and Criteria:

1. Provide electrical check between metallic non-ferrous pipe or appurtenances and ferrous elements of construction to assure discontinuity has been maintained.
2. Wherever electrical contact is demonstrated by such test, locate the point or points of continuity and correct the condition.

3.7 THRUST RESTRAINT

- A. Thrust Blocks shall be allowed only when approved by the Engineer, unless shown on the drawings.
- B. Thrust Ties: Buried Ductile Iron Pipe and Fittings shall provide thrust-tie assembly restraint according to NFPA 24.

3.8 CLEANING, DISINFECTION AND PURGING

A. Cleaning:

1. Clean interior of piping systems thoroughly before installing.
2. Maintain pipe in clean condition during installation.
3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
4. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.
5. At completion of work and prior to Final Acceptance, thoroughly clean work installed under these Specifications.
 - a. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes.
 - b. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.
6. After erection of piping and tubing, but prior to installation of service outlet valves, blow natural gas systems clear of free moisture and foreign matter by means of air, nitrogen or carbon dioxide.
 - a. Oxygen shall never be used.
7. Clean chlorine piping in accordance with CI Pamphlet 6.
8. Purge all neat liquid polymer tubing or piping between the neat polymer storage tank or tote and the polymer blending units with mineral oil to remove residual water prior to introducing neat polymer. Following purging, drain as much of the mineral oil out of the system as possible. Dispose of purged fluids and waste mineral oil in accordance with local environmental regulations.

B. Disinfection of Potable Water Systems:

1. After favorable performance of pressure test and prior to Final Acceptance, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed.
2. Perform work, including preventative measures during construction, in full compliance with AWWA C651.
3. Perform disinfection using sodium hypochlorite complying with AWWA B300.

4. Flush each segment of system to provide flushing velocity of not less than 2.5 FT per second.
5. Drain flushing water to sanitary sewer.
 - a. Do not drain flushing water to receiving stream.
6. Use continuous feed method of application.
 - a. Tag system during disinfection procedure to prevent use.
7. After required contact period, flush system to remove traces of heavily chlorinated water.
8. After final flushing and before placing water in service, obtain an independent laboratory approved by the Owner to collect samples and test for bacteriological quality.
 - a. Repeat entire disinfection procedures until satisfactory results are obtained.
9. Secure and deliver to Owner, satisfactory bacteriological reports on samples taken from system.
 - a. Ensure sampling and testing procedures are in full compliance to AWWA C651, local water purveyor and applicable requirements of State of Alaska.

C. Purging Natural gas:

1. Existing piping:
 - a. Turn off gas supply.
 - b. Vent line pressure outdoors.
 - c. If section exceeds the following, then remaining gas shall be displaced with an inert gas.
 - 1) 50 FT for 2-1/2 IN pipe.
 - 2) 30 FT for 3 IN pipe.
 - 3) 15 FT for 4 IN pipe.
 - 4) 10 FT for 6 IN pipe.
 - 5) Any length for 8 IN or larger pipe.
2. New piping:
 - a. Including but not limited to:
 - 1) All fuel gas piping.
 - b. Purge air filled system with fuel gas:

- 1) Providing piping length is less than:
 - a) 30 FT for 3 IN pipe.
 - b) 15 FT for 4 IN pipe.
 - c) 10 FT for 6 IN pipe.
 - d) Any length for 8 IN and larger pipe.
 - 2) Providing a moderately rapid and continuous flow of fuel gas is introduced.
 - a) Introduce fuel gas at one (1) end.
 - b) Vent air at opposite end.
 - 3) Provided fuel gas flow is continuous without interruption until vented gas is free of air.
 - 4) The point of discharge shall not be left unattended during purging.
- c. If the piping is 3 IN or larger and exceeds lengths stated above.
- 1) Purge air with inert gas in accordance with NFPA 54 and NFPA 69.
 - 2) Purge inert gas with fuel gas.
3. Discharge of purged gases:
- a. Open end of piping shall not discharge into confined spaces or areas where there are sources of ignition.

3.9 LOCATION OF BURIED OBSTACLES

- A. Furnish exact location and description of buried utilities encountered and thrust block placement.
- B. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants and related fixed structures.
- C. Include such information as location, elevation, coverage, supports and additional pertinent information.
- D. Incorporate information on "As-Recorded" Drawings.

3.10 PIPE INSULATION

- A. Insulate pipe and pipe fittings in accordance with Specification Section 40 42 00.

3.11 SCHEDULES

A. SPECIFICATION SCHEDULE - SYSTEM 1

1. General:
 - a. Piping symbol and service:

- 1) ALP – Air Low Pressure.
- 2) Test requirements:
- 3) Test medium: Low pressure air.
- 4) Pressure: See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.
- 5) Duration: See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.
- 6) Gaskets:
 - a) Flanged, Proprietary Restrained Joint (ductile iron): 1/8-inch thick EPDM rated to 300 degrees F. Hardness 60, ASME 16.21 and ASTM D2000 4CA 415 A25 B35 C32 EA14F19

2. System components:

- 1) Pipe size 3 IN through 48 IN:
 - a) Buried service:
 - (1) Materials: Ductile iron, Class 51.
 - (2) Reference: AWWA/ANSI C151/A21.51.
 - (3) Lining: Cement.
 - (4) Coating: Bituminous.
 - (5) Fittings:
 - (a) Either AWWA/ANSI C110/A21.10 ductile or gray iron.
 - (b) Optional: AWWA/ANSI C153/A21.53 ductile iron compact fittings for sizes 3 IN to 16 IN.
 - (6) Joints: Proprietary Restrained Joint (ductile iron): 250 psi minimum, AWWA C151/A21.51, US Pipe TR Flex, Clow Corp., Super Lock, American CIP Co., Lok-Ring or Flex Ring.
- 2) Pipe Size 1 – 2 IN
 - (1) Buried Service :
 - (a) Materials: HDPE
 - (b) Reference: As specified in Section 40 05 25
 - (c) SDR 21 pressure rated as specified.
 - (d) Lining: None
 - (e) Coating: None
 - (f) Fittings: As specified in Section 40 05 25
 - (g) Joints: Butt Fusion Welded as specified in Section 40 05 25
- 3) Pipe Size: 3-48 IN:

- (1) Exposed and/or Submerged:
 - (a) Material: Stainless steel 304L, Schedule 10.
 - (b) Reference: ASTM A778.
 - (c) Lining: None.
 - (d) Coating: None.
 - (e) Fittings: Seamless steel 304L meeting ASTM A774.
 - (f) Joints:
 - (g) Butt welded with unions at equipment and valves.
 - (h) Harnessed compression sleeve couplings where indicated on Drawings.

B. SPECIFICATION SCHEDULE - SYSTEM 2

1. General:

- a. Piping symbol and service:
 - 1) OF - Overflow.
 - 2) PLI – Plant Influent
 - 3) RS – Raw Sewage
 - 4) SE – Secondary Effluent
 - 5) ML – Mixed Liquor
 - 6) RAS - Return Activated Sludge.
 - 7) WAS –Waste Activated Sludge
- b. Test requirements:
 - 1) Test medium: Water.
 - 2) Pressure: 25 psig.
 - 3) Duration: 6 HRS.

2. System components:

- a. Pipe size 3 IN through 24 IN:
 - 1) Exposed service:
 - a) Material:
 - (1) Flanged: Ductile iron, Class 51.
 - (2) Grooved type joint system: Use pipe thickness per AWWA C606.
 - b) Reference: AWWA/ANSI C115/A21.15.
 - c) Lining: Cement.
 - d) Coating: HPIC; See Specification Section 09 96 00.

- e) Gaskets: Flanged, push-on, and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.
 - f) Fittings: Either AWWA/ANSI C110/A21.10 ductile or gray iron.
 - g) Joints: AWWA/ANSI C115/A21.15 flanged joints with flanges at valves and structure penetrations.
- 2) Buried service:
- a) Materials: Ductile Iron: Class 51
 - b) Reference: AWWA/ANSI C15/A21.51
 - c) Lining: Cement
 - d) Coating: Bituminous
 - e) Fittings:
 - (1) Either AWWA/ANSI C110/A21.10 Ductile
 - (2) Optional: AWWA/ANSI C153/A21.53 compact fittings for ductile iron size 3 IN through 16 IN
 - f) Joints: Proprietary Restrained Joint (ductile iron): 250 psi minimum, AWWA C151/A21.51, US Pipe TR Flex, Clow Corp., Super Lock, American CIP Co., Lok-Ring or Flex Ring.
- 3) OPTIONAL BURIED SERVICE:
- a) Materials : HDPE: PE 4710 with Standard Dimension Ratio (SDR) 32.5
 - b) Minimum ID 24-inch dia pipe shall be equal to or greater than 22.4 inch
 - c) Minimum pressure rating 64 psi
 - d) Joints: Butt Fusion Welded, remove all internal weld material as specified in Section 40 05 25.

C. SPECIFICATION SCHEDULE - SYSTEM 3

- 1. General:
 - a. Piping symbol and service:
 - 1) PD – Pumped Drainage
 - 2) SCUM - Scum
 - 3) PW – Potable Well Water.
 - 4) NPW – Nonpotable water
 - 5) SP-Sump Pump Discharge
 - b. Test requirements:
 - 1) Test medium: Water.

- 2) Pressure: 125 psig.
- 3) Duration: 6 HRS.

2. System components:

a. Pipe size 3 IN through 24 IN:

1) Exposed/Interior Service:

a) Material:

- (1) Flanged: Ductile iron, Class 52
- (2) Grooved type joint system: Use pipe thickness per AWWA C606.

2) Gaskets:

- 3) Flanged, push-on and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.
- 4) Grooved coupling joints (ductile and steel): Rubber, AWWA C606.
- 5) Flanged joints (steel): AWWA C207.

a) Reference: AWWA/ANSI C115/A21.15.

b) Lining: Glass on RAS, SCUM, WAS, All others Cement

c) Coating: HPIC; See Specification Section 09 96 00.

d) Fittings: Either AWWA/ANSI C110/A21.10 ductile or gray iron.

e) Joints:

- (1) Flanged or grooved type mechanical coupling (AWWA C606) joints.
- (2) With both systems, provide screwed-on flanges at equipment, valves and structure penetrations.

6) Exposed/Exterior Service:

a) Materials: SDR 11 HDPE Pipe.

b) Reference: As specified in Section 40 05 35

c) SDR 11 pressure rated as specified.

d) Lining: None

e) Fittings: As specified in Section 40 05 35 and Section 40 05 25.

f) Joints: Butt Fusion Welded as specified in Section 40 05 35: Optional Section 40 05 25.

b. Pipe size 1 IN through 3 IN

1) Buried Service :

a) Materials: SDR 11 HDPE pipe.

- b) Reference: As specified in Section 40 05 25
 - c) SDR 11 pressure rated as specified.
 - d) Lining: None
 - e) Fittings: As specified in Section 40 05 25
 - f) Joints: Butt Fusion Welded as specified in Section 40 05 25
- 2) Exposed Service :
- a) Materials: Stainless Steel, Schedule 40S, 316L.
 - b) Joints/Fittings:
 - (1) Threaded for 1-1/2 inch or smaller except flanged at valves
 - (2) Butt Welded for pipe greater than 1-1/2 inch except flanged at valves
 - c) Gaskets: 1/8-inch thick, EPDM, rated to 300 degrees F. Hardness 60, ASME 16.21.
- c. Pipe size 4 IN through 12 IN:
- 1) Buried Service:
 - a) Materials: Prefabricated, insulated and jacketed, HDPE, Arctic Pipe.
 - b) Reference: Optional Section 40 05 25
 - c) SDR 11 pressure rated as specified.
 - d) Lining: None
 - e) Coating: Insulated and jacketed as specified in 40 05 35 Optional Section 40 05 25
 - f) Fittings: As specified in Section 40 05 25
 - g) Joints: Butt Fusion Welded
- d. Pipe size to 2 IN for PD and SP only:
- 1) Exposed Service:
 - a) Materials: Galvanized Steel, Schedule 80.
 - b) Joints/Fittings:
 - (1) Threaded except flanged at valves
 - c) Unions Threaded ASME B16.3
 - d) Teflon Tape or joint compound insoluble in water shall be used at threaded connections

D. SPECIFICATION SCHEDULE - SYSTEM 5

1. General:

- a. Piping symbol and service:
 - 1) NG - Natural Gas.
 - b. Test requirements:
 - 1) Test medium: Cylinder Nitrogen.
 - 2) Pressure: Refer to local gas company for recommended test pressure and duration requirements.
 - 3) Duration: Refer to local gas company for recommended test pressure and duration requirements.
2. System components:
- a. Pipe size through 26 IN:
 - 1) Exposed service:
 - a) Material: Steel, Grade B, black, Schedule 40.
 - b) Reference: ASTM A53.
 - c) Lining: None.
 - d) Coating: HPIC; See Specification Section 09 96 00.
 - e) Fittings: Malleable iron meeting ASTM A197, ASME B16.3, Class 150.
 - f) Joints: Threaded, ASME B16.9 steel butt- or socket-welded joints.
 - 2) Buried service:
 - a) Materials: Steel, Grade B, black, Schedule 40.
 - b) Reference: ASTM A53.
 - c) Linings: None.
 - d) Coatings: Factory coating-mill wrapped with 3-M "Scotchkote," or Energy Coating Company "Encoat" with fittings and uncoated portions fully wrapped after testing with 3-M "Scotchkote" tape.
 - e) Fittings: Malleable iron meeting ASTM A197, ASME B16.3, Class 150.
 - f) Joints: Threaded, ASME B16.9 steel butt- or socket-welded joints.
3. Natural Gas Piping Installation:
- a. Install piping in accordance with NFPA, local gas company regulations, codes and local ordinances, complete with necessary appurtenances.
 - b. Install buried pipe at approximately 30 IN deep.
 - c. Gas cocks:

- 1) Install before gas utilization equipment connected to system, at each branch main and at connection to meter.
 - 2) Design to operate safely under pressures indicated.
 - 3) Install ground joint unions at intervals to facilitate repairs.
 - 4) Cocks shall be of type and lubricant recommended by manufacturer for this class of service, and as approved by local gas company.
- d. Pipe drainage:
- 1) Drain horizontal piping to risers.
 - 2) Locate drains where required for system drainage.
 - 3) Install tee fitting with bottom outlet plugged or provide with threaded, capped nipple at bottom of risers or in accordance with applicable codes.
- e. Make piping connections with shellacked joints or ground joint unions.
- f. Provide vents from gas regulators, pressure reducing valves, and other vented devices to the outdoors and terminate in accordance with applicable codes.
- g. Connect piping to pressure reducing valve outside each building as shown on drawings and schedule.
- h. Provide flexible connections to vibration isolated equipment suitable for pressures, local and national codes and intended application.
- i. Remove cutting and threading burrs.
- j. Plug each gas outlet (including valves) with threaded plugs or caps immediately after installation and retain until the piping or equipment connections are completed.
- k. Continuously ground gas piping electrically, bond tightly to the grounding connection.
- l. Install piping parallel to other piping, but maintain a minimum 12 IN clearance between gas piping and any piping that could reach 200 DegF.
- m. All gas piping in air plenums to be all-welded and encased in a Schedule 40 pipe sleeve.
- 1) Ends of the sleeve open to atmosphere or sealed with the annulus vented (gas pipe size) to atmosphere.

E. SPECIFICATION SCHEDULE - SYSTEM 7

1. General:

a. Piping symbol and service:

- 1) ALS - SPARE.
 - 2) CLS - Chlorine Solution.
 - 3) DF – Defoaming Agent
 - 4) POL – Neat Polymer
 - 5) POS - Polymer Solution
- b. Test requirements pressure lines:
- 1) Test medium: Water.
 - 2) Pressure: 125 psig.
 - 3) Duration: 6 HRS.
- c. Test requirements vacuum lines:
- 1) Test medium: Air.
 - 2) Pressure: -27 IN HG.
 - 3) Duration: 6 HRS.
- d. Gaskets and O-rings:
- 1) Viton for ALS, CLS, DF, POL, POS
2. System components:
- a. Pipe size 12 IN and smaller:
- 1) Exposed Interior Service:
 - a) Material: PVC, Type 1, Grade 1, Schedule 80.
 - b) Reference: ASTM D1785.
 - c) Lining: None.
 - d) Coating: HPIC; See Specification Section 09 96 00.
 - e) Fittings: Solvent welded socket type complying with ASTM D2467.
 - f) Joints: Solvent welded with unions at valves, penetrations through structures and equipment connections for pipe 2 IN and less and flanges at those locations for pipe above 2 IN.
 - 2) Exposed Exterior and Buried Service:
 - a) Materials: Heat Traced, prefabricated, insulated and jacketed, HDPE, Arctic Pipe Carrier Pipe with PEX chemical solution lines as shown on the Drawings and Standard Details.
 - b) Reference: As specified in Section 40 05 35
 - c) Provide HDPE Carrier Pipe as shown in Drawings and Standard Details
 - d) Lining: None

- e) Coating: Insulated and jacketed as specified in 40 05 35
- f) Fittings: As specified in Section 40 05 35
- g) Joints: Butt Fusion Welded as specified in Section 40 05 35

F. SPECIFICATION SCHEDULE - SYSTEM 8

1. General:

- a. Piping symbol and service:
 - 1) SHY - Sodium Hydroxide.
- b. Test requirements:
 - 1) Test medium: Water.
 - 2) Pressure: 125 psig.
 - 3) Duration: 6 HRS.
- c. Gaskets and O-rings: Polypropylene.

2. System components:

- a. Pipe size 12 IN and smaller:
 - 1) Exposed Interior service:
 - a) Material: CPVC, Schedule 80.
 - b) Reference: ASTM F441.
 - c) Lining: None.
 - d) Coating: HPIC; See Specification Section 09 96 00.
 - e) Fittings: Solvent welded socket type complying with ASTM F439.
 - f) Joints:
 - (1) Solvent welded with unions at valves, penetrations through structures and equipment connections for pipe 2 IN and less and flanges at those locations for pipe above 2 IN.
 - (2) For sodium hydroxide, provide pipe joint primer IPS-70 and pipe joint solvent cement IPS-724.
 - 2) Exposed Exterior and Buried Service:
 - a) Materials: Heat Traced, prefabricated, insulated and jacketed, HDPE, Arctic Pipe Carrier Pipe with PEX chemical solution lines as shown on the Drawings and Standard Details.
 - b) Reference: As specified in Section 40 05 35
 - c) HDPE Carrier Pipe with SHY HDPE pipe routed inside of carrier pipe as shown on the drawings.
 - d) Lining: None

- e) Coating: Insulated and jacketed as specified in 40 05 35
- f) Fittings: As specified in Section 40 05 35
- g) Joints: Butt Fusion Welded as specified in Section 40 05 35

G. SPECIFICATION SCHEDULE - SYSTEM 10

1. General:

- a. Piping symbol and service:
 - 1) PCW - Potable Cold Water.
 - 2) HW - Hot Water.
 - 3) TW – Tempered Water
- b. Test requirements:
 - 1) Test medium: Water.
 - 2) Pressure: 150 psig.
 - 3) Duration: 6 HRS.
- c. Gaskets and O-rings:
 - 1) O-rings: Neoprene or rubber.
 - 2) Flanged, push-on and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.
 - 3) Flanged joints (steel): Rubber, AWWA C207.
 - 4) Grooved coupling joints (ductile and steel): Rubber, AWWA C606.

2. System components:

- a. Pipe size to 3 IN:
 - 1) Exposed service:
 - a) Material: Copper tubing, Type L.
 - b) Solder: Cadmium and lead-free solder compatible with tubing and fittings materials.
 - c) Reference: ASTM B88.
 - d) Lining: None.
 - e) Coating: HPIC; See Specification Section 09 96 00.
 - f) Fittings: Wrought copper or bronze fittings meeting ASME B16.22.
 - g) Joints: Soldered or brazed with unions at valves and equipment.
- b. Pipe size 3 IN through 24 IN:
 - 1) Exposed service:

- a) Materials:
 - (1) Flanged: Ductile iron, Class 52.
 - (2) Grooved type joint system: Use pipe thickness per AWWA C606.
 - (3) With both systems, provide screwed on flanges at equipment, valves and structural penetrations.
 - b) Reference: AWWA/ANSI C115/A21.15.
 - c) Lining: Cement.
 - d) Coating: HPIC; See Specification Section 09 96 00.
 - e) Fittings: Either AWWA/ANSI C110/A21.10 ductile or gray iron.
 - f) Joints:
 - (1) Flanged or grooved type mechanical coupling (AWWA C606) joints.
 - (2) With both systems, provide screwed-on flanges at valves, equipment, and structure penetration.
- 2) Buried service:
- a) Materials: Ductile iron, Class 52.
 - b) Reference: AWWA/ANSI C151/A21.51.
 - c) Lining: Cement.
 - d) Coating: Bituminous.
 - e) Fittings:
 - (1) Either AWWA/ANSI C110/A21.10 ductile or gray iron.
 - (2) Optional: AWWA/ANSI C153/A21.53 ductile iron compact fittings for sizes 3 to 16 IN.
 - f) Joints: Proprietary Restrained Joint (ductile iron): 250 psi minimum, AWWA C151/A21.51, US Pipe TR Flex, Clow Corp., Super Lock, American CIP Co., Lok-Ring or Flex Ring.

~~c. Pipe size greater than 24 IN:~~

~~1) Exposed service:~~

- ~~a) Material: Steel, fabricated pipe.~~
- ~~b) Reference: AWWA C200.~~
- ~~c) Lining: Cement.~~
- ~~d) Coating: HPIC; See Specification Section 09 96 00.~~
- ~~e) Fittings: AWWA C208.~~
- ~~f) Joints: Butt welded with rigid AWWA C207 flanges at equipment, valves, and structure penetrations.~~

- ~~2) Buried service:
 - ~~a) Material: Steel, fabricated pipe.~~
 - ~~b) Reference: AWWA C200.~~
 - ~~c) Lining: Cement.~~
 - ~~d) Coating: Bituminous.~~
 - ~~e) Fittings: AWWA C208.~~
 - ~~f) Joints: Butt welded.~~~~
- 3. Install drain tees with capped nipples of IPS brass 3 IN long at low points.
 - a. If low point occurs in concealed piping, provide approved flush access panel.
 - b. These drains are not shown on Drawings.
- 4. Slope water lines down to drain points not less than 1 IN in 60 FT.
- 5. Install all threaded piping with clean-cut tapered threads and with ends thoroughly reamed after cutting to remove burrs.
 - a. Pipe joint cement permitted only on external threads.
- 6. For screwed nipples for connections to flush valves, lavatory supplies, and other equipment with threaded connections use iron, copper, or brass pipe.
- 7. Install ball, butterfly and plug valves where indicated or required to adequately service all parts of system and equipment.
 - a. Install valves on each branch serving restroom.
 - b. Install valves on inlet and outlet connections of heat exchangers and on other equipment connected to water lines.
- 8. Install unions between valves and connections to each piece of equipment, and install sufficient number of unions throughout piping system to facilitate installation and servicing.
 - a. On copper pipe lines, install wrought, solder-joint, copper to copper unions for lines 2 IN and smaller and, for lines 2-1/2 IN and over install brass flange unions.
- 9. Construct and equip plumbing fixtures and equipment with anti-siphon devices as to entirely eliminate any danger of siphoning waste material into potable water supply system.
- 10. Where exposed pipes 6 IN in size and smaller pass through floors, finished walls, or finished ceilings, fit with nickel or chrome-plated plates large enough to completely close hole around pipes.
 - a. Secure plates to pipe by set screw in approved manner.

11. Size supply branches to individual fixtures as scheduled or indicated on Drawings.
12. Install piping so as to be free to expand with proper loops, anchors and joints without injury to system or structure.
13. Provide branches to wall hydrants or hose bibbs in exterior locations with interior shutoff and drain valves.
14. Provide approved type vacuum breaker and backflow preventer installations indicated or as required by Code.
15. Install concealed in finished structures such as administration and office facilities and at locations shown on Drawings.

H. SPECIFICATION SCHEDULE - SYSTEM 11

1. General:
 - a. Piping symbol and service:
 - 1) IA - Instrument Air.
 - 2) HPA – High Pressure Air
 - b. Test requirements:
 - 1) Test medium: See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.
 - 2) Pressure: 150 psig.
 - 3) Duration: 6 HRS.
 - c. Gaskets and O-rings:
 - 1) O-ring and flanged joints: Rubber or neoprene, 250 DegF.
 - 2) Grooved coupling joints (steel): AWWA C606, rubber, 250 DegF.
2. System components:
 - a. Pipe size to 1 IN for A, 3/8 IN to 1 IN for IA:
 - 1) Exposed service:
 - a) Material: Stainless steel tubing, TP-304L.
 - b) Reference: ASTM A269.
 - c) Lining: None.
 - d) Coating: None.
 - e) Fittings: Stainless steel 304L, compression type tube fittings.
 - f) Joints: Compression type couplings, unions at equipment and valves.

- b. Pipe size 1 IN to 4 IN:
 - 1) Exposed service:
 - a) Materials:
 - (1) Threaded: Steel, Grade B, black, Schedule 40.
 - (2) Grooved type joint system: Use pipe thickness per AWWA C606.
 - b) Reference: ASTM A53.
 - c) Linings: None.
 - d) Coating: HPIC; See Specification Section 09 96 00.
 - e) Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASME B16.3, ASTM A234.
 - f) Joints:
 - (1) Threaded or grooved type mechanical coupling (AWWA C606) joints.
 - (2) With both systems, provide rigid flanges at equipment, valves and structure penetrations above 2 IN and unions at those locations 2 IN and below.
 - 2) Buried service:
 - a) Materials: Steel, Schedule 40, Grade B, black.
 - b) Reference: ASTM A53.
 - c) Lining: None.
 - d) Coating: Bituminous.
 - e) Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASME B16.3, ASTM A234.
 - f) Joints: Threaded.
- 3. Slope all piping mains approximately 1:100 toward points of drainage.
- 4. Provide driplegs at low points:
 - a. Provide ball type isolation valve.
 - b. Route dripleg to nearest wall or column and terminate 4 FT above finished floor.

I. SPECIFICATION SCHEDULE - SYSTEM 12

- 1. General:
 - a. Piping symbol and service:
 - 1) HPA – High Pressure/Compressed Air
 - b. Test requirements:

- 1) Test medium: Air.
 - 2) Pressure: 100 psig.
 - 3) Duration: 6 HRS.
- c. Gaskets and O-rings:
- 1) O-rings and flanged joints: Neoprene, 250 DegF.
- d. Temperature:
- 1) Normal: 170 DegF.
 - 2) Maximum: 250 DegF.
2. System components:
- 1) Pipe size through 2 IN:
 - a) Exposed service outside of channels and tankage:
 - (1) Material: Steel, Schedule 40, Grade B, black.
 - (2) Reference: ASTM A53.
 - (3) Lining: None.
 - (4) Coating: HPIC; See Specification Section 09 96 00.
 - (5) Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASTM A106, Grade B.
 - (6) Joints:
 - (a) Welded with flanges at equipment and valves.
 - (b) Harnessed compression sleeve couplings where indicated on Drawings.
 - 2) Pipe size above 2 IN:
 - a) Exposed service outside of channels and tankage:
 - (1) Material: Steel, Schedule 10, Grade B, black.
 - (2) Reference: ASTM A53.
 - (3) Lining: None.
 - (4) Coating: HPIC; See Specification Section 09 96 00.
 - (5) Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASTM A106, Grade B.
 - (6) Joints:
 - (a) Welded with flanges at equipment and valves.
 - (b) Harnessed compression sleeve couplings where indicated on Drawings.
 - b) Piping within channels and tankage:
 - (1) Material: Stainless steel 304L, Schedule 10.

- (2) Reference: ASTM A778.
- (3) Lining: None.
- (4) Coating: None.
- (5) Fittings: Seamless steel 304L meeting ASTM A774.
- (6) Joints:
 - (a) Butt welded with flanges at equipment and valves.
 - (b) Harnessed compression sleeve couplings where indicated on Drawings.

J. SPECIFICATION SCHEDULE - SYSTEM 21

1. General:

a. Piping symbol and service:

- 1) D - Drain
- 2) RL - Rain Leader.
- 3) TD – Tank Drain
- 4) V - Vent.
- 5) VTR – Vent Thru Roof
- 6) WST - Waste.

b. Test requirements:

- 1) Test medium: Water.
- 2) Pressure: See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.
- 3) Duration: 6 HRS.

c. Gaskets: Rubber, ASTM C564.

2. System components:

a. Pipe size 1-1/4 IN and 1-1/2 IN:

- 1) Exposed service.
 - a) Material: Galvanized steel, Schedule 40.
 - b) Reference: ASTM A53.
 - c) Lining: Galvanized.
 - d) Coating: HPIC; See Specification Section 09 96 00.
 - e) Fittings: Cast iron drainage.
 - (1) ASTM A126, Class B.
 - f) Joints: Threaded.

- b. Pipe size 4 IN and larger:
 - 1) Exposed service.
 - a) Material: Cast iron soil pipe.
 - b) Reference: ASTM A74, CISPI 301.
 - c) Lining: None.
 - d) Coating: HPIC; See Specification Section 09 96 00.
 - e) Fittings: ASTM A74.
 - f) Joints: No-hub with elastomeric sealing sleeve and stainless steel clamp assembly conforming to CISPI 301.
 - 2) Buried service (to 5 FT outside of structure):
 - a) Material: Cast-iron soil pipe.
 - b) Reference: ASTM A74.
 - c) Lining: None.
 - d) Coating: Bituminous.
 - e) Fittings: ASTM A74.
 - f) Joints: Hub and spigot.
- c. Pipe 6 IN and larger:
 - 1) Buried service and Buried Concrete Encased:
 - a) Materials: Ductile Iron: Class 51
 - b) Reference: AWWA/ANSI C15/A21.51
 - c) Lining: Cement
 - d) Coating: Bituminous
 - e) Fittings: AWWA/ANSI C110/A21.10 Ductile
 - f) Joints: Proprietary Restrained Joint (ductile iron): 250 psi minimum, AWWA C151/A21.51, US Pipe TR Flex, Clow Corp., Super Lock, American CIP Co., Lok-Ring or Flex Ring.

K. Soil and Waste Piping Installation:

1. Install horizontal soil or waste lines less than 4 IN diameter with a slope of not less than 1/4 IN/FT or 2 percent toward the point of disposal.
2. Install 4 IN and larger piping at 1/8 IN per foot.
3. Install as close to construction as possible to maintain maximum head room.
4. Make changes of direction with 1/8 bends and junctions with wye fittings.
5. Use short wye fittings in vertical pipe only.

6. Install handhole test tee at base of each stack.
7. Install cleanouts at dead ends, at changes of direction and at 50 FT intervals on horizontal runs.
 - a. Where cleanouts occur in concealed spaces, provide with extensions to floors above or to walls as required.
8. Install piping true to grade and alignment.
 - a. Begin at the system low point.
9. Locate vertical extensions of underground piping below partition walls for concealment in wall.
 - a. In locations where hubs are wider than partition, set hubs 1 IN below final floor.
10. Install concealed in finished structures such as administration and office facilities and at locations shown on Drawings.
11. For hub and spigot joints, install hub facing flow.

Vent Piping Installation:

12. Run vent stack parallel to each soil or waste stack to receive branch vents from fixtures.
13. Originate each vent stack from soil or waste pipe at its base.
14. Where possible, combine soil, waste or vent stacks before passing through roof so as to minimize roof openings.
15. Offset pipes running close to exterior walls away from such walls before passing through roof to permit proper flashing.
16. Provide pipes passing through roofs with cast iron increasers minimum of 12 IN below roof one size larger than pipe but in no case less than 4 IN.
17. Terminate each vent with approved frostproof jacket.
18. Carry vent stacks 4 IN and larger full size through roof.
 - a. Extend vent stacks at least 12 IN above roofing.
19. Pipe vents from pressure regulating devices in compliance with local codes.
20. Install concealed in finished structures such as administration and office facilities and at locations shown on Drawings.

L. SPECIFICATION SCHEDULE - SYSTEM 23

1. General:

- a. Piping symbol and service:
 - 1) SAN - Sanitary Sewer (gravity).
 - b. Test requirements:
 - 1) See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.
 - c. Gaskets:
 - 1) Push-on joints: Neoprene.
2. System components:
- a. Pipe size 6 IN through 24 IN:
 - 1) BURIED SERVICE:
 - a) Materials : HDPE: PE 4710 with Standard Dimension Ratio (SDR) 26
 - b) Minimum pressure rating 80 psi
 - c) Joints: Butt Fusion Welded, remove all internal weld material as specified in Section 40 05 25.

M. SPECIFICATION SCHEDULE - SYSTEM 27

1. General:
- a. Piping symbol and service:
 - 1) SMP - Sample.
 - b. Test requirements pressure lines:
 - 1) Test medium: Water.
 - 2) Pressure: 100 psig.
 - 3) Duration: 6 HRS.
 - c. Gaskets and O-rings:
 - 1) O-rings and flanged joints: Neoprene or rubber.
2. System components:
- a. Pipe size 12 IN and smaller:
 - 1) Exposed service:
 - a) Material: PVC, Type 1, Grade 1, Schedule 80.
 - b) Reference: ASTM D1785.
 - c) Lining: None.
 - d) Coating: HPIC; See Specification Section 09 96 00.

- e) Fittings: Solvent welded socket type complying with ASTM D2467.
- f) Joints: Solvent welded with unions at valves, penetrations through structures and equipment connections for pipe 2 IN and less and flanges at those locations for pipe above 2 IN.

END OF SECTION

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SECTION 40 05 07
PIPE SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe support and anchor systems.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 03 15 19 - Anchorage to Concrete.
4. Section 05 50 00 - Metal Fabrications.
5. Section 09 96 00 - High Performance Industrial Coatings.
6. Section 40 42 00 - Pipe, Duct and Equipment Insulation.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
 - a. B31.1, Power Piping.
 - b. B31.3, Process Piping.
2. ANVIL International (ANVIL).
3. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A276, Standard Specification for Stainless Steel Bars and Shapes.
 - c. A510, Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
 - d. A575, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
 - e. A576, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.

- f. A917, Standard Specification for Steel Sheet, Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface (General Requirements).
 - g. A918, Standard Specification for Steel Sheet, Zinc-Nickel Alloy Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
 - h. B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- 4. American Welding Society (AWS):
 - a. D1.1, Structural Welding Code - Steel.
 - 5. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
 - a. SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - b. SP-69, Pipe Hangers and Supports - Selection and Application.

B. Responsibility:

- 1. Support systems for piping greater than 12 IN DIA with internal pressure over 100 psi and piping with product temperatures over 200 DegF are shown on the Drawings.
- 2. Contractor shall design support systems for 12 IN DIA piping and smaller, and for larger diameter piping where supports are not shown on the Drawings.
- 3. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to design, furnish and install the system of hangers, supports, guidance, anchorage and appurtenances.
- 4. General piping support details may be indicated on the Drawings in certain locations for pipe smaller than 12 IN DIA.
- 5. Contractor shall incorporate those details with requirements of this Specification Section to provide the piping support system.

C. Each type of pipe hanger or support shall be the product of one manufacturer.

1.3 SUBMITTALS

A. Shop Drawings:

- 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- 2. Product technical data including:

- a. Acknowledgement that products submitted meet requirements of standards referenced.
- b. Manufacturer's installation instructions.
- c. Itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.
- d. Scaled drawings showing location, installation, material, loads and forces, and deflection of all hangers and supports.
- e. Analyze each pipe system for all loads and forces on hangers and supports and their reaction forces to the structure to which they are fastened.
- f. Support systems for piping systems over 12 IN DIA, systems operating over 100 psig or systems operating over 200 DegF designed by the Contractor: Submit detail design calculations and scaled drawings prepared and signed by a registered Professional Engineer in the state of Alaska.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. General:

1. Galvanized components:

a. Electro-galvanized components:

- 1) Bar, forged or cast fabrications: ASTM B633, SC4.
- 2) Rolled sheet fabrications: ASTM A917 and ASTM A918, 50N50NU.

b. Hot-dipped galvanized components: See Specification Section 05 50 00.

2. Dissimilar metals protection:

a. Galvanized-to-galvanized and galvanized-to-aluminum: No protection required.

b. All other galvanized-to-dissimilar metal connections: Neoprene or nylon pads, shims, grommets, etc.

B. Hanger Rods:

1. Material:

a. Wet and corrosive and Class I areas: Interior and exterior areas of existing building and new building addition.

- 1) Stainless steel or FRP.

- b. All other areas:
 - 1) Galvanized or aluminum
 - 2) For fabricated items, hot dip galvanized after fabrication.
 - c. Minimum allowable tensile stress of 12,000 psi at 650 DegF per MSS SP-58.
2. Continuously threaded.
 3. Electro-galvanized or cadmium plated after threads are cut.
 4. Load limit:

| NOMINAL ROD DIAMETER | MAXIMUM SAFE LOAD, (LBS) |
|----------------------|--------------------------|
| 3/8 IN DIA (min) | 610 |
| 1/2 IN DIA | 1,130 |
| 5/8 IN DIA | 1,810 |
| 3/4 IN DIA | 2,710 |
| 7/8 IN DIA | 3,770 |
| 1 IN DIA | 4,960 |

C. Hangers:

Materials for corrosive areas: 304 stainless steel.

1. Hangers for use directly on copper pipe: Copper or cadmium plated.
2. Hangers for use other than directly on copper pipe: Cadmium plated or galvanized.
3. Hanger type schedule:

| APPLICATION | PIPE SIZE | HANGER TYPE |
|---|---------------|----------------------------------|
| All except noted | 4 IN and less | ANVIL Figure 108 with Figure 114 |
| All except noted | Over 4 IN | ANVIL Figure 590 |
| Steam, condensate and hot water | All | ANVIL Figure 181, Figure 82 |
| Service in chemical storage areas and as indicated on drawings for corrosion resistance | All | CorPro CP - Hanger or equal |

D. Concrete Inserts for Hanger Rods:

1. Continuous slots: Unistrut #P1000.
2. Individual inserts: ANVIL Figure 281.
3. See Specification Section 03 15 19, mechanical anchors.

E. Beam Clamps for Hanger Rods:

1. Standard duty.
2. ANVIL Figure 133.

F. Trapeze Hangers for Suspended Piping:

1. General:
 - a. Material: Steel.
 - b. Galvanized.
 - c. Angles, channels, or other structural shapes.
 - d. Curved roller surfaces at support point corresponding with type of hanger required.
2. In chemical storage and feed areas and as indicated on the drawings:
 - a. Materials: FRP.
 - b. Unistrut fiberglass channel or equal.
 - c. Corrosive areas: Material: 304 stainless steel. Angles, channels or other structural shapes.

G. Vertical Pipe Supports:

1. At base of riser.
2. Lateral movement:
 - a. Clamps or brackets: Stainless steel.
 - 1) ANVIL

H. Expanding Pipe Supports:

1. Spring hanger type.
2. MSS SP-58.

I. Pipe Support Saddle:

1. For pipe located 3 FT or less from floor elevation, except as otherwise indicated on Drawings. Stainless steel.
2. ANVIL Figure 264.

J. Pipe Support Risers:

1. Schedule 40 pipe.

2. 304 L stainless steel for exterior installations
3. Size: As recommended by saddle manufacturer.

K. Pipe Support Base Plate:

1. 4 IN larger than support.
2. Collar 3/16 IN thickness, circular in shape, and sleeve type connection to pipe.
3. Collar fitted over outside of support pipe and extended 2 IN from floor plate.
4. Collar welded to floor plate.
5. Edges ground smooth.
6. Assembly hot-dipped galvanized after fabrication.

L. Pipe Covering Protection Saddle:

1. For insulated pipe at point of support.
2. ANVIL Figure 167, Type B.

M. Wall Brackets:

1. For pipe located near walls and 8 FT or more above floor elevation or as otherwise indicated on the Drawings.
2. ANVIL Figure 199.

N. Pipe Anchors:

1. For locations shown on the Drawings.
2. 1/4 IN steel plate construction.
3. Hot-dipped galvanized after fabrication.
4. Designed to prevent movement of pipe at point of attachment.

O. Pipe Guides:

1. For locations on both sides on each expansion joint or loop.
2. To ensure proper alignment of expanding or contracting pipe.
3. ANVIL Figure 256.
4. Sway Strut: ANVIL Figure 640.

2.2 DESIGN REQUIREMENTS

- A. Supports capable of supporting the pipe for all service and testing conditions.
 - 1. Provide 5 to 1 safety factor.
- B. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.
- C. Design supports and hangers to allow for proper pitch of pipes.
- D. For chemical and waste piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:
 - 1. ASME B31.3.
 - 2. MSS SP-58 and MSS SP-69.
 - 3. Except where modified by this Specification.
- E. For steam and hot and cold water piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:
 - 1. ASME B31.1.
 - 2. MSS SP-58 and MSS SP-69.
- F. Check all physical clearances between piping, support system and structure.
 - 1. Provide for vertical adjustment after erection.
- G. Support vertical pipe runs in pipe chases at base of riser.
 - 1. Support pipes for lateral movement with clamps or brackets.
- H. Place hangers are to be installed on outside of pipe insulation.
 - 1. Use a pipe covering protection saddle for insulated pipe at support point.
 - 2. Insulated piping 1-1/2 IN and less:
 - a. Provide a 9 IN length of high density perlite or high density calcium silicate at saddle.
 - b. See Specification Section 40 42 00.
 - 3. Insulated piping over 1-1/2 IN: Provide a 12 IN length of high density perlite or high density calcium silicate at saddle.
- I. Provide 20 GA galvanized steel pipe saddle for fiberglass and plastic support points to ensure minimum contact width of 4 IN.
- J. Pipe Support Spacing:

1. General:

- a. Factor loads by specific weight of liquid conveyed if specific weight is greater than water.
- b. Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the Drawings.
- c. Provide at least one (1) support for each length of pipe at each change of direction and at each valve.

2. Steel, stainless steel, cast-iron pipe support schedule:

| PIPE SIZES - IN | MAXIMUM SPAN - FT |
|-----------------|-------------------|
| 1-1/2 and less | 5 |
| 2 thru 4 | 10 |
| 5 thru 8 | 15 |
| 10 and greater | 20 |

3. Copper pipe support schedule:

| PIPE SIZES - IN | MAXIMUM SPAN - FT |
|-----------------|-------------------|
| 2-1/2 and less | 5 |
| 3 thru 6 | 10 |
| 8 and greater | 15 |

4. PVC pipe support schedule:

| PIPE SIZES - IN | MAXIMUM SPAN - FT |
|-----------------|-------------------|
| 1-1/4 and less | 3 |
| 1-1/2 thru 3 | 4 |
| 4 and greater | 5 |

* Maximum fluid temperature of 120 DegF.

5. Support each length and every fitting:

- a. Bell and spigot piping:
 - 1) At least one (1) hanger.

- 2) Applied at bell.
- b. Mechanical coupling joints:
 - 1) Place hanger within 2 FT of each side of fittings to keep pipes in alignment.
6. Space supports for soil and waste pipe and other piping systems not included above every 5 FT.
7. Provide continuous support for nylon tubing.
8. For PVC, FRP and copper piping:
 - a. Provide Unistrut Unicushion wrap of pipe at each support.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide piping systems exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition.
 1. Included in this requirement are movements from:
 - a. Trap discharge.
 - b. Water hammer.
 - c. Similar internal forces.
 2. Seismic Restraints:
 - a. Provide seismic restraints on all piping with the exception of the following:
 - 1) Piping less than 1 IN DIA when used for gas and compressed air.
 - 2) Piping less than 2-1/2 IN DIA for all other cases.
 - 3) Piping suspended by individual hangers where the distance from the top of the pipe to the bottom of the support for the hanger is 12 IN or less.
 - 4) The restraint shall be capable of resisting seismic loads as defined in the California Building Code.
- B. Weld Supports:
 1. AWS D1.1.
 2. Weld anchors to pipe in accordance with ASME B31.3.
- C. Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.

- D. Inspect hangers for:
 - 1. Design offset.
 - 2. Adequacy of clearance for piping and supports in the hot and cold positions.
 - 3. Guides to permit movement without binding.
 - 4. Adequacy of anchors.
- E. Inspect hangers after erection of piping systems and prior to pipe testing and flushing.
- F. Install individual or continuous slot concrete inserts for use with hangers for piping and equipment.
 - 1. Install concrete inserts as concrete forms are installed.
- G. Welding:
 - 1. Welding rods: ASTM and AWS standards.
 - 2. Integral attachments:
 - a. Include welded-on ears, shoes, plates and angle clips.
 - b. Ensure material for integral attachments is of good weldable quality.
 - 3. Preheating, welding and post heat treating: ASME B31.3, Chapter V.
- H. Field Painting:
 - 1. Comply with Specification Section 09 96 00.

END OF SECTION

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SECTION 40 05 17

PIPE: COPPER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper piping, fittings, and appurtenances.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
4. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.
5. Section 40 05 07 - Pipe Support Systems.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
 - a. B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.
 - b. B16.23, Cast Bronze Solder Joint Drainage Fittings - DWV.
 - c. B16.26, Cast Bronze Alloy Fittings for Flared Copper Tubes.
2. ASTM International (ASTM):
 - a. B32, Standard Specification for Solder Metal.
 - b. B42, Standard Specification for Seamless Copper Pipe, Standard Sizes.
 - c. B88, Standard Specification for Seamless Copper Water Tube.
 - d. B306, Standard Specification for Copper Drainage Tube (DWV).
3. American Welding Society (AWS):
 - a. A5.8M/A5.8, Specification for Filler Metals for Brazing and Braze Welding.

1.3 SUBMITTALS

- A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- B. See Specification Section 40 05 00.

1.4 MATERIALS

- A. Copper Tubing:
 - 1. Pressure non-buried: ASTM B88, Type L hard.
 - 2. Pressure buried: ASTM B88, Type K.
 - 3. Non-pressure: ASTM B306.
- B. Copper Pipe: ASTM B42, regular strength.
- C. Fittings:
 - 1. Pressure non-buried: ASME B16.22.
 - 2. Pressure buried: ASME B16.22 or ASME B16.26.
 - 3. Non-pressure: ASME B16.23
- D. Soldering and Brazing:
 - 1. Non-buried:
 - a. ASTM B32 solder with a tin/antimony ratio of 95/5 and non-corrosive flux up to 180 DegF water temperature.
 - b. At 180 DegF and above, use brazing alloy with melting temperature above 1000 DegF and suitable flux.
 - 2. Buried: Silver solder per AWS A5.8M/A5.8.
- E. See Piping Schedules in Specification Section 40 05 00.
- F. Unions:
 - 1. Pipe sizes 2 IN and smaller: Copper, ground joint.
 - 2. Pipe sizes 2-1/2 IN and larger: Brass flanged unions.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Comply with Specification Section 40 05 00.

2.2 FIELD QUALITY CONTROL

- A. Test piping systems in accordance with Specification Section 40 05 00.
- B. Utilize only annealed (soft) type tubing where flared joints are used and drawn temper (hard) type tubing where soldered or brazed joints are used.
- C. Support exposed piping in accordance with Specification Section 40 05 00 and Specification Section 40 05 07.
- D. Install buried piping in accordance with Specification Section 31 23 33 and Specification Section 40 05 00.

END OF SECTION

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TYSECTION 40 05 19
PIPE: DUCTILE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ductile iron piping, fittings, and appurtenances.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
 - a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
 - b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. ASTM International (ASTM):
 - a. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
3. American Water Works Association (AWWA):
 - a. C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
 - b. C606, Standard for Grooved and Shouldered Joints.
4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C105/A21.5, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - b. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.

- c. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - d. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - e. C150/A21.50, Standard for Thickness Design of Ductile-Iron Pipe.
 - f. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
5. Society of Automotive Engineers (SAE):
- a. AMS-QQ-P-416, Cadmium Plating - Electro-deposited.

1.3 SUBMITTALS

A. Shop Drawings:

- 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- 2. See Specification Section 40 05 00.
- 3. Certification of factory hydrostatic testing.
- 4. If mechanical coupling system is used, submit piping, fittings, and appurtenant items which will be utilized to meet system requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents and American Iron and Steel requirements, the following manufacturers are acceptable:
- 1. Flanged adaptors:
 - a. Dresser (Style 128 (steel)) (Style 127 (cast)).
 - b. Or approved equal
 - 2. Compression sleeve coupling:
 - a. Dresser (Style 153 (cast)) (Style 38 (steel)).
 - b. Or approved equal
 - 3. Mechanical coupling:
 - a. Victaulic (Style 31).
 - b. Tyler.

4. Glass lining:
 - a. Ceramic Coating (Non-Stick Glass Lining).
 - b. Permutit (SG-14 Glass Lining).
 5. Insulating couplings:
 - a. Dresser (Style 39).
 - b. Or approved equal
 6. Reducing couplings:
 - a. Dresser (Style 62).
 - b. Or approved equal
 7. Transition coupling:
 - a. Dresser (Style 62).
 - b. Or approved equal
 8. Polyethylene encasement tape:
 - a. Chase (Chasekote 750).
 - b. Kendall (Polyken 900).
 - c. 3 M (Scotchrap 50).
 9. Restrained joints:
 - a. American (Lock Fast) - 12 IN and below.
 - b. U.S. Pipe (TR-Flex) - 4 IN to 54 IN.
 - c. American (Lock Fast) - Above 12 IN.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

- A. Ductile Iron Pipe:
1. AWWA/ANSI C115/A21.15.
 2. AWWA/ANSI C150/A21.50.
 3. AWWA/ANSI C151/A21.51.
- B. Fittings and Flanges:

1. AWWA/ANSI C110/A21.10.
 2. AWWA/ANSI C115/A21.15.
 3. Flanges drilled and faced per ASME B16.1 for both 125 and 250 psi applications.
- C. Nuts and Bolts:
1. Buried: Cadmium-plated meeting SAE AMS-QQ-P-416, Type 1, Class 2 (Cor-Ten) for buried application.
 2. Exposed: Mechanical galvanized ASTM B695, Class 40.
 3. Heads and dimensions per ASME B1.1.
 4. Threaded per ASME B1.1.
 5. Project ends 1/4 to 1/2 IN beyond nuts.
- D. Gaskets: See individual piping system requirements in Section 40 05 00.
- E. If mechanical coupling system is used, utilize pipe thickness and grade in accordance with AWWA C606.
- F. Polyethylene Encasement: See AWWA/ANSI C105/A21.5.
- G. See Piping Schedules in Section 40 05 00.

2.3 MANUFACTURED UNITS

- A. Couplings:
1. Flanged adaptors:
 - a. Unit consisting of steel or carbon steel body sleeve, flange, followers, Grade 30 rubber gaskets.
 - b. Provide units specified in the ACCEPTABLE MANUFACTURERS Article.
 - c. Supply flanges meeting standards of adjoining flanges.
 - d. The working pressure rating of the entire assembly shall be greater than or equal to the test pressure specified on piping schedule for each respective piping application.
 2. Compression sleeve coupling:
 - a. Unit consisting of steel sleeve, followers, Grade 30 rubber gaskets.
 - b. Provide units specified in the ACCEPTABLE MANUFACTURERS Article.

- c. Supply flanges meeting standards of adjoining flanges.
 - d. The working pressure rating of the entire assembly shall be greater than or equal to the test pressure specified on piping schedule for each respective piping application.
 - e. Provide field coating for buried couplings per AWWA C203.
3. Mechanical couplings:
- a. Use of mechanical couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Section 40 05 00.
 - b. Utilize units defined in the ACCEPTABLE MANUFACTURERS Article.

2.4 FABRICATION

- A. Furnish and install without outside coatings of bituminous material any exposed pipe scheduled to be painted.
- B. Furnish cast parts with lacquer finish compatible with finish coat.
- C. Glass Lining:
 - 1. Minimum two-coat process.
 - a. Base coat heated to solidly fuse glass to pipe surface.
 - b. Subsequent coat(s) heated to form integral bond with preceding coat.
 - 2. Final finish parameters:
 - a. Thickness: 8-12 mils.
 - b. Hardness: Above 5 on MOHS scale.
 - c. Density: 2.5-3.0 grams per cubic centimeter.
 - d. Metal to lining bonding: Capable of withstanding strain of 0.0001 IN/IN without damage to lining.
 - 3. Complete compatibility between fittings and piping.

2.5 LININGS AND COATINGS

- A. Where specified in piping schedule, provide linings to a minimum thickness of 40 mils.
 - 1. Polyethylene, "Polybond" by American Pipe.
 - 2. Polyurethane, "Polythane" by U.S. Pipe.
 - 3. Ceramic epoxy, "Protecto 401" by U.S. Pipe.

2.6 SOURCE QUALITY CONTROL

A. Factory Test:

1. Subject pipe to hydrostatic test of not less than 500 psi with the pipe under the full test pressure for at least 10 seconds.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Joining Method - Push-On Mechanical (Gland-Type) Joints:

1. Install in accordance with AWWA/ANSI C111/A21.11.
2. Assemble mechanical joints carefully according to manufacturer's recommendations.
3. If effective sealing is not obtained, disassemble, thoroughly clean, and reassemble the joint.
4. Do not overstress bolts.
5. Where piping utilizes mechanical joints with tie rods, align joint holes to permit installation of harness bolts.

B. Joining Method - Push-On Joints:

1. Install in accordance with AWWA/ANSI C151/A21.51.
2. Assemble push-on joints in accordance with manufacturer's directions.
3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
 - a. Use lubricant that is non-toxic, does not support the growth of bacteria, has no deteriorating effects on the gasket material, and imparts no taste or odor to water in pipe.
4. Assure the gasket groove is thoroughly clean.
5. For cold weather installation, warm gasket prior to placement in bell.
6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.

C. Joining Method - Flanged Joints:

1. Install in accordance with AWWA/ANSI C115/A21.15.
2. Extend pipe completely through screwed-on flanged and machine flange face and pipe in single operation.

3. Make flange faces flat and perpendicular to pipe centerline.
 4. When bolting flange joints, exercise extreme care to ensure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress, bending or torsional strains to be applied to cast flanges or flanged fittings.
 5. Allow one (1) flange free movement in any direction while bolts are being tightened.
 6. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
 7. Gradually tighten flange bolts uniformly to permit even gasket compression.
- D. Joining Method - Mechanical Coupling Joint:
1. Arrange piping so that pipe ends are in full contact.
 2. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
 3. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.
- E. Flange Adaptors 12 IN and Less:
1. Locate and drill holes for anchor studs after pipe is in place and bolted tight.
 2. Drill holes not more than 1/8 IN larger than diameter of stud projection.
- F. Cutting:
1. Do not damage interior lining material during cutting.
 2. Use abrasive wheel cutters or saws.
 3. Make square cuts.
 4. Bevel and free cut ends of sharp edges after cutting.
- G. Support exposed pipe in accordance with Section 40 05 00.
- H. Install buried piping in accordance with Section 40 05 00.
- I. Install restrained joint systems where specified in Section 40 05 00 under specific piping system.

3.2 FIELD QUALITY CONTROL

- A. Test piping systems in accordance with Section 40 05 00.

END OF SECTION

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SECTION 40 05 23
PIPE: STAINLESS STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless steel tubing, piping, fittings and appurtenances.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125 and 250).
 - b. B31.1, Power Piping.
2. ASTM International (ASTM):
 - a. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - b. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - c. A312, Standard Specification for Seamless, Welded, and Heavy Cold Worked Austenitic Stainless Steel Pipes.
 - d. A320, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
 - e. A530, Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.
 - f. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

- g. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 05 00.
3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
4. Fabrication details and welding procedure specifications for all work to be done under this Specification Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All Materials must meet American Iron and Steel Requirements

B. Tubing:

1. ASTM A269.
2. Filler material: Extra low carbon (ELC) with 0.03 percent maximum carbon.

C. Pipe, unless noted otherwise on individual piping system in Specification Section 40 05 00:

1. ASTM A778.
2. ASTM A312.

D. Pipe Fittings:

1. ASTM A774.

E. Flanges, unless noted otherwise on individual piping system in Specification Section 40 05 00:

1. Flat faced.
2. Welding neck or slip on type.
3. ASTM A182, Type 316L.

- F. Nuts, Bolts and Washers, unless noted otherwise on individual piping system in Specification Section 40 05 00:
 - 1. ASTM A320, Type 316.
 - 2. Two (2) nuts provided for 1 IN DIA bolt applications and larger.
- G. Elastomeric Bellows Type Expansion Joint (for hot air service):
 - 1. Refer to Section 40 05 00 for expansion joints for liquid service.
 - 2. Manufacturers:
 - a. Mercer Series 500 or equal.
 - 3. Two Arch construction.
 - 4. Material: EPDM (tube and cover)
 - 5. Restraint: Provide control rods sized to restrain joint at test pressure.
 - a. Materials: 316 stainless steel.
 - 6. Allow for minimum of 1 IN of lateral movement.
 - 7. Pressure Rating: Working pressure of joint equal or greater than test pressure of connecting piping. Provide minimum 25 psig rating.
- H. Gasket Material, unless noted otherwise on individual piping system in Specification Section 40 05 00:
 - 1. Rubber or neoprene.
 - 2. Temperature rating of 250 DegF.
- I. Flexible Metal Hose:
 - 1. General: Braided stainless steel flexible hose.
 - 2. Connections: Provide ANSI 125 flanged connections.
 - 3. Length: Minimum 12 IN or as noted on the Drawings.
 - 4. Pressure: Working pressure of hose equal or greater than test pressure of connecting piping.

2.2 FABRICATION

- A. All tube, piping, fitting product to be immersion pickled subsequent to manufacturing and fabrication operations and prior to shipping.
 - 1. Pickling solution of 6-10 percent nitric acid and 3-4 percent hydrofluoric acid.

2. Temperature and exact concentrations to be such only a modest etch is produced but all oxidation and ferrous contamination is removed from metal surface.
 3. All pickling solution residues are to be neutralized after pickling.
- B. Diameter tolerance and wall thickness tolerance are to conform to ASTM A530.
- C. Joints:
1. Shop welded circumferential buttweld joints.
 2. ASME B16.1, Class 150.
- D. Elastomeric Bellows Type Expansion Joints:
1. Ensure aerial travel in expansion joints of 3.1 IN minimum for 15,000 cycles or 5.2 IN for 1000 cycles.
 2. Furnish each assembly with a minimum of two control tie rods.
 3. Fabricate with 125 LB flanged end connections.
- E. Expansion Joints:
1. Fabricate for 15 psi internal pressure and 250 DegF operation.
 2. Ensure aerial travel in expansion joints of 3.1 IN minimum for 15,000 cycles or 5.2 IN for 1000 cycles.
 3. Furnish each assembly with minimum four control tie rods.
 4. Fabricate with 125 LB flanged end connections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation, inspect and verify condition of piping and appurtenances.
1. Installation constitutes installer's acceptance of condition for satisfactory installation.

3.2 PREPARATION

- A. Correct defects or conditions which may interfere with or prevent a satisfactory installation.
- B. Ensure ends of pipe to be fitted with flanges have all protrusions ground flush.

3.3 INSTALLATION

- A. Ensure all pipe cutting, threading and jointing conforms to requirements of ASME B31.1.
1. Lubricate all pipe threads with Teflon tape.
- B. Welding:
1. Provide welds sound and free from embedded scale or slag, and tensile strength at weld not less than pipe.
 2. Perform butt welds only with an inert gas shielded process.
 3. Adequate inert gas protection is to be provided to the top and under or backside of the weld to protect from atmospheric contamination.
 4. Filler metal is to be applied to all manually-performed welds appropriate for the base material being welded.
 5. Only inert gas shielded welding processes are to be used for spool fabrication.
 6. Provide butt welds with 100 percent penetration to the interior or back side of the weld joint.
 7. Weld reinforcement on both sides of the weld are to be smooth, uniform and no more than 1/16 IN in height.
- C. Joining Method - Flanges:
1. Leave 1/8 IN to 3/8 IN flange bolts projecting beyond face of nut after tightening.
 - a. Coordinate dimensions and drillings of flanges with flanges for valves, equipment, and other systems.
 - b. Tighten bolts evenly around pipe until following range of torques is achieved:

| BOLT SIZE, IN | RANGES OF TORQUE, FT/LBS |
|---------------|--------------------------|
| 5/8 | 40 - 60 |
| 3/4 | 60 - 90 |
| 1 | 70 - 100 |
| 1-1/4 | 90 - 120 |

- D. Expansion Joints:
1. Install in accordance with manufacturer's instructions.

2. Apply anti-seize compound to all exposed steel threads.

3.4 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Specification Section 40 05 00.

3.5 CLEANING

A. Clean in accordance with Specification Section 40 05 00.

END OF SECTION

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SECTION 40 05 25

PIPE: UNDERGROUND, PREFABRICATED, INSULATED AND JACKETED

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Prefabricated, insulated and jacketed piping.

B. Related Sections include but are not necessarily limited to the following:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
4. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.
5. Section 40 41 13 – Heat Tracing Cable.

1.2 QUALITY ASSURANCE

A. See Section 40 05 00.

B. See Section 40 05 33

1.3 SYSTEM DESCRIPTION

A. Provide underground piping for water system piping.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Section 40 05 00.
3. Product technical data including:
 - a. Complete system layout and details:
 - 1) Indicating amount of expansion.
 - 2) Indicating provisions for system expansion.
 - b. Anchorage.

- c. Component details.
 - d. Location of miscellaneous fittings including anchors and seals.
 - e. Field closures.
 - f. Location of field joints.
 - g. Detail of requirement for two (2) flexible joint systems at each structure.
 - 1) Instructions for assembly of these joints.
4. Detailed piping and penetration drawings.
 - a. Minimum scale 1/2 IN equal 1 FT.
 - b. Details to be specific and to include:
 - 1) Flexible joint details.
 - 2) Floor and foundation elevations.
 - 3) Final grades.
 - 4) Anchors.
 - 5) Sleeves.
 - 6) Seals.
 - 7) Crossovers and related items.
 5. Factory test report.
 6. Field hydrostatic test report.
- B. Contract Closeout Information:
1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Rovanco Corporation, Joliet, Illinois.
 2. Or equal
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. Service Pipe:

1. PEX Service Pipe pre-insulated with polyurethane foam insulation and enclosed with high density polyethylene jacket

B. Insulation:

1. Foamed polyurethane.
2. "K" factor ≤ 0.15 Btu/HR SF/DegF/IN at 75 DegF.
3. Density ≥ 1.8 LB/CF.
4. Thickness ≥ 1 IN.
5. Provide additional thickness in expansion loops to maintain minimum 1-1/2 IN thickness after pipe expansion.

C. Vapor Seal Jacket:

1. Buried Service Jacket shall be: High Density Polyethylene (HDPE).
2. Exterior Exposed Service shall be Aluminum Spiral type with impact and chemical resistance equivalent to H-14 Temper T-3003 in accordance with ASTM B 313

D. Joints:

1. Comply with Section 40 05 00.
2. Fusion Welded Joints.
3. Factory supplied insulation closure kit including foam insulation filler kit, diffusion barrier and adhesive lined heat shrink closure
4. Heat Shrink/wrap outer cover.

E. Anchors:

1. Steel plate minimum 1/4 IN thick.
2. Coat exposed steel with jacket material.
3. Concrete collar.

F. Fittings

1. Pre-insulated, factory fabricated long radius elbows, tees, and reducers with fusion weld ends.
2. Factory supply PEX to NPT male fittings for all transitions to other piping systems.

G. Flanges

1. As required to connect to piping systems
2. Factory supplied flange to match PEX to NPT Male transition fittings.

H. Bolting/Nuts at Flanges

1. Type 316 SST, ASTM A320/A320M Grade B8M hex head bolt kits and ASTM A194/A194M Grade 8M hex head bolts

I. Gaskets at Flanges

- a. 1/8 inch thick, EPDM, hardness 60

2.3 ACCESSORIES

A. Pipe Accessories:

1. End seals.
2. Elbows.
3. Tees.
4. Field joint closures.
5. Insulated flexible joint system.
6. Factory-fabricated expansion/contraction loops and anchors to prevent moisture ingress.

B. Wall Penetration Accessories:

1. Wall sleeve with water stop and seals per Section 01 73 20.

2.4 FABRICATION

A. Pre-insulated Pipe:

1. Fabricate pre-insulated pipe up to 2000 FT roll lengths without fittings.
2. Factory fabricate pre-insulated pipe sections with fittings capable of absorbing expansion with anchors and other accessories to job dimensions.
3. Polyethylene jacketed pipe:
 - a. End seal for each joint.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Observe manufacturer's recommendation for handling, cutting, jointing, installing, and testing.
- B. Trenching, Backfilling, and Compaction:
 - 1. See Section 31 23 33.
 - 2. Comply with manufacturer's recommendations where they are more stringent.
- C. Anchors:
 - 1. Provide anchors at each take-off point, as required by the system.
 - 2. Anchors to be welded to the pipe and extend beyond the jacket.
- D. Expansion Loops:
 - 1. Provide expansion loops as required for system integrity.
 - 2. Provide elbows with flexibility for maximum pipe movement.
 - 3. Provide pipe guides at expansion loops and between loops to assure longitudinal pipe movement.

3.2 FIELD QUALITY CONTROL

- A. Tests:
 - 1. See Section 40 05 00.
- B. Manufacturer's Field Service:
 - 1. Factory-trained field service person present for minimum of three (3) working days including two (2) site visits.
 - 2. Factory-field service person visits to provide instruction for installation and testing and to verify installation is being performed in accordance with manufacturer's recommendations.

END OF SECTION

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SECTION 40 05 31

PIPE: PLASTIC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic pipe.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. See Specification Section 40 05 00.

B. Referenced Standards:

1. ASTM International (ASTM):

- a. PVC (polyvinyl chloride) materials:

- 1) D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 2) D1785, Standard Specification for Poly(Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80 and 120.
 - 3) D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 4) D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 5) D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 6) D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 7) F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - 8) F679, Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

- 9) F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
 - 10) F949, Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings.
- b. Installation:
- 1) D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
2. American Water Works Association (AWWA):
- a. PVC (polyvinyl chloride) materials:
 - 1) C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN Through 12 IN, for Water Distribution.
 - 2) C905, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 IN through 48 IN, for Water Transmission and Distribution.
 - b. Polyethylene (PE) materials:
 - 1) C901, Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 IN through 3 IN, for Water Service.
3. National Sanitation Foundation International (NSF).

1.3 SUBMITTALS

- A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- B. See Specification Section 40 05 00.

PART 2 - PRODUCTS

2.1 PVC PRESSURE PIPING (EXPOSED)

- A. General:
 - 1. Provide Schedule 80 pipe with Schedule 80 fittings and appurtenances to locations shown on Drawings.
 - 2. Furnish materials in full compliance to following material specifications:
 - a. Manufacture pipe, fittings and appurtenances from polyvinyl chloride (PVC) compound which meets the requirements of Type 1, Grade 1 (12454-B) Polyvinyl Chloride as outlined in ASTM D1784.
 - b. Manufacture pipe, fittings and valves from materials that have been tested and approved for conveying potable water by the NSF.

B. Pipe:

1. Furnish pipe meeting requirements of ASTM D1785.
2. Pipe 2 IN and less to be solvent welded.
3. Pipe larger than 2 IN may be either flanged or solvent welded unless shown otherwise on Drawings.

C. Fittings: Provide ASTM D2467 PVC socket type fittings having the same pressure and temperature rating as the pipe.

D. Flanges/Unions:

1. Furnish flanges and unions at locations shown on Drawings.
2. Provide either flanges or unions at valves, penetrations through structures and equipment connections.
3. For pipe larger than 2 IN, provide 150 LB socket type PVC flange.
4. For pipe 2 IN and less, provide socket type PVC union with Buna O-rings.
5. Use flat, full faced natural rubber gaskets at flanged connections.
 - a. Furnish heavy hex head bolts, each with one (1) heavy hex nut, ASTM F593 Type 316 stainless steel.
6. Use spacers supplied by pipe manufacturer when mating raised-faced flanges to other flanges.

E. Installation:

1. Field threading PVC will not be permitted.
 - a. Perform required threaded connections or attachments by the use of factory molded socket by threaded adapters.
 - b. Female adapters are not acceptable.
2. Employ installation and pipe support practices and solvent welding all in compliance to the manufacturer's printed recommendation.
 - a. Continuously support PVC piping at liquid operating temperatures in excess of 100 DegF.
 - b. For vertical piping, band the pipe at intervals to rigidly support load of twice vertical load.
 - c. Support riser clamps on spring hangers.
 - d. Do not clamp PVC tightly or restrict movement for expansion and contraction.

2.2 CPVC PRESSURE PIPING (EXPOSED)

A. General:

1. Provide Schedule 80 pipe with Schedule 80 fittings and appurtenances to locations shown on Drawings.
2. Furnish materials in full compliance to following material specifications:
 - a. Manufacture pipe, fittings and appurtenances from chlorinated polyvinyl chloride (CPVC) compound which meets or exceeds the requirements of ASTM D-1784, Type IV, Grade 1, cell classification 23447B
 - b. Pressure pipe used in fabrication must be listed by the National Sanitation Foundation (NSF) for potable water applications
 - c. All solvent cements used, to conform to ASTM F493, listed by NSF for potable use applications.

B. Pipe:

1. Furnish pipe meeting requirements of ASTM D1784.
2. Pipe 2 IN and less to be solvent welded.
3. Pipe larger than 2 IN may be either flanged or solvent welded unless shown otherwise on Drawings.

C. Fittings: Provide ASTM F439 CPVC socket type fittings having the same pressure and temperature rating as the pipe.

D. Flanges/Unions:

1. Furnish flanges and unions at locations shown on Drawings.
2. Provide either flanges or unions at valves, penetrations through structures and equipment connections.
3. For pipe larger than 2 IN, provide 150 LB socket type CPVC flange.
4. For pipe 2 IN and less, provide socket type CPVC union.
5. Use flat, full faced natural rubber gaskets at flanged connections.
 - a. Furnish heavy hex head bolts, each with one (1) heavy hex nut, ASTM F593 Type 316 stainless steel.
6. Use spacers supplied by pipe manufacturer when mating raised-faced flanges to other flanges.

E. Installation:

1. Field threading CPVC will not be permitted.
 - a. Perform required threaded connections or attachments by the use of factory molded socket by threaded adapters.
 - b. Female adapters are not acceptable.
2. Employ installation and pipe support practices and solvent welding all in compliance to the manufacturer's printed recommendation.
 - a. Continuously support CPVC piping at liquid operating temperatures in excess of 100 DegF.
 - b. For vertical piping, band the pipe at intervals to rigidly support load of twice vertical load.
 - c. Support riser clamps on spring hangers.
 - d. Do not clamp CPVC tightly or restrict movement for expansion and contraction.

2.3 PVC DRAINAGE AND SEWER PIPING

A. Materials:

1. Furnish materials in full compliance to the following material specification.
2. PVC pipe shall be rigid, unplasticized polyvinyl chloride (PVC) made of PVC plastic having a cell classification of 12454-B or 12454-C as described in specification ASTM D1784.
3. The requirements of this Specification are intended to provide for pipe and fittings suitable for non-pressure drainage of wastewater and surface water.
4. Joining systems shall consist of an elastomeric gasket joint meeting requirements of ASTM D3212.
5. Supply to the Engineer all information and sample of joining method for his evaluation.
 - a. Only jointing methods acceptable to the Engineer will be permitted.
6. Provide pipe and fittings meeting or exceeding the following requirements:
 - a. 4-27 IN DIA: ASTM D3034 and ASTM F679, SDR 35.
 - b. 8-30 IN DIA: ASTM F794.
 - c. 4-18 IN DIA: ASTM F949.
7. Ensure impact strengths and pipe stiffness in full compliance to these Specifications.

- B. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.
 - 1. Provide for a maximum deflection of not more than 5 percent.
- C. Infiltration and Exfiltration:
 - 1. The maximum allowable infiltration measured by test shall not exceed 100 GAL per inch of pipe diameter per mile per 24 HRS.
 - 2. For exfiltration, all the pipe and fittings shall exceed performance requirements by an air test procedure as specified in Section 40 05 00.
 - 3. Observe full instructions of the Engineer for carrying of testing procedures.
 - a. Perform tests only during presence of the Engineer or his authorized representative.
 - 4. Should any test on any section of pipe line disclose either infiltration rates greater than allowed or disclose air loss rate greater than that permitted, locate and repair the defective joints or pipes at no cost to Owner and retest until requirements stated are met.
- D. Deflection:
 - 1. After backfilling, each section of pipe shall be checked for deflection by pulling a mandrel through the pipe.
 - 2. Pipe with deflection exceeding 5 percent of the inside diameter shall have backfill removed and replaced to provide a deflection of less than 5 percent.
 - 3. Any repaired pipe shall be retested.

2.4 PVC TUBING

- A. General: Provide nylon tubing with fittings and appurtenances as shown on Drawings.
- B. Materials:
 - 1. Furnish clear outer braided tubing with braid outside the walls.
 - 2. Have tubing manufactured of nylon with working temperatures from 5 to 180 DegF.
 - 3. Design tubing with a minimum safety factor of 4 to 1 ratio of burst pressure to working pressure at maximum temperature.
 - 4. Provide tubing with working pressure of 75 psi at 180 DegF.
 - 5. Ensure that tubing is self-extinguishing and fire resistant.
- C. Fittings:

1. Install tubing with nylon fittings and connectors.
2. Use barbed type adapters with stainless steel clamps.
3. Provide fittings capable of withstanding temperatures from a -70 to 250 DegF.
4. Ensure fittings have the same pressure and temperature rating as the tubing.

PART 3 - EXECUTION

3.1 IDENTIFICATION

- A. Identify each length of pipe clearly at intervals of 5 FT or less.
1. Include manufacturer's name and trademark.
 2. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications and NSF approvals when applicable.

3.2 PVC DRAINAGE AND SEWER PIPING

- A. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.
1. Provide for a maximum deflection of not more than 5 percent.
- B. Infiltration and Exfiltration:
1. The maximum allowable infiltration measured by test shall not exceed 100 GAL per inch of pipe diameter per mile per 24 HRS.
 2. For exfiltration, all the pipe and fittings shall exceed performance requirements by an air test procedure as specified in Section 40 05 00.
 3. Observe full instructions of the Engineer for carrying of testing procedures.
 - a. Perform tests only during presence of the Engineer or his authorized representative.
 4. Should any test on any section of pipe line disclose either infiltration rates greater than allowed or disclose air loss rate greater than that permitted, locate and repair the defective joints or pipes at no cost to Owner and retest until requirements stated are met.
- C. Deflection:
1. After backfilling, each section of pipe shall be checked for deflection by pulling a mandrel through the pipe.

2. Pipe with deflection exceeding 5 percent of the inside diameter shall have backfill removed and replaced to provide a deflection of less than 5 percent.
3. Any repaired pipe shall be retested.

3.3 PVC TUBING

A. Fittings:

1. Install tubing with nylon fittings and connectors.
2. Use barbed type adapters with stainless steel clamps.
3. Provide fittings capable of withstanding temperatures from a -70 to 250 DegF.
4. Ensure fittings have the same pressure and temperature rating as the tubing.

END OF SECTION

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SECTION 40 05 33
PIPE: POLYETHYLENE (HDPE)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyethylene pipe.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.
4. Section 40 05 35

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - b. A197, Standard Specification for Cupola Malleable Iron.
 - c. D638, Standard Test Method for Tensile Properties of Plastics.
 - d. D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
 - e. D1693, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
 - f. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
 - g. D2513, Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
 - h. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
 - i. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

- j. D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- 2. Society for Protective Coatings (SSPC):
 - a. SP 3, Power Tool Cleaning.

1.3 DEFINITIONS

- A. SDR: Standard Dimension Ratio.
- B. IPS: Iron Pipe Size.
- C. CTS: Copper Tube Size.
- D. ESCR: Environmental Stress Crack Resistance.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. See Specification Section 40 05 00.
 - 3. Certifications:
 - a. Installer certification.
 - 4. Field quality control documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers of PE pipe are acceptable:
 - 1. Phillips Driscopipe.
 - 2. Plexco.
 - 3. Polypipe.
- B. See Specification Section 40 05 00.
- C. Submit request for substitution in accordance with Specification Section 01 25 13.
- D. Schedule:

2.2 PE 3408 PIPING

A. General:

1. Provide PE 3408 piping with fittings and appurtenances to locations shown on Drawings.
2. Furnish materials in accordance with ASTM D2513 and full compliance to the following material specifications:
 - a. Material description: ASTM D1248, Type III, Class C, Category 5, Grade P34.
 - b. Cell classification: ASTM D3350, PE 345434C.
 - c. ESCR: ASTM D1693, condition C, $F_o > 5,000$ HRS.
3. Modulus of elasticity: ASTM D638, 130,000 psi.
4. Hardness: ASTM D2240, 65 Shore D.
5. SDR: 26.0}
6. IPS for line size greater than 1 IN.
7. CTS for line size less than or equal to 1 IN.

B. Fittings:

1. ASTM D2513.
2. SDR: 11.0.
3. 1/2 to 3 IN: ASTM D2683.
4. 4 to 10 IN: ASTM D3261.
5. End connections:
 - a. Socket fused ends for fittings 1 IN and under.
 - b. Butt-fused ends for fitting 1-1/2 IN and greater.
6. Use IPS reducers on the service mains.
7. Use tapping tees or straight outlet service saddles to join service lines to the main.
8. Mitered or field fabricated fittings are not allowed.

C. Installation: Install pipe and fittings in accordance with ASTM D2774 and as recommended by the manufacturer.

1. Provide for a maximum deflection of not more than 5 percent.

2. PE 3408 shall not be field threaded and such threaded joints shall not be used in gas distribution systems.

D. Deflection:

1. After backfilling, each section of pipe shall be checked for deflection by pulling a mandrel through the pipe.
2. Pipe with deflection exceeding 5 percent of the inside diameter shall have backfill removed and replaced to provide a deflection of less than 5 percent.
3. Any repaired pipe shall be retested.

E. Utility Inter-Tie:

1. Provide insulated flange to connect to utility meter station.
2. Above ground piping shall be Schedule 40, ASTM A53.
3. Provide in accordance with Drawings.
4. Paint exposed steel piping.
 - a. Prep in accordance with SSPC SP 3.
 - b. Paint pipe with Tnemec Series 66: Two (2) coats at 3 mils DFT and one (1) coat Series 74 at 2.5 mils DFT.

F. PE 3408 to Steel Transition Fittings:

1. When connecting plastic to steel use either Universal Maxi-Grip Coupling or weld-in transition fitting.
2. Universal Maxi-Grip Coupling:
 - a. Match coupling size with pipe size.
 - b. For 1-1/4 IN IPS and 2 IN IPS Maxi-Grip provide sheer sleeve protector.
3. Install according to Maxi-Grip Fitting Installation Procedures.
 - a. Construction:
 - 1) 12 IN long steel nipple, swaged at one end and weld bevel of 37-1/2 on the other.
 - a) Closed grooves machined on inside of diameter of the swaged section.
 - b) Plastic pipe with a steel insert pushed into the swaged end shall form a joint stronger than the yield strength of the plastic pipe.
 - c) Steel nipple shall be coated with heat fused epoxy.
 - 2) Firmly pack and bed the sleeve to its final grade with sand or sand/clay mixture.

- a) Manually backfill and tamp the bellhole to ensure the sleeve is centered around the pipe and the pipe and transition fitting are well supported.
- b. Installation:
 - 1) Connect the steel side of the transition fitting to steel pipe by welding.
 - a) During installation, prevent plastic pipe portion of fitting from being overheated by wrapping wet cloths around plastic pipe portion of fitting before welding.
 - b) After second weld pass, stop and allow joint to cool for at least 5 minutes then continue with final pass.
 - 2) During welding process, keep the cloths wet.
 - a) Do not remove wet cloths until you can put your hand on the weld area.
 - 3) Before fusion of the plastic, place a protective sleeve over the steel section of the fitting.
 - a) See the following table for protective sleeve size.
 - 4) Join the plastic side of the transmission fitting to the plastic pipe by heat fusion.
 - a) Position protective sleeve to proper cantilever length as indicated on the following table.
 - 5) Firmly pack and bed the sleeve to its final grade with sand or sand/clay mixture.
 - a) Manually backfill and tamp the bellhole to ensure the sleeve is centered around the pipe and the pipe and transmission fitting are well supported.

4. Transition fitting and protective sleeve sizes:

| TRANSITION FITTING | PROTECTIVE SLEEVE SIZES | | | |
|--------------------|-------------------------|--------|---------|---------|
| 1 IN CTS | 1-1/4 IN | 1.8 IN | 13.8 IN | 10.8 IN |
| 2 IN IPS | 2 IN | 4.7 IN | 23 IN | 19 IN |
| 3 IN IPS | 3 IN | 6.0 IN | 28 IN | 23 IN |
| 4 IN IPS | 4 IN | 7.0 IN | 34 IN | 29 IN |

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify each length of pipe clearly at intervals of 5 FT or less.

- 1. Include manufacturer's name and trademark.

2. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications, and "NSF" approvals when applicable.

3.2 INSTALLATION

A. See Specification Section 40 05 00.

B. General:

1. Install buried pipe as indicated on Drawings.
2. Remove and extract internal fusion bead from all pipe.
 - a. Contractor shall provide verification to the Engineer that all internal fusion beads are removed. CCTV shall be used to verify removal of internal bead.
 - b. Extracted Internal Fusion Bead appearance to have similar double roll bead semblance as external fusion bead.
 - c. Removal of the internal bead wall mass not to exceed 1/10th of pipe wall thickness.
3. Contractor shall insure that kinking or excessive bend diameters of the pipe do not occur during the installation process.
4. Contractor shall insure that the pipe installed in the trench is firmly supported.
5. Contractor shall cap all open pipe ends at the end of the work day.
6. All installed valves shall be tested in the presence of the Engineer.
 - a. All repairs deemed necessary by the Engineer shall be made by the Contractor.
7. Contractor shall remove any cave-in portions of the trench prior to placing sand bagging around the pipe.
8. HDPE pipe and fittings shall be by the same manufacturer.
 - a. The minimum strength of the fittings shall not be less than that of the pipe.
9. Service taps shall be installed as shown on the Drawings.
10. Changes in direction of PE Pipe:
 - a. Pipe may be cold-bent to minimum radius of 20 times the pipe diameter as it is installed.

- b. If fittings or fusions are present in the bend, the minimum recommended cold bending radius is 125 times the outside diameter of the pipe.

11. Remove cutting and threading burrs.

C. Joining Procedures:

1. HDPE pipe joints shall be fused on the surface prior to installation into the trench.
 - a. Alternative methods of fusing shall be approved by the Engineer.
 - b. PE pipe 1 IN and under shall be socket fused.
 - c. PE pipe joints 1-1/2 IN and over shall be butt fused.
2. Fusion joiner must be qualified by type of fusion (i.e., butt fusion, socket fusion or sidewall fusion) and fuse pipe only as qualified.
3. Each joint must be visually inspected inside and outside for damage, dirt, moisture, or any other abnormalities prior to fusing.
4. All joint fusion shall be performed in strict accordance with the manufacturer's specifications.
5. All fusion equipment must be approved by the manufacturer and operated by qualified and certified operators.
 - a. Cost for testing and certifying personnel shall be born by the Contractor.

END OF SECTION

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SECTION 40 05 35
PIPE: ARCTIC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Arctic piping, fittings, and appurtenances.

B. Related Sections include but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.
4. Section 40 41 13 – Heat Tracing Cable.

1.2 SUBMITTALS

A. Shop Drawings:

1. See Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Section 40 05 00.
3. See Section 40 41 13.
4. Detailed piping and penetration drawings.
 - a. Minimum scale 1/2 IN equal 1 FT.
 - b. Details to be specific and to include:
 - 1) Joint details.
 - 2) Floor and foundation elevations.
 - 3) Final grades.
 - 4) Anchors.
 - 5) Sleeves.
 - 6) Seals.
 - 7) Crossovers and related items.
5. Factory test reports.

- 6. Field hydrostatic test report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Arctic Insulation and Manufacturing.
 - 2. Or equal.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 SYSTEM COMPONENTS

- A. Core Pipe
 - 1. All core pipe shall be made of materials as listed in piping system schedules specified in Section 40 05 33.
- B. Insulation
 - 1. Insulation between core pipe and outer jacket of all pipe and fittings shall be low-density rigid closed-cell urethane insulation with a nominal thickness as shown on the drawings. It shall be applied and cured in strict accordance with the manufacturer's recommendations and good commercial practices such that the resulting insulation completely fills the annular space between core pipe and outer jacket and is free of defects affecting its intended purpose.
 - 2. Urethane insulation shall exhibit the following properties and characteristics specified by the referenced ASTM tests below.

| | | | |
|------------|----|--|------------------------------------|
| ASTM C518 | or | Maximum K-factor, as produced | 0.15 btu-in/hr-ft ² -°F |
| C177 | | | |
| ASTM D1622 | | Core Density Range | 3.0 to 4.0 lbs/ft ³ |
| ASTM D1621 | | Minimum Compressive Strength (parallel and perpendicular to pipe axis) | 35 psi |
| ASTM D2842 | | Maximum Water Absorption | 0.05 lb/ft ³ |
| ASTM D2126 | | Dimensional Stability (Maximum Linear Change) | 1% at -20°F 3% at +100°F |

- 3. Exposed urethane insulation faces at pipe and fitting ends shall be coated to protect against physical abuse, UV exposure during shipping and storage, and against water intrusion in service. The coating shall be suitable for direct application over urethane insulation with no deleterious

effects to the insulation or coating. The coating shall be formulated for long-term service and retained flexibility over extended periods of exposure to sunlight, harsh weather, and saltwater spray. The strength of the adhesive bond of the coating to the insulation shall be greater than the tensile strength of the coating. In the event the coating is nicked or an edge is rolled up in handling, the coating that has been dislodged shall tear free from the coating still adhering to the insulation rather than pull the balance of the coating off as a sheet.

4. The coating shall be applied and cured in strict accordance with the manufacturer's recommendations and good commercial practice such that the finished product is free of defects affecting its intended purpose.
5. The coating material shall exhibit the following properties and characteristics:

| | | | |
|-----------|----|-------------------------------|---------------|
| ASTM E398 | or | Maximum Water Vapor Permeance | 1.0 perm |
| E96 | | Dry Film Thickness Range: | 15 to 63 mils |

C. Metal Outer Jacket

1. Metal outer jackets for pipe and fittings shall be constructed of 16-gauge internal helical lock-seam corrugated aluminum pipe. Aluminum alloy material shall be 3004-H34 with a 7072 coating on the outside of the jacket or 5052-H32. All helical seams shall be continuous, tightly locked and folded. The outer jacket of all pipe and fittings shall be watertight under a five-foot head of water.
2. The outer jacket corrugations shall be between 3/16-inch and 3/8-inch deep as measured from the flat area between corrugations to the bottom of the corrugation on the outside of the jacket and shall be spaced no more than 2 2/3-inches apart and formed diagonally around the pipe, resulting in not less than 2 nor more than 10 complete corrugations crossing the pipe's circumference at a given cross-section.
3. The nominal diameter shall be the inside diameter as measured between the innermost portion of the corrugations, with a dimensional tolerance of +1/2".
4. All joints in the aluminum outer jacket fabricated around fittings shall be welded with a continuous bead, resulting in a finished jacket that is watertight per the requirements of section 2.3A.
5. The Contractor shall provide company name and production date (month and year) on the outer jacket of each pipe and fitting. Information shall be engraved on aluminum jackets with 1/8-inch to 1/4-inch high lettering within 24" of one end of the jacket.
6. All surfaces of the outer jacket, including end-cuts and welds, shall be finished such that no jagged edges exist that could cause personal injury.

7. The interior of the jacket shall be free of oils, grease, or other residue that could interfere with the adhesion of insulation to the outer jacket.
8. Outer jacket shall be Spir-I-ok aluminum pipe by Spiraltec or approved equal.

D. Heat Trace Channel

1. Heat trace channels shall be fully enclosed, in direct contact with the core pipe for its entire length, and there shall be no intrusion of insulation between the heat trace channel and the core pipe unless otherwise specified.
2. Heat trace channels for all straight lengths of pipe shall be made of PE or ABS material and shall be half-moon shaped with inside dimensions of 1 1/2-inches to 1 3/4-inches wide by 3/4-inch to 1-inch high and installed as shown on the drawings. The heat trace channel shall extend 2-inches past the insulation face of the pipe, with ends cleanly cut, square, smooth, and free from burrs or other protrusions that could interfere with installing the heat trace in the field, as shown in the drawings.
3. Heat trace channels installed along angular bends of fittings shall be constructed with 1-1/2-inch diameter flexible, liquid-tight PVC non-metallic conduit. Conduit material shall be nonconductive and non-corrosive, with a smooth interior surface that will maintain the internal diameter in tight radius bends. Conduit material shall be UL listed for outdoor use. A transition fitting shall be installed on all ends of heat trace channel that results in a half-moon channel protruding from the insulation face as specified for straight pipe channel. All transition fittings shall be constructed with smooth interiors, free from burrs or other protrusions that could interfere with installing the heat trace in the field, as shown in the drawings.
4. Pieces of half-moon heat trace channel to fit within the joint area (jumpers) shall be provided with each piece of pipe and with each fitting. The jumpers must be sized to slip snugly over the outside of the specified straight pipe heat trace channel with an overlap of not less than 1 1/2-inches on each side after a typical field fusion of individual lengths of pipe.

E. See Piping Schedules in Section 40 05 00.

2.3 SOURCE QUALITY CONTROL

A. Factory Test:

1. Subject pipe to hydrostatic test of not less than 500 psi with the pipe under the full test pressure for at least 10 seconds.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. In accordance with manufacturer's recommendations.
- B. In accordance with Section 40 05 00.

3.2 FIELD QUALITY CONTROL

- A. Test piping systems in accordance with Section 40 05 00.

END OF SECTION

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SECTION 40 05 51
VALVES: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Valving, actuators, and valving appurtenances.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 01 61 03 - Equipment: Basic Requirements.
 - 4. Section 09 96 00 - High Performance Industrial Coatings.
 - 5. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B1.20.1, Pipe Threads, General Purpose.
 - b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - c. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - b. D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
 - c. D638, Standard Test Method for Tensile Properties of Plastics.
 - d. D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
 - e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.

- f. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
3. American Water Works Association (AWWA):
 - a. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
 - b. C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
 - c. C504, Standard for Rubber-Seated Butterfly Valves.
 - d. C509, Standard for Resilient-Seated Gate Valves for Water Supply Service.
 - e. C550, Standard for Protective Coatings for Valves and Hydrants.
 4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 5. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. MG 1, Motors and Generators.

1.3 DEFINITIONS

- A. The following are definitions of abbreviations used in this Specification Section or one (1) of the individual valve sections:
 1. CWP: Cold water working pressure.
 2. WOG: Water, oil, gas working pressure.
 3. WWP: Water working pressure.

1.4 SUBMITTALS

- A. Shop Drawings:
 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.

- c. Valve pressure and temperature rating.
 - d. Valve material of construction.
 - e. Special linings.
 - f. Valve dimensions and weight.
 - g. Valve flow coefficient.
 - h. Wiring and control diagrams for electric or cylinder actuators.
3. Test reports.
- B. Contract Closeout Information:
- 1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, refer to individual valve Specification Sections for acceptable manufacturers.

2.2 MATERIALS

- A. Refer to individual valve Specification Sections.

2.3 VALVE ACTUATORS

- A. Valve Actuators - General:
 - 1. Provide actuators as shown on Drawings or specified.
 - 2. Counter clockwise opening as viewed from the top.
 - 3. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
 - 4. Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or chainwheel or 300 foot-pounds torque on the operating nut.
 - 5. Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.

6. Extension stem:
 - a. Install where shown or specified.
 - b. Solid steel with actuator key and nut, diameter not less than stem of valve actuator shaft.
 - c. Pin all stem connections.
 - d. Center in valve box or grating opening band with guide bushing.
 7. Provide valve OPEN and CLOSED limit switches having rating of not less than 6 A at 120 Vac (where noted in paragraph 3.2.A.1 under "Actuator" column).
- B. Exposed Valve Manual Actuators:
1. Provide for all exposed valves not having electric or cylinder actuators.
 2. Provide handwheels for gate and globe valves.
 - a. Size handwheels for valves in accordance with AWWA C500.
 3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller.
 - a. Lever actuators for butterfly valves shall have a minimum of 5 intermediate lock positions between full open and full close.
 - b. Provide at least two (2) levers for each type and size of valve furnished.
 4. Gear actuators required for plug valves, butterfly valves, and ball valves 4 IN DIA and larger.
 5. Provide gearing for gate valves 20 IN and larger in accordance with AWWA C500.
 6. Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.
 7. Provide chain actuators for valves 6 FT or higher from finish floor to valve centerline.
 - a. Cadmium-plated chain looped to within 3 FT of finish floor.
 - b. Equip chain wheels with chain guides to permit rapid operation with reasonable side pull without "gagging" the wheel.
 - c. For smaller valves with lever or handle operators, provide offset tee handles with attached chain for operation from the operating floor.
 8. Provide cast iron floor stands where shown on Drawings.

- a. Stands to be furnished by valve manufacturer with actuator.
- b. Stands or actuator to include thrust bearings for valve operation and weight of accessories.

C. Submerged Actuators:

1. Mount the valve actuator on top of an extension bonnet 3 FT above any adjacent personnel access.
2. The valve and bonnet connection shall be flanged and watertight.
3. Provide a top brace support for the bonnet.
 - a. Mount the brace 6 IN below the top of the wall as shown.
4. Materials:
 - a. Extension bonnet: Cast iron ASTM A126 or steel.
 - b. Brace and anchor bolts: Type 304 stainless steel.

D. Electric Actuators (480 V, 3 PH):

1. Acceptable Manufacturers:
 - a. Rotork – IQ3.
 - b. Limitorque – MX or QXM.
 - c. Or equal.
2. Design and Fabrication:
 - a. Input Power: 480 VAC, 3-Phase, 60 Hz.
 - b. Conform to AWWA C542.
 - c. Provide electric valve actuators with integral control devices and a remote pushbutton station, unless valve actuator control station is more than 6 FT above an operating floor; then provide a remote control station.
 - d. Furnish electric actuator integral with valve consisting of:
 - 1) Motor.
 - 2) Gearing.
 - 3) Handwheel.
 - 4) Limit and torque switches.
 - 5) Lubricants.
 - 6) Heating elements.

- 7) Wiring.
 - 8) Terminals for motor power and controls.
 - 9) Drive nut.
- e. Housing/enclosure:
- 1) Provide cast iron gear housing and cast iron load bearing enclosure.
 - 2) Non load bearing enclosure and housing: Aluminum or cast iron.
 - 3) Standard or Explosion-Proof enclosure as called out in the schedule:
 - a) Standard Enclosure: NEMA enclosure type 4X.
 - b) Explosion-Proof Enclosure: NEMA enclosure type 7, suitable for Class I, Division 2 hazardous locations.
 - 4) Provide O-ring seals for covers and entries.
 - 5) Terminal and limit switch compartment covers are to be fastened to gear housing by stainless steel fasteners with capture device to prevent loss.
- f. Motors:
- 1) Provide motors that are totally enclosed, high torque design made expressly for valve actuator service and capable of operating the valve under full differential pressure for complete open-close and reverse cycle of travel at least twice in immediate succession without overheating.
 - 2) Design motors in accordance with NEMA MG 1 standards, with Class B insulation, and to operate successfully at any voltage within 10 percent above or below rated voltage.
 - 3) Provide positive method to ensure motor bearings are permanently lubricated.
 - 4) Provide three (3) thermal switches imbedded in windings:
 - a) 120 degrees apart.
 - b) Provide motor shutdown at high temperature.
 - 5) Motor housing:
 - a) Aluminum or cast iron.
 - b) Totally enclosed nonventilated with cooling fins.
 - 6) Provide motor capable of operating in any position.
 - 7) Provide motor sealed from gear case to allow any mounting position.
 - 8) Provide motors suitable for 480 V, 3 PH, 60 Hz.
- g. Gearing:
- 1) Provide power gearing consisting of heat treated steel helical gears, carburized and hardened alloy steel worm, and alloy bronze worm

- gear, all grease or oil bath lubricated, designed for 100 percent overload, and effectively sealed against entrance of foreign matter.
- 2) Provide gearing mechanism constructed to permit field changes of reduction gear ratio.
 - 3) Design actuators so that motor comes up to speed before stem load is encountered in either opening or closing operation.
 - 4) Limit switch gearings and feedback device reduction gearing:
 - a) Steel or bronze.
 - 5) Support rotating shafts with anti-friction bearings.
 - 6) Provide separate drive nut/thrust bearing assembly:
 - a) Mounted to base of actuator.
 - b) High tensile bronze.
 - c) Quarter turn actuator: Provide 90 degree mounting intervals.
 - d) Provide grease fitting on drive assembly.
- h. Handwheel:
- 1) Permanently attached for manual operation.
 - 2) Positive declutch mechanism to engage and disengage handwheel.
 - 3) Handwheel shall not rotate during motor operation.
 - 4) Inoperable motor shall not prevent manual operation.
- i. Limit torque and thrust loads in both closing and opening directions by torque limit switches.
- 1) Provide torque switches with micrometer adjustment and reference setting indicator.
 - a) Assure adjustment variation of approximately 40 percent in torque setting.
 - 2) Provide switches having rating of not less than 6 A at 120 Vac and 2.2 A at 115 Vdc.
 - 3) Limit and torque switches shall have totally sealed contacts.
- j. Furnish electric actuator with two (2) geared limit switch assemblies with each switch assembly having four (4) separate limit switches:
- 1) Assure each limit switch assembly is geared to driving mechanism and is independently adjustable to trip at any point at and between the fully open and fully closed valve position.
 - 2) Provide minimum of two (2) normally open contacts and two (2) normally closed contacts at each end of valve travel.
 - 3) Provide switches with inductive contact rating of not less than 6 A at 120 Vac, 3 A at 240 Vac, 1.5 A at 480 Vac, 2.2 A at 115 Vdc and 1.1 A at 230 Vdc.

- 4) Limit switches shall be fully adjustable when power is applied to actuator.
- k. Provide space heating elements sized to prevent condensation in both motor and geared limit switch compartment(s).
- 1) Furnish heating elements rated at 120 Vac with heaters continuously energized.
- l. The control package shall incorporate a digital microprocessor controller. The control unit shall include the following features as a minimum:
- 1) A phase discriminator shall ensure proper rotation direction of the motor regardless of the connection of the power phase leads to the operator.
 - 2) All settings of the microprocessor shall be password protected.
 - 3) All adjustments of the microprocessor shall be configurable by both portable handheld programmer and from a personal computer.
 - 4) Configuration adjustments from both the portable programmer and the personal computer shall be made without opening the operator enclosure via optical (or similar) data coupling technology.
 - 5) Personal computer configuration: Microsoft Windows 10 operating system compatible software, cable and interface module required to allow operator configuration and diagnostics from a personal computer shall be furnished by the operator manufacturer.
 - a) The personal computer shall be furnished by the OWNER.
 - b) The configuration software shall allow setup, adjustment and monitoring of all parameters in the operator microprocessor controller.
 - c) The software shall be furnished on CD complete with an executed licensing agreement for unlimited OWNER users.
 - 6) The operator shall have an integral LED display that includes indication of the following data as a minimum:
 - a) Valve position in percent of open in 1% increments.
 - b) Malfunction/diagnostics messages.
 - c) Full open, full close and in transition LED indicators.
 - d) Four (4) output contacts configurable for position indication.
 - e) One (1) output contact configured for operator controller switch in the REMOTE position.
- m. Open-Close Service Actuator Controls:
- 1) Provide control assembly with necessary holding relays, reversing starter, control transformers of sufficient capacity to provide control power, space heating element power and valve position transmitter.

- 2) Local Control Station, Stanchion Mounted:
 - a) Provide a remotely mounted control station for each actuator with the following features:
 - (1) Open pushbutton.
 - (2) Close pushbutton.
 - (3) Stop pushbutton.
 - (4) Remote/local switch.
 - (5) Full open light.
 - (6) Full close light.
 - (7) Open and close relays as required.
 - b) Provide control enclosure to accept:
 - (1) Remote open/close dry relay contacts.
 - c) Provide contacts in control enclosure:
 - (1) Remote/local contact.
 - (2) Full open contact.
 - (3) Full close contact.
 - (4) Fault contact.
 - d) Wire all components to an internal terminal strip and include mounted wiring diagram inside enclosure.
 - e) Stainless steel enclosure with NEMA 4X rating.
- n. Modulating Service Actuator Controls:
 - 1) Additional requirements for modulating valve actuators:
 - a) Operator rated for continuous duty with servo and shall be rated for 100 percent modulation operation.
 - b) Actuator torque shall be designed to operate at 1 ½ times the required operating torque. Motor torque shall not exceed that the valve torque capacity. Submittal shall provide verification of torque requirements and capacity.
 - c) Proportional position servo-amplifier mounted integral with the actuator control compartment.
 - d) Positioning of valve shall be proportional to a 4-20 mA signal input to the position servo-amplifier when remote control has been selected.
 - e) Servo-amplifier adjustments shall include zero, span, gain, and dead-band.
 - f) Provide 4-20 mA signal position control that interfaces with the position control/position feedback instrumentation wiring to and from the Plant Control System.

- g) Provide mounting bracket to mount operator to valve and provide minimal torque to piping system when in operation.

E. Electric Actuators (120 V, 1 PH):

1. Acceptable Manufacturers:

- a. Bray – Series 70.
- b. Rotork.
- c. Or equal.

2. Design and Fabrication:

a. General:

- 1) Input Power: 120 VAC, 1-Phase, 60 Hz.
- 2) Conform to AWWA C542.
- 3) Self contained including motor, gearing, torque switch, limit switches and cast housing.
- 4) Standard or Explosion-Proof enclosure as called out in the schedule:
 - a) Standard Enclosure: NEMA enclosure type 4X.
 - b) Explosion-Proof Enclosure: NEMA enclosure type 7, suitable for Class I, Division 2 hazardous locations.
- 5) Factory assembled requiring only field connection of power and control wires.
- 6) Comply with Specification Section 01 61 03.
- 7) Provide travel limit switches, single pole, double throw
- 8) Provide motor overheating protection

b. Motors:

- 1) Produce 1.5 times the required torque.
- 2) Sized for two (2) complete open-close cycles without overheating.
- 3) One (1) fully closed to fully open cycle to occur within 60 SEC.
- 4) Class F insulation.
- 5) Operate at plus or minus 10 percent voltage.
- 6) 120 Volt, single phase, 60 Hz.
- 7) Provide thermal cutout switch and internal heater for actuator enclosure.

c. Local Control Station, Stanchion Mounted:

- 1) Provide a remotely mounted control station for each actuator with the following features:

- a) Open pushbutton.
- b) Close pushbutton.
- c) Stop pushbutton.
- d) Remote/local switch.
- e) Full open light.
- f) Full close light.
- g) Open and close relays as required.
- 2) Provide control enclosure to accept:
 - a) Remote open/close dry relay contacts.
- 3) Provide contacts in control enclosure:
 - a) Remote/local contact.
 - b) Full open contact.
 - c) Full close contact.
 - d) Fault contact.
- 4) Wire all components to an internal terminal strip and include mounted wiring diagram inside enclosure.
- 5) Stainless steel enclosure with NEMA 4X rating.

2.4 FABRICATION

A. End Connections:

- 1. Provide the type of end connections for valves as required in the Piping Schedules presented in Specification Section 40 05 00 or as shown on the Drawings.
- 2. Comply with the following standards:
 - a. Flanged: ASME B16.1, Class 125 unless otherwise noted or AWWA C207.
 - b. Bell and spigot or mechanical (gland) type: AWWA/ANSI C111/A21.11.

B. Refer to individual valve Specification Sections for specifications of each type of valve used on Project.

C. Nuts, Bolts, and Washers:

- 1. Wetted or internal to be bronze or stainless steel.
 - a. Exposed to be zinc or cadmium plated.

D. On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.

- E. Epoxy Interior Coating: Provide epoxy interior coating for all ferrous surfaces in accordance with AWWA C550.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Painting Requirements: Comply with Specification Section 09 96 00 for High Performance Industrial Coatings.
- C. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.
- D. Install electric or cylinder actuators above or horizontally adjacent to valve and gear box to optimize access to controls and external handwheel.

3.2 ADJUSTMENT

- A. Adjust valves, actuators and appurtenant equipment to comply with Specification Section 01 75 00.
 - 1. Operate valve, open and close at system pressures.
- B. For all 120 Vac and 480 Vac electric actuators, employ and pay for services of valve actuator manufacturer's field service representative to:
 - 1. Inspect valve actuators covered by this Specification Section.
 - 2. Supervise adjustments and installation checks:
 - a. Open and close valves electrically under local manual and demonstrate that all limit switches are properly adjusted and that switch contacts are functioning properly by verifying the inputs are received at the Plant Control System.
 - b. Position modulating valves electrically under local manual control and demonstrate that the valve position feedback potentiometer is properly adjusted and that the feedback signal is received at the Plant Control System.
 - c. Simulate a valve position command signal at the RIO panel or local control panel as appropriate and demonstrate that the valve is controlled to the desired position without excessive hunting.
 - 3. Provide Owner with a written statement that the valve actuator manufacturer has verified that the actuators have been installed properly, that all limit switches and position potentiometers have been properly adjusted and that the valve actuator responds correctly to the valve position command.

C. Actuated Valve Schedule as follows:

| Valve Number | Service | Size, Inches | Valve Type/ Enclosure Type | Input Power | Operation, Notes |
|--------------|--------------|--------------|---|---------------------|--|
| MV-2101 | MBBR 1 - ALP | 6 | Butterfly Valve/ Standard Enclosure | 480 VAC, 3-Phase | Electric Actuator, Modulating Service, Note 1 |
| MV-2102 | MBBR 2 - ALP | 6 | Butterfly Valve/ Standard Enclosure | 480 VAC, 3-Phase | Electric Actuator, Modulating Service, Note 1 |
| MOV-3301 | HW | | Ball Valve / Explosion-Proof Enclosure | 120 VAC, 1-Phase | Electric Actuator, Open/Close Type, Note 1 |
| MOV-2201 | MBBR 2 - NPW | 1 | Ball Valve / Explosion-Proof Enclosure | 120 VAC, 1-Phase | Electric Actuator, Open/Close Type, Note 1 |
| MOV-2301 | MBBR 2 - NPW | 1 | Ball Valve / Explosion-Proof Enclosure | 120 VAC, 1-Phase | Electric Actuator, Open/Close Type, Note 1 |
| MOV-2401 | MBBR 2 - NPW | 1 | Ball Valve / Explosion-Proof Enclosure | 120 VAC, 1-Phase | Electric Actuator, Open/Close Type, Note 1 |
| MOV-2202 | MBBR 2 - NPW | 1 | Ball Valve / Explosion-Proof Enclosure | 120 VAC, 1-Phase | Electric Actuator, Open/Close Type, Note 1 |
| MOV-2302 | MBBR 2 - NPW | 1 | Ball Valve / Explosion-Proof Enclosure | 120 VAC, 1-Phase | Electric Actuator, Open/Close Type, Note 1 |
| MOV-2402 | MBBR 2 - NPW | 1 | Ball Valve / Explosion-Proof Enclosure | 120 VAC, 1-Phase | Electric Actuator, Open/Close Type, Note 1 |
| MOV-3201 | MBBR 2 - | 1 | Ball Valve / | 120 VAC, | Electric |

| Valve Number | Service | Size, Inches | Valve Type/ Enclosure Type | Input Power | Operation, Notes |
|--|---------------|--------------|--|------------------|--|
| | NPW | | Explosion-Proof Enclosure | 1-Phase | Actuator, Open/Close Type, Note 1 |
| MOV-3202 | MBBR 2 - NPW | 1 | Ball Valve / Explosion-Proof Enclosure | 120 VAC, 1-Phase | Electric Actuator, Open/Close Type, Note 1 |
| MOV-7402 | CAUSTIC - NPW | 1 | Ball Valve / Standard Enclosure | 120 VAC, 1-Phase | Electric Actuator, Open/Close Type, Note 1 |
| <p><u>NOTES:</u></p> <p>1. Provide Remote Control station and stanchion mounting for remote operation. See details for stanchion mounting requirements.</p> | | | | | |

END OF SECTION

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SECTION 40 05 52
MISCELLANEOUS VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Air release and vacuum relief valves.
2. Pressure-reducing valves (2 IN and smaller).
3. Pressure relief valves (1 IN and smaller).
4. Solenoid valves.
5. Mud valves.
6. Elastomeric check valves.
7. Diaphragm valves.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 01 61 03 - Equipment: Basic Requirements.
4. Section 40 05 51 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. American Water Works Association (AWWA):
 - a. C512, Standard for Air-Release, Air-Vacuum, and Combination Air Valves for Waterworks Service.
 - b. C550, Standard for Protective Interior Coatings for Valves and Hydrants.
3. Canadian Standards Association (CSA).

4. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

- A. Shop Drawings:
 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. See Specification Section 40 05 51.
- B. Contract Closeout Information:
 1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 AIR RELEASE AND VACUUM RELIEF VALVES

- A. General: Conform to AWWA C512.
- B. Air Release Valve (Water):
 1. Acceptable manufacturers:
 - a. APCO 50/200.
 - b. GA Industries, Figure 905/910/912/920.
 - c. Valmatic 15/22/25/38/45.
 - d. Or approved equal.
 2. Materials:
 - a. Body and cover: Cast iron or semi-steel.
 - b. Interior coating: Epoxy coat all wetted parts, NSF approved for potable water use and resistant to acids, bases, and oxidants.
 - c. Float: Stainless steel.
 - d. Linkage and trim: Stainless steel.
 - e. Seats: Viton, EPDM, or Teflon and compatible with service fluid.
 3. Design requirements:
 - a. Working pressure: 150 psi or equal to the test pressure, whichever is greater.
 - b. Release 10 cfm at 10 psi differential at 150 psi line pressure.

- C. Combination Air Release Valves (Water):
 - 1. Acceptable manufacturers:
 - a. GA Industries, Model 945.
 - b. Valmatic Model 100
 - c. APCO Model 140C.
 - d. Or approved equal.
 - 2. Materials:
 - a. Body and cover: Cast iron.
 - b. Interior coating: Epoxy coat all wetted parts, NSF approved for potable water use and resistant to acids, bases, and oxidants.
 - c. Float, linkage and hardware: Stainless steel.
 - d. Seat: Viton, EPDM, or Teflon and compatible with service fluid.
 - 3. Design requirements:
 - a. Working pressure: 150 psi or system test pressure, whichever is greater.
 - b. Unit may be combined in one valve body or be duplex type.

- D. Vacuum Relief Valves (Water):
 - 1. Acceptable manufacturers:
 - a. Valmatic Model 100.
 - b. GA Industries Model 930.
 - c. APCO Model 140.
 - d. Or approved equal.
 - 2. Materials of construction:
 - a. Body: Cast or ductile iron.
 - b. Interior coating: Epoxy coat all wetted parts, NSF approved for potable water use and resistant to acids, bases, and oxidants.
 - c. Trim: Stainless steel.
 - d. Float: 304 stainless steel.
 - e. Seals: Viton, EPDM, or Teflon and compatible with service fluid.

2.3 PRESSURE-REDUCING VALVES (2 IN AND SMALLER)

- A. Water Pressure Regulators:
 - 1. Acceptable manufacturers:
 - a. Fisher, Type 75A.
 - b. Watts Series LF25AUB-Z3.
 - 2. Materials:
 - a. Body: Bronze.
 - b. Strainer body: Bronze.
 - c. Strainer screen: Stainless steel.
 - 3. Design requirements:
 - a. Self-contained diaphragm operated.
 - 1) Spring loaded.

- 2) Field adjustable.
- b. Strainer: Y-type on supply.
- c. Size as shown on Drawings or size equal to connecting line size with 125 psi inlet and 50 psi outlet pressure.

2.4 PRESSURE RELIEF VALVE (1 IN AND SMALLER)

- A. Materials:
 - 1. Body: Cast iron coated or stainless steel.
 - 2. Interior coating: Epoxy coat all wetted parts, NSF approved for potable water use and resistant to acids, bases, and oxidants.
 - 3. Spring: Steel. Material to be compatible with fluid
 - 4. Diaphragm water – neoprene and air - 302 stainless steel.
 - 5. Trim: 416 stainless steel.
- B. Design Requirements:
 - 1. Pipe relief to discharge at non-hazardous location.
 - 2. Relief pressure: Dependent on system operating and/or test pressure. Initial relief to be operating pressure plus 10 percent.

2.5 SOLENOID VALVES

- A. General Service (Water):
 - 1. Acceptable manufacturer:
 - a. ASCO.
 - 2. Materials:
 - a. Body: Brass.
 - b. Seat: Buna-N.
 - c. Insulation: Class F.
 - 3. Design requirements:
 - a. 110 Vac.
 - b. Two-way, normally closed.
 - c. Enclosure: Compatible with area classifications indicated on Drawings.
 - d. Working pressure, air and water: 125 psig.
 - 4. Accessories: Provide strainer on supply.

2.6 MUD VALVES

A. Acceptable Manufacturers:

1. Trumbull.
2. Troy Valve.
3. Clow.
4. M&H.

B. Materials:

1. Yoke: Stainless steel Type 316.
2. Frame: Stainless steel Type 316.
3. Stem: Stainless steel Type 316.
4. Thrust nut: Stainless steel Type 316.
5. Operating nut: Stainless steel Type 316.
6. Plug: Stainless steel Type 316.
7. Seat: SBR or Buna N.
8. Seat ring: Stainless steel Type 316.

C. The Mud Valve shall be of the flanged type and designed to provide a positive seal under both seating and unseating head conditions.

1. Provide with rising stem.

D. Accessories:

1. Provide floor stand assembly for mud valves with stems adjacent to basin walkways.
2. Provide extension stems, floor stands and stem guides as indicated on the drawings.
3. Provide factory epoxy coating which meets the requirements of Specification Section 09 96 00.

2.7 ELASTOMERIC CHECK VALVE

- A. Elastomeric, slip-on, clamped, duckbill configuration, circular entry with flat bill construction..
- B. Valves shall open with a maximum pressure of 3-inches of water column
- C. Shall be designed for 9 feet of backpressure and return to closed position under zero flow.

- D. Acceptable Manufacturer:
 - 1. Tideflex TF-2.
 - 2. Or equal
- E. Materials:
 - 1. Body: Elastomer - Nylon Reinforced Neoprene
 - 2. Minimum of two 304 SST Mounting Bands.

2.8 DIAPHRAGM VALVES FOR CHEMICAL SERVICE

- A. Material:
 - 1. Body: PVC conforming to ASTM 1784.
 - 2. Diaphragm – EPDM backed Teflon for 15 percent hypochlorite solution.
 - 3. Bolts and other external hardware – 304 SST.
 - 4. Indicating Rod – 304 SST.
 - 5. Bonnet – PVC conforming to ASTM 1784.
 - 6. O-rings – EPDM
 - 7. Hand wheel – Polypropylene.
 - 8. Gas barrier – PVDF conforming to ASTM D3222 cell classification Type 11.
 - 9. Pneumatic actuator:
 - a. Corrosion resistant, coated, die cast aluminum or injected and extruded polypropylene or polyarylsufone.
 - b. Diaphragm – nylon-reinforced neoprene.
 - c. Double acting.
 - d. Position indicator.
 - e. Rated for 60 psig air pressure.
- B. End Connections:
 - 1. Air Operated Valves – Flanged.
 - 2. All Others –Flanged or true union.
- C. Valve Style
 - 1. Weir.
 - 2. Adjustable travel stops.
- D. Accessories
 - 1. Locking handle covers
 - a. Provide 8

2.9 ACCESSORIES

- A. Furnish any accessories required to provide a completely operable valve.

2.10 FABRICATION

- A. Completely shop assemble unit including any interconnecting piping, speed control valves, control isolation valves and electrical components.
- B. Provide internal epoxy coating suitable for potable water for all iron body valves in accordance with AWWA C550.

2.11 SOURCE QUALITY CONTROL

- A. Shop hydrostatically test to unit test pressure.

2.12 MAINTENANCE MATERIALS

- A. Provide one (1) set of any special tools or wrenches required for operation or maintenance for each type valve.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: See Specification Section 01 61 03 and Specification Section 40 05 51.
- B. Air Release, Vacuum Relief, and Pressure Relief Valves:
 - 1. Pipe exhaust to a suitable disposal point.
 - 2. Where exhausted to a trapped floor drain, terminate exhaust line 6 IN minimum above floor.
- C. Float-Operated Valves: Install baffle around float to minimize turbulence adjacent to float.

3.2 FIELD QUALITY CONTROL

- A. Clean, inspect, and operate valve to ensure all parts are operable and valve seats properly.
- B. Check and adjust valves and accessories in accordance with manufacturer's instructions and place into operation.

END OF SECTION

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SECTION 40 05 59
FABRICATED STAINLESS STEEL SLIDE GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fabricated Stainless Steel Slide Gates.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 01 61 03 - Equipment: Basic Requirements.
4. Section 09 96 00 - High Performance Industrial Coatings.
5. Section 10 14 00 - Identification Devices.
6. Section 40 05 51 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Water Works Association (AWWA):
 - a. C561, Fabricated Stainless Steel Slide Gates.
2. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
3. National Sanitation Foundation International (NSF):
 - a. 61, Drinking Water System Components - Health Effects.
4. Society for Protective Coatings/NACE International (SSPC/NACE):
 - a. SP 5/NACE No. 1, White Metal Blast Cleaning.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. See Specification Section 01 61 03.
 3. Product technical data including:
 - a. Acknowledgment that products submitted meet the requirements of standards referenced.
 - b. Calculations that demonstrate compliance with the deflections, stress and factor of safety specified.
 - c. Certified drawings and material specifications for all components.
 - d. Test records.
 - 1) Performance Test
 - 2) Leakage Test
- B. Operation and Maintenance Manuals:
1. See Specification Section 01 33 00 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.
- C. Affidavit of Compliance: See AWWA C561.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. RW Gate Company
 2. Whipps.
 3. Rodney Hunt
 4. Aquanox / Fontaine
 5. Hydro-Gate.
 6. Golden Harvest.
 7. Mechanical Associates
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 EQUIPMENT – SLIDE GATES

- A. General: Provide gates, stems, lifts and other appurtenances of size, type, material and construction shown on the Contract Drawings and as specified herein.
- B. Comply with requirements of Specification Section 01 61 03.
- C. Gates: Meet all requirements of AWWA C561 as modified per this Specification Section.
- D. Materials:
 - 1. Materials subject to dezincification or dealuminization prohibited.
 - 2. “L” grades for all welded components.
 - 3. Thimble, frame, guides, slide, yoke and stem guides:
 - a. Stainless steel, Type 304 and Type 304L.
 - 4. Gear housing:
 - a. Cast iron, steel or ductile iron.
 - 5. Actuator pedestal:
 - a. Stainless steel, Type 304.
 - 6. Rising stem thrust nuts:
 - a. Stainless steel, Type 304
 - 7. Stem couplings:
 - a. Stainless steel, Type 304
 - 8. Stem guide bushings:
 - a. Cast or extruded UV stabilized UHMW-PE.
 - 9. Stems:
 - a. Stainless steel, Type 304
 - 10. Seals:
 - a. UV stabilized UHMW-PE.
 - 11. Anchor bolts and fasteners: Stainless steel, Type 304.
 - 12. Flush-bottom sill retainer: Stainless steel, Type 304 .
 - 13. Wedges and Pressure Pads: UV stabilized UHMW-PE.

- E. Fabrication: One-piece frames.
 - 1. One-piece frame: Self-contained.
 - 2. Flush bottom seals: Easily replaceable without disassembly of the gate.
 - 3. Side and top seals of gate: Replaceable without removing gate or without dewatering.

2.3 GATE OPERATORS AND LIFTS

- A. General: Provide lifts in accordance with AWWA C541 and C542, or as modified in this Specification Section.
- B. Rising Stem: Provide clear butyrate plastic stem cover with Mylar open-close indicator.
- C. Manual Operators:
 - 1. Equip the lift mechanism with a pedestal, torque tube, or baseplate, machined and drilled for mounting the lift housing and ready for bolting to the operating floor, top wall mounting bracket, or gate yoke, as shown on Drawings or specified.
 - 2. Centerline of crank or handwheel: Approximately 36 IN above operating floor.
 - 3. Stop slide gates: manual gate with fabricated dual handholds for complete gate removal. Top of gate shall be 6" below top of wall.
- D. Electric Operators: See Specification Section 40 05 51.

2.4 FABRICATION

- A. Specified in AWWA C561.
- B. Welded Stainless Steel: Passivated after fabrication.

2.5 SOURCE QUALITY CONTROL

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. For identification and tagging, and for warning or caution signs, comply with Specification Section 10 14 00.

3.2 FIELD QUALITY CONTROL

- A. Employ and pay for services of equipment manufacturer's field service representative(s) to:

1. Inspect equipment covered by this Specification Section.
2. Supervise adjustments and installation checks.
3. Provide test equipment, tools, and instruments necessary to accomplish equipment testing.
4. Conduct initial start-up of equipment, perform operational checks, and supervise acceptance testing.
5. Provide, through Contractor, a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.
6. Instruct Owner's personnel on operation and maintenance of furnished equipment.
7. Field Leakage Test for Stainless Steel Slide Gates: Test gate under design seating head and adjust to maximum leakage specified.

3.3 GATE SCHEDULE:

A. The following table is a schedule of the fabricated slide gates.

| GATE EQUIPMENT ID# | SIZE WxH (INCH) | DESIGN HEAD, (FEET) ^a | | OPENING DIRECTION ^b | TYPE OF CLOSURE ^c | TYPE OF LIFT MECHANISM ^d | RISING OR NON-RISING STEM ^e | THIMBLE REQUIRED ^f |
|--------------------|-----------------|----------------------------------|-----------|--------------------------------|------------------------------|-------------------------------------|--|-------------------------------|
| | | SEATING | UNSEATING | | | | | |
| G-5101 | 24 DIA | 20 | 20 | UpOp | FM | SQN | NRS | Yes |
| G-5102 | 24 DIA | 20 | 20 | UpOp | FM | SQN | NRS | Yes |
| G-5201 | 24 DIA | 10 | 10 | UpOp | FM | SQN | NRS | Yes |
| G-4301 | 54X30 | 6 | 6 | DnOp | W | CH | R | No |
| G-2601 | 48 x 48 | 4 | 4 | UpOp | FB | HAND | NA | No |
| G-2602 | 48 x 48 | 4 | 4 | UpOp | FB | HAND | NA | No |
| G-2603 | 48 x 48 | 4 | 4 | UpOp | FB | HAND | NA | No |
| G-2604 | 48 x 48 | 4 | 4 | UpOp | FB | HAND | NA | No |

Abbreviations:

- a Design Head: Measured from surface of water to centerline of gate, in feet.
- b Opening Direction: Dn Op = Downward Opening; Up Op = Upward Opening.
- c Type of Closure: W = Weir Service; FB = Flush Bottom (Embedded); FM = Face Mounted.
- d Type of Lift Mechanism: Ped = Pedestal; Elec = Electric; Hdwl = Handwheel; Hyd = Hydraulic, CH = Crank Handle, SQN = Square Nut, HAND = handles or slots for complete gate removal.
- e Rising or Nonrising Stem: R = Rising; NR = Nonrising. NA= Not Applicable
- f Thimble Required: Wall Thimble is required = Yes; Wall Thimble is not required = No.

END OF SECTION

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SECTION 40 05 61
GATE VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gate valves.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 51 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
2. American Water Works Association (AWWA):
 - a. C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
 - b. C504, Standard for Rubber-Seated Butterfly Valves.
 - c. C550, Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.
3. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
 - a. SP-9, Spot Facing for Bronze, Iron and Steel Flanges.
 - b. SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - c. SP-80, Bronze Gate, Globe, Angle and Check Valves.
 - d. SP-81, Metal Seated Valves.

1.3 DEFINITIONS

A. OS&Y: Outside Screw and Yoke.

B. NRS: Non-rising Stem.

C. RS: Rising Stem.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 05 51.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 VALVES: WATER (HOT, COLD, HEATING, COOLING, SERVICE, PROCESS, POTABLE, NON-POTABLE, AND WASTEWATER)

A. Double Disc Gate Valve, 3 to 12 IN (Water Application):

1. Comply with AWWA C500.
2. Materials:
 - a. Seating surfaces, stems, stem nut: Bronze.
 - b. Body, disc: Cast iron.
3. Design requirements:
 - a. 200 psi working pressure.
 - b. Buried: NRS, O-ring stem seal, 2 IN operation nut.
 - c. Exposed: NRS, O-ring stem seal, handwheel OS&Y, RS, stuffing box stem seals, handwheel.

4. Acceptable manufacturers:
 - a. American Flow Control.
 - b. Clow.
 - c. M&H.
 - d. Mueller.
 - e. Or equal.
- B. Knife Gate Valves, 2 to 36 IN (Wastewater Sludge Application):
 1. Comply with MSS SP-81.
 2. Materials:
 - a. Body construction:
 - 1) 2 to 4 IN: Cast stainless steel.
 - 2) 6 to 24 IN: Cast iron body with stainless steel lining.
 - b. Wetted parts: Stainless steel Type 304
 - c. Packing: Flax, 150 DegF max.
 - d. Stem: Stainless steel, double pitch thread.
 - e. Resilient seat material (2 to 36 IN): Butadiene.
 3. Design requirements:
 - a. Working pressure (WOG non-shock):
 - 1) 2 to 24 IN: 150 psi.
 4. Acceptable manufacturers:
 - a. DeZurik, Series L.
 - b. Fabri-Valve.
 - c. Or equal.

2.3 ACCESSORIES

- A. Refer to Drawings and valve schedule for type of actuators.
 1. Furnish actuator integral with valve.
- B. Refer to Specification Section 40 05 51 for actuator requirements.

2.4 FABRICATION

A. General:

1. Provide valves with clear waterways the full diameter of the valve.

B. Spot valves in accordance with MSS SP-9.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 40 05 51.

B. Where larger buried valves utilize smaller bypass valves, provide a second valve box installed over the bypass valve operating nut.

C. Do not install gate valves inverted or with the stems sloped more than 45 degrees from the upright unless the valve was ordered and manufactured specifically for this orientation.

END OF SECTION

SECTION 40 05 62
PLUG VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plug valves.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 51 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125 and 250.
2. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - b. A536, Standard Specification for Ductile Iron Castings.
 - c. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
3. American Water Works Association (AWWA):
 - a. C517 Resilient-Seated Cast-Iron Eccentric Plug Valves

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 05 51.

B. Contract Closeout Information:

1. Operation and Maintenance Data:

- a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

2. See Specification Section 40 05 51.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed under the specific valve types are acceptable.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 NON-LUBRICATED ECCENTRIC PLUG VALVES (SEWAGE, SLUDGE APPLICATIONS)

A. Acceptable Manufacturers, subject to American Iron and Steel requirements:

1. DeZurik.
2. ValMatic.
3. Victaulic.

B. Materials:

1. Body: Cast-iron ASTM A126, Class B.
2. Plug: One or two-piece construction ductile iron, ASTM A536 65-45-12 or cast iron, ASTM A126 Class B.
3. Plug facing: Grease and/or petroleum-resistant resilient Neoprene or Buna-N compound, 70 Type A durometer hardness per ASTM D2240.
4. Shaft bearing bushings: Permanently lubricated TFE or Delrin sleeve type stainless steel or bronze.
5. Valve seats: Welded-in overlay of 90 percent nickel, (minimum 1/8 IN thick).
6. Stem seal: per AWWA C517, Section 4.4.7.

2.3 NON-LUBRICATED ECCENTRIC PLUG (HEATING-COOLING WATER APPLICATIONS)

A. Acceptable Manufacturers, subject to American Iron and Steel requirements:

1. DeZurik Figure 499.
2. Victaulic Series 365.

B. Materials:

1. Body: Cast iron, ASTM A126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Bearings: Bronze or nickel.
4. Plug seal: Isobutene-isoprene (250 DegF).

2.4 ACCESSORIES

A. Refer to Drawings and valve schedule for type of actuator.

1. Furnish actuator integral with valve.

B. Refer to Specification Section 40 05 51 for actuator requirements.

2.5 DESIGN REQUIREMENTS

A. Non-Lubricated Eccentric Plug Valves (Wastewater, Sludge):

1. Port area:
 - a. Valves 4 IN through 20 IN: Equal to or exceed 80 percent of full pipe area.
2. Valve body: Fitted with bolted bonnet.
3. End connections: See Specification Section 40 05 51.
4. Stem seal: Adjustable and replaceable without disassembling valve or bonnet.
5. Designed for seating drip tight in any flow direction.
6. Rating:
 - a. 1/2 through 12 IN, 175 psi working pressure.
7. Actuator:
 - a. Actuator gearing in enclosure suitable for running in oil with seals on shaft to prevent entry of dirt or water.
 - b. Positive identification on actuator indicating valve position.
 - c. Adjustable stop to set closing torque.

B. Non-Lubricated Eccentric Plug Valve-(HVAC):

1. Port area: Valves 1/2 IN through 2-1/2 IN: Equal to or exceed 100 percent of full pipe area.
2. Valve body: Fitted with threaded bonnet or bolted bonnet.
3. End connections:
 - a. Flanges: In full accordance with ASME B16.1, Class 125 including facing, drilling and thickness.
 - b. Threaded connection: In full compliance with NPT.
4. Stem seal: Self-adjusting U-cups or multiple O-ring seals.
5. Shut-off: Designed for setting drip-tight at the full rated pressure.

2.6 FABRICATION

- A. See Specification Section 40 05 51.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Specification Section 40 05 51.
- B. Install valves with valve stem horizontal, plug seat on inlet side and with plug rotating up into the open position for valves in horizontal lines.
- C. Install valve with actuator above pipe or plug centerline.

END OF SECTION

SECTION 40 05 63
BALL VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 51 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - c. A276, Standard Specification for Stainless Steel Bars and Shapes.
 - d. A351, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
 - e. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
2. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
 - a. SP-110, Ball Valves; Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 DEFINITIONS

- A. PVDF: Polyvinylidene fluoride.
- B. PTFE: Polytetrafluoroethylene.
- C. RPTFE: Reinforced PolyTetraFluoroEthylene.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 05 51.
3. Test results for AWWA valves.

B. Contract Closeout Information:

1. Operation and Maintenance Data:

- a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 METALLIC BALL VALVES 1/4 TO 3 IN DIA

A. Comply with MSS SP-110.

B. Acceptable Manufacturers:

1. Apollo.
2. Or approved equal

C. Materials (All Stainless Steel):

1. Body: Three-part stainless steel, ASTM A351 CF8M.
2. Ball: Stainless steel ASTM A276.
3. Seats: RPTFE.

D. Design Requirements:

1. Rated for a minimum of:
 - a. 500 psi CWP.

- b. 150 psi of saturated steam.
- c. 29 IN vacuum.
- 2. Two-position lockable handle.
- 3. Stem with blowout-proof design.
- 4. Balancing stop for all applications.
- 5. Bodies with mounting pad for applications requiring actuators.

2.3 ACCESSORIES

- A. Refer to Drawings and valve schedule for type of actuators.
 - 1. Furnish actuator integral with valve.
- B. Refer to Specification Section 40 05 51 for actuator requirements.

2.4 SOURCE QUALITY CONTROL

- A. Shop test AWWA C507 ball valves in accordance with AWWA C507.
- B. Furnish record of test.
- C. Product Testing: MSS SP-110.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Specification Section 40 05 51.

3.2 FIELD QUALITY CONTROL

- A. For AWWA C507 ball valves and in accordance with Specification Section 01 75 00, employ and pay for services of equipment manufacturer's field service representative(s) to:
 - 1. Inspect equipment covered by this Specification Section.
 - 2. Supervise adjustments and installation checks.
 - 3. Provide test equipment, tools, and instruments necessary to accomplish equipment testing.
 - 4. Conduct startup of equipment and perform operational checks.
 - 5. Provide Owner with a written statement that manufacturer's equipment has been installed properly, has been started up, and is ready for operation by Owner's personnel.

END OF SECTION

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SECTION 40 05 64
BUTTERFLY VALVES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Butterfly valves.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.
 - 4. Section 40 05 51 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B16.5, Pipe Flanges and Flanged Fittings - NPS 1/2 Through NPS 24.
 - 2. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - c. A276, Standard Specification for Stainless Steel Bars and Shapes.
 - d. A395, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
 - e. A436, Standard Specification for Austenitic Gray Iron Castings.
 - f. A536, Standard Specification for Ductile Iron Castings.
 - 3. American Water Works Association (AWWA):
 - a. C504, Standard for Rubber-Seated Butterfly Valves.
 - 4. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):

- a. SP-67, Butterfly Valves.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 05 51.
3. For valves 8 IN and larger, furnish "Affidavit of Compliance" with Owner in accordance with AWWA C504.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. DeZurik.
2. Clow.
3. Pratt a Mueller Water Company.
4. Bray.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 HIGH PERFORMANCE BUTTERFLY VALVES:

A. In locations where reliability is critical, for automated valves that modulate for flow control or actuate periodically in intervals less than 2 HRS, high performance butterfly valves with an offset disc design shall be used.

B. Design Requirements:

1. One-piece shaft.
2. Separate shaft seal.
3. Minimum shaft diameter to conform to AWWA C504, Class 150B.

C. Materials of construction:

1. Disc: 316 stainless steel.
2. Shaft and pins: 17-4PH stainless steel or 316 stainless steel.
3. Seals:
 - a. Water: PTFE.
 - b. Process air and high temperature: Graphite rings.
4. Backing ring: Stainless steel.
5. Bushings/Bearings: TFE/Glass liner with a 316 Stainless steel shell.
6. Seat:
 - a. Two part with encapsulated RTFE or PTFE.
 - b. Seat Retainer: Stainless Steel.
 - c. Or Stainless Steel.
7. End connection: Lugged valves may be used.

2.3 GENERAL USE BUTTERFLY VALVES

- A. For use in all location, except where high performance butterfly valves are required.
- B. Comply only with AWWA C504, as noted in this Specification Section.
- C. Materials:
 1. Valve bodies:
 - a. ASTM A126, Class B or ASTM A536 Grade 65-45-12 ductile iron.
 - b. Wafer valves may be constructed of ASTM A48, Class 40 cast iron.
 2. Valve shafts:
 - a. One-piece stainless steel, Type 304.
 - b. Pins: 304 stainless steel.
 - c. Bushings/Packing/O-rings: EPDM, RTFE or TFE.
 - d. Bearings: Reinforced TFE or equal.
 3. Valve discs:
 - a. Cast iron with welded nickel edge or 304 Stainless Steel disk.

4. Valve seats:
 - a. Water: EPDM or Hycar.
 - b. Compressed air: Teflon, PTFE.
 - c. Process air: Viton, RTFE, rate for 300 DegF minimum or higher if required by service.
5. Shaft bearing: Bronze, TFE-coated stainless steel or reinforced TFE.
6. Shaft seal in addition to any sealing provided by seat: Suitable synthetic rubber rings or PTFE V-ring suitable for operating conditions.

D. Design Requirements:

1. Seat type: Resilient.
2. Body type:
 - a. Wafer Lug (laying length may vary from AWWA C504).
 - b. Equip wafer type with fully tapped anchor lugs drilled per ASME B16.5.
3. Direct buried valves:
 - a. All valves: Working pressure rated for 150 psi (Class 150B per AWWA C504).
4. Shaft diameter: One-piece constant diameter.

2.4 ACCESSORIES

- A. Refer to Drawings and/or valve schedule for type of actuators.
 1. Furnish actuator integral with valve.
- B. Refer to Section 40 05 51 for actuator requirements.
- C. Valve Flange Seal Rings:
 1. If Steel Slip-on flanges are being used on the process piping, flange seals will be required for proper installation of valves.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Section 40 05 51.

END OF SECTION

SECTION 40 05 66
CHECK VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Check valves.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 51 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. American Water Works Association (AWWA):
 - a. C508, Standard for Swing-Check Valves for Waterworks Service, 2 IN through 24 IN NPS.
3. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
 - a. SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - b. SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.3 DEFINITIONS

A. PVDF: Polyvinylidene fluoride.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. See Specification Section 40 05 51.
- B. Contract Closeout Information:
1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, manufacturers listed under the valve with types are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 CHECK VALVES: 2.5 IN AND SMALLER

- A. Class 125 Bronze Swing Check Valves (Compressed Air, Water, Wastewater):
 1. Comply with MSS SP-80.
 2. Acceptable manufacturers:
 - a. Nibco T413-Y.
 - b. Stockham B-319Y.
 3. Materials:
 - a. Body, bonnet, disc: Bronze.
 4. Design requirements:
 - a. 125 psi steam to 406 DegF, 200 psi WOG.
 - b. Horizontal swing, renewable disc.

2.3 SWING CHECK VALVES: 3 IN TO 24 IN

- A. Swing Check Valves (Water, Wastewater, Sludge):
 1. Comply with AWWA C508.
 2. Acceptable manufacturers:
 - a. Clow.
 - b. American Darling.

- c. Golden Anderson.
 - d. Or approved equal.
3. Materials:
- a. Body and cover: Cast iron.
 - b. Seat ring, hinge: Bronze.
 - c. Disc:
 - 1) 3 to 4 IN: Bronze.
 - 2) 6 to 24 IN: Cast iron with bronze face.
 - 3) 6 to 24 IN: Cast iron with rubber face.
 - d. Hinge shaft: Stainless steel.
 - e. Bearings, connecting hardware: Bronze.
4. Design requirements:
- a. 175 psi working pressure (3 to 12 IN).
 - b. Furnish with outside weight and lever or lever and spring.
 - c. Air cushion closure.

2.4 BALL CHECK VALVES: 1/2 IN TO 4 IN

- A. 150 psi at 73 DegF.
- B. Acceptable Manufacturers:
 - 1. R&G Sloane.
 - 2. Corr Tech.
- C. Materials:
 - 1. Body: PVC.
 - 2. Ball: Glass filled or polypropylene.
 - 3. Seals: Viton or EPDM.
- D. Design Requirements:
 - 1. Connectors: Double union.

2.5 WAFER STYLE CHECK VALVE 2 IN TO 12 IN

- A. 150 psi at 73 DegF.

B. Materials:

1. Body: 316 SST: ASTM A216 Gr. WCB
2. Wafer: 316 SST
3. Seals: Viton or EPDM.

C. Design Requirements:

1. Provide Oil Filled Hydraulic Damping Cushion for Vertical Turbine Pump Discharge application.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Specification Section 40 05 51.
- B. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 40 41 13
HEAT TRACING CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heat tracing cable as required for heat tracing of pipes as indicated on the Drawings.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 26 05 00 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data:
 - a. Power requirements for each circuit based upon actual length of heat trace and maintained temperature.
 - b. Circuit breaker rating based upon inrush current at minimum expected start-up temperature.
 - c. Length of heat tape for each pipe size and run.
 - d. Coordinate and verify length and Watts/FT of heat tape required based upon pipe size and insulation thickness.
 - 1) Include the calculations to support the heat tape output.
 - e. See Section 26 05 00 for additional requirements.

3. Fabrication and/or layout drawings:
 - a. Wiring diagrams showing physical locations of thermostats and heat trace power supply.
- B. Contract Closeout Information:
 1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
- C. Informational Submittals:
 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. Test reports: Megger test results.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Shall be stored such that they are not exposed to sunlight or other UV rays.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
 1. Thermon.
 2. Chemelex Division; Raychem Corp.
 3. Chromalox.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 HEAT TRACING

- A. Design Parameters:
 1. Pipe diameter, length and material: See Drawings and relevant piping Specifications.
 2. Flange, valve, pipe support size: See Drawings and relevant piping Specifications.
 3. Pipe insulation type and thickness: See Drawings and relevant piping Specifications.

4. Temperatures requirements:
 - a. Low ambient temperature for the specific location: -20 DegF.
 - b. Start-up temperature (alarm thermostat set point):
 - 1) Water/wastewater lines: 32 DegF.
 - 2) Chemical feed lines: 32 DegF.
 5. Wind factor for the specific location: 30 MPH.
 6. Electrical requirements:
 - a. Voltage: 120 V; 277 V.
 - b. Circuit breaker: Field coordinate if other than 20A GFEPCL type.
 7. Safety factor: 10 percent.
- B. Self-regulating or power-limiting parallel circuit construction consisting of an inner core of conductive material between parallel copper bus wires, with inverse temperature - conductivity characteristics with metal overbraid.
 - C. Thermostats adjustable between 35 and 200 DegF minimum with maximum differential range of 9 DegF, furnished complete with NEMA 4 enclosures in all areas, stainless steel temperature bulb and capillary.
 - D. All necessary or required components and accessories, such as power connection boxes, end seals, straps, tape and fitting brackets.
 - E. In noncorrosive and nonhazardous locations, insulation shall be Polyolefin.
 - F. In corrosive, hazardous and hydrocarbon locations insulation shall be Fluoropolymer (Teflon).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install materials after piping has been tested and approved.

3.2 INSTALLATION

- A. Insulate and heat trace wet pipe systems as indicated on Drawings.
- B. Install materials in accordance with manufacturer's instructions.
 1. Each circuit shall not exceed the manufacturer's recommended maximum length.
- C. For Metallic Piping:
 1. Heat tracing shall be installed completely wired.

2. Cut heat trace to lengths as required and secure to pipe with glass or polyester fiber tape.

D. For Nonmetallic Piping:

1. Allow for extra heat trace output because nonmetallic pipe has a lower heat transfer.
 - a. Heat tracing shall be installed completely wired.
2. Cut heat trace to lengths as required and secure to pipe with aluminum tape through out the length of the trace.

E. Protection and Control Requirements:

1. Protection by a GFEPIC circuit breaker.
 - a. Breaker amperage rating shall be coordinated with Contractor when different than the Contract Drawings.
2. The alarm thermostat shall be placed on the opposite end of the circuit from the power thermostat or power connection to allow for annunciation of partial failure of a circuit or the loss of power from a tripped GFEPIC circuit breaker.
3. Provide a monitoring module that monitors the voltage (circuit breaker status) to each circuit.
4. The alarm from the alarm thermostat and monitor module shall be annunciated on the indicated control system.

3.3 TESTING

- A. Megger the cables at the manufacturers recommended voltage level three (3) times.
 1. Before installation.
 2. After attachment to pipe but before insulation is installed.
 3. After pipe insulation is installed but before energization.

END OF SECTION

SECTION 40 42 00
PIPE, DUCT AND EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation:
 - a. Piping insulation.
 - b. Duct insulation.
 - c. Equipment insulation.
2. Adhesives, mastics, sealants, and finishes.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 05 07 - Pipe Support Systems.
4. Section 40 05 25 - Pipe: Underground, Prefabricated, Insulated and Jacketed.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
 - a. C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of Guarded-Hot-Plate Apparatus.
 - b. C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - c. C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - d. C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - e. C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

- f. C1071, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
 - g. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
 - h. E96, Standard Test Methods for Water Vapor Transmission of Materials.
 - i. F25, Standard Test Method for Sizing and Counting Airborne Particulate Contamination in Cleanrooms and Other Dust-Controlled Areas.
 - j. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - k. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - l. E119 Standard Method of Fire Tests of Building Construction, 2 Hour Wall Panel Test, 2 Hour External Total Engulfment Test, hose stream evaluation.
 - m. E136, Combustion Characteristics of Building Materials in a Vertical Tube Furnace.
 - n. E162, Surface Flammability of Materials.
 - o. E814, Through-Penetration, 2-Hour Firestop Test.
 - p. E2336: Standard Test Methods Fire Resistive Grease Duct Enclosure Systems.
2. ISO 6944-1985, Method of Determining Fire Resistance of Ventilation Ducts.
 3. National Fire Protection Association (NFPA):
 - a. 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.
 4. Underwriters Laboratories, Inc. (UL):
 - a. 723, Standard for Test for Surface Burning Characteristics of Building Materials.
 5. National Commercial and Industrial Insulation Standards (2013 seventh edition).
 - a. Published by Midwest Insulation Contractors Association (MICA).
 - b. Endorsed by National Insulation Association (NIA).
 - c. MICA plate numbers listed in this specification reference this document.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Submit complete specification of insulation materials, adhesives, cement, together with manufacturer's recommended methods of application and coverage for coatings and adhesives.
3. Submit itemized schedule by building of proposed insulation systems showing density, thermal conductivity, thickness, adhesive, jackets and vapor barriers.
4. Certifications: Products will meet the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- #### **A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:**
1. Elastomeric insulation:
 - a. Rubatex.
 - b. Armstrong.
 2. Fiberglass insulation:
 - a. CertainTeed Corporation.
 - b. Johns Manville.
 - c. Owens Corning.
 - d. Knauf.
 3. PVC jacket:
 - a. Ceel-Co.
 - b. PIC Plastics.

4. Equipment insulation:
 - a. CertainTeed Corporation.
 - b. Johns Manville.
 - c. Owens Corning.
5. Ductwork insulation:
 - a. CertainTeed.
 - b. Johns Manville.
 - c. Owens Corning.
6. High density perlite:
 - a. Johns Manville.
 - b. Industrial Insulation Group (LIC).
7. High density calcium silicate:
 - a. Industrial Insulation Group (LIC).
8. Adhesives, mastics, sealants, and finishes:
 - a. Foster Products.
 - b. Childers.
 - c. Dow Corning.
 - d. Johns Manville.
 - e. Knauf.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 PIPING INSULATION - ELASTOMERIC

A. General:

1. Insulation fire and smoke hazard ratings for composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation), as tested by procedure ASTM E84, NFPA 255 and UL 723, not exceeding:
 - a. Flame spread: 25.
 - b. Smoke developed: 50.

2. Accessories adhesives, mastics, cements, and tapes: Same component ratings as listed above.
 3. Indicate on product labels or their shipping cartons: Flame and smoke ratings do not exceed above requirements.
 4. Permanent treatment of jackets or facings to impart flame and smoke safety is required.
 - a. Water-soluble treatments are prohibited.
 5. Insulated shields at pipe support points.
- B. Pipe, Fitting, and Valve Insulation:
1. Flexible elastomeric closed cell pipe insulation.
 - a. Average thermal conductivity not to exceed 0.27 (Btu-IN)/(HR-FT²-DegF) at mean temperature of 75 DegF, temperature range -40 to 220 DegF; permeability not to exceed 0.20 by ASTM E96; water absorption 3 percent by ASTM D1056 and ozone resistance.
 2. Provide minimum insulation thickness conforming to schedules or as shown on the Drawings.

2.3 PIPING INSULATION - FIBERGLASS

- A. Pipe and Fitting Insulation:
1. Preformed fiberglass pipe insulation:
 - a. Density: 4 LBS/CF.
 - b. Temperature rated: 650 DegF.
 - c. Average thermal conductivity not to exceed 0.23 (Btu-IN)/(HR-FT²-DegF) at mean temperature of 75 DegF.
 - d. Fire hazard rating:
 - 1) UL 723, ASTM E84, NFPA 255.
 - 2) Flame spread not exceeding 25 and smoke developed not exceeding 50.
 2. Moisture adsorption:
 - a. ASTM C553.
 - b. Not greater than 0.5 percent moisture by volume when exposed to moisture laden air at 120 DegF and 96 percent RH.

3. Fungi and bacteria resistance:
 - a. ASTM C665.
 - b. Does not breed or promote growth.
 - c. Flame attenuated glass fibers bonded with thermosetting resin.
4. Piping jackets (general applications):
 - a. Aluminum: 16 mil embossed aluminum.
 - b. PVC: Preformed 0.028 IN thick PVC jackets fabricated from B.F. Goodrich PVC sheeting V-66 with proven resistance to ultraviolet degradation when temperatures do not exceed the limits of PVC.
 - c. Piping jacket not required on concealed piping.
5. Provide minimum insulation thickness conforming to schedules or as shown on the Drawings.

2.4 PIPE INSULATION INSERTS AT HANGERS

A. High Density Perlite:

1. Pre-formed.
2. Fire hazard rating:
 - a. UL 723, ASTM E84, NFPA 255.
 - b. Flame spread: Zero (0).
 - c. Smoke developed: Zero (0).
3. Average density: 13 LBS/CF.
4. Compressive strength: 80 psi to produce 5 percent compression.
5. Maximum surface temperature: 1,200 DegF.

B. High Density Calcium Silicate:

1. Pre-formed.
2. Fire hazard rating:
 - a. UL 723, ASTM E84, NFPA 255.
 - b. Flame spread: Zero (0).
 - c. Smoke developed: Zero (0).
3. Average density: 14 LBS/CF.

4. Compressive strength: 100 psi to produce 5 percent compression.
5. Maximum surface temperature: 1,200 DegF.

2.5 DUCTWORK INSULATION, NON-FLEXIBLE

- A. Material: Commercial-grade fiberglass thermal insulation formed with a thermosetting resin into semi-rigid or rigid boards.
- B. Temperature Range: 0 to 450 DegF.
- C. Minimum Density:
 1. Semi-rigid: 3.0 PCF.
 2. Rigid: 6.0 PCF.
- D. Thermal Conductivity at Mean Temperature:
 1. Semi-rigid:
 - a. $k \leq 0.22$, 75 DegF.
 - b. $k \leq 0.27$, 150 DegF.
 - c. $k \leq 0.38$, 300 DegF.
 2. Rigid:
 - a. $k \leq 0.23$, 75 DegF.
 - b. $k \leq 0.27$, 150 DegF.
 - c. $k \leq 0.37$, 300 DegF.
- E. Facing: All-Service-Jacket (ASJ).
- F. Temperature range: -20 to 150 DegF.
- G. Base Product:
 1. Semi-Rigid: Owens-Corning Fiberglas Type 703.
 2. Rigid: Owens-Corning Fiberglas Type 705.

2.6 DUCTWORK INSULATION - FLEXIBLE

- A. For Interior Use.
 1. Material: Commercial-grade fiberglass thermal insulation, formaldehyde free.
 2. Temperature range: 40 to 250 DegF.
 3. Thermal conductivity at mean temperature: $k \leq 0.27$, 75 DegF.
 4. Installed R-value: 5.6 HR-FT²-DegF/BTU based on 2 IN nominal thickness.
 5. Density: 3.75 PCF.

6. Facing: Foil-Reinforced-Kraft (FRK) vapor-retarding.
7. Seams: 2 IN facing tab.
8. Base product: Owens-Corning Fiberglass commercial-grade all-service duct wrap.
 - a. Recommend formaldehyde free product.

B. For Exterior Use:

1. Material: Commercial-grade closed-cell elastomeric or unicellular polyolefin thermal insulation.
2. Temperature range: -40 to 180 DegF.
3. Thermal conductivity at mean temperature: $k \leq 0.27$, 90 DegF.
4. Water vapor permeability: 08 perm-in.
5. Base Product: AP Armaflex Sheet and Roll.

2.7 EQUIPMENT INSULATION

A. Insulation for Equipment:

1. Fire hazard classification:
 - a. UL 723, ASTM E84, NFPA 255.
 - b. Flame spread not exceeding 25 and smoke developed not exceeding 50.
2. Provide minimum insulation thickness conforming to Schedules, or as shown on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. General:
 1. Piping below ground covered with earth will not be insulated except as specified in Specification Section 40 05 25.
 2. Consider ductwork, piping and equipment as exposed, except as otherwise indicated.

3. Consider ductwork, piping and equipment in walls, partitions, floors, pipe chases, pipe shafts and duct shafts as concealed.
 - a. Consider ductwork, piping and equipment above ceilings as concealed.
4. Provide release for insulation application after installation and testing is complete.
 - a. Apply insulation on clean, dry surfaces after inspection.
5. Provide insulation continuous through wall, roof and ceiling openings, pipe hangers, supports and sleeves.
6. Provide insulation with vapor barrier for piping, ductwork and equipment where surfaces may be cooler than surrounding air temperatures.
 - a. Provide vapor barrier (0.17 perm-IN; ASTM C553) continuous and unbroken.
 - b. Hangers, supports, anchors, and related items that are secured directly to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.
7. Apply specified adhesives, mastics and coatings at the manufacturer's recommended coverage per unit volume.

C. Piping Insulation - Elastomeric:

1. Do not insulate until satisfactory completion of required pressure testing.
2. Apply insulation to clean, dry surfaces.
3. Slip insulation on pipe prior to connection.
 - a. Whenever the slip-on technique is not possible provide insulation neatly slit and snapped over the pipe.
4. Fabricate and install fitting cover insulation according to manufacturer's recommendations.
5. Seal joints, slits, miter-cuts and other exposed edges of insulation with adhesive, recommended by the insulation manufacturer, to ensure complete vapor barrier.

D. Piping Insulation - Fiberglass:

1. Apply over clean dry pipe.
 - a. Butt all joints together firmly.
2. Seal joints, slits, miter-cuts and other exposed edges of insulation as recommended by the insulation manufacturer.

3. Insulate fittings, valves, and flanges with insulation thickness equal to adjacent pipe.
4. PVC pipe jacket:
 - a. Apply jacketing with a minimum of 1 IN overlap.
 - 1) Weld longitudinal and circumferential seams with adhesives as recommended by manufacturer.
 - b. Provide slip-joints every 30 FT and between fittings if distance exceeds 8 FT.
 - 1) Construct slip-joints by overlapping jacket sections 6 to 10 IN.
 - c. Provide pre-molded PVC covers of same material and manufacturer as jacket for fittings, valves, flanges, and related items in insulated piping systems.
5. Aluminum pipe jacket:
 - a. Field-applied aluminum jacket with vapor-sealed longitudinal and butt joints.
 - b. Provide smooth and straight joint with a minimum 2 IN overlap.
 - c. Secure joints with corrosion-resistant screws spaced 0.25 to 0.50 IN back from edge.
 - d. Center spacing of screws 5 IN maximum or as required to provide smooth tight-fitted joints.
 - e. Place joints on least exposed side of piping to obtain neat appearance.

3.2 REPAIR

- A. Whenever any factory applied insulation or job-applied insulation is removed or damaged, replace with the same quality of material and workmanship.

3.3 SCHEDULES

- A. Refrigeration Lines (35-60 DegF):
 1. Elastomeric.
 2. 1/2 IN thickness for lines 1 IN and smaller.

B. Pipe, Fittings and Valves:

1. Fiberglass.

| APPLICATION | PIPE SIZE | THICKNESS | JACKET |
|-----------------------|------------------|-----------|--------|
| Hot Water (domestic) | 6 IN and less | 3/4 IN | PVC |
| Cold Water (domestic) | 3 IN and less | 3/4 IN | PVC |
| Tepid (domestic) | 3 IN and Less | ¾ IN | PVC |
| | Over 4 IN | 1-1/2 IN | |
| | 2-1/2 IN to 6 IN | 1-1/2 IN | |
| | Over 6 IN | 2 IN | |

C. Equipment:

| EQUIPMENT | INSULATION SYSTEM |
|-----------|-------------------|
| | |

| DUCT SERVICE | INSULATION AND THICKNESS | MINIMUM R-VALUE (HR-FT ² -DegF)/Btu |
|--|--|--|
| Outside air and supply air downstream of heat recovery units, outside building | 2-1/2 IN semi-rigid for outdoor installation | 12.0 |
| Outside air ducts, inside building | 2-1/2 IN semi-rigid with vapor barrier | 12.0 |
| Supply and return air ducts inside building | 2 IN flexible with vapor barrier | 6.0 |
| Return air duct in non-conditioned areas including shafts | 2-1/2 IN flexible with vapor barrier | 12.0 |
| Exhaust air ducts upstream of heat recovery units, inside building | 1-1/2 IN semi-rigid | 6.0 |
| All other ductwork | Uninsulated | N/A |

END OF SECTION

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SECTION 40 90 00

INSTRUMENTATION FOR PROCESS CONTROL: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Basic requirements for complete instrumentation system for process control.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 10 14 00 - Identification Devices.
4. Section 40 98 00 - Control Panels and Enclosures.
5. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
6. Section 26 05 48 - Seismic Bracing Systems.

1.2 QUALIFICATIONS

A. The following firm is pre-qualified as being acceptable Instrumentation Subcontractors (ISC) to provide the work described in this Specification Section.

1. Tecpro Solutions:

- a. Address: 816 E. Whitney Rd., Anchorage, AK 99501
- b. Attn: Wes Saunders
- c. Phone: (907) 348-1800

2. No other firms are acceptable.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. Canadian Standards Association (CSA).
2. FM Global (FM).

3. The International Society of Automation (ISA):
 - a. 7.0.01, Quality Standard for Instrument Air.
 - b. S5.1, Instrumentation Symbols and Identification.
 - c. S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems.
 - d. S5.4, Standard Instrument Loop Diagrams.
 - e. S20, Standard Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
 4. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 5. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 6. National Institute of Standards and Technology (NIST).
 7. Underwriters Laboratories, Inc. (UL):
 - a. 508, Standard for Industrial Control Equipment.
 - b. 913, Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.
- B. Miscellaneous:
1. Comply with electrical classifications and NEMA enclosure types shown on Drawings.

1.4 DEFINITIONS

- A. Architecturally finished area: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.
- B. Non-architecturally Finished Area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
- C. Hazardous Areas: Class I, II or III areas as defined in NFPA 70.
- D. Highly Corrosive and Corrosive Areas: Rooms or areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water, wastewater or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.

- E. Outdoor Area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
- F. Intrinsically Safe Circuit: A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under test conditions as prescribed in UL 913.
- G. Calibrate: To standardize a device so that it provides a specified response to known inputs.
- H. Human-Machine Interface (HMI): The user interface in a process control system. It provides a graphics-based visualization of an industrial control and monitoring system. Typically resides in an office-based Windows computer that communicates with the PLCs.
- I. Programmable Logic Controller (PLC): A programmable microprocessor-based device that is used in automated process control systems; designed for real-time use in industrial environments.
- J. Instrumentation Subcontractor (ISC): A company that is directly accountable to the Contractor or subcontractor and responsible for assembling and configuring common off the shelf (COTS) hardware and software systems (PLCs, enclosures, instruments, etc.) required under the Contract to provide an operational system with proven communication links. The ISC is responsible for the PLC, HMI and OIT programming and configuration to provide the functions described in the Contract Documents. The ISC is responsible for the items described in the SUMMARY OF WORK below.

1.5 SYSTEM DESCRIPTION

- A. Control System Requirements:
 - 1. This Specification Section provides the general requirements for the instrument and control system.
 - 2. The instrument and control system consists of all primary elements, transmitters, switches, controllers, computers, recorders, indicators, panels, signal converters, signal boosters, amplifiers, special power supplies, special or shielded cable, special grounding or isolation, auxiliaries, software, wiring, and other devices required to provide complete control of the plant as specified in the Contract Documents.
 - 3. Current Technology: Meters, instruments, and other components shall be the most recent field-proven models marketed by their manufacturers at the time of submittal of the Shop Drawings, unless otherwise required to match existing equipment.
 - 4. Hardware Commonality: Instruments which utilize a common measurement principle (for example, d/p cells, pressure transmitters, level transmitters which monitor hydrostatic head) shall be furnished by a single manufacturer. Panel-mounted instruments shall have matching style and

general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be from a single manufacturer.

5. Environmental Suitability: Indoor and outdoor control panels and instrument enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Contract Documents. Heating, cooling, and dehumidifying devices shall be provided in order to maintain all instrumentation devices 20 percent within the minimums and maximums of their rated environmental operating ranges. The Contractor shall provide power wiring for these devices. Enclosures suitable for the environment shall be furnished. All instrumentation in hazardous areas shall be suitable for use in the particular hazardous or classified location in which it is to be installed.
- B. All signals shall be directly linearly proportional to measured variable unless specifically noted otherwise.
- C. Single Instrumentation Subcontractor:
1. Furnish and coordinate instrumentation system through a single instrumentation subcontractor.
 - a. The instrumentation subcontractor shall be responsible for functional operations of all systems, PLC programming, SCADA programming performance of control system engineering, network equipment configurations, supervision of installation, final connections, calibrations, preparation of Drawings and Operation and Maintenance Manuals, start-up, training, demonstration of substantial completion and all other aspects of the control system.
 2. Ensure coordination of instrumentation with other work to ensure that necessary wiring, conduits, contacts, relays, converters, and incidentals are provided in order to transmit, receive, and control necessary signals to other control elements, to control panels, and to receiving stations.
 3. Prior to Shop Drawing preparation, the Instrumentation Subcontractor shall inspect the Owner's existing equipment and as-constructed electrical documentation so as to be able to fully coordinate the interface of new and existing instrumentation and controls.
 - a. All costs associated with this Work shall be incorporated into the original bid.
 - b. Although such Work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, complete and compatible installation.

1.6 SUMMARY OF WORK

A. Primary Elements and Transmitters:

1. Furnish and install new instrumentation as specified in Section 40 91 10 and as shown on the Contract Documents. Provide calibration and testing to verify the equipment is ready for operation.

B. Local Control Panels:

1. Furnish and install new local control panels as specified in Section 40 98 00 and as shown on the Drawings:
 - a. Control auxiliary equipment for the control panels shall meet the requirements of specification Section 40 97 00.
 - b. PLC hardware shall meet the requirements of specification Section 40 94 43.
2. PLC Input/Output (I/O) points shall be used to connect new process signals as identified in the PLC Input/Output List:
 - a. See Section 40 94 43 – Attachment A (PLC Component Table).
 - b. See Section 40 94 43 – Attachment B (PLC Input/Output Table).

C. SCADA System Integration:

1. Provide PLC system hardware and HMI software packages as specified and as shown on the Drawings.
 - a. The ISC shall provide their own copy of the required PLC programming software (RSLogix 5000) and computer to perform the programming and configuration requirements as specified.
2. Programming of the PLC systems located in the PLC Control Panels will be provided by the ISC to provide the automatic control functions described in specification Section 40 90 05 and as shown in the Drawings:
 - a. This excludes the programming required for the PLC's that are furnished with equipment manufacturer supplied control panels.
3. Modify the Owner's existing SCADA workstation to include the graphics screens and functionality as specified. The existing SCADA software is Wonderware InTouch HMI.
 - a. The Owner's existing Wonderware license is current and is of adequate tag name database capacity to support this project.
4. Provide Software Development Workshops per Specification 40 90 05.

- D. Assist in placing the completed system in operation and making final adjustments to instruments and components as required during system and plant start-up.
- E. Provide the services of skilled instrument technicians or controls engineers for testing, calibration, and adjustment activities under direct on site supervision of the electrical or controls engineer. Refer to Section 40 98 00 for additional testing requirements.

1.7 SUBMITTALS

A. Shop Drawings:

- 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- 2. Submittals shall be original printed material or clear, unblemished photocopies of original printed material.
 - a. Facsimile information is not acceptable.
- 3. Limit the scope of each submittal to one (1) Specification Section.
 - a. Each submittal must be submitted under the Specification Section containing requirements of submittal contents.
 - b. Do not provide any submittals for Specification Section 40 90 00.
- 4. Product technical data including:
 - a. Equipment catalog cut sheets.
 - b. Instrument data sheets:
 - 1) ISA S20 or approved equal.
 - 2) Separate data sheet for each instrument.
 - c. Materials of construction.
 - d. Minimum and maximum flow ranges.
 - e. Pressure loss curves.
 - f. Physical limits of components including temperature and pressure limits.
 - g. Size and weight.
 - h. Electrical power requirements and wiring diagrams.
 - i. NEMA rating of housings.
 - j. Submittals shall be marked with arrows to show exact features to be provided.

5. Loop diagrams per ISA S5.4 as specified in Specification Section 40 98 00.
6. Comprehensive set of wiring diagrams as specified in Specification Section 40 98 00.
7. Panel fabrication drawings as specified in Specification Section 40 98 00.
8. PLC equipment drawings.
9. HMI graphics.
10. Control Loop Descriptions updates and modifications:
 - a. Specification Section 40 90 05 shall be modified as required using the track changes functionality of MS Word.
11. Nameplate layout drawings.
12. Drawings, systems, and other elements are represented schematically in accordance with ISA S5.1 and ISA S5.3.
 - a. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed exclusively throughout submittals.
13. All Shop Drawings shall be modified with as-built information/corrections.
14. All panel and wiring drawings shall be provided in both hardcopy and softcopy.
 - a. Furnish electronic files on USB flash drive.
 - b. Drawings in AUTO CAD format.
15. Provide a parameter setting summary sheet for each field configurable device.
16. Certifications:
 - a. Documentation verifying that calibration equipment is certified with NIST traceability.
 - b. Approvals from independent testing laboratories or approval agencies, such as UL, FM or CSA.
 - 1) Certification documentation is required for all equipment for which the specifications require independent agency approval.
17. Testing reports: Source quality control reports.

B. Contract Closeout Information:

1. Operation and Maintenance Data:

- a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
- b. Record Document control loop descriptions with differences from bid documents clearly indicated.

2. Warranties: Provide copies of warranties and list of factory authorized service agents.

1.8 COORDINATION

A. The Contractor, the electrical subcontractor, ISC, and all other subcontractors and suppliers shall coordinate with one another, without the need for an intermediary, on all aspects of the Work regarding the physical, mechanical, electrical, communication, and instrumentation and controls aspects of the equipment and installations provided by each party as required to provide fully integrated, fully operable, and fully compatible systems and subsystems as required by the Contract Documents. The parties shall all be jointly and separately responsible for coordination with all other parties on issues that affect the integration and operation of items within their scope of supply in the overall plant and systems.

B. The Contractor shall coordinate with the ISC to ensure the plant and systems are fully operable. A summary of the roles and coordination required between the Contractor and the ISC is as follows:

1. Contractor:

- a. Prepare submittals for review by the Owner and the SI.
- b. Undertake the Pre-operational, Component, and System testing.
- c. Support the SI during start up, testing and Commissioning phases.
- d. Where appropriate, provide utilities, fuel, power, chemicals to allow SI to undertake and complete System and Operational Testing.

C. ISC:

1. Review Contractor submittals.
2. Attend and witness Pre-operational, Component, and System testing undertaken by Contractor.
3. Develop, prepare, install, and test all software programs and program modifications necessary to bring all systems of the plant to full operational status.

4. Undertake System and Operational testing.
5. Support the Owner during Commissioning.
6. The above description is not intended to be complete. The entire scope of work to be completed is provided for in the Contract Documents.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not remove shipping blocks, plugs, caps, and desiccant dryers installed to protect the instrumentation during shipment until the instruments are installed and permanent connections are made.

1.10 SITE CONDITIONS

- A. Area designations are identified on the Drawings.
- B. The control system shall be designed and constructed for satisfactory operation and long, low maintenance service under the following conditions:
 1. Environment: water treatment/supply facility.
 2. Indoor Temperature Range: 32 through 84 degF.
 3. Relative Humidity: 20 through 90 percent, non-condensing.
 4. Seismic bracing per Section 26 05 48.

PART 2 - PRODUCTS

2.1 NEMA TYPE REQUIREMENTS

- A. Provide enclosures/housing for control system components in accordance with the following:
 1. Areas designated as wet: NEMA Type 4.
 2. Areas designated as wet and/or corrosive: NEMA Type 4X.
 3. Areas designated as Class I hazardous, Groups A, B, C, or D as defined in NFPA 70:
 - a. NEMA Type 7 unless all electrical components within enclosure utilize intrinsically safe circuitry.
 - 1) Utilize intrinsically safe circuits to the maximum extent practical and as depicted in the Contract Documents.

4. Areas designated as Class II hazardous, Groups E, F, or G as defined in NFPA 70:
 - a. NEMA Type 9 unless all electrical components within enclosure utilize intrinsically safe circuitry.
 - 1) Utilize intrinsically safe circuits to the maximum extent practical and as depicted in the Contract Documents.
5. Either architecturally or non-architecturally finished areas designated as dry, noncorrosive, and nonhazardous: NEMA Type 12.
6. Areas designated to be subject to temporary submersion: NEMA 6P.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. System Operating Criteria:

1. **Stability:** After controls have taken corrective action, as result of a change in the controlled variable or a change in setpoint, oscillation of final control element shall not exceed two (2) cycles per minute or a magnitude of movement of 0.5 percent full travel.
2. **Response:** Any change in setpoint or change in controlled variable shall produce a corresponding corrective change in position of final control element and become stabilized within 30 seconds.
3. **Agreement:** Setpoint indication of controlled variable and measured indication of controlled variable shall agree within 3 percent of full scale over a 6:1 operating range.
4. **Repeatability:** For any repeated magnitude of control signal, from either an increasing or decreasing direction, the final control element shall take a repeated position within 0.5 percent of full travel regardless of force required to position final element.
5. **Sensitivity:** Controls shall respond to setpoint deviations and measured variable deviations within 1.0 percent of full scale.
6. **Performance:** All instruments and control devices shall perform in accordance with manufacturer's specifications.

2.3 ACCESSORIES

- A. Provide identification devices for instrumentation system components in accordance with Specification Section 10 14 00.
- B. Provide corrosion resistant spacers to maintain 1/4 IN separation between equipment and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Clarifiers, Digesters, Reservoirs, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wherever feasible, use bottom entry for all conduit entry to instruments and junction boxes.
- B. Install electrical components per the requirements of the Electrical design.
- C. Panel-Mounted Instruments:
 - 1. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
 - 2. Locate all devices mounted inside enclosures so terminals and adjustment devices are readily accessible without use of special tools and with terminal markings clearly visible.
- D. See Specification Section 26 05 19.

3.2 FIELD QUALITY CONTROL

- A. See Specification Section 01 75 00.
- B. Maintain accurate daily log of all startup activities, calibration functions, and final setpoint adjustments.
- C. In the event that instrument air is not available during calibration and testing, supply either filtered, dry, instrument quality air from a portable compressor or bottled, dry, instrument quality air.
 - 1. Do not, under any circumstances, apply hydrostatic test to any part of the air supply system or pneumatic control system.
- D. Instrumentation Calibration:
 - 1. Verify that all instruments and control devices are calibrated to provide the performance required by the Contract Documents.
 - 2. Calibrate all field-mounted instruments, other than local pressure and temperature gages, after the device is mounted in place to assure proper installed operation.
 - 3. Calibrate in accordance with the manufacturer's specifications.
 - 4. Bench calibrate pressure and temperature gages.
 - a. Field mount gage within seven (7) days of calibration.

5. Check the calibration of each transmitter and gage across its specified range at 0, 25, 50, 75, and 100 percent.
 - a. Check for both increasing and decreasing input signals to detect hysteresis.
 6. Replace any instrument which cannot be properly adjusted.
 7. Stroke control valves with clean dry air to verify control action, positioner settings, and solenoid functions.
 8. Calibration equipment shall be certified by an independent agency with traceability to NIST.
 - a. Certification shall be up-to-date.
 - b. Use of equipment with expired certifications shall not be permitted.
 9. Calibration equipment shall be at least three (3) times more accurate as the device being calibrated.
- E. Loop check-out requirements are as follows:
1. Check control signal generation, transmission, reception and response for all control loops under simulated operating conditions by imposing a signal on the loop at the instrument connections.
 - a. Use actual signals where available.
 - b. Closely observe controllers, indicators, transmitters, HMI displays, recorders, alarm and trip units, remote setpoints, ratio systems, and other control components.
 - 1) Verify that readings at all loop components are in agreement.
 - 2) Make corrections as required.
 - a) Following any corrections, retest the loop as before.
 2. Stroke all control valves, cylinders, drives and connecting linkages from the local control station and from the control room operator interface.
 3. Check all interlocks to the maximum extent possible.
 4. In addition to any other as-recorded documents, record all setpoint and calibration changes on all affected Contract Documents and turn over to the Owner.
- F. Provide verification of system assembly, power, ground, and I/O tests.
- G. Verify existence and measure adequacy of all grounds required for instrumentation and controls.

END OF SECTION

SECTION 40 90 05
CONTROL LOOP DESCRIPTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Instrumentation control strategies.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 40 90 00 - Process Control and Instrumentation Systems.

1.2 QUALITY ASSURANCE

- A. See Specification Section 40 90 00.

1.3 SYSTEM DESCRIPTION

- A. Add and integrate the new systems and equipment into the existing plant control system, maintaining the functionality and style of the existing system. The following information also serves as a guide.
- B. The control loop descriptions provide the functional requirements of the control loops represented in the Contract Documents.
 - 1. Descriptions are provided as follows:
 - a. Control system overview and general description.
 - b. Major equipment to be controlled.
 - c. Major field mounted instruments (does not include local gages).
 - d. Manual control functions.
 - e. Automatic control functions/interlocks.
 - f. Major indications provided at local control panels and motor starters/VFD's.
 - g. Remote indications and alarms.
- C. The control loop descriptions are not intended to be an inclusive listing of all elements and appurtenances required to execute loop functions, but are rather

intended to supplement and complement the Drawings and other Specification Sections.

1. The control loop descriptions shall not be considered equal to a bill of materials.
- D. Provide instrumentation hardware and software as necessary to perform control functions specified herein and shown on Drawings.
- E. Functional descriptions contained are for informational purposes intended to supplement and complement instrumentation control schematics and other details when included in Drawings and Specifications. Provide instrumentation hardware and software as necessary to perform control functions specified herein and shown on Drawings. Ensure coordination of instrumentation manufacturer with other work to ensure that necessary wiring, conduits, contacts, interposing relays, loop-isolators, converters, and incidentals are provided in order to transmit, receive, and control necessary signals to other control elements, to control panels, and to receiving stations.
- F. Software Development Workshops
1. General Requirements:
 - a. Prior to the start of OIS screen programming, the ISC will lead two Software Development Workshops at the City of Palmer, AK with Owner's staff.
 - b. Development workshops shall include at a minimum:
 - 1) A total of 8 hours shall be allocated to workshops.
 - 2) Each workshop shall be no longer than 4 hours in duration.
 - 3) The purpose of the workshops is to capture Owner's input on graphical screen development, operator interfaces, functionality, alarming, etc.
 - 4) Workshop handout materials shall be provided at the beginning of each workshop.
 - 5) Workshop meeting minutes shall be provided no more than 5 days after each workshop.
 2. Workshop Agendas:
 - a. Workshop 1 – Standby Power and SCADA System Overview:
 - 1) The workshop will capture Owner's input on process equipment groups required for sequential restart upon transfer to standby power and retransfer to utility power.
 - 2) Review PLC and SCADA hardware and software requirements.

- 3) Establish the following graphic display standards and conventions:
 - a) Naming conventions.
 - b) Equipment and process variable naming.
 - c) SCADA tag database naming conventions.
 - d) Alarm text conventions.
 - 4) Graphic standards:
 - a) Equipment graphic symbols.
 - b) Color usage.
 - c) Equipment status.
 - d) Alarm conditions and alarm processing.
 - e) Process analog values.
 - f) Trending.
 - g) Functionality:
 - (1) Motor STOP/START control.
 - (2) Motor speed control.
 - (3) Valve OPEN/CLOSE control.
 - (4) Valve modulation control.
 - (5) P&ID control.
 - (6) Control modes.
- b. Workshop 2 – HMI Graphics 50 percent Completion:
- 1) Review edit standards and conventions.
 - 2) Review the standards developed in workshop 1 and demonstrate, using a computer and LCD projector, the graphic standards and templates.
 - 3) Present the following screens for review and comment:
 - a) Process Screens.
 - (1) Secondary Clarifiers
 - (2) Secondary Scum Pump Station
 - (3) Waste Activated Sludge Pump Station
 - (4) Control Building Standby Power
 - b) Alarm screens.
 - c) Standard equipment control pop-up screens:
 - (1) OPEN/CLOSE valves.
 - (2) Modulating valves.
 - (3) PID controller.

- (4) Motor STOP/START.
 - (5) Motor speed control (VFD).
 - (6) Control modes.
 - d) Screen navigation.
- 4) Data Management Planning:
 - a) Confirm historical logging data sampling intervals.
 - b) Confirm data storage requirements.
 - c) Confirm use of third party query tools and report generation.
 - d) Confirm analog data resolution:
 - (1) Flows.
 - (2) Pressures.
 - (3) Process analyzer signals.
 - (4) Levels.
 - (5) VFD speed.
 - (6) Temperature signals.
- 3. Workshop Schedule:
 - a. Workshop 1 shall be conducted within 60 days of the Contract Award.
 - b. Workshop 2 shall be conducted within 60 days following Workshop 1.

1.4 SUBMITTALS

- A. See Specification Section 01 33 04 for requirements for the mechanics and administration of the submittal process.
- B. See Specification Section 40 90 00.
- C. Provide a detailed schedule that includes, but is not limited to the following milestones:
 - 1. Workshops
 - 2. Startup activities
 - 3. Training.
- D. Submit a detailed agenda for each workshop.
- E. Operations and Maintenance Manuals
 - 1. See Specification Section 01 33 04 for requirements for:
 - a. The mechanics and administration of the submittal process.

- b. The content of Operation and Maintenance Manuals.

F. Control Strategy for Record Documents:

1. Obtain this Specification Section 40 90 05 in electronic format (Microsoft Word) from Engineer at beginning of Project.
2. Revise and update the file monthly during construction and start-up to reflect all changes that occur due to specific equipment and systems supplied on the Project.
 - a. Show all revisions in 'track change' mode.
 - b. Change Specification Section Title to read "Control Loop Descriptions - Contractor Record Document."
 - c. Reference all changes by Request for Information (RFI) number or Change Proposal Request (CPR) number.
3. Deliver the revised and updated file as a final control loop description Record Document in the Operation and Maintenance Manual described in Specification Section 01 33 04.
4. Provide both paper copy and electronic copy (on USB flash drive) of the Record Document control loop descriptions with differences from bid documents clearly indicated in the Operation and Maintenance Manual described in Specification Section 01 33 04.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 SECONDARY CLARIFIERS

A. Secondary Clarifiers 1 and 2:

1. P&ID Reference: 800Y606
2. Description:
 - a. The secondary clarifiers are located downstream of the MBBR basins. A control station shall be located at the top of the bridge of each clarifier. The pump station control shall be local only and monitored for alarm conditions by the Plant Control System PLC.
 - b. Secondary Clarifier Sprays are provided with manual control for open/close on a supply valve for each clarifier. The sprays provide motive for to collect the scum off the top of the water.
 - c. Secondary Scum Trough sprays are provided with OPEN/CLOSE motor operated valves. The motor operated valve on the spray to the scum trough shall be controlled via proximity switch on the scum skimmer arm

to OPEN the MOV when the arm rotates near the scum trough to aid in flushing the scum into the scum trough

3. Local Control:
 - a. The local control station shall be provided with a ON/OFF local selector switch.
 - 1) Local Control is provided for ON/OFF using the pushbuttons.
 - 2) Local Control is provided for RESET using the pushbuttons, once alarm status condition is cleared.
4. Plant Control System Controls:
 - a. OPEN Scum Trough Spray Valves (MOV-3201 and MOV-3202) when the proximity switch on the clarifier arm is approximately five feet upstream of the scum trough and closes when the arm is five feet beyond the scum trough.
 - b. High Torque Alarm shall stop the secondary clarifier skimming arm and ALARM at the HMI.
5. HMI Configuration:
 - a. Status Display:
 - 1) RUN Status
 - b. Operator Entries:
 - 1) None
 - c. Alarms:
 - 1) HIGH Torque.
 - 2) HIGH HIGH Torque.
 - 3) Motor fault
 - d. Historical Trending:
 - 1) None.

3.2 SECONDARY SCUM PUMP STATION

- A. Secondary Scum Pump Station:
 1. P&ID Reference: 800Y608
 2. Description:
 - a. The Secondary Scum Pump Station consists of a wetwell with one submersible pump. It is located between the two secondary clarifiers and receives scum from both clarifiers scum launders. The pump discharge is to Lagoon 2.

- b. The scum pump station uses spray down spray during each pumping sequence.
 - c. A high level float switch shall be provided in the wetwell for alarm.
 - d. A level transmitter shall be provided in the wetwell for automatic control of the pump from the Plant Control System.
3. Local Control:
- a. A manufacturer supplied local control panel shall be located at the top of the pump station. The control panel shall include the following:
 - 1) Hand/Off/Auto selector switch.
 - a) When in Auto mode, the pump shall be controlled from the Plant Control System.
 - 2) Spray water valve Open/Close/Auto selector switch.
 - a) When in Auto, the valve will be called to open when the pump is running and called to close when the pump is stopped.
 - 3) Running indicating light.
 - 4) High Level indicating light.
 - 5) Pump high temperature indicating light.
 - 6) Pump leak alarm indicating light.
 - 7) Motor overload indicating light.
 - 8) Elapsed Time Meter.
4. Plant Control System Controls:
- a. The operator may select between Manual and Auto operation from the HMI:
 - 1) When in Manual Mode, the operator may manually start/stop the pump from the HMI.
 - 2) When in Auto Mode:
 - a) The pump will be called to start based on either of the following triggers:
 - (1) An automatic timer with an operator adjustable preset value will start timing when the pump is stopped. Then the timer expires, the pump will be called to start.
 - (2) Wetwell level rises to an operator adjustable high level.
 - (3) The pump will be called to start when the High float switch is tripped.
 - b) The scum pump will continue to operate until the wetwell level reaches an operator adjustable low level.

- c) The pump will be disabled from operating if either WAS pump is currently operating. The pump will resume operating when both WAS pumps are stopped.

5. HMI Configuration:

- a. Status Display:
 - 1) Remote status.
 - 2) RUN status
 - 3) Wetwell level.
- b. Operator Entries:
 - 1) Manual/Auto mode selection.
 - 2) Pump Start/Stop pushbuttons
 - 3) Repeat cycle timer preset.
 - 4) High wetwell level (pump start).
 - 5) Low wetwell level (pump shut off).
- c. Alarms:
 - 1) HIGH wetwell level.
 - 2) Pump fault.
- d. Historical Trending:
 - 1) Wetwell level signal.

3.3 WASTE ACTIVATED SLUDGE (WAS) PUMP STATION

A. WAS Pump Station:

- 1. P&ID Reference: 800Y608
- 2. Description:
 - a. The WAS Pump Station is located near the two secondary clarifiers and includes two WAS Pumps. A discharge flowmeter is provided on the pump discharge.
 - b. The WAS Pumps shall be used to remove WAS collected at the bottom and from the Secondary Clarifiers and deliver it to Lagoon 2.
 - c. The pumps are with constant speed motors.
- 3. Local Control:
 - a. The WAS Pump motor controllers are located at the WAS Pumping Station. The motor controllers are fitted with Hand/Off/Remote selector switches.

4. Plant Control System Controls:
 - a. The PLC shall totalize the WAS flow signal. The flow totalizer is manually reset daily by the operator.
 - b. The operator may select between Manual and Auto operation for each WAS pump from the HMI:
 - 1) When in Manual mode, the operator may manually start/stop and manually set the pump speed from the HMI.
 - 2) When in Auto mode:
 - a) The pumps will operate in a repeat cycle operation until an operator adjustable flow total is achieved.
 - b) The wasting will begin when an operator presses a START wasting pushbutton on the HMI. When the START wasting button is pressed, the following sequence will begin:
 - (1) Pump 1 will turn on. A run-time counter is used to determine how long the pump has been running. When the run-time reaches an operator adjustable value, the pump will stop.
 - (2) Both pumps will stay off for an operator adjustable OFF time.
 - (3) After the OFF time has expired, Pump 2 will begin operating. When the Pump 2 run-time reaches an operator adjustable value, the pump will stop.
 - (4) Both pumps will stay off for an operator adjustable OFF time.
 - (5) After the OFF time has expired, the sequence will repeat.
 - (6) The sequence will stop when the operator adjustable WAS flow totals has been achieved.
 - c) A low flow alarm will be generated for each pump if the pump is running and less than 25 gpm of flow is measured for more than 30 seconds.

5. HMI Configuration:

- a. Status Display:
 - 1) Remote status (2).
 - 2) Running status (2).
 - 3) WAS flow signal.
 - 4) WAS flow totalizer.
- b. Operator Entries:
 - 1) Manual/Auto mode (2).
 - 2) Start and stop pushbuttons (2).
 - 3) START Wasting pushbutton.

- 4) Pump ON time entry (minutes).
- 5) Pump OFF time entry (minutes).
- 6) WAS flow total operator entry.

c. Alarms:

- 1) FAULT status (2).
- 2) Low flow alarm (2).

d. Historical Trending:

- 1) WAS Flow signal.

B. Control Building Standby Power:

1. P&ID Reference: 800Y607

2. Description:

- a. The Control Building shall be equipped with a diesel standby engine generator and transfer switch.
- b. The generator shall be capable of providing power to one large aeration blower.

3. Local Control:

- a. The generator and ATS may be manually controlled from their respective control panel interfaces.

4. Plant Control System Controls:

- a. Plant Control System provides alarm status only.

5. HMI Configuration:

a. Status Display:

- 1) ATS in Normal position.
- 2) ATS in Standby position.
- 3) Generator running status.
- 4) Generator in Auto.

b. Operator Entries:

- 1) None

c. Alarms:

- 1) ATS in Standby position.
- 2) Generator NOT IN AUTO.
- 3) Generator WARNING.

- 4) Generator FAULT.
- 5) Generator Battery ALARM.

d. Historical Trending:

- 1) None.

C. Intrusion Alarming:

1. P&ID Reference: 800Y607

2. Description:

- a. The WAS Pump Station hatch shall be equipped with door position switch to detect if the hatch is closed.

3. Local Control:

- a. None.

4. Plant Control System Controls:

- a. The intrusion alarm may be Enabled or Disabled from the HMI.
 - 1) When disabled, no intrusion alarms will be generated.
 - 2) When enabled, an intrusion alarm will be generated 90 seconds after any door is detected to be not closed.

5. HMI Configuration:

- a. Status Display:
 - 1) WAS Vault hatch CLOSED.
- b. Operator Entries:
 - 1) Intrusion alarm Enable/Disable.
- c. Alarms:
 - 1) Intrusion alarm.
- d. Historical Trending:
 - 1) None.

END OF SECTION

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SECTION 40 91 10
PRIMARY METERS AND TRANSMITTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flow components.
2. Pressure components.
3. Level components.
4. Temperature components.
5. Analytical components.
6. Position switch components.
7. Pipe, tubing and fittings.
8. Instrument valves.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 90 00 - Instrumentation for Process Control: Basic Requirements.
4. Section 40 90 05 - Control Loop Descriptions.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Iron and Steel Institute (AISI).
2. American National Standards Institute (ANSI).
3. American Society of Mechanical Engineers (ASME):
 - a. B16.5, Pipe Flanges and Flanged Fittings.
 - b. PTC 19.5, Application of Fluid Meters, Part 2.

4. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - b. A182, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - c. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
5. Federal Communications Commission (FCC)
 - a. 47 CFR 15, Radio Frequency Devices.
6. The International Society of Automation (ISA):
 - a. MC96.1, Temperature Measurement Thermocouples.
7. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
8. US Department of Interior Bureau of Reclamation (USDIBR):
 - a. Water Measurement Manual.
9. Occupational Safety and Health Administration (OSHA):
 - a. 1910.27, Fixed Ladders.

1.3 SYSTEM DESCRIPTION

- A. The instruments specified in this Specification Section are the primary element components for the control loops shown on the "Y" series Drawings and specified in Specification Section 40 90 05.
 1. These instruments are integrated with other control system components specified under Specification Section 40 90 00 series to produce the functional control defined in the Contract Documents.

1.4 SUBMITTALS

- A. Shop Drawings:
 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. See Specification Section 40 90 00.

B. Contract Closeout Information:

1. Operation and Maintenance Data:

- a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the Articles describing the elements are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 FLOW COMPONENTS

A. Magnetic Flow Meters:

1. Acceptable manufacturers:

- a. Rosemount.
- b. Endress + Hauser.
- c. Seimens.

2. Materials:

- a. Meter tube: 304 stainless steel.
- b. Flanges: carbon steel or 304 stainless steel.
- c. Grounding rings: 316 stainless steel.
- d. Electrodes: bullet-nosed shape, 316L stainless steel or hastelloy C.
- e. Meter Lining:
 - 1) Waste Activated Sludge: Teflon (PTFE) or hard rubber.
 - 2) Plant Water: neoprene or hard rubber.

3. Design and fabrication:

- a. Electromagnetic flow meters for permanent installations both above and below ground.
- b. The meters shall utilize bipolar pulse DC coil excitation to measure voltage induced by the flow of conductive liquid through a magnetic flux.

The voltage shall be linearly proportional to flow velocity from 0.033 to 33 FT/sec.

- c. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.
- d. Provide all interconnecting cable(s) between sensor and transmitter. Cable lengths between sensors and transmitters shall be continuous (without splices) and as required to accommodate locations as shown on Drawings. Field verify actual conduit lengths prior to fabrication.
- e. Pulsed DC magnetic field excitation.
- f. Accuracy:
 - 1) Flow rates from 1 to 33 FT/sec: +/- 0.5 percent of rate.
 - 2) From low flow cutoff to 1 FT/sec: +/- 0.005 FT/sec.
- g. The transmitter and sensor shall include a method to verify flow meter performance to the original manufacturer specifications.
 - 1) The system shall be traceable to factory calibration using a third party, attested onboard system pursuant to ISO standards.
 - 2) The verification technique shall not require external handhelds, interfaces, special tooling or electrical access for a verification to be performed.
 - 3) A verification of the system shall be possible at any time, locally or remotely, on demand and under process conditions.
- h. Flow sensors:
 - 1) The sensor shall be the proper size to measure the design flow rate of the piping and measure bi-directional flow as a standard.
 - 2) The sensor liner and electrode material shall be compatible with the process fluid.
 - 3) The sensor shall consist of a flow tube with ANSI B16.5 or AWWA C207 flanges.
 - 4) The flanges shall be Class 150 for 24 IN and smaller line sizes.
 - 5) The flanges shall be AWWA Class D for 28 IN and larger line sizes.
 - 6) Operating pressure: 0 to 150 psi.
 - 7) Process temperature: -4 to 165 degF.
 - 8) Inlet and outlet grounding rings for each meter, no exceptions.
 - 9) Sensor coil resistance: 9 to 17 Ohms.
 - 10) Process liquid conductivity limits: 5 micro Siemens/cm, minimum.
 - 11) Flow tube shall be rated for permanent immersion (NEMA 6P/IP68 service) where noted in the schedule.

12) Flow tube shall be rated for Class I, Div. 2 hazardous locations where noted in the schedule.

i. Transmitters:

- 1) Each flow meter shall be furnished with a separately-mounted transmitter, unless shown otherwise.
- 2) Transmitter electronics shall use microprocessor based architecture and be configured using field adjustable parameters via front panel keypad.
- 3) Housing requirements: watertight, NEMA 4X rated, wall-mount enclosure.
- 4) Power supply: 115 V +10 percent, 60 Hz.
- 5) Indication of flow rate and totalized flow in engineering units.
- 6) Adjustable low flow cutoff.
- 7) Automatic zero.
- 8) Minimum signal lock (empty tube zero) to prevent false measurement when tube is empty.
- 9) 4-20 mA DC isolated output into maximum 800 ohms.
- 10) Signal damping: adjustable between 2 and 256 seconds.
- 11) HART capability.
- 12) Operating temperature: -4 to 122 degF.
- 13) Transmitter shall be rated for Class I, Div. 2 hazardous locations where noted in the schedule.

4. Schedule:

| TAG NUMBER | SERVICE | FLOW RANGE | METER SIZE |
|---------------------|---------------------------------------|------------|------------|
| FE-3401 FIT-3401 | WASTE ACTIVATED SLUDGE PUMP 1 FLOW | 0-100 GPM | 3 IN |

B. Low Differential Pressure Switches:

1. Acceptable manufacturer
 - a. Dwyer – Series 1800.
 - b. Or equal
2. Materials:
 - a. Body: 316 stainless steel.
 - b. Trim: 316 stainless steel.

- c. Housing: aluminum.
- 3. Design and fabrication:
 - a. Designed for air flow applications.
 - b. Field adjustable.
 - c. SPDT dry contact snap switch, 5A at 120VAC.
 - d. Agency approval: UL.
 - e. Contractor shall be responsible for providing differential pressure switch appropriate for static pressure of given fan system.
 - f. Provide hard stainless steel tubing with compression fittings.
 - 1) Sized in accordance with manufacturer's recommendations, adequately strapped and supported.
- 4. Schedule:

| TAG NUMBER | SERVICE |
|------------|----------------------------------|
| PDS-3403 | WAS VAULT SUPPLY FAN FLOW SWITCH |

2.3 PRESSURE COMPONENTS

A. Pressure Gage:

- 1. Acceptable manufacturers:
 - a. Ashcroft.
 - b. Wika.
 - c. Trerice.
 - d. Ametek U.S. Gauge.
- 2. Materials:
 - a. Bourdon tube, socket, connecting tube: 316 stainless steel.
 - b. Diaphragm seal housing: 316 stainless steel.
 - c. Case: Phenolic.
 - d. Pressure snubber:
 - 1) Filter disc: 316 stainless steel.
 - 2) Housing: 316 stainless steel.

3. Accessories:
 - a. Provide valve at point of connection to equipment and at panel if panel mounted.
 - b. Utilize pressure snubbers with porous metal discs to provide pulsation dampening on gage applications as shown on schedule.
 - c. Provide 1/2 IN stainless steel antisiphon pigtail inlet connection for hot water and steam applications.

4. Design and fabrication:
 - a. Element type:
 - 1) Direct reading bellows for ranges below 10 psig or compound gauges.
 - 2) Bourdon tube actuated for ranges 10 psig and above.
 - b. Movement: stainless steel, rotary geared.
 - c. Range: as noted. Compound scale when noted.
 - d. Accuracy: plus or minus 1.6 percent of span.
 - e. Mounting: Lower stem, unless otherwise noted.
 - f. Dial: 4.5 IN diameter.
 - g. Pointer: Micrometer pointer with self-locking adjustment.
 - h. Dampening: Pulsation dampener for all pump or blower discharge applications, and as shown in the schedule.
 - i. Process Connection: 1/4 IN NPT, unless otherwise noted.
 - j. Calibrate gages at jobsite for pressure and temperature in accordance with manufacturer's instructions.
 - k. Unless otherwise required by codes, provide stem mounted or flush mounted, as required, with 4.5 IN diameter dial.
 - l. Equip with white faces, black numerals and black pointers.
 - m. Gage tapping position to be clear of equipment functions and movements, and protected from maintenance and operation of equipment.
 - 1) Display to be readable from an accessible standing position.
 - n. Gage accuracy: 1 percent of full range.

- o. Select gage range so that:
 - 1) The normal operating value is in the middle third of the dial.
 - 2) Maximum operating pressure does not exceed 75 percent of the full scale range.

5. Schedule:

| TAG NUMBER | APPLICATION | PRESSURE RANGE | PROTECTOR REQUIREMENTS | SNUBBER REQ'D |
|------------|--|----------------|------------------------|---------------|
| PI-3301 | SECONDARY SCUM PUMP PRESSURE | 0-25 PSIG | ANNULAR SEAL | NONE |
| PI-3401A | WASTE ACTIVATED SLUDGE PUMP 1 PRESSURE | 0-25 PSIG | ANNULAR SEAL | NONE |
| PI-3401B | WASTE ACTIVATED SLUDGE PUMP 2 PRESSURE | 0-25 PSIG | ANNULAR SEAL | NONE |

B. In-Line Isolation Sleeve (Annular Seal):

- 1. Acceptable manufacturers:
 - a. Ametek.
 - b. Red Valve.
 - c. Onyx Valve.
 - d. Noshok.
- 2. Materials:
 - a. Body: carbon steel.
 - b. Flanges: carbon steel.
 - c. Flexible liner: Buna-N.
- 3. Design and fabrication:
 - a. Provide full 360 degree annular pressure sensor with flexible in-line sleeve.
 - b. Sensor shall not restrict the process flow (non-intrusive).
 - c. ANSI Class 150 flanges.
 - 1) Line size as shown on the Drawings.
 - d. Instrument connection: 0.25 IN female NPT.

- e. Fill fluid:
 - 1) Utilize halocarbon fill for process applications involving strong oxidizing agents.
 - a) Agents include but are not limited to: Cl₂, KMNO₄, FeCl, NaOH, and NaOCl.
 - 2) Utilize manufacturer's standard fill for other applications.
 - a) Ensure fill is suitable for application temperatures.
- f. Pressure rating: To meet requirements of schedule.

4. Schedule:

| TAG NUMBER | APPLICATION | LINE SIZE | PROTECTOR REQUIREMENTS | SNUBBER REQ'D |
|------------|--|-----------|------------------------|---------------|
| PE-3401A | WASTE ACTIVATED SLUDGE PUMP 1 PRESSURE | 3 INCH | ANNULAR SEAL | NONE |
| PE-3401B | WASTE ACTIVATED SLUDGE PUMP 2 PRESSURE | 3 INCH | ANNULAR SEAL | NONE |

2.4 LEVEL ELEMENTS

A. Flood Switch:

- 1. Acceptable Manufacturer:
 - a. Madison, Model M8000.
 - b. Or approved equal.
- 2. Materials: All plastic wetted parts: polypropylene.
- 3. Design and Fabrication:
 - a. Float Dimension: 1 IN high, 1 IN diameter.
 - b. Minimum Float Specific Gravity: 0.80.
 - c. Float Material: polypropylene.
 - d. Contact rated at 20VA.
 - e. Field changeable from Normally Open to Normally Closed.
 - f. Lead Wires: No. 22 AWG minimum.
 - g. Connection: 1/8-inch NPT.
 - h. Direct Acting Float Switch: Magnetic reed switch actuates on rising level.

- i. Install such that the level switch activates when the water rises to 3 inches above the finished floor.
 - 1) Contact shall be closed under normal conditions.
 - 2) Contact shall open on high level condition.
 - j. Third party testing laboratory approval: UL, FM or CSA.
4. Schedule:

| TAG NUMBER | SERVICE | TRIP ELEVATION |
|------------|-------------------------------|----------------|
| LSH-3402 | WAS VAULT FLOODED | 1.5 IN AFF |
| LSH-3301 | SECONDARY SCUM PIT HIGH LEVEL | EL 144.0 FT |

B. Cable Suspended Level Transmitters:

- 1. Acceptable manufacturers:
 - a. Ametek-Drexelbrook.
 - b. GE-Druck.
- 2. Materials:
 - a. Sensor body: 316 stainless steel.
 - b. Sensing diaphragm: 316 stainless steel.
 - c. Fill: Silicone oil.
 - d. Grommet, Cover Seal: Viton.
 - e. Cable: polyurethane strengthened with Kevlar.
 - f. Support cable: 316 stainless steel.
- 3. Design and fabrication:
 - a. Submersible Level Transmitter:
 - 1) Submersible pressure transmitter shall include a solid state level transducer with a piezoresistive pressure sensing element.
 - 2) Sensor shall be internally temperature compensated between 32 and 122 DegF.
 - 3) Diaphragm shall be with a 3.5 IN outside diameter, flush design, protected by a plate and gage assembly.

- 4) Sensor cable:
 - a) The level sensor shall be furnished with cable of sufficient length to be run continuously without splices between the sensor and the termination point.
 - b) In addition to electrical conductors, the sensor cable contains a tube which is vented to atmosphere to offset changes in barometric pressure.
 - c) The sensor shall be mounted using a cable hanger and a non-corrosive cable to support the sensor.
 - 5) Provide sensor termination enclosure (NEMA 4X) with micro filter assembly to permit barometric reference, and a replaceable desiccant module to keep vent tube free of moisture.
 - 6) Loop-powered (2-wire) device with 4-20ma DC output and 12-28 VDC excitation.
 - 7) Accuracy: ± 0.25 percent of full scale.
 - 8) Temperature effects: ± 1.5 percent of full scale.
 - 9) Operating temperature range: -25 to 180 DegF.
 - 10) Intrinsically safe:
 - a) Rated for Class I, Division 1 Hazardous Locations.
- b. Cable Terminal Enclosure:
- 1) Shall permit barometric reference of the sensor.
 - 2) Field replaceable, dry-can desiccant module to keep vent tube free of moisture.
 - 3) NEMA 4X rated enclosure.
 - 4) Gortex microfilter for venting.
 - 5) Pipe mounting bracket.

4. Schedule:

| TAG NUMBER | SERVICE | SENSOR ELEVATION | OUTPUT SPAN | TRANSMITTER LOCATION |
|------------|------------------------------|------------------|-------------|----------------------|
| LT-3301 | SECONDARY SCUM WETWELL LEVEL | 6 IN AFF | 0-10 FT | OUTDOORS |

2.5 POSITION SWITCH COMPONENTS

A. Vault Hatch Position Switches:

1. Acceptable Manufacturers:

- a. Emerson TopWorx - GO Switch 80 Series with AMC5 target magnet

2. Design and Fabrication:

a. General:

- 1) Function: indicate open/closed position of doors, hatches, panels, etc.
- 2) Type: leverless limit switch with magnetic actuator.
- 3) Parts: limit switch body, target magnet.

b. Features:

- 1) Brass housing.
- 2) Sensing range: up to 3-7/8 IN.
- 3) Target magnet: ferrous type.
- 4) Lead wires: 18 gauge, potted-in SO rubber covered cable and 36 IN length.

c. Signal Interface:

- 1) Type: SPDT Form C contacts.
- 2) Rating: 5 amperes at 120VAC.
 - a) 5A at 120 VAC.
 - b) 3A at 24 VDC.
- 3) Contact material: silver cadmium oxide, gold flashed.

d. Enclosure: NEMA 4.

e. UL Listed.

3. Schedule:

| TAG NUMBER | APPLICATION |
|------------|---------------------------------|
| DPS-3403 | WAS VAULT HATCH POSITION SWITCH |

2.6 PIPE AND FITTINGS

A. Instrument Piping:

1. For applications where the instrument is supported solely by the sensing line, (e.g., pressure gauge directly mounted to process line) utilize piping as specified below.
 - a. Diameter: 1/2 IN unless specified otherwise.
 - b. Schedule 80.
 - c. 316 stainless steel.

2.7 INSTRUMENT VALVES

A. Process instrument multi-valve manifolds, isolation, vent and blow-down valves:

1. Acceptable manufacturers:
 - a. Whitey Co.
 - b. Anderson-Greenwood USA, Inc.
2. Materials:
 - a. Packing:
 - 1) 450 DegF and above: Graphite.
 - 2) Below 450 DegF: Graphite or Teflon.
 - b. Body: 316 stainless steel per ASTM A479.
 - c. Stem: 316 stainless steel per ASTM A276.
 - d. Ball: 316 stainless steel per ASTM A276.
 - e. Support rings: 316 stainless steel per ASTM A276.
 - f. Seats:
 - 1) Metal:
 - a) 316 stainless steel per ASTM A276.
 - 2) Soft:
 - a) Teflon, Delrin.
 - b) Only utilized on applications where manufacturer's temperature and pressure ratings exceed process design conditions.
3. Design and fabrication:
 - a. Either of the following:
 - 1) Ball valve with 1/4 turn activation.
 - 2) Free-swiveling ball stem.
 - b. Provide body wall thickness sufficient for process design conditions per ASME B31.1.
 - c. Temperature: Manufacturer's temperature rating for all components shall exceed process design conditions.

2.8 ACCESSORIES

- A. Furnish all mounting brackets, hardware and appurtenances required for mounting primary elements and transmitters.
 - 1. Materials, unless otherwise specified, shall be as follows:
 - a. Bolts, nuts, washers, expansion anchors: 316 stainless steel.
 - b. Mounting brackets:
 - 1) Standard: 316 stainless steel.
 - 2) Highly corrosive areas: Aluminum.
 - c. Mounting plates, angles:
 - 1) Standard: Carbon steel.
 - 2) Corrosive areas: 316 stainless steel.
 - d. Instrument pipe stands:
 - 1) Standard: Hot-dip galvanized 2 IN schedule 40, ASTM A106, Grade B carbon steel.
 - 2) Corrosive areas: 316 stainless steel.
- B. Tubing Support Angles and Brackets:
 - 1. Any of the following materials are acceptable:
 - a. Aluminum support with dielectric material between support and tubing.
 - b. Type 316 stainless steel.
 - c. Fiberglass.
- C. Tubing Tray or Channel:
 - 1. Aluminum.
 - 2. Provide dielectric material between tray or channel and tubing.
- D. Cable lengths between sensors and transmitters shall be continuous (without splices) and as required to accommodate locations as shown on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install instrument mounting pipe stands level and plumb.

C. Instrument Valves:

1. Orient stems for proper operation.
2. Install arrays orderly and neat in appearance with true horizontal and vertical lines.
3. Provide a minimum of 2 IN clearance between valve handle turning radii where there are multiple valve handles appearing in a straight line.
4. Valves shall have bonnets and any soft seals removed during welding or soldering into the line.
 - a. When cool, reassemble the valves.
5. Support each valve individually.
 - a. The tubing system does not qualify as support for the valve.

D. Locate instrument piping and tubing so as to be free of vibration and interference with other piping, conduit, or equipment.

E. Keep foreign matter out of the system.

F. Remove all oil on piping and tubing with solvent before piping and tubing installation.

G. Plug all open ends and connections to keep out contaminants.

H. Threaded Connection Seals:

1. Use Tite-Seal or acceptable alternate.
2. Use of lead base pipe dope or Teflon tape is not acceptable.
3. Do not apply Tite-Seal to tubing threads of compression fittings.

I. Instrument Mounting:

1. Mount all instruments where they will be accessible from fixed ladders, platforms, or grade.
2. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.
3. Mount instruments level, plumb, and support rigidly.
4. Mount to provide:
 - a. Protection from heat, shock, and vibrations.
 - b. Accessibility for maintenance.
 - c. Freedom from interference with piping, conduit and equipment.

3.2 TRAINING

- A. Provide on-site training in accordance with Specification Section 01 75 00.

END OF SECTION

SECTION 40 94 43
PROGRAMMABLE LOGIC CONTROLLER (PLC) CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Programmable logic controller (PLC) control system(s), including software, programming, and training.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 01 61 03 - Equipment: Basic Requirements.
4. Section 10 14 00 - Identification Devices.
5. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
6. Section 40 90 00 - Instrumentation for Process Control: Basic Requirements.
7. Section 40 90 05 - Control Loop Descriptions.
8. Section 40 98 00 - Control Panels and Enclosures.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C37.90.2, Trial-Use Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers.
 - b. C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
2. National Electrical Manufacturers Association (NEMA):
 - a. ICS 1, General Standards for Industrial Control and Systems.

B. Qualifications:

1. Installation supervisor shall have had experience in overseeing installation and startup of at least three similar installations.

2. Programmer(s) shall have had experience in programming PLCs for at least two projects of similar size and complexity.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 90 00.
3. Product technical data including:
 - a. Annotated print-outs of PLC application programs.
 - 1) Submit program for logic in ladder diagram format as used for the specific PLC system.
 - 2) Annotate program listing to include the following:
 - a) Written description of each rung's function.
 - b) Reference to control loop number for each rung where applicable.
 - c) Reference to instrumentation tag number of I/O devices for each rung where applicable.
 - 3) Provide written descriptions completely defining all function blocks used in program.
 - 4) Provide list of all addresses referenced in logic diagram with description of data associated with each address.
 - b. Results of factory testing procedures.
 - c. Drawings containing the following information to be submitted as part of Specification Section 40 98 00 submittals:
 - 1) Arrangement drawings for PLC system components.
 - 2) Panel and enclosure plans, sections and details.
 - 3) Access opening locations and required clearances for each panel and enclosure.
 - 4) Enclosure internal wiring and terminal blocks.
 - d. Catalog cut sheets containing information on PLC components to be submitted as part of this Specification Section submittals.

B. Contract Closeout Information:

1. Operation and Maintenance Data:

- a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Rockwell Automation, Allen-Bradley.
 - a. CompactLogix platform.
2. No like, equivalent or or-equal item is acceptable.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. See Section 40 94 43 – Attachment A (PLC Component Table).
- B. See Section 40 94 43 – Attachment B (PLC Input/Output Table).
- C. See Specification Section 40 90 00.
- D. The PLC system shall accomplish the control requirements of the loop descriptions, Drawings, and Specifications.
- E. PLC programming shall be documented and factory tested.
- F. The PLC system shall operate in ambient conditions of 32 to 140 DegF temperature and 5 to 95 percent relative humidity without the need for purging or air conditioning.
- G. Where the PLC is utilized to control multiple trains of equipment and where the equipment in each train operates as a unit relatively independent of other equipment trains (e.g., facility with multiple boiler units or filter trains), the PLC components (I/O modules, power supplies, etc.) shall be assigned so that the failure of any one (1) component does not affect equipment on all trains.
 1. I/O modules shall be segregated on a train basis unless required otherwise for safety reasons.
 2. Where several equipment units operate in parallel, but are not considered assigned to a particular equipment train (e.g., multiple raw water pumps or chemical feed pumps all discharging into a common system), the PLC I/O modules associated with each equipment unit shall be assigned so that the failure of any one (1) I/O module does not affect all of the parallel operating equipment units.

- H. All PLC control system components shall be capable of meeting or exceeding electromagnetic interference tests per IEEE C37.90.2.
- I. Incorporate the following minimum safety measures:
 - 1. Watchdog function to monitor:
 - a. Internal processor clock failure.
 - b. Processor memory failure.
 - c. Loss of communication between processor and I/O modules.
 - d. Processor ceases to execute logic program.
 - 2. Safety function wiring: Emergency shutdown switches shall not be wired into the controller.
 - 3. Safe wiring:
 - a. Unless otherwise specified, activation of alarms and stopping of equipment shall result from the de-energization of control circuits, rather than the energization of control circuits.
 - b. Low voltage control signal wires:
 - 1) Place in conduit segregated for that purpose only.
 - 2) Twisted shielded wire pair.
 - 3) Not located in the same conduit or bundle with power wiring.
 - 4. Initial safety conditions:
 - a. Utilize program module to dictate output states in a known and safe manner prior to running of control program.
 - b. Utilize program each time PLC is re-initiated and the control program activated.
 - 5. Monitoring of internal faults and display:
 - a. Internal PLC system status and faults shall be monitored and displayed.
 - 1) Monitored items shall include:
 - a) Memory ok/loss of memory.
 - b) Processor ok/processor fault.
 - c) Scan time overrun.
 - 6. Control of programs: Protect access to PLC program loading with password protection or with locked, key operated selector switches.

7. Design PLC system with high noise immunity to prevent occurrence of false logic signals resulting from switching transients, relay and circuit breaker noise or conducted and radiated radio frequency interference.
8. Operator intervention:
 - a. Logic system failure shall not preclude proper operator intervention.
 - b. Safety shutdown of equipment or a system shall require manual operator intervention before the equipment or system operation may be reestablished.

2.3 COMPONENTS

A. PLC System Components:

1. See Section 40 94 43 – Attachment A (PLC Component Table).

B. PLC System Enclosure:

1. In accordance with Specification Section 40 98 00.
2. Component placement:
 - a. Mount all controller components vertically within the enclosure to allow maximum convection cooling.
 - b. Either install power supplies above all other equipment with at least 10 IN of clearance between the power supply and the enclosure top, or adjacent to other components, but with sufficient spacing for circulation of cooling air.
 - c. Do not place I/O racks directly above the CPU or power supply.
 - d. Locate incoming line devices (isolation or constant voltage transformers, local power disconnects, surge suppressors, etc.) so as to keep power wire runs within an enclosure as short as possible.
 - e. If items such as magnetic starters, contactors, relays, and other electromagnetic devices must be located within the same enclosure as the PLC system components, place a barrier with at least 6 IN of separation between the magnetic area and the control area.
 - f. Place circulating fans close to major heat generating devices.
 - g. Segregate input/output modules into groups of identical type.
3. Wiring and grounding to be in accordance with Specification Section 40 98 00.

4. Termination requirements:
 - a. In accordance with Specification Section 40 98 00.
 - b. Make connections to I/O subsystem by terminating all field wiring on terminal blocks within the enclosure.
 - c. Prewire I/O modules to terminal blocks.
 - d. Size terminals to accommodate all active database points and spares.
 - e. Provide terminals for individual termination of each signal shield.
 - f. Field wiring shall not be disturbed when removing or replacing an I/O module.

C. PLC System Software and Programming:

1. Provide all hardware and programming required to provide communication between the PLC and the man-machine interface.
2. Provide programming to accomplish all control and monitoring requirements of the Drawings and Specifications.
3. Provide two (2) separate copies of control logic program on USB flash drives.
4. Windows 10 operating system compatible software.
5. Full documentation capability.
 - a. Provide description for each rung.
6. On/off line programming.
7. Offline simulation prior to download.
8. Two-step commands requiring operator verification prior to deletion of any programming.

2.4 ACCESSORIES

- A. Provide all accessories required to furnish a complete PLC control system to accomplish the requirements of the Drawings and Specifications.

2.5 SOURCE QUALITY CONTROL

- A. Provide a performance test after factory completion and prior to shipment.
 1. Conduct a test where the system is operated continuously and checked for correct operation including loop controls, displays, printing, keyboard functions, alarm responses, and on/off sequencing control.
 2. Conduct testing with dummy I/Os to verify each control loop operation.

3. Allow for Owner and Engineer representatives to witness testing program.
 - a. Provide minimum of 15 days' notice prior to testing.
4. Do not ship prior to successful completion of this testing program.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install PLC control system in accordance with manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

- A. Employ and pay for services of equipment manufacturer's field service representative(s) to:
 1. Inspect equipment covered by these Specifications.
 2. Supervise adjustments and installation checks.
 3. Maintain and submit an accurate daily or weekly log of all commissioning functions.
 - a. All commissioning functions may be witnessed by the Engineer.
 - b. All reports shall be cosigned by the Contractor and the Engineer if witnessed.
 4. Conduct startup of equipment and perform operational checks.
 5. Provide Owner with a written statement that manufacturer's equipment has been installed properly, started up, and is ready for operation by Owner's personnel.

3.3 DEMONSTRATION

- A. Demonstrate system in accordance with Specification Section 01 75 00.
- B. On-Site Training:
 1. Provide employee of the manufacturer or certified representative to provide two days of operation and maintenance training at the Project site after the system has successfully undergone all field testing and acceptance procedures.
 - a. As a minimum, training shall cover:
 - 1) Hardware overview.
 - 2) Software overview.
 - 3) Maintenance.

- 4) Trouble shooting.
- 5) Operation, e.g., changing set points, passwords, etc.

END OF SECTION

SECTION 40 97 00
CONTROL AUXILIARIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Operator Interface Terminals (OIT).
2. Industrial Ethernet components.
3. Signal modules.
4. Relays/timers.
5. Intrinsic safety devices.
6. Termination equipment.
7. Power supplies.
8. Voltage surge protection devices.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 40 90 00 - Instrumentation for Process Control: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
2. Underwriters Laboratories, Inc. (UL).

B. Miscellaneous:

1. Assure units comply with electrical area classifications and NEMA enclosure type shown on Drawings.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 90 00.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.
- B. Provide similar components from the same manufacturer for uniformity of appearance, operations, and maintenance.
- C. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 SIGNAL MODULE

A. Operator Interface Terminals (OIT):

1. Acceptable manufacturers:
 - a. Allen-Bradley PanelView Plus 6 1250.
 - b. No like, equivalent or or-equal item is acceptable.
2. Design and fabrication:
 - a. Integrated display computer with color touch-screen and function keys for industrial applications.
 - b. Front panel mounted with panel cutout and flush bezel. Provide an OIT on each of the panels shown in the schedule below.
 - c. Display:
 - 1) 12.1 IN color TFT; 18-bit color.
 - 2) 800x600 resolution.

- 3) Color touch.
 - 4) Anti-Glare.
 - d. Processor: x86, 1.0 GHz.
 - e. RAM: 512 MB DDR2.
 - f. Internal Storage: 512 MB.
 - g. Function keys: 40.
 - h. Operating system: Microsoft Windows CE.
 - i. Installed software:
 - 1) FactoryTalk Machine Edition
 - 2) FactoryTalk Viewpoint
 - 3) PDF viewer
 - 4) ActiveX controls,
 - 5) Remote terminal control
 - 6) FTP server.
 - j. NEMA 4X enclosure rating.
 - k. Input Power: 115 VAC.
 - l. Input/Output Interfaces:
 - 1) Two PS/2 for keyboard and mouse.
 - 2) Three USB 2.0 rear accessible.
 - 3) One 10/100/1000 Ethernet ports with EtherNet/IP communications.
 - 4) One serial ports.
 - 5) One PCI.
 - m. Operating temperature: 32 to 130 DegF.
3. Schedule:

| TAG NUMBER | APPLICATION |
|---------------|------------------------------------|
| NODE 6 | CONTROL BUILDING PLC CONTROL PANEL |

2.3 INDUSTRIAL ETHERNET COMPONENTS:

A. Fiber Patch Panels (FPP), Wall-Mounted:

1. Acceptable manufacturers:
 - a. Siecor WIC-012 or 024 with WIC-CP1-15 and guard.
 - b. Siemon SWIC3-M-01 with RIC-F-SA12-01 Adapter Plate.
2. Design and fabrication:
 - a. Provide at each fiber optic trunk cable termination point located within control panels and as shown on the Drawings:
 - b. Wall mount fiber optic cable interconnect center.
 - c. Adapter plates with 6 duplex ST adapters (for 12 fibers).
 - d. Two compartment with hinged doors and integrated hinged fiber guard.
 - e. Enclosure doors with full, 180 degree opening to provide complete access to front and side.
 - f. Door with label holder for storing fiber documentation.
 - g. Cables enter enclosure through dust proof grommets.

B. Modular Industrial Fiber Patch Panels:

1. Acceptable manufacturers:
 - a. Hirschmann – MIPP.
2. Design and fabrication:
 - a. Provide at each fiber optic trunk cable termination point located within PLC Control Panels and as shown on the drawings:
 - b. DIN-rail mounted, expandable housing designed to accept up to six modules.
 - c. Single fiber module with 6 duplex LC adapters (for 12 fibers).
 - 1) Splice tray with multiple fingers for fiber management.
 - 2) Cables enter enclosure through dust proof grommets.
 - d. UL Listed.

C. Ethernet Switches, Industrial:

1. Acceptable manufacturers:
 - a. N-Tron: Model 708-FX2.
 - b. Or approved equal.
2. Design and fabrication:
 - a. Managed industrial Ethernet switch with 8 ports minimum. More ports shall be provided when required to provide a complete and functional system.
 - 1) Six 10/100BaseTX RJ-45 ports.
 - 2) Two 100BaseFX Fiber ports, ST style, multimode.
 - b. Rugged steel DIN-Rail Enclosure.
 - c. Operating Temperature: -20 to 70 DegC.
 - d. Ethernet copper to fiber, unless otherwise shown.
 - e. Up to 1.0 Gb/s aggregate bandwidth.
 - f. Redundant Power Inputs: 10 to 30 VDC.
 - g. Full IEEE 802.3 & 100BaseFX Compliance.
 - h. DIN rail mounted.
 - i. UL Listed.

D. Media Converters, Fiber to Copper (F/C), Industrial:

1. Industrial media converter with two Ports:
 - a. Port 1: 10/100BaseTX RJ45, auto-sensing speed and full/half duplex.
 - b. Port 2: 100BaseFX-ST, configurable for full or half duplex operation.
2. Rugged Steel DIN-Rail Enclosure .
3. Operating Temperature: -20 to 70 DegC.
4. Plug and Play Operation.
5. Redundant Power Inputs: 10 to 30 VDC.
6. Full IEEE 802.3 & 100BaseFX Compliance.
7. UL Listed.

8. Acceptable manufacturers:
 - a. N-Tron 202MC-ST.
 - b. Or approved equal.

2.4 SIGNAL MODULES

A. Loop Isolators:

1. Acceptable manufacturers:
 - a. Moore Industries.
 - b. PR Electronics.
 - c. Pepperl+Fuchs.
 - d. Acromag.
2. Design and fabrication:
 - a. Solid state electronics.
 - b. Transmit analog output signal directly proportional to measured input signal.
 - c. Power source: 24 Vdc.
 - d. Analog input: 4-20 mA DC or 1-5 Vdc.
 - e. Output signal: 4-20 mA DC into 1400 ohms.
 - f. Impedance:
 - 1) Voltage input: 10 Meg.
 - 2) Current input: 50 ohms.
 - 3) Voltage output: 1 ohm.
 - 4) Current output: 1650 ohms.
 - g. Accuracy: Better than ± 0.10 percent of span.
 - h. Isolation: Up to 500 V rms (input, output and case).
 - i. Temperature effect: ± 0.0025 percent of span per DegF.
 - j. Ambient temperature range: 0-140 DegF.
 - k. Factory calibrated.

B. Signal Splitters:

1. Acceptable manufacturers:

- a. Moore Industries.
- b. PR Electronics.
- c. Pepperl+Fuchs.
- d. Acromag

2. Design and fabrication:

- a. Solid state electronics design.
- b. Dual output channels.
- c. Transmit analog output signals directly proportional to measured input signal.
- d. Power source: 24 Vdc.
- e. Analog input: 4-20 mA DC or 1-5 Vdc.
- f. Output signal: 4-20 mA DC into 600 ohms.
- g. Impedance:
 - 1) Voltage input: 1 Meg.
 - 2) Current input: 50 ohms.
 - 3) Voltage output: 1 ohm.
 - 4) Current output: 600 ohms.
- h. Accuracy: Better than ± 0.10 percent of span.
- i. Isolation: Up to 500 V rms (input, output and case).
- j. Radiated Field Immunity (RFI).
- k. Ambient temperature effect: ± 0.0025 percent of span per DegF.
- l. Ambient temperature range: -10 to 165 DegF.
- m. Factory calibrated.

2.5 RELAYS/TIMERS

A. Control Relays:

1. Acceptable manufacturers:
 - a. Idec.
 - b. Potter & Brumfield.
 - c. Allen-Bradley.
 - d. Eaton Cutler-Hammer.
2. Design and fabrication:
 - a. Plug-in general purpose relay.
 - b. Blade connector type.
 - c. Switching capacity: 10 A.
 - d. Contact material: Silver cadmium oxide.
 - e. Provide relays with a minimum of 3 SPDT contacts.
 - f. Coil voltage: 120 Vac or 24 Vdc.
 - g. Relay sockets are DIN rail mounted.
 - h. Internal neon or LED indicator is lit when coil is energized.
 - i. Clear polycarbonate dust cover with clip fastener.
 - j. Check button.
 - k. Temperature rise:
 - 1) Coil: 85 DegF max.
 - 2) Contact: 65 DegF max.
 - l. Insulation resistance: 100 Meg min.
 - m. Frequency response: 1800 operations/hour.
 - n. Operating temperature: -20 to +150 DegF.
 - o. Life expectancy:
 - 1) Electrical: 500,000 operations or more.
 - 2) Mechanical: 50,000,000 operations or more.
 - p. UL listed or recognized.

B. Time Delay Relays:

1. Acceptable manufacturers:
 - a. Eagle Signal Controls.
 - b. Idec.
2. Design and fabrication:
 - a. Meet design test and performance requirements of NEMA ICS 2-218.
 - b. Heavy-duty.
 - c. Solid-state construction.
 - d. External adjusting dial.
 - e. Auxiliary relays as required to perform functions specified or shown on Drawings.
 - f. Operates on 117 Vac (± 10 percent) power source.
 - g. Contact rating: A150 per NEMA ICS 2-125.
 - h. Furnish with "on" and "timing out" indicators.

2.6 INTRINSIC SAFETY DEVICES

A. Intrinsic Safety Barriers:

1. Acceptable Manufacturers:
 - a. Endress+Hauser: Active Barrier RN221N.
2. Design and Fabrication.
 - a. Active barrier with power supply for safe separation of 4-20 mA DC signals.
 - b. Galvanic isolation.
 - c. Capable of providing power to 2-wire instruments.
 - d. Bi-directional HART communication with smart transmitters is possible using the built-in communication sockets.
 - e. DIN rail mounting.
 - f. Housing material: plastic.
 - g. Operating temperature: 0 to 122 DegF.

- h. FM approval for intrinsically safe circuits for Class I, Div 1, Groups A-D areas.
- i. UL Recognized.

B. Intrinsic Safety Relays/Isolators:

1. Acceptable Manufacturers:

- a. R. Stahl, Inc.
- b. MTL Instruments.
- c. Phoenix Contact.
- d. SymCom.
- e. Gems Sensors and Controls.

2. Design and Fabrication.

- a. Uses a low-power, electrically isolated to safely interface with devices located in hazardous areas.
- b. Provided with green and red LED for indication of module and field circuit status.
- c. Interface as required by application.
- d. External power: 120 Vac; 60Hz.
- e. Pole reversal protection
- f. Captured, self-opening screw terminals.
- g. Response time: less than 20ms.
- h. Galvanic isolation:
 - 1) Input/Output: 1500V.
 - 2) Input/external supply: 1500V.
 - 3) Output/External supply: 500V.
- i. Radio interference suppression: Class A.
- j. Housing material: polyimide.
- k. Operating temperature: -20 to +60 DegC.
- l. DIN rail mounting.
- m. Grounding method: not required.

- n. Testing laboratory approvals: FM and UL.

2.7 TERMINATION EQUIPMENT

A. Terminal Blocks:

1. Acceptable manufacturers:
 - a. Phoenix Contact.
 - b. Allen-Bradley.
2. Design and fabrication:
 - a. Modular type with screw compression clamp.
 - b. Screws: Stainless steel.
 - c. Current bar: Nickel-plated copper allow.
 - d. Thermoplastic insulation rated for -40 to +90 DegC.
 - e. Wire insertion area: Funnel-shaped to guide all conductor strands into terminal.
 - f. Install end sections and end stops at each end of terminal strip.
 - g. Install machine-printed terminal markers on both sides of block.
 - h. Spacing: 6 mm.
 - i. Wire size: 22-12 AWG.
 - j. Rated voltage: 600 V.
 - k. Din rail mounting.
 - l. UL listed.
3. Standard-type block:
 - a. Rated current: 30 A.
 - b. Color: Gray body.
4. Bladed-type block:
 - a. Terminal block with knife blade disconnect which connects or isolated the two (2) sides of the block.
 - b. Rated current: 10 A.

- c. Color:
 - 1) Panel control voltage leaves enclosure - normal: Gray body, orange switch.
 - 2) Foreign voltage entering enclosure: Orange body, orange switch.
- 5. Grounded-type block:
 - a. Electrically grounded to mounting rail.
 - b. Use to terminal ground wires and analog cable shields.
 - c. Color: Green and yellow body.
- B. Fuse Holders:
 - 1. Acceptable manufacturers:
 - a. Phoenix Contact.
 - b. Allen-Bradley.
 - 2. Design and fabrication:
 - a. Modular-type with screw compression clamp.
 - b. Screws: Stainless steel.
 - c. Current bar: Nickel-plated copper alloy.
 - d. Thermoplastic insulation rated for -40 to +105 DegC.
 - e. Wire insertion area: Funnel-shaped to guide all conductor strands into terminal.
 - f. Blocks can be ganged for multi-pole operation.
 - g. Install end sections and end stops at each end of terminal strip.
 - h. Install machine-printed terminal markers on both sides of block.
 - i. Spacing: 9.1 mm.
 - j. Wire size: 30-12 AWG.
 - k. Rated voltage: 300 V.
 - l. Rated current: 12 A.
 - m. Fuse size: 1/4 x 1-1/4.
 - n. Blown fuse indication.
 - o. DIN rail mounting.

- p. UL listed.

2.8 POWER SUPPLIES

A. DC Power Supplies:

1. Acceptable manufacturers:

- a. PULS – Dimension Q-Series.
- b. Phoenix Contact.
- c. Rockwell Automation.

2. Design and fabrication:

- a. Converts 120 Vac input to DC power at required voltage.
- b. DIN rail mount with enclosure (i.e., not open frame).
- c. Switching type.
- d. AC input: 120 Vac +/-15 percent, nominal 60 Hz.
- e. Efficiency: Minimum 86 percent.
- f. Rated mean time between failure (MTBF): 500,000 HRS.
- g. Voltage regulation:
 - 1) Static: Less than 1.0 percent Vout.
 - 2) Dynamic: +/-2 percent Vout overall.
- h. Output ripple/noise: Less than 100 mV peak to peak (20 MHz).
- i. Overload, short circuit and open circuit protection.
- j. Temperature rating: 0 to 60 DegC full rated, derated linearly to 50 percent at 70 DegC.
- k. Humidity rating: Up to 90 percent, non-condensing.
- l. LED status indication for DC power.

B. DC Power Supply Redundancy Modules:

1. Acceptable manufacturers:

- a. PULS – Dimension Y-Series.
- b. No like, equivalent, or or-equal item is acceptable.

2. Design and fabrication:

- a. Contains decoupling diodes and monitoring circuit.
 - 1) May be used to build 1+1 and N+1 redundant systems.
 - 2) Two input channels which can be connected to 10A power supplies.
 - 3) One output channel which can carry nominal currents up to 20A.
 - 4) Two diodes, common cathode.
- b. DIN-rail mount with enclosure (i.e., not open frame).
- c. Both input voltages are individually monitored. If one input voltage is too low or completely lost, it will be indicated by an alarm relay contact.
- d. Temperature rating: 0 to 60 DegC full rated.
- e. Humidity rating: Up to 95 percent, non-condensing.
- f. UL Listed.

C. Industrial Uninterruptible Power Supplies (UPS):

1. Acceptable manufacturers:

- a. Allen-Bradley – 1609B
- b. Or approved equal.

2. General:

a. Furnish in all new free-standing PLC Control Panels:

- 1) The following control panel loads shall be UPS protected as a minimum:
 - a) Programmable Logic Controller (PLC) hardware.
 - b) Panel control power – field contact power.
 - c) Power supplies.
 - d) Ethernet switches, taps, and media convertors.
 - e) Loop Isolators.
- 2) The following control panel loads shall not be UPS protected:
 - a) Convenience receptacles.
 - b) Primary elements with 4-wire type transmitters associated with the PLC panel as shown on the drawings.
 - c) Enclosure light fixtures.
 - d) Environmental control devices.

- b. Provides backup power in the event of a temporary power outage or multiple power supply failures.
 - c. Mount in such that dissipated heat does not adversely affect other components.
3. Design and fabrication:
- a. Power rating: 1000 VA.
 - b. Input and output voltage: 120Vac, 60 Hz.
 - c. Configuration:
 - 1) DIN-rail mounted.
 - 2) Hard-wired connections for input and output power.
 - 3) Topology: Line Interactive.
 - 4) True sine wave AC output.
 - d. Battery type: sealed, lead-acid, maintenance-free.
 - e. Field replaceable surge protection.
 - f. Provide UPS and battery with the following, as a minimum:
 - 1) UPS rating VA shall be as required for the associated control panel loads with 20 percent spare capacity. Multiple UPS's shall be used if necessary for the required loads.
 - 2) UPS shall provide battery run-times of 5 minutes minimum with fully operational control panel loads.
 - g. Communications:
 - 1) USB port to allow UPS to communicate with computer.
 - h. Relay output card to provide the following status/alarms:
 - 1) ON Battery.
 - 2) Battery low.
 - 3) UPS fault.
 - i. UL Listed

2.9 VOLTAGE SURGE PROTECTION DEVICES

A. Control Panel Surge Protection Devices:

- 1. Acceptable manufacturers:
 - a. Cutler Hammer model AGSHW CH-120N-15-XS.
 - b. EDCO model HSP121BT-1RU.

- c. MTL model MA15/D/1/Sl.
 - d. Phoenix Contact model SFP 1-20/120AC.
 - e. Eaton - Innovative Technologies.
2. Design and fabrication:
- a. General:
 - 1) Mounted internally to control panels for point-of-use loads.
 - 2) MOV based or multi-stage hybrid solid state high performance suppression system.
 - 3) Designed for series connection.
 - 4) Enclosure: Metallic or plastic, flange or DIN rail mounting.
 - 5) Field connection: Provide unit with external terminal screws for each phase, neutral and ground that will accept #14 through #12 conductors.
 - 6) Device monitoring: Long-life, solid state, externally visible indicators that monitors the on-line status of the units suppression filter system or power loss in any of the phases.
 - 7) Standards: UL 1449.
 - b. Operating voltage: 120 Vac.
 - c. Operating current: 15A minimum.
 - d. Operating frequency: 45 to 65 Hz.
 - e. Modes of protection: All modes, L-N, L-G and N-G.
 - f. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.
 - g. Maximum surge current: 20,000A per phase, 10,000A per mode minimum.
 - h. Minimum repetitive surge current capacity: 1000 impulses with no degradation of more than 10 percent deviation of the clamping voltage.
 - i. Fusing: Optional integral unit level and/or component level short circuit and/or thermal overload protection.
 - 1) External protection as recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 40 98 00
CONTROL PANELS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for control panels and enclosures utilized as follows:
 - a. Unless noted otherwise, all control panels and enclosures housing control components that are specified in Specification Section 40 91 10 or Specification Section 40 94 43.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 10 14 00 - Identification Devices.
4. Section 40 90 00 - Instrumentation for Process Control: Basic Requirements.
5. Section 40 91 10 - Primary Elements and Transmitters.
6. Section 40 94 43 - Programmable Logic Controller (PLC) Control System.
7. Section 40 97 00 - Control Auxiliaries.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American National Standards Institute (ANSI).
2. ASTM International (ASTM):
 - a. B75, Standard Specification for Seamless Copper Tube.
3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. ICS 4, Industrial Control and Systems: Terminal Blocks.

4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC):
 - 1) Article 409, Industrial Control Panels.
 5. Underwriters Laboratories, Inc. (UL):
 - a. 508A, Standard for Safety Industrial Control Panels.
- B. Miscellaneous:
1. Approved supplier of Industrial Control Panels under provisions of UL 508A.
 - a. Entire assembly shall be affixed with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.
 - b. Control panel(s) without an affixed UL 508A label shall be rejected and sent back to the Contractor's factory.
 - c. Control panels with intrinsically safe circuits shall be affixed with a UL label for an "Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions".

1.3 DEFINITIONS

- A. Panel: Control panels or enclosures listed in the schedule included in this Specification Section.
- B. Foreign Voltages: Voltages that may be present in circuits when the panel main power is disconnected.
- C. Intrinsically Safe:
1. A device, instrument or component that will not produce sparks or thermal effects under normal or abnormal conditions that will ignite a specified gas mixture.
 2. Designed such that electrical and thermal energy limits inherently are at levels incapable of causing ignition.
- D. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
- E. Instrumentation Cable:
1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
 2. Instrumentation cable is typically either TSP (twisted-shielded pair) or TST (twisted-shielded triad), and is used for the transmission of low current or low voltage signals.

- F. Ground Fault Circuit Interrupter (GFCI): A type of device (e.g., circuit breaker or receptacle) which detects an abnormal current flow to ground and opens the circuit preventing a hazardous situation.
- G. Programmable Logic Controller (PLC): A specialized industrial computer using programmed, custom instructions to provide automated monitoring and control functions by interfacing software control strategies to input/output devices.
- H. Input/Output (I/O): Hardware for the moving of control signals into and/or out of a PLC or RTU.
- I. Supervisory Control and Data Acquisition (SCADA): Used in process control applications, where programmable logic controllers (PLCs) perform control functions but are monitored and supervised by computer workstations.
- J. Highway Addressable Remote Transducer (HART): An open, master-slave protocol for bus addressable field instruments.
- K. Digital Signal Cable: Used for the transmission of digital communication signals between computers, PLCs, RTUs, etc.
- L. Uninterruptible Power Supply (UPS): A backup power unit that provides continuous power when the normal power supply is interrupted.
- M. Loop Calibrator: Portable testing and measurement tool capable of accurately generating and measuring 4-20ma DC analog signals.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. See Specification Section 40 90 00.
 - 3. Prepared with computer aided design (CAD) software.
 - 4. Printed on 11 by 17 IN sheets.
 - 5. Drawings shall include a title block containing the following:
 - a. Plant or facility name where panel(s) are to be installed.
 - b. Drawing title.
 - c. Drawing number.
 - d. Revision list with revision number and date
 - e. Drawing date.
 - f. Drawing scale.

- g. Manufacturer name, address, and telephone number.
6. Cover sheet for each drawing set shall indicate the following:
 - a. Plant or facility name.
 - b. Project name.
 - c. Submittal description.
 - d. Revision number.
 - e. Issue date.
 7. Table of contents sheet(s) shall indicate the following for each drawing in the set:
 - a. Drawing number.
 - b. Drawing title.
 - c. Sheet number.
 8. Legend and abbreviation sheet shall indicate the following:
 - a. Description of symbols and abbreviations used.
 - b. Panel construction notes including enclosure NEMA rating, finish type and color, wire type, wire color strategy, conductor sizes, and wire labeling strategy.
 - c. Confirmation that the panel(s) are to be affixed with a UL 508A label prior to shipment from the factory.
 9. Bill of Material for each panel shall include the following component information:
 - a. Instrument tag number.
 - b. Quantity.
 - c. Functional name or description.
 - d. Manufacturer.
 - e. Complete model number.
 - f. Size or rating.

10. Panel exterior layout drawings to scale and shall indicate the following:
 - a. Panel materials of construction, dimensions, and total assembled weight.
 - b. Panel access openings.
 - c. Conduit access locations.
 - d. Front panel device layout.
 - e. Nameplate schedule:
 - 1) Nameplate location.
 - 2) Legend which indicates text, letter height and color, and background color.
11. Panel interior layout drawings shall be drawn to scale and shall indicate the following:
 - a. Sub-panel or mounting pan dimensions.
 - b. Interior device layouts.
 - c. PLC general arrangement layouts.
 - d. I/O Chassis Layouts.
 - e. Wire-way locations, purpose, and dimensions.
 - f. Terminal strip designations.
 - g. Location of external wiring and/or piping connections.
 - h. Location of lighting fixtures, switches and receptacles.
12. PLC I/O chassis or rack power calculations.
13. Wiring diagrams shall consist of the following:
 - a. Panel power distribution diagrams.
 - b. Control and instrumentation wiring diagrams.
 - c. PLC I/O information:
 - 1) Model number of I/O module.
 - 2) Description of I/O module type and function.
 - 3) Rack and slot number.
 - 4) Terminal number on module.
 - 5) Point or channel number.

- 6) Programmed point addresses.
 - 7) Signal function and type.
 - 8) Equipment tag number and description.
- d. Wiring diagrams shall identify each wire as it is to be labeled.
14. Shop Drawing electronic files:
- a. Electronic files for each Shop Drawing.
 - b. Electronic files shall be in DWG format.
 - c. Compatible with the latest version AutoCAD software.
 - d. Furnished on CD or DVD-ROM media.
- B. Manufacturer catalog cut sheets for enclosure, finish, panel devices, control auxiliaries, and accessories.
- C. Electrical load calculations for each panel:
1. Total connected load.
 2. Peak electrical demand for each panel.
- D. Climate control calculations for each panel.
1. Verify that sufficient dissipation and/or generation of heat is provided to maintain interior panel temperatures within the rated operating temperatures of panel components.
- E. Contract Closeout Information:
1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
 2. See Specification Section 40 90 00.
- F. Informational Submittals:
1. Record Drawings:
 - a. Updated panel drawings delivered with the panel(s) from the Contractor's factory.
 - b. Drawings shall be enclosed in transparent plastic and firmly secured within each panel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Enclosures:
 - a. Hoffman Engineering Co.
 - b. Rittal.
 - c. Hammond Manufacturing.
 - d. Millbank Mfg. Co.
 2. Panel heaters:
 - a. Hoffman Enclosures, Inc.
 - b. Rittal.
 - c. Hammond Manufacturing.
 3. Heat exchangers and air conditioners:
 - a. Hoffman Enclosures, Inc.
 - b. Rittal.
 - c. Hammond Manufacturing.
 4. Cooling fans and exhaust packages:
 - a. Hoffman Enclosures, Inc.
 - b. Rittal.
 5. Internal corrosion inhibitors:
 - a. Hoffman Enclosures, Inc.; Model A-HCI.
 - b. Northern Technologies International Corporation (NTIC); Model Zerust VC.
 - c. Cortec Corporation; Model VpCI Emitting Systems.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 ACCESSORIES

A. Panel Nameplates and Identification:

1. See Section 10 14 00.

2.3 FABRICATION

A. General:

1. Fabricate panels with instrument arrangements and dimensions identified in the Contract Documents.
2. Provide panel(s) with the required enclosure rating per NEMA 250 to meet classifications identified in the Contract Documents.
3. Devices installed in panel openings shall have a NEMA enclosure rating at least equal to the panel enclosure rating.
 - a. Devices that cannot be obtained with an adequate NEMA rating shall be installed behind a transparent viewing window.
 - b. The window shall maintain the required NEMA rating of the enclosure.
4. Panel(s) shall be completely assembled at the Contractor's factory.
 - a. No fabrication other than correction of minor defects or minor transit damage shall be performed on panels at the jobsite.
5. Painting:
 - a. Panels fabricated from steel shall have their internal and external surfaces prepared, cleaned, primed, and painted.
 - 1) Mechanically abrade all surfaces to remove rust, scale, and surface imperfections.
 - 2) Provide final surface treatment with 120 grit abrasives or finer, followed by spot putty to fill all voids.
 - 3) Utilize solvent or chemical methods to clean panel surfaces.
 - 4) Apply surface conversion of zinc phosphate prior to painting to improve paint adhesion and to increase corrosion resistance.
 - 5) Electrostatically apply polyester urethane powder coating to all inside and outside surfaces.
 - 6) Bake powder coating at high temperatures to bond coating to enclosure surface.
 - a) Panel interior shall be white with semi-gloss finish.
 - b) Panel exterior shall be ANSI #61 gray with flat finish.

- 7) Application of alkyd liquid enamel coating shall be allowed in lieu of polyester urethane powder for wall mounted NEMA 1 or NEMA 12 rated panels.
 - b. Panels fabricated from stainless steel, aluminum, or fiberglass shall not be painted.
 6. Finish opening edges of panel cutouts to smooth and true surface conditions.
 - a. Panels fabricated from steel shall have the opening edges finished with the panel exterior paint.
 7. Panel shall meet all requirements of UL 508A.
 - a. If more than one (1) disconnect switch is required to disconnect all power within a panel or enclosure, provide a cautionary marking with the word "CAUTION" and the following or equivalent, "Risk of Electric Shock-More than one (1) disconnect switch required to de-energize the equipment before servicing."
 8. Provide control panel in accordance with NFPA 70, Article 409.
 - a. In the event of any conflict between NFPA 70, Article 409 and UL 508A, the more stringent requirement shall apply.
- B. Free-Standing Panels:
 1. Welded construction.
 2. Completely enclosed, self-supporting, and gasketed dust-tight.
 3. Rolled lip around all sides of enclosure door opening.
 4. Seams and corners welded and ground smooth to touch and smooth in visual appearance.
 5. Full height, fully gasketed flush pan doors.
 6. Full length piano hinges rated for 1.5 times door plus instrument weight.
 7. Doors with keyed alike locking handles and three-point catch.
 8. Appropriate conduit, wiring, and instrument openings shall be provided.
 9. Lifting eyebolts to allow simple, safe rigging and lifting of panel during installation.
- C. Wall Mounted Panels:
 1. Seams continuously welded and ground smooth.
 2. Rolled lip around all sides of enclosure door opening.

3. Gasketed dust tight.
4. Door clamps and hasp/staple for padlocking.
5. Key doors alike.
6. Continuous heavy GA hinge pin on doors.
 - a. Hinges rated for 1.5 times door plus instrument weight.
7. Front full opening door.
8. Brackets for wall mounting.

D. Internal Panel Wiring:

1. Panel wire duct shall be installed between each row of components, and adjacent to each terminal strip.
 - a. Route wiring within the panel in wire-duct neatly tied and bundled with tie wraps.
 - b. Follow wire-duct manufacturer's recommended fill limits.
 - c. Wire-duct shall have removable snap-on covers and perforated walls for easy wire entrance.
 - d. Wire-duct shall be constructed of nonmetallic materials with rating in excess of the maximum voltage carried therein.
2. Wiring shall be installed such that if wires are removed from one (1) device, source of power will not be disrupted to other devices.
3. Splicing and tapping of wires permitted only at terminal blocks.
4. Wire bunches to doors shall be secured at each end so that bending or twisting will be around longitudinal axis of wire.
 - a. Protect bend area with sleeve.
5. Arrange wiring neatly, cut to proper length, with surplus wire removed.
 - a. Arrange wiring with sufficient clearance.
 - b. Provide abrasion protection for wire bundles that pass through openings or across edges of sheet metal.
6. AC circuits shall be routed separate from analog signal cables and digital signal cables.
 - a. Separate by at least 6 IN, except at unavoidable crossover points and at device terminations.

7. Provide at least 6 IN of separation between intrinsically safe devices and circuits and non-intrinsically safe devices and circuits.
8. Wiring to pilot devices or rotary switches shall be individually bundled and installed with a "flexible loop" of sufficient length to permit the component to be removed from panel for maintenance without removing terminations.
9. Conductors for AC and DC circuits shall be type MTW stranded copper listed for operation with 600 V at 90 DegC.
 - a. Conductor size shall be as required for load and 16 AWG minimum.
 - b. Internal panel wiring color code:
 - 1) AC circuits:
 - a) Power wiring: Black.
 - b) Control interconnections: Yellow.
 - c) Neutral: White.
 - d) Ground: Green.
 - 2) Low voltage DC circuits:
 - a) Power wiring: Blue.
 - b) Control interconnections: Violet.
 - 3) Foreign voltage circuits: Pink.
 - 4) Annunciator circuits: Red.
 - 5) Intrinsically safe circuits: Orange.
10. Analog signal cables shall be of 600 V insulation, stranded copper, twisted-shielded pairs.
 - a. Conductor size: 18 AWG minimum.
 - b. Terminate shield drain conductors to ground only at one (1) end of the cable.
11. High precision 250 ohm resistors with 0.25 percent accuracy shall be used where 4 - 20 mA DC analog signals are converted to 1 - 5 Vdc signals.
 - a. Resistors located at terminal strips.
 - b. Resistors terminated using individual terminal blocks and with no other conductors.
 - c. Resistor leads shall be un-insulated and of sufficient length to allow test or calibration equipment (e.g., HART communicator, loop calibrator) to be properly attached to the circuit with clamped test leads.

12. Analog signals for devices in separate enclosures shall not be wired in series.

- a. Loop isolators shall be used where analog signals are transmitted between control enclosures.

13. Wire and cable identification:

- a. Wire and cables numbered and tagged at each termination.
- b. Wire tags:
 - 1) Slip-on, PVC wire sleeves with legible, machine-printed markings.
 - 2) Adhesive, snap-on, or adhesive type labels are not acceptable.
- c. Markings as identified in the Shop Drawings.

E. Grounding Requirements:

1. Equipment grounding conductors shall be separated from incoming power conductors at the point of entry.
2. Minimize grounding conductor length within the enclosure by locating the ground reference point as close as practical to the incoming power point of entry.
3. Bond electrical racks, chassis and machine elements to a central ground bus.
 - a. Nonconductive materials, such as paint, shall be removed from the area where the equipment contacts the enclosure.
4. Bond the enclosure to the ground bus.
 - a. It is imperative that good electrical connections are made at the point of contact between the ground bus and enclosure.
5. Panel-mounted devices shall be bonded to the panel enclosure or the panel grounding system by means of locknuts or pressure mounting methods.
6. Sub-panels and doors shall be bonded to ground.

F. Termination Requirements:

1. Wiring to circuits external to the panel connected to interposing terminal blocks.
2. Terminal blocks rigidly mounted on DIN rail mounting channels.
3. Terminal strips located to provide adequate space for entrance and termination of the field conductors.

4. One side of each strip of terminal blocks reserved exclusively for the termination of field conductors.
5. Terminal block markings:
 - a. Marking shall be the same as associated wire marking.
 - b. Legible, machine-printed markings.
 - c. Markings as identified in the shop drawings.
6. Terminal block mechanical characteristics, and electrical characteristics shall be in accordance with NEMA ICS 4.
7. Terminal blocks with continuous marking strips.
 - a. Each terminal block shall be identified with machine printed labels.
8. Terminals shall facilitate wire sizes as follows:
 - a. 120 Vac applications: Conductor size 12 AWG minimum.
 - b. Other: Conductor size 14 AWG minimum.
9. Analog signal cable shield drain conductors shall be individually terminated.
10. Install minimum of 20 percent spare terminals.
11. Bladed, knife switch, isolating type terminal blocks where control voltages enter or leave the panel.
12. Fused terminal blocks shall be used in the following circuits:
 - a. Control voltage is used to energize a solenoid valve.
 - b. DC power is connected to 2-wire, loop-powered instruments.
13. Fused terminal blocks shall be provided with blown fuse indicators.
14. When control circuits require more than one (1) field conductor connected to a single wiring point, a sufficient number of terminal points shall be connected internally to allow termination of only one (1) field conductor per terminal block.
15. DIN rail mounting channels shall be installed along full length of the terminal strip areas to facilitate future expansion.
16. Connections to devices with screw type terminals shall be made using spade-tongue, insulated, compression terminators.

G. Component Mounting and Placement:

1. Components shall be installed per manufacturer instructions.
2. Control relays and other control auxiliaries shall be mounted on DIN rail mounting channels where practical.
3. Front panel devices shall be mounted within a range of 40 to 70 IN above the finished floor, unless otherwise shown in the Contract Documents.
4. PLC and I/O rack installation:
 - a. Located such that the LED indicators and switches are readily visible with the panel door open.
 - b. Located such that repair and/or replacement of component can be accomplished without the need to remove wire terminations or other installed components.
5. Locate power supplies with sufficient spacing for circulation of air.
6. Where components such as magnetic starters, contactors, relays, and other electromagnetic devices are installed within the same enclosure as the PLC system components, provide a barrier of at least 6 IN of separation between the "power area containing the electromagnetic devices" and the "control area".
7. Components mounted in the panel interior shall be fastened to an interior sub-panel using machine screws.
 - a. Fastening devices shall not project through the outer surface of the panel enclosure.
8. Excess mounting space of at least 20 percent for component types listed below to facilitate future expansion:
 - a. Fuse holders.
 - b. Circuit breakers.
 - c. Control relays.
 - d. Time delay relays.
 - e. Intrinsically safe barriers and relays.
9. Components installed on sub-panels shall be provided with a minimum spacing between component and wire duct of 1 IN.
 - a. Minimum of 2 IN separation between terminal strips and wire ducts.

H. Power Distribution:

1. Main incoming power circuits shall be protected with a thermal magnetic circuit breaker.
 - a. Limit load to maximum of 80 percent of circuit breaker rating.
2. Components shall be individually fused so that they may be individually de-energized for maintenance:
3. Each control panel with PLC components shall be furnished with power protection in the form of a double conversion UPS.
4. Equip each panel with necessary power supplies with ratings required for installed equipment and with minimum 25 percent spare capacity.
5. Constant voltage transformers, balancing potentiometers, and rectifiers as necessary for specific instrument requirements.

I. Internal Panel Lighting and Service Receptacles:

1. Panels less than or equal to 4 FT wide:
 - a. One electrical GFCI duplex receptacle.
 - b. One compact fluorescent light fixture with door activated switch(es).
2. Panels or panel faces greater than 4 FT wide:
 - a. One duplex electrical GFCI receptacle per 6 FT of length.
 - b. Continuous fluorescent lighting strip with door activated switches.

J. Environmental Controls:

1. Indoor panels located in a designated electrical room or control room:
 - a. Thermostat controlled cooling fans with exhaust louvers if required to maintain temperature inside panel(s) below the maximum operating temperature rating of the internal components.
 - b. Internal corrosion inhibitors.
2. Indoor panels not located within a designated electrical room or control room:
 - a. Thermostat controlled heaters to maintain temperature approximately 10 DegF above ambient for condensation prevention inside the panels.
 - b. Automatically controlled, closed-loop heat exchangers or closed-loop air conditioners where required to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the panel(s).

- c. Internal corrosion inhibitors.
3. Outdoor panels:
- a. Climate data for Palmer, Alaska:
 - 1) Record high: 86 DegF.
 - 2) Average high: 66 DegF.
 - 3) Record low: -39 DegF.
 - 4) Average low: 8 DegF.
 - b. Thermostat controlled heaters to maintain temperature approximately 10 DegF above ambient for condensation prevention inside the panels.
 - c. Thermostat controlled closed-loop heat exchangers or closed-loop air conditioners if required to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the panel.
 - d. Internal corrosion inhibitors.
4. Environmental control components:
- a. Panel heaters:
 - 1) Thermostat controlled.
 - 2) Fan driven.
 - 3) Components mounted in an anodized aluminum housing.
 - 4) Designed for sub-panel mounting.
 - 5) Powered from 120 Vac and protected with a dedicated circuit breaker.
 - b. Cooling fans and exhaust packages:
 - 1) Cooling fan with louver or grill and replaceable filter.
 - 2) Designed to be mounted within a panel cutout to provide positive airflow through the panel.
 - 3) Cooling fan and exhaust louvers shall be designed and listed to maintain a NEMA 12 enclosure rating.
 - 4) Fitted with replaceable, high-density foam or synthetic fiber.
 - 5) Cooling fan controlled with a separately mounted thermostat with bi-metal sensor and adjustable dial for temperature setting.
 - 6) Powered from 120 Vac and protected with a dedicated circuit breaker.

- c. Heat exchangers and air conditioners:
 - 1) Dual-loop design to isolate panel interior air from exterior air.
 - 2) Thermostat controlled.
 - 3) Operate from 120 Vac and protected with a dedicated circuit breaker.
- d. Internal corrosion inhibitors:
 - 1) Contains chemical which vaporizes and condenses on surfaces in the enclosure.
 - 2) Inhibitor shall be applied in accordance with manufacturer instructions for the enclosure volume.
 - 3) Inhibitor shall be applied in the panel(s) prior to shipment from the Contractor's factory.

2.4 MAINTENANCE MATERIALS

A. Extra Materials:

- 1. One quart of exterior finish touch-up paint.

PART 3 - EXECUTION

3.1 FACTORY TESTING

- A. Scope: Inspect and test entire panel assembly to verify readiness for shipment.
- B. Location: Contractor's factory.
- C. Factory Tests:
 - 1. Tests shall be fully documented and signed by the Contractor's factory supervisor.
 - 2. The panel shop shall fully test the control panel for correct wiring.
 - a. Each I/O point shall be checked by measuring or connecting circuits at the field terminal blocks.
 - 3. Burn-in test: Panel(s) shall be fully energized for a minimum period of 48 HRS.
 - 4. A PLC Central Processing Unit (CPU) shall be obtained and connected to the panel(s) if necessary for testing purposes.
 - 5. Testing equipment (such as digital multi-meters, analog loop calibrators, and laptop computers with PLC programming software) shall be used as required for testing.

6. The following functions shall be tested as a minimum:
 - a. Demonstrate functions of the panel(s) required by the Contract Documents.
 - b. Correctness of wiring from all panel field terminals to all I/O points and to all panel components.
 - c. Simulate and test each discrete signal at the field terminal strips.
 - d. Simulate and test each analog signal using loop calibrators.
 - e. Correct operation of communications between PLC system Central Processing Units (CPUs) and Remote I/O bases.
 - f. Correct operation of single-loop controllers (including digital communication to microprocessor based devices).
 - g. Correct operation of all digital communication devices.
 - h. Demonstrate online and offline diagnostic tests and procedures.
 - i. The Contractor shall notify the Engineer in writing a minimum of 15 calendar days prior to the Factory Tests.
 - 1) Engineer has the option to witness all required tests.
7. Make following documentation available to the Engineer at test site during the tests:
 - a. Contract Documents.
 - b. Factory demonstration testing procedures.
 - c. List of equipment to be testing including make, model, and serial number.
 - d. Shop drawing submittal data for equipment being tested.
8. Deficiencies shall be corrected prior to shipment from the Contractor's factory.

3.2 INSTALLATION

- A. Install free-standing panels on 4 IN high concrete housekeeping pads, unless noted otherwise.
- B. Anchor panels in a manner to prevent the enclosure from racking, which may cause the access doors to become misaligned.
- C. Obtain approved panel layouts prior to installation of conduits.
- D. Install products in accordance with manufacturer's instructions.

3.3 SCHEDULE

A. Control Panel Schedule:

| TAG NUMBER | INSTALLATION LOCATION | ENCLOSURE RATING | UPS REQUIRED | ELEVATION DRAWING |
|------------|-----------------------|------------------|--------------|-------------------|
| NODE 7 | WAS PUMPING STATION | NEMA 4 | YES | 800Y701 |

END OF SECTION

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DIVISION 43

**PROCESS GAS AND LIQUID HANDLING,
PURIFICATION, AND STORAGE EQUIPMENT**



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SECTION 43 21 00
PUMPING EQUIPMENT: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pumping equipment.
 - 2. Accessories – including portable davit crane.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 09 96 00 - High Performance Industrial Coatings.
 - 4. Section 01 61 03 - Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ANSI/Hydraulic Institute (ANSI/HI):
 - a. 9.6.3, Rotodynamic (Centrifugal and Vertical) Pumps – Guideline for Allowable Operating Region.
 - b. 9.6.4, Rotodynamic Pumps for Vibration Measurements and Allowable Values.
 - c. 9.6.6, Rotodynamic Pumps for Pump Piping.
 - d. 11.6, Rotodynamic Submersible Pump for Hydraulic Performance, Hydrostatic Pressure, Mechanical, and Electrical Acceptance Tests.
 - e. 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.
- B. Coordinate all mechanical seal systems specified to ensure pump and seal compatibility.
- C. Pump/motor and VFD coordination: See Specification Section 01 61 03.

1.3 DEFINITIONS

- A. The abbreviations used in this section are defined as follows:
1. AOR: Allowable Operating Range
 2. BEP: Best Efficiency Point
 3. IPS: Iron Pipe Size.
 4. NPSH3: Net Positive Suction Head for 3% head loss.
 5. POR: Preferred Operating Range
 6. TDH: Total Dynamic Head.
 7. TEFC: Totally Enclosed Fan Cooled.
 8. VFD: Variable Frequency Drive.
- B. Pump Service Category: Pump or pumps having identical names (not tag numbers) used for specific pumping service.

1.4 SUBMITTALS

- A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 2. See Specification Section 01 61 03.
 3. Product technical data including:
 - a. Performance data and curves with flow (gpm), head (FT), horsepower, hydraulic efficiency, rotating speed (rpm), AOR, BEP, POR, NPSH3 requirements, minimum bowl submergence requirements for vertical mixed flow, axial and turbine pumps
 - b. Pump accessory data.
 - c. Bearing supports, shafting details and lubrication provisions.
 - 1) Bearing life calculations.
 - 2) Critical speed calculations.
 - d. Solids passage information.
 4. Certifications:
 - a. Certified pump performance curves as described in the SOURCE QUALITY CONTROL Article.
 - b. Verification of Primary and Secondary conditions in POR and AOR.

5. Test reports:
 - a. Factory hydrostatic test.
- B. Contract Closeout Information:
 1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
- C. Informational Submittals:
 1. Certifications:
 - a. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Pumps:
 - a. See individual pump Specification Sections.
 2. Mechanical seals:
 - a. Chesterton.
 - b. John Crane.
 - c. Or as noted in the individual pump Specification Sections.
 3. Seal water station:
 - a. Chesterton.
 - b. John Crane.
 - c. AESSEAL.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 CENTRIFUGAL PUMP DESIGN

- A. Provide units with increasing head characteristics from the end run out portion of the curve to:
 - 1. Shut-off condition.
 - 2. For Mixed flow, Axial Flow and Propeller pumps to the right hand edge of the AOR.

2.3 ACCESSORIES

- A. See Specification Section 01 61 03.
- B. Each Unit:
 - 1. Lifting eye bolts or lugs.
 - 2. Plugged gage cock connection at suction and discharge nozzles.
 - 3. Tapped and plugged openings for casing and bearing housing vents and drains.
 - 4. Fittings for properly adding flushing lubricant.
 - 5. Pressure relief fittings for grease lubrication.
- C. Packing Seal:
 - 1. Provide packing unless mechanical seal is specified in narrow-scope pump sections.
 - 2. Minimum of five rings graphite impregnated synthetic packing.
 - 3. Provide minimum 1/4 IN DIA supply tap and 1/2 IN DIA minimum drain tap.
 - 4. Provide split Teflon or bronze water seal ring.
 - 5. Adjustable split follower cast iron or bronze gland.
- D. Mechanical Seals:
 - 1. Provide as specified in the narrow-scope pump sections.
 - 2. Provide stationary balanced O-ring type.
 - 3. Provide water lubrication – cooling.
 - 4. Materials:
 - a. Metal parts except springs: 316 stainless steel.
 - b. Springs: Hastelloy C.

- c. Seal faces: Unfilled carbon graphite versus silica-free Grade 99.5 ceramic.
- d. Elastomers: Viton.

E. Seal Water Station:

1. Provide one unit per pump with manual shut-off valve on all pumps with seals.
2. Features:
 - a. Pressure regulating.
 - b. Flow regulating.
 - c. Cleanable flow tube(s) while in service.
 - d. Hose barb connection.
 - e. Liquid filled pressure gage.
3. Materials of construction:
 - a. Flowmeter tubes: Polysulfone.
 - b. Unit body: Polyoxymethylene.
 - c. Pressure gage: 316 stainless steel case and wetted parts.
 - d. Pressure regulating valve: 316 stainless steel.
 - e. Flow regulating valve: 316 stainless steel.
 - f. Tube fittings: 316 stainless steel.
 - g. Mounting brackets: 316 stainless steel.
4. Service:
 - a. Temperatures up to 150 DegF.
 - b. Pressure up to 140 psig.
5. Connection:
 - a. Hose barb threaded to pump.
 - b. Hose barb to seal water unit.

- c. Reinforced polyurethane hose:
 - 1) Minimum size: 3/8 IN ID.
 - 2) Minimum pressure rating:
 - a) At 180 DegF: 115 psi.
 - b) At 73 DegF: 200 psi.
 - 3) Minimum wall thickness: 1/8 IN.
 - d. Non-potable water to shut-off valve: See Section 40 05 00 with isolation ball valve.
6. Mounting:
- a. To pump or pipe flange with stainless steel bracket.
 - b. Maximum distance from non-potable water to shut-off ball valve to seal water station and seal water station to pump seal, 2 FT each direction.

F. Portable Davit Crane

- 1. A portable davit crane shall be provided to remove pumps from wetwells/vaults for maintenance purposes. Provide three bases.
- 2. Thern Series 5110, or equal, with boom extension to 66-inches from base.
- 3. Portable davit crane shall have a minimum capacity of 500 lbs at the fully extended position.
- 4. Crane base shall allow for removal of the mast. Crane base shall have a pin bearing to support the end of the mast and a Nylatron GSM bearing sleeve to support the mast at the top of the base. Coordinate location of bases with Owner for anchoring by Contractor. Provide adequately sized SST adhesive anchors for anchoring.
- 5. The davit crane shall break down into portable components with no single component weighing more than 100 pounds. Carrying handles shall be welded to mast and boom.

2.4 FABRICATION

A. Pump Support:

- 1. Design base to support weight of drive, shafting and pump.
- 2. Comply with HI vibration limitations.
- 3. Mount horizontal pump, motor and coupling on single piece drip lip type baseplate.
- 4. Mount vertical pumps on single piece pedestal baseplate.

5. Fabricate to withstand all operating loads transmitted from the pump and drive.
6. On vertically configured end suction centrifugal pumps when supplied with a fabricated steel mounting frame and suction elbow, the suction elbow shall be a long radius reducing elbow with greater than 50% area reduction to comply with Table 9.6.6.3.2 of ANSI/HI 9.6.6 standard for straight pipe lengths.

2.5 SOURCE QUALITY CONTROL

- A. Verification primary design condition in POR.
- B. Verification secondary design condition in AOR.
- C. Factory hydrostatic test all pumps at 150 percent of shut-off head for a minimum of 5 minutes.
- D. If specifically required in the individual pump specification sections, provide factory tests:
 1. All units:
 - a. Conduct tests in accordance with HI.
 - 1) Shut-off head and design condition: Positive unilateral performance tolerance meeting Grade 1U per ANSI/HI 14.6 for Rotodynamic Pumps.
 - 2) Shut-off head and design conditions: Positive unilateral performance tolerances meeting Grade 1U per ANSI/HI 11.6 for Rotodynamic Submersible Pumps.
 2. All pumps:
 - a. Head (FT) versus flow (gpm) pump curves:
 - 1) Efficiencies along curve.
 - 2) Brake horsepower along each curve.
 3. Results certified by a registered professional engineer.
- E. Statically and dynamically balance each pump per ANSI/HI standards.
 1. If specifically required in the individual pump specification sections or in Specification Section 01 61 03, field vibration test pumps:
 - a. To meet requirements of ANSI/HI 9.6.4 for Rotodynamic Pumps at any point on the pumps and motor.
- F. To meet requirements of ANSI/HI 11.6 for Submersible Pumps.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Specification Section 01 61 03.
- B. Floor or Pad-Mounted Units (Non-Submersible):
 - 1. Align vertically and horizontally level, wedge and plumb units to match piping interfaces.
 - 2. Assure no unnecessary stresses are transmitted to equipment flanges.
 - 3. Tighten flange bolts at uniform rate and manufacturer's recommended torque for uniform gasket compression.
 - 4. Support and match flange faces to uniform contact over entire face area prior to bolting pipe flange and equipment.
 - 5. Permit piping connecting to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
 - 6. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
 - 7. Assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
 - a. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
 - b. Realign as necessary, install flange bolts and make equipment connection.
 - 8. Field paint units as defined in Specification Section 09 96 00.
 - 9. Provide pressure gage, visible from grade or operating floor, on discharge of all pumps and on suction and discharge of all non-submersible units.
- C. Submersible Units:
 - 1. Assemble connecting piping with gaskets in place and minimum of four bolts per joint installed and tightened.
 - a. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
 - b. Realign as necessary, install flange bolts and make equipment connection.
 - 2. Field paint units as defined in Specification Section 09 96 00.

3. Provide discharge pressure gage visible from grade or operating floor.

3.2 FIELD QUALITY CONTROL

- A. Provide services of equipment manufacturer's field service representative(s) to:
 1. Inspect equipment covered by this Specification Section.
 2. Supervise pre-start adjustments and installation checks.
 3. Conduct initial start-up of equipment and perform operational checks.
 4. Instruct Owner's personnel for the specified minimum number of hours at jobsite per Specification Section 01 30 00 on operation and maintenance of each of following pumping equipment:

END OF SECTION

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SECTION 43 21 23
WET PIT PREROTATION SCREW CENTRIFUGAL IMMERSIBLE NON-CLOG
PUMPING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies screw centrifugal pumping systems.
 - 1. This specification section includes pump systems that include screw centrifugal pumps with integral Prerostal basin, inverter rated motors, bearings, seals, base plates, couplings, supports, anchor bolts, lifting eyes, stands, local control panels and other items as necessary for a complete and operational system.
- B. Section Includes:
 - 1. Immersible non-clog pumps:
 - a. Wet pit application.
- C. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 – General Requirements.
 - 3. Section 09 96 00 – High Performance Industrial Coatings
 - 4. Section 43 21 00 – Pumping Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Bearing Manufacturers Association (ABMA).
 - 2. American National Standards Institute (ANSI).
 - 3. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - 4. FM Global (FM).

5. American National Standards Institute/Hydraulic Institute (ANSI/HI):
 - a. 1.1.-1.2, Rotodynamic (Centrifugal) Pumps for Nomenclature and Definitions
 - b. 1.3, Rotodynamic (Centrifugal) Pumps for Design and Application
 - c. 9.1-9.5, Pumps-General Guidelines
 - d. 11.6, Rotodynamic Submersible Pumps: for Hydraulic Performance, Hydrostatic Pressure, Mechanical and Electrical Acceptance Tests .
6. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. MG 1, Motors and Generators.
7. National Fire Protection Agency (NFPA):
 - a. 70, National Electrical Code (NEC):
 - 1) Article 500, Hazardous (Classified) Locations, Classes I, II, and III, Divisions 1 and 2.
8. Underwriters Laboratories, Inc. (UL).
 - a. 62, Flexible Cord and Fixture Wire.
 - b. 508A, Standard for Safety Industrial Control Panels.
 - c. 913, Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.

1.3 SYSTEM DESCRIPTION

- A. Dewatering Pump (DP-3501):
 1. Wastewater pumps utilizing wet well level control.
- B. Secondary Scum Pump (SCP-3301):
 1. Secondary Scum Wastewater pumps utilizing wet well level control.
- C. Provide single source coordination responsibility through the pump manufacturer for the entire system including but not limited to the following:
 1. Pumps.
 2. Prerostal basins and associated systems
 3. Motors.

4. Cables.
5. Local Control Panels.
6. Lifting/removal guide system.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Requirements in Specification Section 43 21 00.
3. Source quality control test reports.
4. Certified statement signed by a registered professional engineer that the ABMA L-10 bearing lives meet or exceed the specified requirements.
5. Local Control Panels:
 - a. Panel front and interior back panel layout drawings drawn to scale.
 - b. Wiring diagrams.
 - c. Bill of materials.
 - d. Manufacture catalog cut-sheets.

B. Operation and Maintenance Manuals:

1. See Specification Section 01 33 00 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.

C. Final Shop Performance Data Submittal.

D. Manufacturer to provide a written guarantee to the Owner for a period for 12 months after startup.

1. Should the pump impeller clog with solids or debris normally found in domestic wastewater.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Like items of equipment provided herein this specification section shall be the end products of one manufacturer.
- B. Responsibility: This Work including the pumping system, shall be complete with all accessories (including motors, rails, safety guards and spare parts, operation and control manuals and training) shall be the end product of one manufacturer or supplier. These systems utilize variable frequency drives and this work shall be coordinated with Contract Drawings and Specification Section 26 29 23 – Variable Frequency Drives Units. The Contractor shall be responsible to the Owner for coordination with the supplier/manufacturer to provide the systems as specified.

2.2 MANUFACTURERS

- A. Hidrostal, LLC
 - 1. Dewatering Pump (DP-3501) and spare pump: Model D4K-LP
 - 2. Secondary Scum Pump (SCP-3301) and spare pump: Model D3K-S
- B. No or equal

2.3 GENERAL REQUIREMENTS

- A. Pump and associated electrical equipment shall meet the Area Classification ratings for the areas shown on the drawings and as specified in the electrical specifications.
- B. The pump system shall include an immersible pump and shall be a clog-free, single passage pump using a screw-centrifugal impeller. The pump system shall self-cleaning, able to pump large unscreened sewage containing rags, fibers, stringy material without clogging be high efficiency and a low required NPSH.
- C. The pumping system shall be designed to operate without the use of variable frequency drive or modulating valves to provide the ability to match flow automatically using the pump impeller and Prerostal basin geometry.
- D. Each pump shall have a spare pump provided matching the pump characteristics and model number of the primary, installed pump.

2.4 MATERIALS

A. Wet Well Applications:

1. Pump casing, backhead and suction nozzle: Grey Cast iron, ASTM A48, Class 30
2. Suction Liner: Shimmed Hi-Chrome Iron liner, ASTM A532-CL III Type A1, 450 BN.
3. Motor housing: Cast iron, ASTM A48, Class 25 or Class 35B minimum.
4. Impeller: DUCTILE IRON
 - a. DIN material code: A536-80-55-06
 - b. Brinell hardness: 187-269
5. Shaft:
 - a. Stainless steel: Series 400 stainless steel
6. Liner: Hi-Chrome, A532-III-A
7. Sealing surfaces: Precision machined and fitted mating surfaces.
8. Sealing of Watertight surfaces on motor: O-rings: Nitrile (Buna-N) or fluorocarbon (Viton).
9. Fasteners: Stainless steel, ANSI Series 316.
10. Guide rails: Stainless steel.
11. Lifting Handle: Stainless steel, ANSI Series 300
12. Lifting cables: Stainless steel.
13. Lower ring seal: Rubber Booted with Tungsten-carbide rotating face and silicon-carbide stationary face.
14. Upper ring seal: Carbon/silicon-carbide.
15. Seal metal parts: Stainless steel.

2.5 EQUIPMENT

A. Performance and Configuration Requirements:

1. Dewatering Pump (DP-3501) plus one spare pump:
 - a. Design condition: 193 gpm minimum at 47 FT TDH maximum with minimum pump efficiency of 56 percent.
 - b. Minimum shutoff condition: 0 gpm at 55 FT.

- c. Pump configuration:
 - 1) Immersible wet pit.
 - d. Maximum pump speed: 1750 rpm.
 - e. Drive type: Constant speed.
 - f. Minimum solids passage: 2.75 IN.
 - g. Suction: 4 IN DIA.
 - h. Discharge: 4 IN DIA.
- B. Secondary Scum Pump (SCP-3301) plus one spare pump:
- a. Design condition: 100 gpm minimum at 23 FT TDH maximum with minimum pump efficiency of 63 percent.
 - b. Minimum shutoff condition: 0 gpm at 27 FT.
 - c. Pump configuration:
 - 1) Immersible wet pit.
 - d. Maximum pump speed: 1750 rpm.
 - e. Drive type: Constant speed.
 - f. Minimum solids passage: 2.25 IN.
 - g. Suction: 4 IN DIA.
 - h. Discharge: 3 IN DIA.

2.6 COMPONENTS

- A. General:
- 1. Provide pumps capable of handling raw, unscreened sewage.
 - 2. Where watertight sealing is required, precision machined and fitted mating surfaces with O-rings.
 - 3. Provide with heavy duty lift lugs or hoisting bail designed for lifting the entire pump and motor assembly.
- B. Impeller:
- 1. Single passage clog free screw centrifugal nonclog-type dynamically balanced impeller in accordance with HI standards.
 - 2. Impeller flange or impeller shall contain a spiral groove on the rear face so that any solids in the pumped media are discharged from the space between the backplate and the rear of the impeller.

C. Shaft:

1. Design pump shaft of sufficient size to transmit full driver output.
2. Use shaft which is accurately machined and constructed..
3. Design shaft for a maximum deflection of 0.002 IN measured. at the mechanical seal.

D. Mechanical Seal:

1. Seal shaft with two independent, tandem mounted seals running in an oil filled chamber.
2. Hold interface in contact by its own spring system. The seal faces shall be a solid tungsten steel spring which loads the seal.
3. The outboard mechanical seal shall utilize a ceramic/carbon faces.
4. Both mechanical inner and outer seals shall be interchangeable with standard off-the –shelf, size, John Crane mechanical seals, or equal to allow for second source available seals from a local distributor to allow for emergency repair.
5. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.

E. Bearings:

1. Support shaft on upper and lower permanently lubricated bearings with a minimum ABMA L-10 life of 100,000 HRS..

F. Immersible Motor

1. Motors shall be explosion-proof design, approved by Factory Mutual for Class I, Groups C&D, hazardous locations as specified.
2. The motors shall be immersible type, suitable for full-load, continuous operation in either a completely dry environment and/or fully submerged environment in wet wells with up to 65 feet water depths.
3. Motors shall be air-filled type, to optimize efficiency with stator and rotor housed in a watertight housing containing air only.
4. Service factor: 1.15.
5. Minimum motor efficiency: 92 percent.
6. Minimum power factor: 75% at full load and 68 percent at 3/4 of load.

7. Ambient conditions:
 - a. Wastewater maximum temperature: 80 DegF.
 - b. Air maximum temperature: 120 DegF.
 8. Squirrel-cage induction motor suitable for 460 VAC, 3-phase power.
 9. Stator windings insulated with moisture resistant Class H insulation rated for 180 DegC, with Class F insulation for slot and phase laminations.
 10. Motor shall be designed for continuous duty handling pumped media of 40 DegC and capable of no less than 10 evenly spaced starts per hour.
 11. Thermal temperature switches embedded for motor winding temperatures. Assure motor is capable of running dry for extended periods without damage to motor or seal, 30 minutes
 12. The motor horsepower provided shall be adequate for all points on the pump curve and non-overloading throughout the curve.
- G. Power and Control Cables:
1. Provide power cable(s) and control cable(s) to pump suitable for submersible applications in wastewater and indicate same by a code or legend permanently embossed on cables.
 2. Size cables in accordance with applicable NFPA 70 specifications.
 3. Provide power cable and control cables with lengths as required to reach the respective pump control panel.
 - a. The pump cable terminal cabinets shall be located adjacent to the pump station wet well, refer to Drawings.
 - b. The pump cables shall be routed through cable trenches constructed into the top slab of the wet well to the pump cable terminal boxes.
 - c. Supplier shall coordinate with the Contractor to determine the pump cable length requirements and provide this information in the submittals.
 - d. Provide Metric Plug attached to each cable for ease of connecting to the control panel as specified in Sections 26 05 00 Electrical Work, and 26 05 19 Wire and Cables
 - e. Provide each cable with a strain relief and cord grip installed in accordance with NFPA 70, Article 500.

4. Non-armored cable gland:
 - a. Furnish each cable with a cable gland (Crouse-Hinds).
 - b. The gland will be used to route the cables into the respective pump cable terminal cabinet or disconnect panel.

H. Integrally Mounted Pump Sensors:

1. Thermal switches (3 in a series) or thermistors for stator temperature
2. Conductivity probe to monitor the moisture content of the oil in the chamber between the outer and the inner mechanical seals.

I. Coatings and finishes:

1. Wet pit applications: Apply coating system to the exterior of the pump casing and motor housing as specified in Specification Section 09 96 00.
2. Protect all metallic surfaces coming into contact with sewage except stainless steel and bronze by a corrosion-resistant coating.

J. Wet Pit Applications:

1. Provide a dual 304L stainless steel guide rail system for each pump.
2. Provide sliding guide bracket integral to pump unit which properly aligns the pump discharge with the discharge connection elbow for watertight seal during pumping.
3. Guide the entire weight of the pumping unit by guide rail(s).
4. The guide rail(s) shall not support any portion of the weight of the pump.
5. Provide chains or cable of sufficient strength to lift pumps from sump.
6. Furnish guiding rail assembly and the discharge flange assembly of nonsparking components.
7. Design pump to allow for removal without entering the wet well and without removal of bolts, nuts or other fastenings.
8. Provide pump unit connecting to discharge connection with a simple downward motion without rotation.
9. Provide necessary sliding guide bracket and discharge connection which, when bolted to the floor of the sump and to the discharge line, will receive the pump discharge connecting flange without need of adjustment, fasteners, clamp, or similar devices.
10. No portion of the pump shall bear directly on the floor or the wet well.

2.7 MOUNTING

- A. The manufacturer shall provide a heavy-duty cast iron fast-out fixture, conforming to ASTM A536 which shall be permanently mounted to the prerotation basin in the wet well as shown on the Contract Drawings.
- B. The fast-out fixture shall cantilever the entire pump volute and motor from the volute discharge flange, providing an un-obstructed sump floor under the pump; supports from the underside of the pump volute or pump suction to sump floor (which could collect rags, stringy material and impede flow to the pump) shall not be acceptable.
- C. The fast-out fixture shall include a 90-degree cast iron, schedule 80, elbow to connect to the vertical piping, and shall provide mounts for two stainless steel guide rails which will guide the pump into position.
- D. The pump shall be supported by a positive metal to metal interlocking flange, which is additionally sealed by a leak proof nitrile rubber ring pressed against the fixture flange by the weight of the pump.

2.8 SUCTION BELL

- A. Provide one stainless steel suction bell to prevent premature vortexing of the liquid column, thereby extending the prerotation range. The hot-dipped coating shall be in accordance with ASTM A123

2.9 PREROTATION BASIN

- A. The pump/prerotation system manufacturer shall provide one patented prefabricated basin for installation by the Contractor. The pump/prerotation system manufacturer shall be responsible for the design geometry and shall certify that the installed basins will allow the prerotation system to meet the specified pumping criteria.
- B. The prerotation basin shall be self-cleaning and shall capture, entrain and remove floatables and other debris from the wet-well and shall be designed by the manufacturer.
- C. The pump/prerotation manufacturer shall provide a circular fiberglass basin of the appropriate geometry that allows the basin, pump/motor and base/elbow, fast-out fixture to be pre-assembled outside the wet-well for simplified field installation. The basin shall be constructed that it can easily be filled with concrete grout outside the wet-well by the Contractor, and the manufacturer shall furnish a plate and/or a discharge elbow, which locates and contains the anchor bolts for the fast-out fixture during the concrete grout pour. This plate/elbow shall also be designed so that it can be used to rotate and move the basin after filling. Three anchor bolts shall also be encapsulated in the concrete grout for lifting and lowering, and the anchor bolts and eye bolts shall be furnished by the manufacturer.
- D. After the concrete grout has set, the basin shall be turned over using the locator plate/elbow, the fast-out fixture shall be mounted on the anchor bolts, the pump

shall be attached to the fast-out fixture while outside the wet-well. The assembly shall then be lowered into the wet well for final adjustment and grouting.

- E. The prefabricated basin shall be constructed of a minimum thickness of 3/8-inch reinforced fiberglass plastic. The coating shall be a gel coat of 9-12 mils equal to Pittsburg Paint #56 -5335 (blue).

2.10 CONTROLS

A. Local Control Panels:

1. General requirements:

- a. Enclosed motor controllers and motor protector panel.
- b. Stainless steel enclosure with NEMA 4X rating:
 - 1) Dead-front design.
 - 2) Continuous seam welded.
 - 3) Single front door with continuous hinge, neoprene gasket.
 - 4) Mechanism designed for securing enclosure with padlock.
 - 5) Mounted on a support frame, pedestal mounting.
 - 6) Inner door in cabinet-mounted on a continuous vertical steel hinge; size to completely cover wiring and components mounted on the back panel; provide for mounting of controls and instruments on inner door.
- c. Incoming power: 480 VAC, 3-phase.
 - 1) Main circuit breaker with external circuit breaker operating handle.
 - 2) Handle shall include locking tabs that prevent the door from being opened with the breaker in the ON position.
 - 3) Transient Voltage Surge Suppression (TVSS):
 - a) UL 1449 listed.
- d. Combination motor starter for the pump:
 - 1) NEMA rated, full-voltage non-reversing type.
 - 2) 3-pole ambient compensated bimetal overload relay.
- e. Control transformer with line and load fuses.
- f. Moisture and temperature sensing relays for the pump.
 - 1) Shall be fully compatible with the moisture and temperature sensors embedded in the pump/motor.

- g. Terminal strip for connections to level switches and plant control system.
 - 1) Each discrete interface point shall be in the form of a dry, relay contact wired to terminal blocks.
- h. Intrinsically safe relays or intrinsically safe barriers to interface to the float switches located in the wetwell per UL 913.
- i. Pump Elapsed Time Meter (ETM).
- j. Electronic time delay relays.
- k. Ice cube, industrial control relays.
- l. Pilot device requirements:
 - 1) Heavy-duty type.
 - 2) Oiltight, NEMA 4X rating.
 - 3) Mounting hole: 30.5 mm.
 - 4) Knob type operators.
 - 5) Push-to-test pilot lights, lens color as indicated.
 - 6) Legend plates:
 - a) Laminated, phenolic plastic with white field and black letters.
 - b) Size: 2 IN x 2 IN.
- m. Condensation protection shall be provided with a space heater controlled with a thermostat.
- n. Fabrication requirements:
 - 1) All internal wiring shall be neat and color coded. Each wire shall be labeled at both ends with a heat-shrinkable wire label. All incoming wires shall terminate into a box clamp type terminal block. All control wires shall be 14 Ga. Type TEW, tinned copper, rated for 105 DegC.
 - 2) A schematic diagram (showing wire color) shall be permanently fastened to the inside of the enclosure. An Installation and Service Manual shall also be included with each control panel.
 - 3) Apply corrosion inhibitors inside the panel after fabrication and prior to shipment to the jobsite. Inhibitor shall consist of agents that vaporize and then condenses on all internal surfaces of the enclosure.
 - 4) Panel shall be factory wired and tested.
 - 5) The control panel shall be U.L. listed as an assembly.

2. Specific requirements for the Dewatering Pump Local Control Panel.
 - a. Tag number: LCP-3501.
 - b. Local control pilot devices:
 - 1) HAND/OFF/AUTO selector switch for the pump.
 - 2) RUNNING light for the pump, red lens.
 - 3) OFF light for the pump, green lens.
 - 4) Overload FAULT light for the pump, amber lens.
 - 5) Motor SEAL LEAK light for the pump, amber lens.
 - 6) Motor HIGH TEMPERATURE light for the pump, amber lens.
 - 7) Control power ON light, white lens.
 - 8) Alarm RESET pushbutton.
 - c. Plant Control System interface requirements:
 - 1) Discrete Outputs to the Plant Control System:
 - a) Pump RUNNING status for the pump.
 - b) FAULT alarm for the pump.
 - c) HOA switch in AUTO for the pump.
 - d) Lift station HIGH level alarm.
 - 2) Discrete Inputs from Plant Control System:
 - a) Pump RUN command.
 - d. Controls description:
 - 1) When the selector switch for the pump in HAND, the pump shall operate.
 - 2) The pump shall be inhibited from operation in either HAND or AUTO operation with the following alarm conditions:
 - a) Overload
 - b) Seal Leak
 - c) High Temperature
 - 3) When the selector switch for the pump is AUTO, the pump shall be called to start by the Plant Control System.
 - 4) The alarms shall latch in and must be manually reset.
3. Specific Requirements for the Secondary Scum Pump Local Control Panel.
 - a. Tag number: LCP-3301.
 - b. Local control pilot devices:
 - 1) HAND/OFF/AUTO selector switch for the pump.

- 2) RUNNING light for the pump, red lens.
 - 3) OFF light for the pump, green lens.
 - 4) Overload FAULT light for the pump, amber lens.
 - 5) Motor SEAL LEAK light for the pump, amber lens.
 - 6) Motor HIGH TEMPERATURE light for the pump, amber lens.
 - 7) OPEN/CLOSE/AUTO selector switch for the spray water valve.
 - 8) Control power ON light, white lens.
 - 9) Alarm RESET pushbutton.
- c. Plant Control System interface requirements:
- 1) Discrete Outputs to the Plant Control System:
 - a) Pump RUNNING status for the pump.
 - b) FAULT alarm for the pump.
 - c) HOA switch in AUTO for the pump.
 - d) Lift station HIGH level alarm.
 - 2) Discrete Inputs from Plant Control System:
 - a) Pump RUN command.
- d. Controls description:
- 1) When the selector switch for the pump in HAND, the pump shall operate.
 - 2) The pump shall be inhibited from operation in either HAND or AUTO operation with the following alarm conditions:
 - a) Overload
 - b) Seal Leak
 - c) High Temperature
 - 3) When the selector switch for the pump is AUTO, the pump shall be called to start by the Plant Control System.
 - 4) When the selector switch for the valve is in OPEN, the valve shall be opened.
 - 5) When the selector switch for the valve is in AUTO, the valve will be called to open when the pump is running and called to close when the pump is stopped.
 - 6) A level float switch shall be installed in the wetwell for high level alarm.
 - 7) The alarms shall latch in and must be manually reset.

- B. Level Float Switches: Mechanical tilt switches in a solid polypropylene casing.
 - 1. Provide float with large radius top at electrical cable connection to assure trouble-free operation.
 - 2. The float switches shall be attached to a weighted chain as shown in the Drawings. Reference Detail 40 91 10-57.
 - 3. Provide floats to operate at elevation shown on Drawings.
 - 4. Design float switch installations to be field-adjustable.
 - 5. Provide an intrinsically safe relay or barrier for each level control circuit to reduce the energy in the circuit to the point that no spark is created by switching per UL 913.
 - 6. Stainless steel cable support grip.

2.11 EQUIPMENT LABELING/TAGGING

- A. As specified. See Section 10 14 00 Identification Devices

2.12 ACCESSORIES

- A. See Specification Section 43 21 00 Pumping Equipment Basic Requirements.

2.13 SOURCE QUALITY CONTROL

- A. Secure from the pump manufacturer the following inspections and tests on each pump before shipment from factory:
 - 1. Check impeller, motor rating and electrical connections for compliance with this Specification Section.
 - 2. Test motor and cable insulation for moisture content or insulation defects.
 - 3. Prior to submergence, run pump dry to establish correct rotation and mechanical integrity.
 - 4. Submerge pump for 30 minutes, a minimum of 6 FT under water.
 - 5. After operational test #4, perform insulation test (#2) again.
- B. Factory test of head (FT) versus flow (gpm) for one pump of each service category as specified in Section 43 21 00 Pumping Equipment Basic Requirements.

2.14 SPARE PARTS AND TOOLS

- A. Provide one spare pump for each pump supplied including the pump, motor and cable, ready to be installed if the duty pump fails or needs replacement.
- B. Any special tools required for installation and maintenance.

- C. Furnish for each pump the following items:
1. Complete set of bearings.
 2. Complete set of shaft sleeves.
 3. Suction Liner and sheaves.
 4. Complete set of O-rings and gaskets.
 5. Complete set of keys, dowels, pins, etc.
 6. All spare parts shall be labeled/tagged with the project equipment number and name and properly protected with lubricants for long term storage as necessary. See Section 10 14 00 Identification Devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Specification Section 43 21 00 Pumping Equipment Basic Requirements.
- B. Attach pump cable end as specified in to make it impervious to moisture or water seepage prior to electrical installation.

3.2 FIELD QUALITY CONTROL

- A. See Specification Section 43 21 00 Pumping Equipment Basic Requirements.

3.3 FIELD VIBRATION TEST

- A. Perform field vibration test on each pump per 40 05 05 Pipe and Pipe Fittings Basic Requirements.

END OF SECTION

SECTION 43 23 17
PUMPING EQUIPMENT: VORTEX (TORQUE-FLOW)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vortex (torque-flow) pumps.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 43 21 00 - Pumping Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Bearing Manufacturers Association (ABMA).
2. American Iron and Steel Institute (AISI):
 - a. Steel Products Manual.
3. American National Standards Institute (ANSI).
4. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - b. A532, Standard Specification for Abrasion-Resistant Cast Irons.
5. Hydraulic Institute (HI).

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 43 21 00.

B. Contract Closeout Information:

1. Operation and Maintenance Data:

- a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Severe duty pumps:

- a. Wemco (Model C).
b. Or equal.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. WAS Pumps (Equipment Tags: WASP-3401A and WASP 3401B):

1. Casing: Super Ni-Hard, ASTM A532, (minimum Brinell Hardness of 650)
a. Impeller: Same as casing.
b. Wearplate: Same as casing.
c. Suction piece: Same as casing.
d. Shaft: Steel AISI C1144.
e. Shaft sleeve: Ceramic coated sleeve Rc 63.
f. Baseplate or pedestal base: Steel.
g. Packing gland bolts, studs and nuts: 326 stainless steel.

2.3 EQUIPMENT

A. Performance and Configuration Requirements:

1. WAS Pumps (Equipment Tags: WASP-3401A and WASP 3401B):
a. Design condition: 75 gpm at 7 FT TDH efficiency of 11.5 percent.
b. Shutoff condition: 0 gpm at 125 FT TDH.

- c. Pump configuration: Horizontal.
- d. Maximum pump speed: 1700 rpm.
- e. Nameplate driver horsepower: 2.5 hp.
- f. Drive type: Variable speed.
- g. Drive configuration: Overhead motor base with V-belt sheeves
- h. Minimum solids passage: 2 IN.
- i. Maximum Net Positive Suction Head Required (NPSHR): 0 FT.
- j. Suction 3 IN DIA minimum, discharge 3 IN DIA minimum.

2.4 ACCESSORIES

A. See Section 43 21 00.

B. General:

- 1. Two-piece radial split design casing.
- 2. Separate and removable suction pieces
- 3. Completely open from suction to discharge requiring no impeller face plates.
- 4. Allow removal of impeller without disturbing the piping.
- 5. Cast case of the following minimum thickness for severe duty units:
 - a. 3 IN pump size: 9/16 IN.
- 6. Suction piece (severe duty units):
 - a. Provide following minimum thickness at the areas of greatest wear:
 - 1) 3 IN pump size: 1-1/16 IN.
- 7. Support vertical dry pit pumps by a pedestal base with openings large enough to permit access to the suction line and to the inspection opening in the suction elbow.
 - a. Assure legs of pedestal are of such a length that the suction elbow of the pump will not touch the floor or level foundation upon which it stands.

C. Suction and Discharge:

- 1. ANSI, Class 150 flanged.

D. Impeller:

1. Mount completely out of flow path between inlet and outlet so that solids do not flow through impeller.
2. Key to shaft and secure with impeller bolt locked against reverse rotation.
3. Recessed type with semi-open design.
4. Cup-type such that blade ends are surrounded by an integral rim.
 - a. Flow must be directed to center of volute, minimizing particle impact and reducing wear and degradation.
5. Taper rim from a maximum thickness of at least 7/8 IN at the tip of the discharge portion of the impeller vane to a minimum thickness of at least 1/2 IN on the backside of the vane.
6. Taper vane from a minimum thickness of 1-1/8 IN at the bottom of the cup to a minimum thickness of 1/2 IN at the top of the vane.
7. Provide removable wearplate back of impeller designed to direct flow from behind impeller to center of volute for maximum protection of casing.
8. Provide wearplate separate from stuffing box.
9. Statically and dynamically balance per HI standards.

E. Shaft Seal:

1. A single cartridge mechanical seal, requiring no external flushing, shall be furnished for installation in the pump. The seal shall utilize a rotational sealing ring mounted in an elastomer cup with an o-ring mounted stationary ring, loaded by a non-fouling conical spring encapsulated in Viton. Installation of the seal shall require no measurements or scribe marks on the shaft. The stationary sealing ring shall be constructed of silicon carbide.

2.5 SOURCE QUALITY CONTROL

A. All Pumps:

1. Hydrostatically test volute at 150 percent of shut off head.
 - a. Furnish documentation of test.

B. Factory test one pump of each service category.

1. Measure head (FT) versus flow (gpm).
2. Furnish characteristic curve and include efficiency and horsepower.
3. Certify curves by registered professional engineer.

2.6 MAINTENANCE MATERIALS

A. Extra Materials:

1. Furnish Owner the following extra parts for each pump service category:
 - a. One full gasket set.
 - b. One bearing set.
 - c. One shaft sleeve.
 - d. Two sets of packing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with requirements of Section 43 21 00.

3.2 FIELD QUALITY CONTROL

- A. See Section 43 21 00.

END OF SECTION

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SECTION 43 24 16
PUMPING EQUIPMENT: SUMP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sump pumps.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 43 21 00, Pumping Equipment: Basic Requirements

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Iron and Steel Institute (AISI):
 - a. Steel Products Manual.
2. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - b. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Section 43 21 00.
3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.

B. Operation and Maintenance Manuals:

1. See Section 01 33 00 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. WAS Vault Sump pump:
 - a. Hydromatic
 - b. Flygt.
 - c. KSB.
 - d. Or Approved Equal.

B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

A. WAS Vault Sump Pump SUP-3402:

1. Pump casing:
 - a. Cast iron, ASTM A48, Class 30B.
2. Impeller:
 - a. Thermoplastic, ASTM C581
 - b. Cast iron, ASTM A48, Class 35A.
3. Shaft:
 - a. Stainless steel, AISI Type 304.
4. Base elbow: Cast iron
5. Lifting Cables: Stainless steel
6. Motor pedestal: Cast iron

2.3 EQUIPMENT

A. Performance and Configuration Requirements:

1. Building Sump Pumps:
 - a. Design condition: 38 gpm at 10 FT TDH
 - b. Shutoff condition: 25 FT.
 - c. Pump configuration: Submersible.
 - d. Maximum pump speed: 1550
 - e. Drive type: Constant speed.
 - f. Minimum motor horsepower: 0.3.
 - g. Motor electrical: 115V, 1-phase.
 - h. Drive configuration: Direct coupled.
 - i. Minimum solids passage: 0.5 IN.

2.4 ACCESSORIES

A. See Sections 43 21 00.

- ### **B. Integral wide-angle mechanical float switch for automatic pump operation with piggyback plug-in arrangement. Switches and plugs are adjustable to allow for manual operation.**

2.5 FABRICATION

A. General:

1. Pump casing uniform and free from blowholes or other defects and designed to withstand 150 percent of shutoff head.
2. Equipped with bolted-on strainer with opening equal to specified solids passage of pump.

B. Impeller:

1. Key to pump shafts with same material as shaft.
2. Provide positive means of external axial adjustment of shaft and impeller.

2.6 SOURCE QUALITY CONTROL

A. See Section 43 21 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements of Section 43 21 00.

3.2 FIELD QUALITY CONTROL

A. See Section 43 21 00.

END OF SECTION



DIVISION 46

WATER AND WASTEWATER EQUIPMENT



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SECTION 46 43 24

SLUDGE COLLECTION: CIRCULAR SPIRAL SCRAPER-TYPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Design, fabrication, and installation and testing requirements for:
 - a. Secondary clarifiers.
 - b. Local control panels.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Section 01 61 03 - Equipment: Basic Requirements.
4. Section 03 15 19 - Anchorage to Concrete.
5. Section 05 12 00 – Structural Steel.
6. Section 05 50 00 - Metal Fabrications.
7. Section 09 96 00 - High Performance Industrial Coatings.
8. Section 26 05 19 - Wire And Cable: 600 Volt And Below
9. Section 26 05 33 - Raceways and Boxes

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. 350, Code Requirements for Environmental Engineering Concrete Structures.
2. Aluminum Association (AA):
 - a. ASD 1, Aluminum Standards and Data.
3. American Bearing Manufacturers Association (ABMA):
 - a. 9, Load Ratings and Fatigue Life for Ball Bearings.

4. American Gear Manufacturers Association (AGMA):
 - a. 2001-D, Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
 - b. 6034-B, Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors.
5. American Institute of Steel Construction (AISC):
 - a. 325, Manual of Steel Construction.
6. American Society of Civil Engineers (ASCE):
 - a. ASCE 7-10, Minimum Design Loads for Buildings and Other Structures.
7. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A48, Standard Specification for Gray Iron Castings.
 - c. A276, Standard Specification for Stainless Steel Bars and Shapes.
 - d. A536, Standard Specification for Ductile Iron Castings.
 - e. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - f. E18, Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials.
8. American Welding Society (AWS):
 - a. D1.1, Structural Welding Code – Steel.
9. International Building Code (IBC):
 - a. 2012 International Building Code.
10. NACE International (NACE).
11. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. MG 1, Motors and Generators.
12. National Fire Protection Agency (NFPA):
 - a. 70, National Electrical Code (NEC):
 - 1) Article 500, Hazardous (Classified) Locations, Classes I, II, and III, Divisions 1 and 2.

13. Occupational Safety and Health Administration (OSHA).
14. Society of Automotive Engineers (SAE):
 - a. AMS 6440M, Steel. Bars, Forgings, and Tubing 1.45Cr (0.98 1.10C) (SAE 52100) For Bearing Applications.
15. Underwriters Laboratories, Inc. (UL).
 - a. 508A, Standard for Safety Industrial Control Panels.

B. Qualifications:

1. Comply with AWS D1.1 procedures and practices.
2. Manufacturer experience:
 - a. Minimum five (5) similar clarifier mechanism installations with diameters greater than or equal to 90 percent of the diameter of this specified clarifier.
 - b. Supplied similar equipment for the past 10 years.
 - c. The mechanism shall be a standard production product of the manufacturer.
3. NACE inspector shall be a certified Level 3 inspector and have a minimum 5 years' experience performing inspections indicated.
 - a. NACE inspector shall also be a certified coatings inspector and shall have a minimum 5 years' experience performing coating inspections.

C. Independent Design Evaluation of Drive:

1. Clarifier manufacturer to submit the following information for the proposed drive unit to an independent AGMA member engineer for design evaluation:
 - a. Complete drive assembly fabrication drawings.
 - b. Drive component drawings and/or brochures for all drive components.
 - c. Manufacturer and model of all drive components.
 - d. Gear and pinion interval specifications, including all heat-treating procedures.
 - e. AGMA calculations for drive components.
 - f. Additional information needed to completely evaluate proposed drive assembly.

1.3 SYSTEM DESCRIPTION

- A. Provide single source coordination responsibility through the manufacturer for the complete sludge collection system.

1.4 SUBMITTALS

- A. Submit the following with the Proposal:

- 1. Proposal data sheets.
- 2. Clarifier mechanism drawings for column support and sludge removal.
- 3. Sufficient data to verify compliance with specifications and to illustrate construction or assembly of the product.

- B. Shop Drawings:

- 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer, model and type.
 - c. Complete erection, installation, operation and maintenance information provided by the manufacturer.
 - d. Complete construction details, materials of construction, drawings of mechanisms, gears, gear reducers, bridge, electrical wiring diagrams, control wiring diagrams, and other pertinent information.
 - e. Catalog cutsheets for purchase subcomponents.
 - f. Submit evidence of compliance with Article 2.7 requirements, including:
 - 1) Reference standards.
 - 2) Independent evaluation of drive.
 - 3) Structural design requirements.
 - g. Main drive speeds.
 - h. Size, make, and type of electric motors and drive systems.
 - i. AGMA rated alarm, stall, and ultimate torque capabilities.
 - j. Details of any revision necessary to adapt the piping, structural, electrical and instrumentation design to the equipment proposed.

- k. Manufacturer, model and certification of compliance to ABMA 9 bearing life.
- l. NACE inspector qualifications.
- m. Certification report from AGMA engineer confirming that equipment design meets referenced AGMA standards.
- n. Statement signed by a registered professional Civil or Structural Engineer registered in the state of the project that all members have been designed to support the loadings as specified.
- o. For-information-only calculations as follows:
 - 1) Center column calculations.
 - 2) Complete sludge transport calculations substantiating the spiral rake blade design, rake tip speed, and floor slope.
 - 3) Complete process calculations substantiating the size of the center column and ports, the energy dissipating inlet (EDI) including tangential ports and flocculating center well.
- p. Calculations and details must bear the stamp of a professional engineer.

3. Local Control Panels:

- a. Panel front and interior back panel layout drawings drawn to scale.
- b. Wiring diagrams.
- c. Bill of materials.
- d. Manufacture catalog cut-sheets.

C. Contract Closeout Information:

- 1. Operation and Maintenance Data:
 - a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
- 2. Certified as-built drawings (general arrangement and general arrangement details).
- 3. Erection drawings.
- 4. Complete bill of materials for the equipment, including the weights of all structural steel components.

5. Installation and maintenance instructions for the specific equipment including:
 - a. Erection sequence.
 - b. Maintenance and trouble-shooting check points.
 - c. Complete lubrication procedures with recommended grades of lubricants.
6. Cut sheets for all equipment items purchased from sub-vendors.
7. Clarifier manufacturer's recommended spare parts, specifically denoting:
 - a. Wear items.
 - b. Long-delivery items.
 - c. All items convenient for stock as optional replacement items.

D. Informational Submittals:

1. Manufacturer's certification regarding installation and start-up.
2. Submit copy of field-torque test results to Engineer.
3. Submit copy of report verifying completion of start-up and related field services.
4. NACE certification of surface preparation and paint application at factory.
5. Structural calculations stamped and signed by a professional Structural Engineer licensed in the State of Alaska.
 - a. Include list of design loads and loads:
 - 1) Transmitted to clarifier concrete foundation through anchorage of clarifier feed well center pier.
 - 2) Transmitted to clarifier support beams through connection to mechanism drive and/or to upper structure of clarifier feed well center pier.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 65 50.
- B. Factory Assembly:
 1. Assemble each mechanism in factory to ensure proper fit of parts.
 2. Mark parts with erection marks.
 3. Disassemble mechanism into largest sections allowed by carrier regulations for shipment.

1.6 SITE CONDITIONS

- A. Equipment suitable for installation following Mixed Bed Biofilm Reactor (MBBR) process.
- B. Wastewater temperature: 40 to 60 DegF.
- C. Ambient temperature: -40 to 100 DegF.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. WesTech Engineering, Inc.
 - 2. Or Approved Equal.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

- A. General:
 - 1. Structural members and connections:
 - a. Unit stresses shall not exceed 130 percent of AISC allowable stresses when subjected to operational loadings, such as the higher of cutout torque and/or field test torque, and environmental loads, such as from wind and seismic events.
 - 2. Compression members:
 - a. Slenderness ratio not to exceed 120 for any axis parallel to bending action.
 - 3. Tension members:
 - a. Slenderness ratio not to exceed 240 for any axis parallel to bending action.
- B. Center Column: Steel, ASTM A36.
- C. Plate: Steel, ASTM A36.
- D. Structural Shapes: Steel, ASTM A36.
- E. Tube: Steel, ASTM A36.

- F. Main Spur Gear:
 - 1. Ductile iron: ASTM A536, 80-55-06 or 80-60-03.
 - 2. Cast iron: ASTM A48, Class 60 or 50A.
- G. Main Bearings: SAE AMS 6440M, Rockwell C64, ASTM E18.
- H. Worm, Worm Shaft:
 - 1. Ductile iron: ASTM A536, 80-55-06.
- I. Pinion and Pinion Shaft:
 - 1. Ductile iron: ASTM A536, 80-55-06.
- J. Gear Housing:
 - 1. Gray iron, ASTM A48.
 - 2. Forged alloy hardened steel, ASTM A36.
- K. Shear Pins (if used): 2017-T4, AA ASD 1, aluminum screw machine stock.
- L. Shear Pin Holes (if used): Hardened steel, Rockwell "C" 62-64, ASTM E18.
- M. Turntable Base:
 - 1. Gray iron, ASTM A48.
 - 2. Forged alloy hardened steel, ASTM A36.
- N. Liner Strips: Steel, Rockwell "C" 38-42, ASTM E18.
- O. Plow Squeegees: Brass or 304 stainless steel.
- P. Drive Dust Shield: Steel, ASTM A36.
- Q. Drive Seal: Neoprene.
- R. Lip Seals: Neoprene.
- S. Submerged Fastening Hardware including Anchor Bolts: 316 stainless steel.
- T. Center Cage, Truss, Manifold: Steel, ASTM A36.
- U. Scum Skimmer Blade: 304 stainless steel, 16 GA.
- V. Scum Skimmer Wiper: Neoprene.
- W. Wear Strips: Polyurethane.
- X. Scum Drop Box: 304 stainless steel.

Y. Weirs and Baffles:

1. Effluent weirs: FRP or 316 stainless steel.
2. Angle brackets: 316 stainless steel.
3. Baffles: FRP or 316 stainless steel.

Z. Bolts and Anchor Bolts:

1. Bolts: Comply with Section 05 12 00.
2. Anchor Bolts: Comply with Section 03 15 19.
3. Stainless steel, Type 316.

2.3 EQUIPMENT

A. Clarifier Performance Requirements:

1. Clarifier service category and tag number:
2. Tank dimensions: 55 FT DIA.
3. Sidewater depth: 17 FT.
4. Floor slope: 1V to 12H.
5. Influent column inside diameter: 24 IN. (MIN.)
 - a. Outlets: Four at 9 IN wide by 17 IN water depth and 20 IN overall depth.
6. AGMA 20 year continuous rated running torque applied at output of drive unit: 14,700 FT-LBS minimum.
7. Stall or motor cut-out torque: 120% of continuous rated torque.
8. AGMA yield torque applied at output of drive unit: 49,400 FT-LBS minimum.
9. EDI, including tangential flow directors:
 - a. Size: 6.0 FT DIA by 2.5 FT.
 - b. Depth below water surface: 2.0 FT.
 - c. Ports: Four at 9 IN wide by 14 IN water depth and 17 IN overall depth.
10. Minimum turntable ball race diameter: 34.98 IN.
11. Minimum internal spur gear pitch diameter: 31 IN.
12. Minimum drive motor horsepower: 0.5 HP.
13. Maximum drive motor speed: 1800 rpm.

14. Drive output speed: 0.07 rpm (11.8 fpm tip speed).
15. Drive pinion: Single.
16. Minimum spur gear face width: 3 IN.
17. Flocculating feedwell:
 - a. Size: 12 FT DIA.
 - b. Depth below water surface: 4 FT-6 IN.
 - c. Overall height: 6 FT.
18. Spiral scraper blades (inward):
 - a. Blade depth: Tapered 18 IN to 6 IN minimum.
 - b. Angle of attack: 30 - 32 degrees.
 - c. Number of spiral blades: One per rake arm.
 - d. Number of rake arms: Two.
 - e. Length of spiral blade: 24 FT.
19. Oblique scraper blades (outward):
 - a. Blade depth: Uniform 9 IN.
 - b. Angle of attack: 60 degrees.
 - c. Number of blades: 2.
 - d. Length of blade: 4 FT.
20. Sludge collector ring:
 - a. Diameter: 11 FT.
 - b. Cross-section: Tapered to limit maximum RAS velocity to less than 3 FT/second and head loss of 6 IN.
 - c. Orifices: 6; area/orifice: 12 IN² minimum.
 - d. Design for maximum RAS flow rate.
21. Influent head loss at maximum flow: 3 IN.
22. Thickness of all submerged steel members: 1/4 IN minimum.

B. Structural Design:

1. Maximum ratio of unbraced length to least radius of gyration (slenderness ratio):
 - a. Compression members: 120.
 - b. Tension members: 240 (for angle about the Z-Z axis).
2. Maximum unit stress: 1.333 times AISC allowable stresses at all structural members when subject to twice the drive motor running torque.
3. Design clarifier components and support structure in accordance with the 2012 IBC and to withstand the following environmental loading criteria, in addition to dead loads and operational live loads:
 - a. Comply with ASCE 7-10, Minimum Design Loads for Buildings and Other Structures.
 - b. Ground Snow: 50 PSF; 1.1 Importance Factor; and 1.0 Snow Exposure Coefficient.
 - c. Wind: Basic Wind Speed of 130 MPH; Class C Site Exposure.
 - d. Seismic:
 - 1) Site Classification D; Seismic Design Category D; 1.25 Importance Factor; $S_s = 1.50$; $S_1 = 0.70$, $S_{ds} = 1.00$, $S_{d1} = 0.70$.
 - 2) Hydrodynamic loading (seismically-induced wave action on structural components) shall be included in design, assuming operational water levels.

C. Process Parameters:

1. The following data to be used to calculate clarifier dimensions:

| | ANNUAL AVERAGE | MAXIMUM MONTH | MAXIMUM DAY |
|------------------------------|----------------|---------------|-------------|
| Influent flow (w/o RAS), mgd | 1.0 | 1.2 | 1.5 |
| RAS flow, mgd | 0.0 | 0.0 | 0.0 |
| Influent + RAS flow, mgd | 1.0 | 1.2 | 1.5 |
| MLSS, mg/L | | 4,800 | 6,700 |
| RAS solids, mg/L | | | |
| SVI, mg/L | 130 | | |

2.4 COMPONENTS

A. Overload Monitoring and Protection System:

1. Furnish an electrical-mechanical overload control system for each clarifier drive mechanism, including:
 - 1) Factory calibrated torque switches, rated 5 amps at 120 Vac minimum.
 - b. Field adjustable over the full torque range of the unit.
 - c. Alarm switch set at 100 percent of AGMA rated drive torque capacity in case of an impending overload.
 - d. Second alarm switch set at 120 percent of AGMA rated drive torque capacity to shut down drive motor.
 - e. Amperage and current sensing devices shall not be acceptable for the overload sensing system.
2. Provide time delay relays with timers to prevent alarms on start-up and shutdown.
3. Mechanism loading indicator:
 - a. Separate device, suitable for outdoor mounting.
 - b. Mechanism loading indicated on a 0-130 percent graduated scale at all times during operation.
4. Provide all necessary current transformers, relays and other appurtenances for a complete system.

B. Shear Pins (if used):

1. Shear pin device: Set for 125 percent of AGMA rated torque.
2. Provide straight, non-tapered shear pins with bushings.

C. Local Control Panels:

1. Provide each tank with a local control panel for operating the thickener mechanisms.
 - a. Tag numbers: LCP-3201 and LCP-3202.
 - b. Enclosed motor controllers and motor protector panel.
 - c. Stainless steel enclosure with NEMA 4X rating:
 - 1) Continuous seam welded.
 - 2) Single front door with continuous hinge, neoprene gasket.

- 3) Mechanism designed for securing enclosure with padlock.
 - 4) Wall mounted.
- d. Incoming power: 480 VAC, 3-phase.
- 1) Main circuit breaker with external circuit breaker operating handle.
 - 2) Handle shall include locking tabs that prevent the door from being opened with the breaker in the ON position.
 - 3) Transient Voltage Surge Suppression (TVSS):
 - a) UL 1449 listed.
- e. NEMA rated combination motor starter:
- f. Control transformer with line and load fuses.
- g. Terminal strip for connections to plant control system.
- h. Operator controls and indicators located on panel exterior:
- 1) START and STOP pushbuttons, maintained contact, mechanically interlocked.
 - 2) RUNNING light, red lens.
 - 3) OFF light, green lens.
 - 4) TORQUE warning, amber lens.
 - 5) TORQUE alarm, amber lens.
 - 6) Overload FAULT light, amber lens.
 - 7) Elapsed Time Meter.
 - 8) Control power ON light, white lens.
 - 9) Alarm RESET pushbutton.
- i. Pilot devices:
- 1) Heavy-duty type.
 - 2) Oiltight, NEMA 4X rating.
 - 3) Mounting hole: 30.5mm.
 - 4) Knob type operators.
 - 5) Push-to-test pilot lights, lens color as indicated.
 - 6) Legend plates:
 - 7) Laminated, phenolic plastic with white field and black letters.
- j. Enclosure condensation protection shall be provided with a space heater.
- k. Motor condensation protection shall be provided with a space heater.

- I. Plant Control System interface requirements:
 - 1) Each discrete interface point shall be in the form of a dry, relay contact wired to terminal blocks.
 - 2) The following is a list of interface points required between the Local Control Panel and the Plant Control System.
 - a) RUNNING status.
 - b) High TORQUE warning.
 - c) High TORQUE alarm.
 - d) FAULT alarm.
 - e) Skimmer Arm PROXIMITY switch.

- m. Fabrication requirements:
 - 1) All internal wiring shall be neat and color coded. Each wire shall be labeled at both ends with a heat-shrinkable wire label. All incoming wires shall terminate into a box clamp type terminal block. All control wires shall be 14 Ga. Type TEW, tinned copper, rated for 105 DegC.
 - 2) A schematic diagram (showing wire color) shall be permanently fastened to the inside of the enclosure. An Installation and Service Manual shall also be included with each control panel.
 - 3) Apply corrosion inhibitors inside the panel after fabrication and prior to shipment to the jobsite. Inhibitor shall consist of agents that vaporize and then condenses on all internal surfaces of the enclosure.
 - 4) Panel shall be factory wired and tested.
 - 5) The control panel shall be U.L. listed as an assembly.
 - 6) Clarifier manufacturer shall provide mounting support for the drive control panel.

2.5 ACCESSORIES

A. Cathodic Protection:

- 1. Furnish cathodic protection system for each collector:
 - a. Provide protection through the use of sacrificial anodes.
 - b. Conform to the recommended practices of the NACE.
- 2. Provide a minimum of 1 LB of anode per 100 LBS of steel:
 - a. Chemical composition:
 - 1) Aluminum: 5.0 - 7.0 percent, maximum.
 - 2) Zinc: 2.0 - 4.0 percent, maximum.
 - 3) Manganese: 0.15 percent, maximum.

- 4) Copper: 0.1 percent, maximum.
 - 5) Nickel: 0.003 percent, maximum.
 - 6) Other impurities: 0.005 percent, maximum.
 - 7) Lead: 0.1 percent, maximum.
 - 8) Silicon: 0.3 percent, maximum.
 - 9) Iron: 0.003 percent, maximum.
 - 10) Magnesium: Remainder.
- b. Hull type.
 - c. Cast with mounting straps.
 - d. Manufacturer: Federated Metals Corporation.
3. Bond cables, rectifier anode cables, and cathode cables:
 - a. AWG #4, 7-strand annealed single conductor wire.
 - b. Insulation: High molecular weight polyethylene (HMW/MWPE), approximately 110 mils (0.110 IN) thick.
 4. Weld coatings: Compatible with coatings specified for collector.

2.6 FABRICATION

- A. See Sections 01 61 03 and 05 50 00.
- B. General:
 1. Welds on submerged or partially submerged components shall be continuous.
 2. Dull sharp corners of cut or sheared edges by at least two (2) passes of a power grinder.
- C. Center Pier:
 1. Fabricate center pier of cylindrical steel with a minimum 24 IN DIA by minimum 1/4 IN wall thickness.
 2. Provide flanged base for anchor bolting to concrete base of clarifier.
 - a. Provide water-tight connection seal.
 - b. In accordance with Paragraphs 2.3 B and 2.6 L of this Specification Section, provide minimum of twelve (12) stainless steel anchor bolts having minimum diameter of 1.5 IN DIA and minimum embedment as shown on the Drawings.

3. Provide a flanged top and stiffeners for supporting the sludge collection mechanism, the drive mechanism, drive-mounting plate, access platform, and the access bridge.
4. Provide a drive mechanism mounting plate set plumb with the centerline of the center pier.
5. Provide center pier which serves as an influent pipe and has a minimum of 4 equally-spaced ports at the upper end to direct the flow into the EDI at a velocity less than 1 fps.
6. Provide easily accessible and removable plate near the bottom of the center pier for draining center pier.
 - a. Opening shall be large enough to insert a submersible pump to dewater the clarifier influent pipe.
 - b. Removable plate shall provide a clear square opening not less than 18 IN by 18 IN.
 - c. The opening shall be reinforced as needed to handle the imposed loads on the center pier.

D. EDI (Influent Feedwell):

1. Fabricate from 3/16 IN minimum steel plate with welded connections.
2. Design EDI to control and evenly distribute influent water into the flocculator feedwell and prevent undesirable currents.
3. Support EDI from the center cage:
4. Provide multiple tangential diffuser gates:
 - a. Gates shall induce a clockwise tangential flow.
 - b. Gates shall specifically preclude any vertical currents.
 - c. Ports shall have bottom plates to prevent vertical flow.
 - d. Bottom plates shall be welded to EDI and the diffuser gate guide plate.
5. Reinforcing rim angles, angle stiffeners and supporting brackets shall be structural steel members of minimum thickness 1/4 IN.
6. EDI shall project 6 IN above water surface minimum.
7. Provide full bottom and seals at center column and center cage.
8. Design EDI to prevent accumulation of sludge at bottom.
9. Maximum headloss shall be 3 IN at peak flow from center pier column to flocculating feedwell.

E. Flocculating Feedwell:

1. Fabricate from 3/16 IN minimum steel plates (or 0.06 IN smooth surfaced FRP.).
2. The feedwell shall be located outside the EDI to diffuse the liquid into the tank without disturbance or formation of velocity currents.
3. Support the feedwell from drive cage above water level.
 - a. Locate feedwell structural members on the outside of the feedwell to provide smooth interior.
4. Feedwell shall project 6 IN above water surface minimum.
5. Provide baffled openings in well at liquid level to allow release of scum in a tangential direction.
 - a. Minimum 4 openings.
 - b. Do not locate openings in line with plumes from EDI.

F. Center Drive Cage:

1. All-welded steel box truss construction: 3 FT by 3 FT minimum.
2. Drive cage shall transmit and/or carry all torques (including stall torque) without over stressing members.
 - a. Do not transmit any torque to the access bridge.
3. Design drive cage to encompass center column.
 - a. Design cage to withstand 200 percent of design torque.
4. Design adjustable connection between drive unit and drive cage to provide for proper alignment and allowance for structural tolerance.
5. Design to support and rotate spiral scraper arms under maximum load with 1.5 safety factor.

G. Rotating sludge scraper assemblies:

1. Provide two (2) full radius rotating spiral scraper arms supported from drive cage.
2. Fabricate collector assemblies from structural steel shapes using a box truss construction.
3. Reinforce top and bottom for proper distribution of loads to supports.
4. Design truss arms to avoid use of tie rods.

5. Attach truss arms to drive cage.
 - a. Provide adjustment arrangement to allow setting the truss arms symmetrically above the clarifier floor and the center drive cage.
 - b. After the truss arms are adjusted and certified by the manufacturer's representative, weld truss arms to center drive cage.
6. Provide spiral blades under truss arms to move settled sludge to central sludge hopper.
 - a. Provide smooth, unobstructed face of spiral blade to efficiently convey sludge to hopper.
 - b. Do not thread spiral blade through or within the truss arm.
 - c. Install blade-supporting system on back side of blade.
7. Arrange scraper blades to collect sludge for full radius of basin and transport sludge to collection ring or hopper at center of basin.
8. Provide blades that are vertically-adjustable and conforming to tank bottom.
9. Fabricate truss arms parallel to the top alignment of spiral scraper blade.
10. Calculate the size of blade based on the quantity of sludge to convey.
 - a. Blade depth to be depth of sludge plus 1 IN

H. Scum Removal System:

1. Scum skimmers assembly:
 - a. Include circumferential scum baffles, skimmers, wiper assembly, beaching assembly, and scum trough and discharge piping.
 - b. Provide two rotating scum skimmer arms per basin.
 - c. Mount skimmers tangentially to influent well and support entire weight on sludge collector truss.
 - d. Do not support the skimmer on the scum baffle.
 - e. Design skimmer to collect and move scum the full distance between the flocculating center well and scum baffle.
 - f. Provide wiper assembly with neoprene wiping edge attached to hinged steel blade, designed to sweep scum up beaching plate and into scum trough.
 - g. Ramp crest of scum trough to be at same elevation as top of scum baffles.

- h. Support wiper assembly at its outer end while traveling across scum trough.
 - i. Proximity switch for actuation of trough water flush.
2. Scum box:
- a. Size: 3 FT long by 3 FT wide.
 - b. Support from tank wall.
 - c. Connect to scum withdrawal pipe.
 - d. Assembly shall include:
 - 1) Scum trough.
 - 2) Vertical steel sides.
 - 3) Sloping ramp.
 - e. Provide flexible connector for connection to scum withdrawal pipe.
 - f. Scum withdrawal piping as shown on Drawings.
- I. Drive Mechanism:
1. Option A
- a. Provide drive mechanism, completely factory assembled, consisting of a primary gear reduction unit, an intermediate reduction unit, plus a final reduction unit consisting of a pinion and internal gear enclosed in a turntable base.
 - b. Enclose all gearing in a cast iron ASTM A48, Class 40B housing.
 - 1) Exposed gearing is not acceptable.
 - c. Provide all bearings of anti-friction type and running in oil.
 - d. Provide totally enclosed motor of ample power for starting and continuously operating the mechanism without overloading.
 - 1) The motor shall conform to NEMA standards and be name plated for operation on 230/460 V, 3 PH, 60 Hz current.
 - 2) Motor shall be a minimum of 1/2 HP.
 - 3) Motor shall comply with NEMA MG 1, Design B and shall be totally enclosed with Class B insulation designed for continuous duty outdoor service.
 - e. Primary reduction unit:
 - 1) Provide a primary reduction unit which drives the intermediate reduction unit through a chain and sprocket arrangement.

- 2) Furnish drive chain of #80L self-lubricated roller chain and OSHA approved removable chain guard of molded polyethylene.
 - 3) Provide an adjustable steel base mounted on the intermediate reduction unit for chain tension adjustments.
- f. Intermediate reduction unit:
- 1) Provide an intermediate reduction unit consisting of a cast iron housed worm gear speed reducer, with grease and oil lubricated, anti-friction type bearings and service factor of 2.0.
 - 2) Mount the unit on a machined face on the top of the final reduction unit and properly aligned to maintain accurate centers for the final reduction gearing.
 - 3) Worm assembly: Worm and shaft of heat treated alloy and integral construction and the worm gear of cast manganese bronze or aluminum bronze.
- g. Fabricate drive components in accordance with AGMA 2001-D and AGMA 6034-B for 24 HRS continuous duty and 20 year design life based on rated AGMA torque.
- 1) Design bearings for a L_{10} life of 200,000 HRS.
- h. Final reduction unit:
- 1) Provide internal gear drive by a heat-treated pinion from the slow speed shaft of the primary gear reducer.
 - a) Construct the main pinion of heat treated alloy steel, machined after heat treatment.
 - b) Support pinion at both top and bottom by a taper roller bearing assembly.
 - c) Use one-piece pinion shaft construction without an intermediate coupling.
 - 2) Provide ductile iron internal gear of AGMA quality 7 minimum.
 - 3) Provide internal gear design to support center cage, collector and all other rotating components.
- i. Turntable base:
- 1) Provide turntable base with annular raceway to contain balls on which the internal gear rotates.
 - 2) Furnish ball race without guide shoes and steady bearings.
 - 3) Furnish ball bearings of alloy steel, bearing vertically and horizontally on four (4) removable liner strips pressed into annular raceways in turntable base and internal gear.
 - a) Liner strips shall be minimum 3/8 IN thickness.
 - 4) Protect internal gear, pinion and ball race by a seal and dust shield.

- 5) Internal gear, pinion and ball race is to run in oil bath.
- 6) Furnish turntable base bolted to the center column and designed to support the internal gear with rotating mechanism, access platform, and one end of the access bridge.
- 7) Provide a pipe attached to bottom of turntable base for condensate removal.
- 8) Furnish plugged or capped oil piping which terminates within the center of the base.
 - a) Provide oil level sight glass and oil drain.
- 9) Provide a turntable assembly designed so that the internal gear, balls and strip liners may be removed without raising the access bridge.
- 10) Underwater bearings carrying any part of the load are not acceptable.

2. Option B

- a. Design Parameters: The drive unit shall be designed and manufactured by the clarifier equipment supplier to ensure unit responsibility. The drive unit shall be designed for the torque values previously listed. It shall turn the mechanism at the design collector tip speed. The drive main bearing shall be designed for the total rotating mechanism loads with a minimum L-10 life of 50 years or 433,500 hours. The drive main gear shall be designed to a minimum AGMA 5 rating when rated in accordance with the latest AGMA standard. Gear teeth shall be designed for proper load distribution and sharing. Stub tooth design and surface hardening of the main gear shall not be allowed. The main bearing shall be capable of withstanding the listed overturning moment without the aid of any underwater guides or bearings to ensure correct tooth contact for AGMA rating of the main gear.
 - 1) All spur gearing shall be designed to the latest AGMA spur gear standard for strength and surface durability, based on a life of 175,000 hours. The design running torque rating of the drive gearing shall be based on the smaller of the strength and durability values determined from the above AGMA standard. To ensure safety and ease of maintenance, all components of the drive shall be direct coupled and enclosed within the gear housing.
- b. Physical Characteristics: The drive unit shall consist of the following items: Electric motor, speed reducer, overload protection, pinion gear, lower pinion bearing, internal main spur gear, cross contact precision main bearing, fabricated steel support base and cage adapter. The drive shall be mounted on the center column and support the entire rotating load of the mechanism.
 - 1) The support base and cage adapter for the drive shall be of ASTM A36 fabricated steel to assure rigidity. The center cage shall be fastened to and supported from the cage adapter. The support base

- shall be designed to eliminate any condensate from coming in contact with the lower pinion bearing. The gear housing shall be designed so that the main bearing and gear teeth are submerged in oil. It shall have an annular cavity for oil and condensate storage. Any condensate that collects shall flow 180 degrees away from the lower pinion bearing. The oil bath shall be enclosed and protected by a neoprene dust shield. A two inch diameter "Bulls Eye" type oil sight glass, oil fill pipe, and drain line shall be provided for the reservoir. Lubrication fittings shall be readily accessible.
- 2) The pinion shall be heat treated alloy steel. A lower pinion bearing shall be provided to support the separating loads caused from the gear-to-pinion mesh. No overhung pinions shall be allowed on the speed reducing unit. The lower pinion bearing shall not be located below the turntable base.
- c. Overload Protection: An overload device shall be provided in a stainless steel, weatherproof enclosure. A minimum of three adjustable set points (for alarm and motor cutout and backup motor cutout) shall be actuated from the reaction torque due to a heavy sludge loading in the tank. The two set points shall be set at the following percentages of design running torque: a) Alarm shall be set at 100 percent; b) Motor cutout shall be set at 120 percent; c) Backup motor cutout shall be set at 140 percent. These three set points shall be factory calibrated and set. A torque indicator shall be provided and oriented so that it may be read from the walkway. It shall be calibrated from 0 to 160 percent of design running torque.
 - d. Turntable: The support base shall have a maximum allowable deflection in accordance with the bearing manufacturer's specifications under load. The allowable tensile yield strength shall be a minimum of 45,000 psi.
 - 1) The main internal gear shall be integral with the main bearing and be forged of alloy hardened steel. The drive bearing shall include fully contoured raceways hardened to a minimum 58-60 Rc and protected by a neoprene seal. Ball bearings shall be of high carbon chrome alloy 52100 steel running in fully contoured races, as part of a precision gear/bearing set.
 - e. Speed Reducing Unit: The speed reducing unit shall consist of cycloidal, helical, or planetary speed reducers directly connected to a motor without the use of chains or v-belts, and shall be keyed to the pinion. All speed reducers shall be fully enclosed and running in oil or grease.
 - 1) The main ring gear of cycloidal drives shall be made of high carbon chromium bearing steel and be fixed to the drive casing. An eccentric bearing on the high speed shaft shall roll cycloidal discs of the same material around the internal circumference of this main ring gear. The lobes of the cycloid disc shall engage successively with pins in the fixed ring gear. The movement of the cycloid discs shall be transmitted then by pins to the low speed shaft. Speed reducer efficiency shall be a minimum of 90% per reduction stage.

- 2) Speed reducer helical or planetary gearing shall be manufactured to AGMA standards and shall provide at least 95% power transmission efficiency per stage. The speed reducer shall have a minimum service factor of 1.25 based on the output torque rating of the drive.
 - 3) The reducers shall be fitted with radial and thrust bearings of proper size for all mechanism loads and be greased. As a safety feature, the speed reducer shall be back drivable to release any stored energy as the result of an over torque condition.
- f. Motor: The 3/4 HP motor shall be a squirrel cage, induction type, TEFC, ball bearing heavy duty unit of ample power for starting and operating the mechanism without overload, with a minimum service factor of 1.15.
- 1) Power supply to the equipment shall be 240/480 volt, 60 hertz, 3 phase.

J. Access Platforms:

1. Minimum 8 FT by 8 FT.
 - a. 3 FT minimum clearance around drive unit assembly for maintenance and service, and access from platform.
2. Fabricate for uniform live load of 100 LBS per SQ FT.
3. Construct with minimum 1/4 IN structural steel frame, with any necessary stiffeners and supports. Frame shall be attached to two support beams connected to the tank wall; spanning the full diameter of the tank. Platform shall use 1-1/2 IN aluminum grating with slip resistant aluminum checkered plate cover.
4. Include lift-out sections where required for routine maintenance of equipment.

K. Braced Support Beams: Comply with Sections 05 12 00 and 05 50 00.

1. Provide cambered, braced support steel beams that span the full diameter of the clarifier walls and which are attached to the mechanism platform and connected to the tank wall. The beams and associated bracing are intended to stabilize the mechanism and support the clarifier's aluminum cover panels (cover panels by others).
2. Provide at locations and orientation shown on Drawings.
3. Provide structural design showing the anchoring system of the center pier integrated with the platform and beams to resist operational and environmental loads, as well as support cover load.
4. Provide coatings on support beams, bracing and associated ferrous hardware in accordance with Section 09 96 00 for immersion in wastewater and abrasive conditions.

- L. Contractor-Designed Anchorage: Comply with Section 03 15 19.
1. Contractor shall design anchorage of clarifier center pier to concrete foundation in accordance with ACI 350, Appendix D.
 2. In accordance with ASCE 7-10, determine all design loads and critical load combinations, including dead loads, operating live loads and environmental loads.
 3. Provide ASTM F593 Type 316 stainless steel hex-headed anchor bolts complete with nuts and washers for equipment installation in submerged conditions.
 4. Anchor bolts shall be cast-in-place and provide the minimum embedment shown on the Drawings.
 5. Bolts shall be 1.5 IN DIA minimum.
- M. Fasteners:
1. All fasteners shall be Type 316 stainless steel.
 2. Bolts shall be 1/2 IN DIA minimum.
- N. Weir and Baffles:
1. Weir:
 - a. Provide around periphery of tank on launder.
 - b. Weir shall be adjustable to allow leveling.
 - c. Weir shall be 3/16 IN thick x 9 IN deep fiberglass sections.
 - d. Provide with 90 degree V-notches at 6 IN intervals.
 - e. Weir shall be curved and fastened to tank launder wall with large washers, anchor bolts and nuts to allow vertical adjustment.
 - f. Level tolerance: ± 0.01 FT.
 - g. Weir elevations shall be the same for all secondary clarifiers.
 2. Density Current Baffle
 - a. Provide around periphery of tank on launder.
 - b. Minimum 1/4" thick fiberglass sheets supported on triangular aluminum or fiberglass supports which are anchored to the tank wall.
 - c. Slope downward toward at a minimum 45 degree.

3. Scum baffle:
 - a. Provide around interior face of effluent launders and mounted on bracket.
 - b. Space the mounting brackets to prevent sagging, deformation or buckling of scum baffle.
 - 1) Spacing not more than 6 FT on center.
 - c. Install mounting bracket as shown on Drawings.
 - d. Baffle shall be 1/4 IN x 18 IN wide fiberglass sections.
 - e. Individual baffle section shall be bolted to the adjacent section to form a continuous baffle around periphery of tank.

O. Shop or Factory Finishing:

1. Surface preparation and shop painting is required for all ferrous metals, equipment and accessories and shall be as specified under Section 09 96 00.
2. Apply a heavy application of a rust-resistant coating to gears, bearing surfaces, and other unpainted surfaces.
 - a. Maintain coating during storage and until the equipment is placed into operation.
3. All aluminum in contact with dissimilar materials shall be coated with Koppers Hi-guard, two (2) coats, 2.0-3.0 dry mils per coat.

2.7 SOURCE QUALITY CONTROL

- A. Provide evidence of compliance with PART 1 requirements for the following:
 1. Referenced standards.
 2. Independent design evaluation of drive.
- B. Provide evidence of compliance with PART 2 requirements, signed by a Registered Professional Civil or Structural Engineer, for the following:
 1. Structural members and connections are designed so that unit stresses do not exceed 130 percent of AISC allowable stresses.
 2. Compression and tension member slenderness ratios do not exceed 120 and 240, respectively.
 3. Statement that all members have been designed to support the loadings as specified.
 4. Center column and platform support calculations.

2.8 MAINTENANCE MATERIALS

- A. For each drive furnished, provide:
1. One set of all bearings and bearing seal rings for drive unit.
 2. Two sets of all gaskets.
 3. Two sets of spur gear felt seals and replaceable bearing races (if used).
 4. Additional sprockets and chain links for tip speeds of 5, 10 and 15 fpm (if used).
 5. Two sets neoprene lip seals.
 6. One spare sight glass or oil gauge.
 7. Two sets scum box seals for pipe trough connection.
 8. One set of all bearings for skimmer system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install clarifier equipment according to manufacturer's recommendations.
1. Manufacturer's service technician shall observe and direct equipment installation.
 2. Manufacturer's service technician shall certify that mechanism has been installed in accordance with manufacturer's recommendations.
- B. Grout:
1. Install a 2 IN finished grout floor on the clarifier tank. Also grout clarifier trough slope.
 - a. Use temporary screeds attached to the collector arms and the mechanism for placing clarifier floor grout using power from drive unit.
 - b. Grout clarifier trough slope by hand.
 - c. See Section 03 61 00 Clarifier Grout.

3.2 FIELD QUALITY CONTROL

- A. Employ and pay for services of equipment manufacturer's field service representative(s) to:
1. Inspect equipment covered by these Specifications.
 2. Supervise adjustments and installation checks.

3. Provide test equipment, tools, and instruments necessary to accomplish equipment testing.
4. Conduct initial startup of equipment, perform operational checks, and supervise acceptance testing.
5. Provide through Contractor a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.
6. Instruct Owner's personnel as specified in Section 01 75 00 at jobsite on operation and maintenance of furnished equipment.
7. Provide the following:
 - a. For equipment inspections: 8 HRS minimum, or as needed, for each clarifier.
 - b. For equipment startup and testing: 8 HRS minimum for each clarifier.

B. Torque Test:

1. Load test the entire collector mechanism by anchoring collector arms individually, one at a time.
 - a. In successive tests, demonstrate the sludge collection mechanism's (including drive unit, cage, gears and structures) capability to withstand not less than 130 percent of the specified rated running torque.
2. Field torque test the clarifier mechanism under the supervision of the equipment manufacturer's representative before the mechanisms are approved and placed into operation.
3. The torque test shall consist of securing the rake arms by cables to anchor bolts installed by the contractor in the tank floor at locations recommended by the manufacturer and the Engineer.
 - a. Apply a torque load to the scraper arm by means of a ratchet lever and cylinder connected to the cable assembly.
4. Measure the magnitude of the applied load by calculating the torque from the distance of the line of action of each cable to the center line of the mechanism.
 - a. Readings shall be taken at 100 percent and 120 percent of the AGMA rated torque.
 - b. The test load shall be applied and noted on the torque overload device.
5. The manufacturer's service representative shall certify that the alarm and motor cut-out torque of the drives as calibrated in the manufacturer's shop are in proper operation to shut down the units as specified.

C. Operation Test:

1. Fill clarifier with water to its operating level and operate mechanism continuously at its maximum speed for a period of not less than 48 HRS.
 - a. At no time during the operating tests shall the equipment exceed the rated torque or exhibit indications of binding or uneven operation.
 - b. Record torque values as registered on the drive mechanism torque indicator and motor amperage (all three phases) at 3 HRS intervals.
2. After successful completion of the fully submerged operating test, operate the mechanism at full speed with no more than 1.5 FT of water at the sidewall in the tank for a period of not less than 6 HRS.
 - a. Record data as described above.
3. If the mechanism exceeds rated torque or the mechanism exhibits indications of binding or improper adjustment:
 - a. Contractor shall immediately halt the tests and remedy the problem.
 - b. Repeat the tests after completion of necessary repairs or adjustments.
 - c. Failure to successfully complete the test in three attempts is sufficient cause for rejection.
 - d. Failure to complete the testing program as outlined in the preceding paragraphs is sufficient cause for the Owner to require that the equipment be removed from the Project.

D. Mechanism Speed Setting:

1. After completion of the specified field tests, fit the drive mechanism with a sprocket set which shall provide the rake arms with a tip speed of 15 fpm.

END OF SECTION

SECTION 46 73 18
ALUMINUM FLAT PANEL COVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes aluminum flat panel covers and appurtenances for:
 - 1. Top mount extruded flat cover with integral exterior truss system for round clarifiers.
 - 2. Miscellaneous top mount extruded flat cover for splitter box, drain pump station manhole, and clarifier skimmings manhole.
- B. The primary function of the system is to limit heat loss and control odor emissions and allow access thereon.
- C. Related Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 05 50 00 - Metal Fabrications.
 - 4. Section 09 96 00 – High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Aluminum Association (AA):
 - a. ADM-1, Aluminum Design Manual, current edition.
 - 2. ASTM International (ASTM):
 - a. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - b. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
 - c. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - d. F594, Standard Specification for Stainless Steel Nuts.
 - e. C864, Standard Specifications for Preformed Gasket and Sealing Material

3. American Welding Society (AWS), D1.2, Structural Welding Code - Aluminum.
4. Building Code: 2012 International Building Code.

B. Qualifications:

1. Manufacturer's Qualifications: Manufacturer shall have experience in the design, manufacturing and production of extruded flat aluminum covers of similar size and type to the system specified. For a manufacturer to be determined acceptable for providing aluminum covers on this project, they must show evidence of at least one (1) **extruded** panel flat cover of the same type and size (or larger) as the unit(s) specified herein. The flat cover must be in satisfactory use for a period not less than ten years. The cover manufacturer must be ISO 9001 certified and fabricate the system at its own facilities.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Fabrication and layout drawings showing dimensions, sizes, thicknesses, gauges, materials, finishes, typical details, hatches, attachments and appurtenances.
3. Erection procedures and directions.
4. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
5. Certifications:
 - a. Complete set of design drawings and calculations signed by a Professional Engineer registered in the State of Alaska. Calculations are submitted for record purposes only, but will be checked for compliance with contract documents.

B. Project Information:

1. Manufacturer qualifications.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. The extruded flat covers shall be clear-span and self-supporting from the peripheral structure and from the integral truss structure provided by the manufacturer for round structures. The extruded panels shall utilize extruded panel structural members, slip-resistant top planks with stiffeners, and integral perimeter flashing/endcaps. Both male and female panels shall be independently designed to meet both the design loading and the deflection limits specified herein. Elastomeric weather seal gasket shall form a continuous watertight seal along all panel edges. The seal shall be substantially air and water tight under the specified design loading conditions.
- B. Each panel shall be able to be removed without needing to remove more than the two adjacent panels. Separate “hold-down” extrusions longer than the width of the panel shall not be used. Panels shall incorporate integral lifting handles on each end and not penetrate the cover panels or pond water. The lifting handles on top mounted covers shall be integral with the panel endcaps. The extruded flat cover shall have an integral bi-directional slip resistant surface which extends a minimum of 0.1-inch above the panel surface.
- C. The extruded flat cover system shall be either flush mounted or top mounted, depending on the cover location. All metal components shall be aluminum or 300 series stainless steel. Fasteners shall be designed with a factor of safety of 2.34 on ultimate strength and 1.65 on yield strength. Galvanize, painted or plated steel nor structural plastic shall not be used. Dissimilar materials in the supporting structure shall be isolated from the aluminum flat cover by means of a compatible elastomeric gasket. The cover shall have a mill finish surface.

2.2 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
- B. Cover:
 - a. CST Covers Hallsten.
 - b. Ultraflote, LLC
- 2. Sealant:
 - a. Dow Corning Corp.
 - b. General Electric.

2.3 DESIGN AND MATERIALS

A. Materials:

1. Extrusions and miscellaneous shapes: Alloy 6061-T6 or 6063-T6 aluminum.
2. Plate, Sheet: Alloy 6061-T6 or 6063-T6 aluminum.
3. All structural shapes shall be alloy 6061-T6 or 6063-T6 aluminum.
4. Fasteners and anchor bolts: 316 stainless steel.
5. Sealant: Urethane or Silicone.
6. Gaskets: Neoprene, silicone rubber or hypalon and shall be resistant to ozone and shielded from exposure to ultraviolet light.
 - a. Minimum Thickness: 1/4 IN

B. Criteria: Design covers in accordance requirements of AA SAS-30 and all applicable sections of the Building Code.

1. Symmetrical Live Load: 40 psf.
2. Unbalanced Live Load: Reduce live-load by 50 percent over one-half of the area.
3. Symmetrical snow load: 50 psf over projected area.
4. Unbalanced snow load: Drifting from wind and snow piling from personnel clearing adjacent pathways.
5. Concentrated Load: 400 pounds on a 12 IN x 12 IN area.
6. Maximum Weight of any individual removable or operable section: Not exceed 5.5 LBS per square foot of surface area.
7. Clear Spans: As shown on the Drawings. No intermediate supports unless otherwise noted.
8. Deflection: For the above uniform and concentrated loads, the deflection of all components (structural and cladding) shall not exceed L/240 with L equal to the clear span of the component.
9. Ambient Design Temperature Range: -40°F to 160°F.
10. Design connections to allow expansion and contraction of panels without imposing temperature-related loads on supporting concrete structures.
11. Wind and Seismic: Reference project's structural notes drawing.

- C. Covers shall be low profile-type design and not project more than 3/8 IN above the top of the adjacent concrete slabs or walls.
 - 1. The top of the covers shall be integrally ribbed to provide a full area non-skid surface.
 - 2. Cover Support elements or beams shall not extend into the normal wastewater flow level.
 - 3. Covers shall attach to the top of the adjacent concrete walls or slabs with mushroom carriage bolts or bolts that are countersunk into the plank to minimize projection.
- D. All work shall be fabricated and erected in accordance with the approved drawings.
- E. Center Drive Platform: A center drive platform shall be provided which allows 24 inches clearance outside the center drive components. It shall consist of 1/4 inch aluminum checkered plate with necessary stiffeners and supports, resting on the drive unit and center column, and provided with connections to the walkway.
- F. Covers shall be designed specifically for installation in wastewater treatment plant applications and shall be capable of withstanding corrosion, pitting and degradation from the action of wastewater and associated gases, including hydrogen sulfide in concentrations of up to 200 ppm. The covers shall provide a complete seal for use in an odor control application. Odor control takeoff flanged connections shall be provided at the locations shown on the Drawings. All splice joints shall be interlocked and gasketed.
- G. Dissimilar materials shall be separated from each other through the use of approved gaskets or coatings. Reference Division 09.

2.4 ACCESSORIES

- A. Access Hatches:
 - 1. Hatch sizes as shown on the drawings.
 - 2. Hardware:
 - a. Stainless steel.
 - b. Weather stripping.
- B. Hinged Personnel/Equipment Access Panels: Provide hinged access panels where required for equipment access and at locations shown on the Drawings. Openings shall be 3 FT long x the maximum width of the panel's, unless otherwise noted.
 - 1. Provide stainless steel hinges and accessories including quick release connection device and latches to hold in place when open.

- a. Install neoprene gasket to prevent air leakage.
- C. Hinged Clarifier Trough Access Hatch:
1. Provide hinged access panels on the full perimeter of the clarifiers as shown on the Drawings for access to the clarifier trough. Contractor shall coordinate the location of the access hatches with the Engineer and Cover Panel Manufacturer in the submittal process.
 2. 27 IN x 27 IN panels. A minimum of 12 hatches shall be provided per clarifier cover.
 3. **Hatches shall be factory located and cut. Hatch shall be installed onsite to avoid damage during transport.**
 4. Provide lifting handle and full gasketing.
- D. Air Vents: Provide flanged pipe connections where required for air vents with bolted cover and at locations shown on the Drawings.
1. 12 IN Diameter, Aluminum pipe.
 - a. Extending 12 IN above the cover.
 - b. Flange: 1/4 IN, Aluminum, T6061-T6, plate
 2. 1/16 IN Neoprene gasket.
 3. 1/4 IN Stainless Steel bolts.
 4. Connections shall be factory fabricated into the covers. Field cutting or fabrication shall not be allowed.
 5. Seal all connections with silicon.
- E. Instrumentation Connections: Provide flanged pipe connections where required for instrumentation connection with bolted cover and at locations shown on the Drawings.
1. 6 IN Diameter, Aluminum pipe.
 - a. Extend 6 IN above the cover.
 - b. Flange: 1/4 IN, Aluminum, T6061-T6, plate
 2. 1/16 IN Neoprene gasket.
 3. 1/4 IN Stainless Steel bolts.
 4. Connections shall be factory fabricated into the covers. Field cutting or fabrication shall not be allowed.
 5. Seal all sensor cable penetrations with air tight gland.

F. Round Duct: ASTM B209 aluminum with minimum thickness of 0.051 IN.

PART 3 - EXECUTION

3.1 ERECTION

- A. Erect all components in accordance with manufacturer's recommendations.
- B. Do not force components during erection.
- C. All work shall be completed by installers skilled and experienced in the erection of similar aluminum products. Covers shall be erected plumb and level and in proper alignment.

3.2 FIELD QUALITY CONTROL

- A. Field re-fabrication of structural components or covers will not be accepted.

END OF SECTION

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