PORT OF TACOMA INVITATION TO BID #81362

STORMWATER PUMP STATIONS

ADDENDUM #3

DATE 03/09/18

The following is additional information regarding ITB-81362 titled Stormwater Pump Stations released on 2/21/2018. **The due date and time for responses remains as 3/14/2018 @ 2:00PM PST.** This addendum includes revisions to the ITB. This addendum is hereby made part of the ITB and therefore, the information contained herein shall be taken into consideration when preparing and submitting a bid.

PART 1 – CHANGES TO TECHNICAL SPECIFICATIONS

A. **Attachment C, Specification 08 31 13** – Access Hatches; delete paragraph 2.01A, and replace with the following:

   A. All hatches shall be airport rated for a minimum 150,000-pound point load unless noted to be H-20 load rated on the Drawings.

B. **Attachment C, Specification 08 31 13** – Access Hatches; delete paragraph 2.02B, and replace with the following:

   B. Hatches shall be airport extra heavy duty rated, proof tested to 200,000 pounds and rated for a continuous minimum 150,000-pound point load.

C. **Attachment C, Specification 33 05 16** – Precast Concrete; delete paragraph 2.02C, and replace with the following:

   C. Where not specifically noted, design for exposure to container handling equipment, which shall be a minimum of two sustained 150,000-pound point loads at 10-feet on center. Additionally, the sidewalls of all vaults shall be designed to resist the surcharge live load of the container handling equipment.

D. **Attachment C, Specification 33 05 16** – Precast Concrete; delete paragraph 2.03D.1, and replace with the following:

   1. Furnish access hatches with frames cast integrally with the concrete top unit, in accordance with the notes on the Drawings, and as detailed herein. At a minimum each wet well shall be provided with two (2) hatches with minimum 48-inch by 48-inch clear openings and one (1) hatch with a minimum 36-inch by 74-inch clear opening. Final sizing and arrangement of hatches shall be coordinated by the pump station supplier to allow for removal of the submersible pumps and the hinged flap gates located within each wet well.

E. **Attachment C, Specification 33 44 13** – Pump Stations; delete paragraph 2.01A.1a, and replace with the following:

   a. The pump station supplier shall coordinate with the Engineer and pump manufacturer to provide an HDPE inlet baffle with 316 stainless steel stiffeners for each pump station

to mitigate the risk of air entrainment. Final baffle plate design will be shown in the final design drawings to be provided following Contract execution. For the purpose of this bid the pump station supplier shall assume the baffles will consist of 1-inch thick HDPE plate extending across the shorter span within the wet well, from the invert of the wet well influent pipe to the bottom of the wet well. Baffle shall be provided with 3-inch by 3-inch by 3/8-inch angle stiffeners around the parameter and at 18" on-center horizontally and vertically.

F. **Attachment C, Specification 40 67 00** – Process Control System Equipment Panels; add paragraph 2.06F.5 as follows:

5. In addition to the specified beacon lights and horns, each pump station control panel shall be provided with a stainless steel NEMA 4X rated alarm bell mounted on the exterior and an alarm silence button mounted within the panel to allow the audible alarms to be temporarily turned off.

PART 2 – CHANGES TO CONTRACT DRAWINGS

A. **Not Used**

PART 3 – QUESTIONS AND ANSWERS

A. **Not Used**

END OF SECTION

ATTACHMENTS:

ATTACHMENT C – SPECIFICATION 08 31 13

ATTACHMENT C – SPECIFICATION 33 05 16

ATTACHMENT C – SPECIFICATON 33 44 13

ATTACHMENT C – SPECIFICATION 40 67 00

PART 1 - GENERAL

1.1 WORK SCHEDULED

A. Contractor shall provide all materials, labor, equipment, and services necessary to furnish and install factory-fabricated access hatches as shown on the Contract Drawings and specified herein. Hatches shall be cast into the tops of precast concrete structures.

B. This section covers the provision and installation of metal access hatches.

C. Hatches shall be installed in precast vaults as specified in Section 33 05 16 – Precast Concrete.

1.2 GENERAL REQUIREMENTS

A. The unit shall be single leaf or double leaf as shown. Hatch hinge locations shall be specifically coordinated within the required submittals to maximize accessibility and ensure removal of interior components at a later date for maintenance or replacement.

B. The manufacturer shall guarantee the unit against defects in materials and workmanship for a period of not less than 5 years.

1.3 SUBMITTALS

A. Provide manufacturer's standard product literature.

B. Provide load ratings for door.

C. Shop Drawings: Submit detailed fabrication and installation drawings prior to fabrication. Show profiles, accessories, locations, and dimensions.

D. Warranty: Submit manufacturer's written warranty.

1.4 WARRANTY

A. Access hatches shall be free of defects in material and workmanship for a period of five (5) years from the date of installation and acceptance by the Owner. Should a part or material fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.1 GENERAL

A. All hatches shall be airport rated for a minimum 150,000-pound point load unless noted to be H-20 load rated on the Drawings.

~~A. All hatches shall be airport rated for a minimum 125,000-pound point load unless noted to be H-20 load rated on the Drawings.~~

2.2 AIRPORT EXTRA HEAVY DUTY HATCHES

A. Hatches shall be configured as noted on the Drawings unless otherwise specified herein.

B. Hatches shall be airport extra heavy duty rated, proof tested to 200,000 pounds and rated for a continuous minimum 150,000-pound point load.

~~B. Hatches shall be airport extra heavy duty rated, proof tested to 200,000 pounds and rated for a continuous minimum 125,000-pound point load.~~

C. Hatch covers and frames shall be cast ductile iron (70-50-05 or 80-55-06) in accordance with ASTM A 536 and sized as required to meet the specified loads. Hatches and frames shall be provided with a dipped coating and a slip resistance surface.

D. Each hatch leaf shall have a minimum of one 304 stainless steel spring-assisted operator to reduce lifting force to 50 pounds, a safety hold open arm, and shall be able to be removed from the hatch frame with minimal disassembly. Each leaf shall be provided with security bolts and EPDM gaskets to prevent inflow of surface water and secure the hatches in a closed position.

E. If center bars are required to meet the loading requirements the bars shall be removable to allow for full use of the hatch clear space.

F. All hardware shall be 304 stainless steel.

G. Hatches shall be by EJ Group, Inc., or approved equal.

2.3 H-20 ACCESS HATCHES

A. Materials and configurations as noted on Drawings, unless otherwise specified herein.

B. A rain gutter shall be around the frame periphery and at the leaf latch area with 1 1/2 inch drain coupling in corner of frame. For vaults provided with drains the drain coupling shall be sloped and routed, using schedule 40 PVC, along the vault ceiling and walls to the associated vault drain.

C. Hardware shall be 316 stainless steel. This includes nuts, bolts, washers, hinges, springs, spring assisted operators, and automatic hold-open arm with release lever.

D. Each leaf shall have a spring-assisted operator to reduce lifting force to 15 pounds.

E. The hatch shall have recessed padlock hasp with hinged cover.

F. The leaves shall securely latch when closed.

G. Frame and hatch shall be aluminum, welded plate or extruded sections, as required. Surfaces of aluminum embedded or in contact with contact with concrete shall be coated with bituminous paint for corrosion protection. Wet well hatches shall be furnished with hinged safety grate systems painted safety orange.

H. Hatches shall be by USF Fabrication, Bilco, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions for installation of access hatches.

B. Coordinate installation with work of other trades.

C. Connect drain from channel frame as indicated.

D. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

3.2 ADJUST AND CLEAN

A. Adjust hardware and doors after installation for proper operation.

B. Remove and replace hatches or frames that are warped, bowed, or otherwise damaged.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section covers furnishing and installation of special purpose precast concrete vaults, manholes, and wet wells.

1.2 ADAPTATION OF PRODUCT

A. Furnish product readily adaptable for installation and operation in the manner shown on the Drawings.

1.3 SUBMITTALS

A. Shop Drawings showing detailed dimensions, block outs, floor doors, and specifications for materials used, parts, devices, and other accessories forming part of the vault.

PART 2 - PRODUCTS

2.1 GENERAL

A. The valve and wet well vaults shall be precast as manufactured by Columbia Precast Products LLC. or approved equal, with tops, walls, and bases as shown on the Drawings.

2.2 DESIGN

A. Conform to ASTM C913.

B. Where noted design for 16,000-pound wheel load, AASHTO HS20-44.

C. Where not specifically noted, design for exposure to container handling equipment, which shall be a minimum of two sustained 150,000-pound point loads at 10-feet on center. Additionally, the sidewalls of all vaults shall be designed to resist the surcharge live load of the container handling equipment.

~~C. Where not specifically noted, design for exposure to container handling equipment, a minimum sustained 125,000-pound point load (airport extra heavy duty rated).~~

2.3 FABRICATION

A. Precast elements shall provide for watertight sealing of mating surfaces using provided rubber gaskets or field applied epoxy grout.

B. Openings shall be located and sized as dimensioned on the Drawings. Where drains are connected to piping below the base of the precast unit, provide adequate opening with keyway to facilitate a field installation and grouting of base drains and trap units as shown on the Drawings. Standard products may be used where provision exists for achieving the configuration shown on the Drawings.

C. Sump pits a minimum of 8 inches deep shall be provided in the corners of all valve vaults. The Contractor will used grout to slope the floor of each vault to the associated sump.

D. Embedded items shall be provided in the tops, walls, and bases where indicated on the Drawings.

1. Furnish access hatches with frames cast integrally with the concrete top unit, in accordance with the notes on the Drawings, and as detailed herein. At a minimum each wet well shall be provided with two (2) hatches with minimum 48-inch by 48-inch clear openings and one (1) hatch with a minimum 36-inch by 74-inch clear opening. Final sizing and arrangement of hatches shall be coordinated by the pump station supplier to allow for removal of the submersible pumps and the hinged flap gates located within each wet well.

~~1. Furnish access hatches with frames cast integrally with the concrete top unit and in accordance with the notes on the Drawings.~~

2. Vault shall be designed to allow for attachment of pipe and pump supports using epoxy anchor bolts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The bottom of the excavation for wet well vaults will be provided with mud slabs provided by the Contractor as detailed on the Drawings. Pump Station Supplier shall be responsible for coordinating with the Contractor and the Engineer to ensure that the precast wet wells are structurally tied into the mud slabs and provided with the appropriate features to allow for installation on top of the mud slab.

B. The bottom of the excavation for the vaults will be fine graded to a plane surface on firm undisturbed subgrade material. Loose subgrade soils will be compacted.

C. Granular bedding material over the bottom of the excavated area will be provided as detailed on the Drawings, evenly spread to provide uniform bearing for the vault. Foundation bedding material will be brought to precise elevations called for on the Drawings and leveled.

D. Vaults and accessories will be installed and provided in conformance with Drawings, Specifications, and recommendations of vault manufacturer unless otherwise instructed in writing by the Engineer. Vault location and orientation shall conform to the Drawings.

E. The vault joints, pipeline, and conduit penetrations through walls, as shown on the plans, shall be sealed using penetration seals as specified and as shown on the Drawings. No leakage will be allowed into the vault.

F. Concrete fill for sloping vault and wet well bottoms will be placed by the Contractor in the field in conformance with the Drawings and Specifications.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes of all labor, equipment, tools and materials associated with the procurement, storage required prior to delivery, insurance, and transportation to the project site of the precast wet well, pumps, connections, flap gates, control panels, floats, fasteners, hatches, and appurtenances required in the construction of the three Pump Stations for Basins A, B, and C and as indicated in the Drawings.

B. Advanced Procurement: The Pump Station components, as detailed below and listed above, shall be sourced by one supplier, the Pump Station Supplier, and shall each be one comprehensive unit.

1.2 SOURCE QUALITY CONTROL

A. Each pump shall be factory tested and certified test results submitted prior to shipment of pumps. The Engineer shall be given notice of the factory pump testing a minimum of 14 days in advance of testing.

1. Impeller, motor rating, and electrical connections shall be checked for compliance to the Specifications.
2. A motor and cable insulation test for moisture content or insulation defects in accordance with ANSI/HI 11.6.
3. Performance Testing: Each pump shall be operationally tested to demonstrate compliance with performance requirements. The pumps shall be tested at full speed with the minimum water depth specified. A minimum of eight test points shall be plotted on the full speed pump curve showing horsepower, efficiency, and head and flow from shut-off head to the specified run out condition plus 20 percent. Reduced speed performance criteria may be demonstrated by applying the affinity laws to the full speed test curve. During the testing, each pump shall be run continuously for a minimum of 30 minutes. Performance testing shall conform to the most recent Hydraulic Institute Standards test codes, ANSI/HI 11.6, Acceptance Grade 1U.
4. Hydrostatic Testing: Perform hydrostatic test that conforms to the most recent HI Standards.
5. After performance and hydrostatic testing, the cable insulation shall be tested again for moisture content.
6. Tabulated and graphical test results shall be certified by the manufacturer and submitted for approval by the Engineer prior to shipment of the pumps.

1.3 QUALITY ASSURANCE

A. Testing and Inspection for Contractor Quality Control: Testing shall be performed for each individual Work Area and shall be supported by the Pump Station Supplier. The Contractor will perform the field inspection and tests described below and based upon the results of these inspections and tests, will take the action required and submit specified reports.

1. Inspection of components upon delivery for any damage or missing components.
2. Coordination and testing for unit activation as directed by the manufacturer.
    a. Complete the recommended start up report as recommended by the pump manufacturer.
3. Contractor shall perform a hydrostatic pressure test for each wet well.
    a. The hydrostatic pressure test shall be performed after the wet wells have been installed and the inlet and outlets have been sealed with flexible pipe connection or non-shrink grout.

1.4 REFERENCES

A. All equipment shall be assembled and tested in accordance with the most current applicable standards as defined by:

1. Confined Space Entry Precautions - OSHA (8-hour training).
2. Institute of Electrical and Electronic Engineers (IEEE).
3. National Electrical Manufacturers' Association (NEMA).
4. Anti-Friction Bearing Manufacturers' Association (AFBMA).
5. American National Standards Institute (ANSI).
    a. ANSI A21.10 force main fittings.
    b. ANSI A21.50 C150 force main thickness.
    c. ANSI A21.51 C151 force main ductile iron.
6. National Fire Protection Association (NFPA).
7. National Electrical Code (NEC, NFPA 70).
8. Underwriters' Laboratory (UL).

B. Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge and Municipal Construction and Amendments (current edition).

1.5 SUBMITTALS

A. Pump Station Supplier shall submit a Loading/Unloading Plan for loading, transfer, unloading and placement of the Pump Station(s) component(s).

B. Submittal Drawings, Product Details, Parts Lists, and Installation Guides for the Pump Stations secured under Advance Procurement shall be provided by the Pump Station Supplier.

C. The Pump Station Supplier shall assist the owner in preparation of an Owner-Furnished Products via Advanced Procurement Memorandum and storage location exhibit.

D. The Pump Station Supplier shall submit materials data and furnish all manufacturer's technical literature, standard details, product specifications, and installation instructions for all products. Submittals shall include the following:

1. Submit applicable shop drawings which shall include the following for all components and equipment to be provided:
    a. Complete description of all materials including the material thickness of all components.
    b. Flap Gate specific requirements: Maximum bending stress and deflection of the flap under the maximum design head (seating head).
2. Product Data: Manufacturer's standard drawings or catalog cuts for all pipe, fittings, structures, valves and controls noted under "Products" in this section or as indicated on the Drawings.
3. Certificates of Conformance: Manufacturer's Certificate of Conformance for each of the materials which are specified to conform to publications referenced under "Products" in this section.
4. Test Results: All manufacturer's test results required by this section.
    a. Functional, leakage, and head loss testing shall be performed on each flap gate to be provided.

1.6 EXTRA MATERIALS

A. The following spare parts shall be provided for each size of pump:

1. One complete set of O-rings and gaskets.
2. One upper and one lower mechanical seal for each pump supplied.
3. One set top and bottom bearing.
4. One set of any special tools required to operate or maintain the equipment.
5. Package to prevent damage during handling and storage.
6. Label with project number, equipment number, part name and number, and description.

1.7 WARRANTY

A. Manufacturer's standard 1-year warranty against defects in materials and workmanship, to begin 12 months following facility start-up, testing and after acceptance by the Owner or 24 months from delivery, whichever occurs first.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

C. Pump manufacturer shall provide a guarantee that its solids-handling pumps will be free from clogging for 12 months after startup, testing, and acceptance by Owner, when pumping stormwater containing solids and debris normally found in domestic stormwater.

PART 2 - PRODUCTS

2.1 PUMP STATION PRODUCT LIST

A. Pump station pumps and all appurtenances shall be provided by a single manufacturer (Pump Station Supplier) and shall be designed to work as an integrated unit. Products include but are not limited to the following:

1. Precast Concrete Wet Well: See Section 33 05 16 – Precast Concrete.

a. The pump station supplier shall coordinate with the Engineer and pump manufacturer to provide an HDPE inlet baffle with 316 stainless steel stiffeners for each pump station to mitigate the risk of air entrainment. Final baffle plate design will be shown in the final design drawings to be provided following Contract execution. For the purpose of this bid the pump station supplier shall assume the baffles will consist of 1-inch thick HDPE plate extending across the shorter span within the wet well, from the invert of the wet well influent pipe to the bottom of the wet well. Baffle shall be provided with 3-inch by 3-inch by 3/8-inch angle stiffeners around the parameter and at 18” on-center horizontally and vertically.

~~a. The pump manufacturer shall coordinate with the Engineer and installing contractor to provide a 316 stainless steel inlet baffle for each pump station to mitigate the risk of air entrainment.~~

2. Piping, fittings, supports, and wall seals, to be coordinated with the final design package and installing contractor. Pump Station supplier's responsibility ends at discharge of pump discharge elbow.

3. Pumps and motors: Pumps shall be:

a. Basin A: Series NP3153LT-435 by Flygt or approved equal

b. Basin B: Series NP3153LT-416 by Flygt or approved equal

c. Basin C: Series NP3202MT-643 by Flygt or approved equal

4. Pump base elbows.

a. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the

discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor. Each pump shall be fitted with stainless steel lifting chain and spectra cord for use with the Grip-Eye lifting device. The working load of the lifting system shall be 50% greater than the pump unit weight.

5. Pump guide rails.
6. Hinged flap gates.
7. Control panels.
    a. Shall be supplied by the pump manufacturer in accordance with all motor protection requirements to ensure full factory warranty.
8. Floats:
    a. As referenced in 40 72 73.
9. Cable supports and mounting brackets:
    a. Quantity 1 per access cover to mount pump power cable and floats.
    b. Shall have no less than 4 mounting hooks and of 316SS material.

2.2 PUMP STATION FOUNDATION

A. The Contractor will provide all subgrade scarification and recompaction and aggregate base materials as indicated in the Drawings. The Pump Station Supplier shall provide confirm that the subgrade shown within the 90% Documents is acceptable for use with the provided equipment.

2.3 PUMPS, GUIDERAILS, AND APPURTENANCES

A. PUMP STATION IDENTIFICATION

1. Three (3) Pump Stations are identified in the Drawings as detailed below. Each basin shall be provided with two pump; pumps shall be duplex, non-clog submersible type pumps in a duty/standby arrangement.
    a. Basin A Pump Station.
    b. Basin B Pump Station.
    c. Basin C Pump Station.

B. PUMP PERFORMANCE CRITERIA

1. Basin A:

a.	Suction size, minimum:	6-inch
b.	Discharge elbow, discharge size, minimum:	8-inch
c.	Minimum diameter solids pump will pass:	3-inch
d.	Motor size, maximum	20 hp
e.	Nominal Speed, maximum	1,800 rpm
f.	Design Capacity, minimum	1,430 gpm
g.	Design TDH, minimum	30.2 feet H2O
h.	Design Static Head, minimum	26.2 feet H2O
i.	Minimum system efficiency at design point	78.0%

2. Basin B:

a.	Suction size, minimum:	6-inch
b.	Discharge size, minimum:	8-inch
c.	Minimum diameter solids pump will pass:	3-inch

d.	Motor size, maximum	12 hp
e.	Nominal Speed, maximum	1,800 rpm
f.	Design Capacity, minimum	1,090 gpm
g.	Design TDH, minimum	25.6 feet H2O
h.	Design Static Head, minimum	23.3 feet H2O
i.	Minimum system efficiency at design point	70.0%

3. Basin C:

a.	Suction size, minimum:	6-inch
b.	Discharge size, minimum:	8-inch
c.	Minimum diameter solids pump will pass:	3-inch
d.	Motor size, maximum	35 hp
e.	Nominal Speed, maximum	1,200 rpm
f.	Design Capacity, minimum	2,420 gpm
g.	Design TDH, minimum	31.6 feet H2O
h.	Design Static Head, minimum	27.6 feet H2O
i.	Minimum pump efficiency at design point	75.0%

C. PUMP DESIGN CONFIGURATION

1. Pump Environment: The wet wells in which the pump and motors shall be installed are considered a Class I, Division 2, Group D Hazardous Area per NFPA 820. All motor and pump components shall be appropriately rated to allow for continuous operation within this environment in accordance with NFPA 70 (NEC).

2. Pump Construction:

   a. Major pump components shall be of grey cast iron, ASTM A 48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

   b. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

   c. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

3. Cooling System:

   Each unit shall be provided with an integral motor cooling system. A stainless steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient

temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

4. Cable Entry Seal:

    a. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.

5. Motor:

    a. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber.

    b. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95 percent.

    c. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable.

    d. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable.

    e. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 30 evenly spaced starts per hour.

    f. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

    g. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

    h. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10 percent. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

    i. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

6. Shielded Power Cable:

    a. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The power cable shall be of a shielded design in which an overall tinned copper shield is included and each individual phase conductor is shielded with an aluminum coated foil wrap. The outer jacket of the cable shall be oil

resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

b. Each combined power and control cable shall be provided with a single rated quick connect plug to allow for connection of the power and controls conductors to the receptacles located on the bottom of the pump control panel. Plugs and receptacles shall be by Meltric or equal.

7. Bearings:

   a. The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two-row angular contact ball bearing. The lower bearing shall be a two-row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve.

8. Mechanical Seals:

   a. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring.

   b. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring.

   c. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring.

   d. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber.

   e. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system.

   f. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable.

   g. The seal springs shall be isolated from the pumped media to prevent materials from packing around the springs, limiting performance. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

   h. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

   i. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50 percent capacity.

   j. Seal lubricant shall be non-hazardous.

9. Pump Shaft:

    a. The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A 479 S43100-T. Shaft sleeves will not be acceptable.

10. Impeller:

    a. The impeller shall be of Hard-Iron™ (ASTM A 532 (Alloy III A) 25 percent chrome cast iron), dynamically balanced, semi-open, multi-vane, back swept, screw-shaped and non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as the impeller passes across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in stormwater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

    b. Impeller shall be N-Type impeller by Flygt or approved equal.

11. Volute/Suction Cover:

    a. The pump volute shall be a single piece grey cast iron, ASTM A 48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of Hard-Iron™ (ASTM A 532 (Alloy III A) 25 percent chrome cast iron) and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

12. Protection:

    a. Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

    b. The thermal switches shall be connected to a Mini CAS control and status monitoring unit. The Mini CAS unit shall be designed to be mounted in the pump control panel. Mini CAS units shall be provided within the pump control panels.

D. PUMP SOURCE QUALITY CONTROL

1. Each pump shall be factory tested and certified test results submitted prior to shipment of pumps. The Engineer shall be given notice of the factory pump testing a minimum of 14 days in advance of testing.

    a. Impeller, motor rating, and electrical connections shall be checked for compliance to the Specifications.

    b. A motor and cable insulation test for moisture content or insulation defects.

    c. Performance and Hydrostatic Testing: Each pump shall be operationally tested to demonstrate compliance with performance requirements. The pumps shall be tested at full speed with the minimum water depth shown on the Drawings. A minimum of eight test points shall be plotted on the full-speed pump curve showing horsepower, efficiency, head, and flow, from shut-off head to the specified run-out condition plus 20 percent. During the testing, each pump shall be run continuously for a minimum of 30 minutes. Performance and hydrostatic testing shall conform to the most recent Hydraulic Institute Standards and meet Acceptance Grade 1U.

d. After performance and hydrostatic testing, the cable insulation shall be tested again for moisture content.

e. Tabulated and graphical test results shall be certified by the manufacturer and submitted for approval by the Engineer prior to shipment of the pumps.

E. PUMP RAILS, LIFTING, MOUNTING SYSTEMS

1. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well.

2. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

3. Each pump shall be fitted with 316 stainless steel lifting chain or cable to allow for removal of the pumps, see drawings for depth to pumps.

4. The working load of the lifting system shall be 50 percent greater than the pump unit weight. The system shall be designed to permit ground level removal of pumping units from the wet well for inspection or service without disconnection or disturbing the discharge piping and for automatic reinstallation when units are lowered into place by positively locking the volute in position.

5. Each pump shall be provided with the following:

a. Lifting Chain, 1/8-inch 316 stainless steel lifting cord of the appropriate strength, and Chain Link Grip Eye.

b. Guide Rails and Base Elbow System

1) A heavy duty, cast iron fixture, conforming to ASTM A 536 shall be permanently mounted to the bottom slab of the wet wells as shown by the Design Drawings and specified herein. The fixtures shall cantilever the entire pump and motor from the volute discharge flange, providing an unobstructed area under the pump.

2) The fixture shall include a 90-degree, cast iron, Schedule 80 elbow with Class 150-pound flange to connect to vertical piping as shown on the Design Drawings. The fixture shall include mounts for two guide rails of minimum standard 2-inch diameter, 316 Stainless Steel Schedule 40 pipe, which will guide the pump into position.

3) Supply a minimum of one guide rail support every 10 feet on center (pump manufacturer's standard supports), including the support mount at the hatch opening to support and connect the guide rails to the discharge pipes and/or vault wall. Manufacturer's Representative shall confirm discharge pipe size with installing Contractor prior to shipment of supports and provide installing Contractor with installation instructions. Supports shall be constructed of Type 316L stainless steel and designed by and installed at the spacing recommended by the pump manufacturer. Manufacturer's Representative shall confirm intermediate guide rail supports permit free, unobstructed removal of the pumps. Notify installing Contractor for correction if binding occurs during pump installation or removal.

4) All components of the guide rail system, excluding base elbow, shall be constructed of Type 316L stainless steel.

5) Anchorage of base elbow fixture to the bottom slab of the wet well as recommended and designed by the pump manufacturer.

2.4 HINGED FLAP GATE

A. Hinged Flap Gates: Hinged flap gates shall be Whipps Series 452 or equal.

B. PERFORMANCE CRITERIA

1. Sized as detailed below, shown on the Drawings, and as required to ensure less than 0.5 feet H2O of head loss at all flow rates up to and including full flow. For this use case head loss is defined as the difference between the upstream and downstream water surface levels. The following sizes of hinged flap gates shall be provided for Basins A, B, and C.

a. Basin A:

1) Clear Opening Height: 3 feet - 0 inch
2) Clear Opening Width: 6 feet - 0 inch
3) Maximum Flow Rate: 29.6 Cubic Feet per Second
4) Maximum Seating Head: 10 feet H2O

b. Basin B

1) Clear Opening Height: 3 feet - 0 inch
2) Clear Opening Width: 6 feet - 0 inch
3) Maximum Flow Rate: 29.9 Cubic Feet per Second
4) Maximum Seating Head: 10 feet H2O

c. Basin C

1) Clear Opening Height: 4 feet - 0 inch
2) Clear Opening Width: 6 feet - 0 inch
3) Maximum Flow Rate: 53.8 Cubic Feet per Second
4) Maximum Seating Head: 10 feet H2O

2. Leakage shall not exceed 0.1 gpm/feet of wetted seal perimeter in seating head condition.
3. All structural components of the frame and reinforcing stiffeners on the flap shall be fabricated of stainless steel having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
4. All welds shall be performed by welders with AWS certification.
5. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale.

C. MATERIALS

1. Frame: Stainless Steel, Type 316L, ASTM A 240.
2. Flap: Stainless Steel, Type 316L, ASTM A 240.
3. Seals: Neoprene or EPDM, ASTM D 2000 or Urethane.
4. Seal fasteners and hardware: Stainless Steel, Type 316L, ASTM A 240.
5. Anchor Bolts Studs, Fasteners and Nuts: Stainless Steel, Type 316, ASTM A 276.

D. FLAP GATE CONSTRUCTION

1. Frame: The frame shall be constructed of formed stainless steel plate with a minimum thickness of 1/4-inch.
    a. Frame design shall be of the flanged back type suitable for mounting directly to a wall with stainless steel anchor bolts and grout or mounting to a pipe flange with stainless steel mounting studs and a mastic gasket material. Mounting style shall be as shown on the Contract Drawings and flanges shall not extend father than 1 foot beyond the edges of the clear opening.
    b. The flap shall not extend out farther then that allowed by the chamber in which it is mounted. Multiple flap sections shall be provided if required to allow for installation in the specified chamber size(s).
    c. The frame shall be outfitted with a continuous, resilient seal around the entire perimeter of the opening. Stainless steel retainers and attachment bolts shall hold the seal in place.
    d. All frame members shall be designed to handle a full seating head condition with the flap in the closed position.
    e. The angle of the flap when seated against the frame shall be between 3 degrees and 7 degrees from the vertical.
    f. Lifting lugs shall be provided on the top of the frame to facilitate installation.
2. Flap: Shall be reinforced stainless steel plate designed for a maximum deflection of l/360 of the span under maximum design head.
    a. Reinforcing stiffeners shall be welded to the flap and mounted horizontally.
    b. The flap shall be attached to the frame with two hinge arms of formed stainless steel plate with a minimum thickness of 3/4 inch. Dual hinge arms shall be provided and shall have two pivot joints per arm. An adjustable lower pivot with limited rotation and a fixed or adjustable upper hinge lug arrangement to permit adjustment of the opening sensitivity to unseating heads. The hinge pins shall have a minimum diameter of 1 inch and shall be constructed of solid stainless steel rod.
    c. Seating head shall be calculated based on the invert of the flap gate and a water surface level located at grade.
    d. A lifting handle shall be welded to the center of the bottom reinforcing stiffener on each flap. The lifting handle shall be constructed of 1/2-inch stainless steel rod.
3. Anchor Bolts: Anchor bolts shall be provided by the flap gate manufacturer for mounting the gates where shown on the Contract Drawings.
    a. Quantity and location shall be determined by the gate manufacturer.
    b. Epoxy type anchor bolts shall be provided and the gate manufacturer shall provide the studs and nuts.
    c. Anchor bolts shall have a minimum diameter of 1/2 inch.
4. Grout: The Contractor shall fill the void in between the gate frame and the wall with non-shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.
    a. Grout shall be non-shrink as recommended by the gate manufacturer; provided and installed by the Contractor.

PART 3 - EXECUTION

3.1 GENERAL

A. Pump stations shall be sourced by one supplier and shall each be one comprehensive unit.

3.2 DELIVERY AND ACCEPTANCE

A. Contractor will need to coordinate with the Pump Station Supplier for delivery of the Pump Station components, including control panels, inspection, unloading, storage, installation and appurtenances. Pump Station Supplier shall support this process as required for timely delivery and construction of the Pump Station.

1. All materials delivered to the job site shall be new, free from defects and marked to identify the material, class and other appropriate data for the Pump Station.

2. Acceptance of materials shall be on-site and subject to inspection of the finished product, in addition to quality testing. Acceptance of the installed Pump Station shall be based on inspection as specified hereinafter.

B. DELIVERY REQUEST

1. The Contractor will determine a delivery sequence, as necessary, to deliver the various components associated with each Pump Station, while taking into consideration the laydown areas and work limits shown on the Drawings.

2. The Contractor will submit the delivery requests in writing, noting the specific Pump Station component(s) to be delivered.

3.3 LOADING/UNLOADING DELIVERED ITEMS

A. If the component(s) delivered to the site does not match the description in the Contractor's written request, the component will be returned to the Pump Station Suppliers storage yard and the correct component(s) shall be delivered.

B. Contractor will perform all unloading, crane transport, storage and installation once the component is delivered on-site and handed over to the Contractor.

C. The Contractor will provide spreader bars and straps to safely lift the main structures and appurtenances per the Pump Station Supplier's recommendations.

3.4 INSTALLATION AND ASSEMBLY

A. The Contractor will set the base for the precast concrete wet well, risers, top slab(s), and all other concrete wet well components.

B. The Contractor will assemble vertical discharge piping, pump guide rails and make all pipe connections.

C. Control panel will be mounted at locations indicated on the Drawings. The Contractor will provide all tools, labor, and equipment to install the control panel, electrical conduit, wiring and connections from the control panel to the associated components. Pump Station Supplier shall be responsible for coordinating conduit penetrations for conduit and junction boxes that will be provided by the Contractor.

D. The Contractor will install pump floats, overflow chamber float, and float located within the hydrodynamic separator as indicated in the Drawings using the floats, mounting equipment, and appurtenances provided by the Pump Station Supplier.

E. The Contractor will provide all conduits to connect the hydrodynamic separator, Pump Station, and control panel for the electrical and controls cables required for system operation.

3.5 HYDROSTATIC TESTING

A. All wet wells will be hydrostatically tested by the Contractor using the below method. If the Pump Station Supplier or Contractor wish to use an alternate method of leakage testing, the proposed method shall be submitted to the Engineer for review and approval.

1. Fill the manhole with water and wait thirty (30) minutes for initial concrete absorption to take place. After the thirty (30) minute wait period is over, Contractor will measure leakage over a period of not less than one hour.

2. Allowable Leakage: less than one (1) inch drop in water surface elevation over the duration of the test.

3.6 START UP

A. The Pump Station Supplier shall support the Contractor in activation of the Pump Station(s). The Contractor will provide a minimum of one (1) week notice. The manufacturer's representative shall perform the following start up tasks:

1. Startup, check, and operate the pump system.

2. Obtain concurrent readings of motor voltage, amperage, pump suction head, and pump discharge head.

B. Pump Lift Test: Manufacturer must demonstrate successful removal of pumps from wet well using the guide rail system.

C. If the pumping system fails to meet the indicated requirements, the Pump Station Supplier shall assist the Contractor in modifying the pumps and re-testing as indicated above, until all stations satisfy the indicated requirements.

1. Defective pumps or parts discovered during testing shall be replaced. Parts shall be provided by the manufacturer and installed by the initial installation party (i.e., Pump Station Supplier or Contractor).

D. Certification

1. After each pumping system has satisfied the requirements, the Pump Station Supplier shall certify in writing that it has satisfactorily tested and that final adjustments have been performed.

2. Certification shall include the date of the field test, a listing of persons present during the tests and the test date.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Measurement includes provision of all required submittals, products, equipment, transfer, unloading, and, if necessary, storage of the Pump Station components.

4.2 PAYMENT

A. Payment will be made at the contract price per each as stated in the Schedule of Unit Prices and shall be full compensation for furnishing all labor, equipment, materials and tools associated with the procurement, storage required prior to delivery, insurance, and transportation of all equipment to the project site.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Refer to Section 33 44 13 – Pump Stations for requirements regarding the Advanced Procurement package supplied by the Pump Station Supplier and the Contractor's responsibility.

B. The pump control panels shall include all components as specified herein, as noted on the drawings, as required to meet electric code provisions, and as required to ensure a complete system.

C. In addition to features specified for the enclosures, the components shall include, but may not be limited to, din rail mounted terminal blocks for connection of external power and control wiring, disconnect rated plug/receptacles for pump power cables, pump number labels, intrinsically safe barriers for control and alarm probes, primary level control sensors, and all other necessary and related accessories and appurtenances.

1.2 RELATED SECTIONS

A. The work of all sections within Division 40 – Process Interconnections is related to the work of this section. Other sections may also be related to the proper performance of this work.

1.3 REFERENCE STANDARDS

A. This section incorporates by reference the latest revision of the following documents. These references are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of a listed document, the requirements of this section shall prevail.

1. National Electrical Manufacturers Association (NEMA) Publications:
   a. ICS1: General Standards for Industrial Controls and Systems.
   b. ICS2: Standards for Industrial Control Devices, Controllers, and Assemblies.
   c. ICS4: Terminal Blocks for Industrial Control Equipment and Systems.
   d. ICS6: Enclosures for Industrial Controls and Systems.
2. UL Underwriters Laboratories:
   a. 508: Industrial Control Equipment.
3. NEC: National Electrical Code.
4. FS W-C-375: Circuit Breakers, Molded Case, Branch Circuit and Series Service, Series Trip.

1.4 SUBMITTALS

A. As specified in Section 33 44 13 – Pump Stations.

B. The following items shall be submitted in this section:

1. Shop Drawings: Submit Shop Drawings and receive approval prior to purchase of any equipment.
   a. Parts list for all hardware including catalog cut sheets, full specifications, current net prices, and a list of recommended spares. Typical hardware list will include, but is not limited to:
      1) All system components such as the PLC bases, cards, enclosures, relays, etc.
      2) Interface hardware such as connectors, cables, etc.
      3) Power supply and conditioning equipment such as line conditioners, voltage regulators, transformers, and power line surge protection device.
   b. A layout Drawing of the enclosure(s) with all components including details of seismic restraints.

c. Complete panel layout and wiring Drawings including wire marking scheme on 11- by 17-inch sheets.

d. Heat load calculation and expected temperature rise for all enclosures containing heat-producing hardware or equipment.

e. Preliminary factory test procedure.

f. Operation and Maintenance Manual: Table of contents with a brief description of contents planned for each section. Sections shall include, but not be limited to, start up, operation description of control panel functions, vendor manuals and Drawings.

2. Factory Testing: Final factory test procedure submitted at least 2 weeks prior to start of testing.

3. Prior to Shipment: Submit the following results for approval prior to shipment of equipment:

a. The factory test results.

b. Provide one copy of the preliminary operation and maintenance (O&M) manual for review. Manual will be returned for completion. The O&M manual shall be bound and organized in such a way for easy reference. The first tab shall include a spreadsheet tabulating the bill of material items provided. This spreadsheet shall include the item number, quantity, tag number, manufacturer's part number, description, manufacturer, and local vendor. A summarized list of contact information shall be provided listing the phone number, address, and web site of each manufacturer and local vendor representative. Each item number will subsequently have its own tab within the manual where the specific O&M, supporting information, configuration documentation and cut sheets are located.

c. The field demonstration test procedure.

4. Substantial Completion: Upon petition for Substantial Completion, submit the following items for review and approval. Substantial Completion shall be dependent upon approval of these complete and comprehensive documents.

a. The field demonstration test results.

b. Final O&M Manual(s): All information required in prior submittals shall be included in final form.

c. Layout Drawings shall identify all instruments and components within the control panels with corresponding item number for easy cross-reference.

5. Through Warranty Period: Provide updates for the O&M manual, with maintenance instructions, within 1 week following changes to the system due to warranty corrections.

C. Arrange submissions in a logical manner and on the Shop Drawings use the device abbreviation identifications and equipment names as shown on the Drawings, in order to expedite and facilitate review by the Engineer.

D. Where unit arrangement or wiring deviates in any way from that shown on the Drawings, provide a complete record and explanation of such deviations.

E. Spare Parts List: Include a spare parts list for all Pump Station Supplier-supplied equipment and devices showing recommended parts and quantities as well as complete ordering information for replacement components. Provide instruction books for special control devices and special equipment installed in the control panels. Submit these to the Engineer prior to installation of the equipment.

1.5 QUALITY ASSURANCE

A. As specified in Section 33 44 13 – Pump Stations.

B. Regulatory Requirements: The completed control panel assembly shall be labeled and listed UL 508-A.

C. Control Panel Supplier / Pump Station Supplier Qualifications:

1. The control panel supplier shall be responsible for the final design and assembly of the system. The system shall be designed to provide the control capabilities and functions indicated and implied by the Drawings and these Specifications and to provide trouble-free operation with minimum maintenance.

2. The control panel supplier shall have specialized in the design, assembly, testing, installation, and service of municipal control systems of the same scale and complexity as this job under its present company name for at least 10 years.

3. The control panel supplier shall be a licensed company in the state of Washington employing service personnel and fabricators with documented experience in the design, assembly, testing, installation, operation, calibration, troubleshooting, service, and repair of control systems for municipal waterworks and wastewater facilities. Employees assigned key roles associated with this Project will have a minimum of 5 years of related experience.

4. Drawings, configurations software, documentation, and licensed software provided and/or used for the Project shall be the property of the Owner. A revocable use agreement will not be acceptable. Configuration software, documentation, and all programming provided shall not be copyrighted, encrypted, or coded.

5. The control panel(s) associated with the Project shall be calibrated, commissioned, and tested using system simulation equipment prior to customer delivery.

1.6 WARRANTY

A. As specified in Section 33 44 13 - Pump Stations.

PART 2 - PRODUCTS

2.1 ELECTRICAL ENCLOSURE AND COMPONENTS

A. Provide Pump Control Panels PCP-A1, PCP-B1, and PCP-C1 as follows and as shown on the Drawings:

1. Enclosure:

a. NEMA 4X 316 stainless steel continuously welded construction, back panel, swing-out panel, hidden continuous hinges, gasketed, three-point latch with rollers, and padlockable quarter-turn handles.

b. Enclosure dimensions will be of appropriate size to house the required equipment.

c. When enclosure cut-outs for instruments and other devices are required, holes shall be cut, punched, or drilled and finished with rounded edges.

d. A door stiffener shall be used where applicable to prevent door deflection under instrument loading or operation.

e. The interior of the enclosure shall be provided with properly sized industrial grade corrosion inhibitors.

f. Provide entry provisions for conduit shown on the Drawings.

g. Manufacturer: Hoffman, Saginaw, or Hammond.

2. Pump Disconnect Plug/Receptacles:

a. Pump disconnect plug/receptacles shall be a combination of a plug/receptacle and a disconnect switch in the same device. These plug/receptacle units shall be horsepower rated and switch rated to UL Standards 1682, 98 (as a Branch Circuit Disconnect) and 508A (as a Manual Motor Controller).

b. The plug/receptacle units shall perform as true functioning disconnect switches for motors or other inductive loads, without the need for an electrical or mechanical interlock. As a switch, the unit shall

be designed to make or break up to 600 VAC and up to one and a half times the rated current, and make or withstand up to 10,000 A short circuit, with a power factor as low as 0.45. The plug/receptacle units shall be rated to function as a "In Line of Sight" disconnect for both inductive and resistive applications per NEC 430.

c. The plug/receptacle unit shall have dead front construction to prevent user access to live parts, and contacts shall use silver-nickel 85/15 butt style spring loaded pressure contacts. Pilot contacts shall be provided as required for motor over temperature sensors, moisture sensors, or other control features as required or as shown on the Drawings. The pilot contacts shall make last and break first when the plug is engaged or disengaged form the receptacle.

d. The plug/receptacle unit shall be 3-pole, 4-wire configuration (female mounted on panel, plug connected to pump cable). Provide a minimum of two (2) pilot contacts in addition to the power and ground contacts (minimum number of pins/sleeves required is: 3-power, 1-ground, and 2-pilot for a total of 6- pins/sleeves) but in no case less than the minimum required for complete connection of all power and control conductors associated within the provided pumps.

e. The Pump Control System and Pump Disconnect System shall be configured and/or programmed such that physical removal of a pump from the wet well and disconnecting it from the disconnect plug/receptacles at the control panel does not generate alarm callouts while the remaining pumps and equipment remain in full automatic mode (i.e., without disabling any alarm or telemetry functions, and without the need for specially wired dummy plugs).

3. Enclosure light, LED lamp, 120 Vac, 60 Hz, remote door switch to activate lights when door is open.

4. Convenience Receptacle:

   a. Duplex 120 VAC Receptacle.

   b. Mount as shown on Drawings.

5. Motor Circuit Protectors as required.

6. Surge protection to protect the following:

   1) Analog and discrete signals from field instruments.

   2) Power supplies.

   3) Main power feed to panel.

7. Thermal management system to maintain rated temperature and humidity within the panel. A hygrotherm shall be provided for the control of any HVAC devices based on the temperature and humidity within the control panels.

8. Additional items indicated below and as needed for a complete and proper installation.

2.2 REDUCED-VOLTAGE CONTROLLERS

A. Minimum Acceptable Short Circuit Withstand Rating in Combination with Motor Circuit Protective Device: 22,000 symmetrical amps, or as required based on the short circuit, coordination, and arc flash study.

B. Solid-State, Reduced-Voltage Controller: NEMA ICS 2, suitable for use with NEMA MG 1, Design B, poly-phase, induction motors.

1. Adjustable acceleration rate control utilizing voltage or current ramp, and adjustable starting torque control with up to 500 percent current limitation for 20 seconds.

2. Surge suppressor in solid-state power circuits providing 3-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.

3. Controller shall provide an internal bypass contactor and overload protection.
4. LED indicators showing motor and control status, including the following conditions:
    a. Control power available.
    b. Controller on.
    c. Overload trip.
    d. Loss of phase.
5. Manufacturers:
    a. Eaton.
    b. Siemens.
    c. Square D.
    d. Allen Bradley.
    e. Or equal.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. General:
    1. Comply with UL 489 requirements.
    2. Provide thermal and magnetic protection.
B. Provide permanent trip lighting panel circuit breakers as follows:
    1. UL listed SWD (switching duty) on 120 V circuits where switched circuits are indicated.
    2. Short circuit rating (integrated equipment rating):
        a. Up to 240 V: 10,000 RMS symmetrical amps minimum, or as required by the short circuit, coordination, and arc flash study.
        b. Up to 480 V: 14,000 RMS symmetrical amps minimum, or as required by the short circuit, coordination, and arc flash study.
C. Where enclosed circuit breakers are required, provide with:
    1. Cover interlock.
    2. Handle position that indicates ON, OFF, or TRIPPED.
    3. Padlock provision in the OFF position.
    4. External trip indication.
    5. Provision for insulated or bonded neutral.
    6. Provision for control circuit interlock.

2.4 PANEL FRONT DEVICES

A. Selector Switches and Push Buttons:
    1. Manufacturers:
        a. Allen Bradley.
        b. Cutler-Hammer.
        c. Square D.
        d. Or equal.

2. Heavy-duty, 30.5 mm, corrosion-resistant Type 4X with contact rated for 120 Vac at 10 A and 24 Vdc at 0.1 A continuous.
3. Single-hole mounting, accommodating panel thickness from 1/16 to 1/4 inch.
4. Selector Switch Operator: Black knob type, maintained position.
5. Operator In Trouble Push Button: Red jumbo mushroom, maintained position type.

B. Indicating Lights:
1. Manufacturers:
a. Allen Bradley.
b. Cutler-Hammer.
c. Square D.
d. Or equal.
2. Heavy-duty, 30.5 mm, corrosion-resistant Type 4X.
3. Single-hole mounting, accommodating panel thickness from 1/16 to 1/4 inch.
4. 120 Vac, LED type.
5. Push to test type.

C. Selector switches for motor circuits:
1. Manufacturers:
a. Allen Bradley.
b. Cutler Hammer.
c. Square D.
d. Or equal.
2. Heavy Duty, minimum 30.5 mm, corrosion-resistant Type 4X.
3. Contacts shall be:
a. Rated 120 Vac minimum.
b. Motor rated and sized for the submitted motor load. Contacts shall also be sized for the upstream overcurrent protection.
c. Rated for use as a lockout device and include a padlock hasp to secure the switch in the open position.
d. The switch nameplate shall include indication of the open and close positions.

2.5 RELAYS

A. Retaining Clip: Provide retaining clip to secure all socket-mounted devices to the associated bases for each.

B. Provide current sensing relays as shown on the Drawings.

C. Contact Rating for Control Relays:
1. Contact Rating: 10 A resistive at 120 Vac.
2. Manufacturers: Potter Brumfield KU series with silver cadmium-oxide contacts or approved equal.

D. Intrinsic Safety Relay:

1. General: Isolate field contacts in classified location from control circuits in non-classified location.
2. Output: Minimum 1 Form C relay contact.
3. UL or FM approved for use with remote pilot-device contacts located in Class I, Division 2, Groups C and D atmospheres.
4. Provide an approved method to separate the intrinsic safety relays from non-intrinsically safe components.
5. Route conductors from field circuits protected by intrinsic safety relay in conduit separate from all other circuits.
6. Manufacturers:
   a. Gems.
   b. Stahl.
   c. Warrick.
   d. Or equal.

2.6 MISCELLANEOUS COMPONENTS

A. Raceways: Plastic slotted-wall wiring duct. Color shall be the manufacturer's standard. Wireway shall only be used inside control panels.

B. Control Power Transformers:

1. Control power transformers required to provide control system and accessory power shall be machine tool type control transformers with epoxy encapsulated coils or resin impregnated coils, high quality silicon steel laminations, copper magnet wire, molded-in terminals and 55-degree C rise (Class 10 insulation system).
2. The secondary neutral conductor shall be properly bonded to ground according to the National Electrical Code requirements for transformer grounding.
3. Minimum size of control power transformer shall be 2,000 VA; but in no case less than that required to power the required loads.

C. Fuse Blocks:

1. Terminal with fuse swing arm and fuse and mounted with rail mount.
2. Manufacturers and Products: Allen-Bradley, Part No. 1492-H4, or equal.
3. Provide typewritten identification for all fuses.

D. Terminal Blocks:

1. Rating: 600 V for signals greater than 30 V and 300 V for signals less than 30 V.
2. Heavy-duty double-screw type with strap screw clamp and mounted with rail mount. The terminal block and terminal lug shall be compatible.
3. Manufacturers and Products: Entrelec or Allen-Bradley Part No. 1492-H1 for control signal.
4. Provide permanent typewritten terminal block identification for all terminals. Identify each terminal with the same number as the wire being terminated.
5. Provide terminals for all external (field) connections and provide at least 15 percent spare terminals.

E. Alarm Beacon Light:

1. 120VAC.
2. Flashing, red or blue LED light.
3. Rated for outdoor use; NEMA 4X enclosure.
4. Manufacturer/Model: Federal Signal SLM200 or approved equal. Provide appropriate mounting base hardware option for each location.
5. Vertical mount.

F. Alarm Annunciator Horn:

1. 120VAC.
2. Rated for outdoor use; NEMA 4X enclosure.
3. Annunciator Sound Level: Vibratone sound 100dB at 10 feet.
4. Manufacturer/Model: Federal Signal 350 or approved equal.
5. In addition to the specified beacon lights and horns, each pump station control panel shall be provided with a stainless steel NEMA 4X rated alarm bell mounted on the exterior and an alarm silence button mounted within the panel to allow the audible alarms to be temporarily turned off.

2.7 FABRICATION

A. General:

1. Provide a copy of the elementary control diagrams for the control panel, enclosed in plastic and stored in a document pocket mounted inside the panel door.
2. Panel fabrication to conform to the requirements of NEMA Standards ICS1, "General Standards for Industrial Controls and Systems" and ICS2, "Standards for Industrial Control Devices, Controllers and Assemblies".
3. No fastening devices shall project through the outer surfaces of the enclosure of box. Components and terminals shall be mounted on mounting pans within the panels.

B. Power:

1. Incoming power wiring shall be terminated at distribution lugs and shall be provided with voltage surge arresters to protect all equipment mounted within the enclosure from switching surges and lighting induced surges. Voltage surge arresters shall be located in the enclosure in such a manner to facilitate inspection and replacement of units if damaged.
2. A main circuit breaker shall be provided for the control panel, with separate circuit breakers for each motor and transformer primary, as well as single-pole circuit breakers for control circuitry, lighting, heaters, outlets, etc.

C. Wiring: Cable panel wiring by securing to the panel surfaces with plastic cable ties. Permanently identify each wire at each termination by means of a heatshrink numbered sleeve. Number all electrically common wires the same, and number each electrically different wire uniquely. Provide red wire color for ac wiring, with white neutral and green ground. Provide blue wiring for dc wiring. Wiring shall be 14 gage, Type SIS, 41 strand, 600 V, copper wire. Where wiring crosses hinged surfaces, provide an 18-inch U-shaped hinge loop of extra flexible wires secured at both ends. Provide ring-type lugs for all new panel wiring; spade-type lugs are unacceptable.

D. Grounding:

1. Control panel enclosure shall be properly grounded in accordance with the National Electrical Code and local code requirements.

2. Hinged doors shall be grounded on both sides of the hinge.
3. Panel back planes shall be grounded to the main panel frame.

E. Nameplates: Provide nameplates identifying all devices and terminal strips. A "CAUTION" nameplate shall be attached to the outside of access doors warning of foreign voltages inside the panel.

F. Mounting:

1. Mounting pans of rigid sheet steel shall be provided for interior components and accessories as required.
2. Provide rigid supports for all devices. Supports shall not cause warping or bowing sides on mounting plates. Attachment methods shall be detailed on panel fabrication Drawing submittals.

G. Ventilation: Provide a thermostatically and humidity controlled fan to circulate air within enclosure.

PART 3 - EXECUTION

3.1 GENERAL

A. As specified in Section 33 44 13 - Pump Stations.

END OF SECTION