City of Dubuque, Iowa
Masterpiece on the Mississippi

City of Dubuque Supplemental Specification
Division 12-Minor Wastewater Lift Station

I hereby certify that this specification was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Gary Sejkora Date 10-11-2021

Gary Sejkora, P.E.
License Number 8384
My license renewal date is 31 December 2022
Pages covered by this seal: All pages

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MINOR WASTEWATER LIFT STATION

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. Submersible wastewater pumps and motors

B. Wet well and valve vault

C. Piping and valves

D. Flow measurement

E. Electrical and controls

1.02 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, operations, facilities, and administration necessary to furnish and complete all work covered by this specification and project drawings to produce a fully functioning wastewater pumping lift station.

B. Provide pumping, flow measurement, and pump control system adjustment and startup services per the Submersible Wastewater Pump Association (SWPA), SWPA startup report, and operator training.

1.03 SUBMITTALS

A. All materials to be incorporated into the work must have submittals furnished which show that the materials comply with the Specifications prior to any construction. See SUDAS General Provisions (Section 1050, Article 1.05).

B. Submit drawings and product data for review by the City Engineer. Submittals to include information to determine compliance with specifications, drawings, and installation requirements, and City approved lift station design by others. SUDAS submittal requirements shall apply.

C. Submit operation, maintenance, and service data and manuals/information for City staff use (three copies required).

D. Equipment and materials submittals include but are not limited to:
   1. Pre-cast concrete structures, pipe connections to structures, concrete mixes, (structural, paving, corrosion resistant, etc.), admixtures, and manhole access castings.

   2. Pumps and motors, wet well top, valve vault hatch, valve vault ladder, pump base elbows, pump guide rails and mounting brackets, trash basket assembly (when required), and certified pump performance testing results (when required).

3. DIP, PVC pipe (gravity and pressure), mechanical joint fittings, flanged fittings, flanged gate valves, check valves, air release valves, cast couplings, flange bolts and gaskets, MJ bolts and gaskets, tapping saddles, ball valves (PVC and bronze), flange adapters, retainer glands, buried gate valves (with boxes and Valve Box Adaptor II), pipe supports, etc.

4. Paint products used for factory finishes and for factory priming. Paint for field touch-up. Paint for field finish coating.

5. Electrical metering equipment, PVC conduit and fittings, aluminum conduit and fittings, wire, main breaker (service entrance), double throw switch, junction box for mounting above wet well, gen-set plug, light fixtures and switch, receptacles, etc.

6. Lift station control panel magnetic flow meter system and lift station monitor.

1.04 SUBSTITUTIONS

A. Comply with SUDAS-General Provisions and Covenants Section 1060 Article 1.02 as modified by City of Dubuque Supplemental Specifications Section 1060 Article 1.02, replacements and addition.

B. Substitution requests for City projects shall comply with SUDAS. Any substitution requests for other projects shall be made, with the design engineer's justification, during the City design document review process.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with SUDAS for City projects. The owner of other projects shall assign responsibility.

B. Materials supplied by the Jurisdiction/City (if any) will be delivered to the construction site by the Jurisdiction or on behalf of the Jurisdiction unless otherwise indicated in the Special Provisions, on the drawings, or by agreement between the City and project owner.

1.06 SCHEDULING AND CONFLICTS

A. Comply with SUDAS as modified, for City projects. Owner responsible for other projects.

1.07 SPECIAL REQUIREMENTS

A. Refer to project drawings, Part 3, and Special Provisions (if included) for additional information specific to the project.

1.08 MEASUREMENT AND PAYMENT

A. **Measurement**: Lump Sum Item. No Measurement will be made

B. **Payment**: Payment will be made at the lump sum price. Contractor must provide the engineer with a schedule of values for this item.

C. **Includes**: See Part 2 A. Also includes all labor, equipment and materials required to completely construct the lift station as shown in the contract documents.

PART 2 – PRODUCTS

2.01 LIFT STATION GENERAL

A. STATION INCLUDES - Submersible wastewater pump lift station shall include:

1. Two identical heavy duty submersible motor driven wastewater pumps with power and sensing cords.

2. Pump mounting bases with disconnecting assemblies and discharge connections.

3. Pump removal guide rails with supports and lifting chain.

4. Wet well and valve vault structures with integral (extended) bases and valve vault top.

5. Wet well cover, trash basket (when required) with guide rails and lifting chain, and valve vault hatch and ladder.

6. Piping from pump bases through valve vault to force main connection including valves and magnetic flow meter.

7. Lift station controls for automatic operation with level sensing, alarms, monitor system, and all electrical work.

B. MADE IN USA - The following equipment and materials shall be made in the USA unless otherwise approved by the City:

1. Submersible pumps and motors and discharge connection pump bases.

2. Pipe and fittings (DIP, PVC pipe, iron fittings).

3. Gate, ball, air release, and check valves.

4. Saddles, couplings and adapters.

C. OTHER MATEREIALS AND EQUIPMENT-The country of origin for other equipment and materials shall be for the brand name and model specified unless alternates are approved by the City.

D. PROJECT SPECIFIC REQUIREMENTS-The project specific requirements shall be as indicated in Part 3 of these specifications and/or on the City approved drawings. These requirements shall include:

1. Pump Requirements:

a. pump inlet and outlet size

b. pump design discharge rate (GPM) at duty point

c. pump total dynamic head (TDH in feet) at duty point

d. pump nominal rotation speed (RPM)

e. pump minimum hydraulic efficiency at duty point (%)

f. maximum power demand at duty point (HP)

g. maximum power demand for the selected pump performance curve (HP)

h. pump manufacturer(s) and model number(s), impeller diameter(s)

i. solids handling or chopper pump

j. any special/additional requirements

2. Motor Requirements:

a. nameplate horsepower (HP)

b. full load efficiency (%)

c. oil filled or air filled

d. service factor

2.02 PUMP AND MOTOR SPECIFICATIONS

A. GENERAL

1. Pump delivery in GPM at TDH in feet at rotational speed per Part 3.

2. Do not exceed motor nameplate horsepower (HP) at duty point. Do not exceed service factor horsepower at any point on the performance curve.

3. Handle (pass or chop) raw unscreened wastewater including 3-inch solid spheres, trash, and stringy material.

4. Pumps and motors shall handle full reverse rotation without damage.

5. Pumps and motors shall be capable of un-submerged operation without damage.

6. The pump/motor assembly shall be removable and replaceable without dewatering or entering wet well**.**

7. Pump efficiency to be as high as possible.

B. SOLIDS HANDLING SUBMERSIBLE WASTEWATER PUMPS AND MOTORS

1. Each pump shall be the sealed submersible type. Submersible pumps shall be designed for intermittent duty (at least 10 starts per hour) and continuous duty at 40 degrees Celsius ambient or higher.

2. Castings including the cord connection cap, motor housing, bearing housing, seal enclosure, and volute/casing shall be ASTM A48 Class 30 cast iron. The pumps shall have centerline 4-inch minimum flanged discharge. All external mating parts shall be machined, and O-ring sealed. All exposed bolts and nuts shall be 300 series stainless steel.

3. The impeller shall be designed for wastewater service and shall be capable of being trimmed to meet various specific conditions of head and capacity. The impeller shall be statically and dynamically balanced. Impellers shall be keyed and secured to the pump/motor shaft by a 300 Series stainless steel fastener with a suitable locking device and shall be removable without the use of special tools. Impellers shall be constructed of ASTM A48 Class 30 cast iron or ASTM A536 Class 65 ductile iron. A stainless steel or bronze replaceable volute wear ring shall be installed to maintain minimum clearances and minimize recirculation.

4. The combination pump and motor shaft shall be 416 stainless steel per ASTM A582 of adequate strength and stiffness for service intended. Motor/pump shaft bearings shall be heavy duty anti-friction ball type adequate to handle all thrust and radial loads.

5. Elastomers for O-rings, mechanical seals and cord grip grommets shall be nitrile.

6. The motor shall be sealed from the pump by double mechanical seals with an oil chamber between the two independent seals. The upper seal and the lower seal shall be carbon/silicon carbide or better. The seals shall require neither maintenance or adjustment but shall be easily inspected and replaced. The lower seal shall be replaceable without disassembly of the seal chamber. No seal damage shall result from operating the pumping unit continuously out of the liquid environment. The seal system shall not rely upon the pumped media for lubrication. All metal parts of the seal including springs shall be stainless steel. The seal chamber shall be fitted with an electrode probe that shall indicate water in the seal chamber.

7. The pumping assembly shall be painted to provide corrosion and chemical exposure protection. The paint shall be a waterborne acrylic unless an epoxy polyamide coating is specified in the Special Provisions or Part 3. Surface preparation prior to painting shall comply with the coating manufacturer's recommendations for the intended service.

8. Pump motors including stator windings, rotor, and bearings shall be O-ring sealed in a submersible housing. The electrical supply shall be as indicated on the drawings and/or in the Special Provisions or Part 3.

9. The motors shall be premium efficiency in accordance with IEC 60034-30, level IE3, and NEMA MG 1 (NEMA 12.60 enclosed motor). Motor rating tests shall be conducted in accordance with CSA C390-10 requirements. Motors shall be housed in an oil filled casing to provide cooling and bearing lubrication or if approved by the City, motors may be air-filled for up to 15 minutes of unsubmerged operation. Cooling systems utilizing auxiliary water supply or utilizing circulation of pumped media will not be approved.

10. The pump motor shall be squirrel cage induction design, NEMA type A or B for 3 phases (per NEMA MG1 1.19) and NEMA type L for single phase (NEMA MG1 1.20) if use of single phase power is approved by City.

11. The motor shall have copper stator windings, that are insulated with moisture resistant Class H insulation materials, rated for 180 degrees Celsius (356 degrees Fahrenheit) per NEMA MG1 1.66. Air filled motors may utilize Class F insulation or better.

12. The motor service factor shall be 1.15 or greater unless the motor is to be rated for "Invertor Duty". Invertor duty (VFD)rated motors shall have a 1.0 service factor as defined by MG1 standard.

13. The motors shall have a voltage tolerance of plus or minus 10% from nominal and a phase to phase voltage imbalance tolerance of 1%.

14. Motors shall be UL Listed for Class 1, Division 1 Groups C and D explosion proof hazardous locations as defined by the National Electric Code.

15. The motors shall be designed for continuous duty with a pumped liquid temperature of 40 degrees Celsius (104 degrees Fahrenheit). Each of the three phases shall have a UL/FM approved thermostat or thermistor. The windings operating temperature at rated horsepower and service factor shall be 130 degrees Celsius, at 40 degrees Celsius ambient.

16. The motors shall meet the requirements of NEMA MG1 Part 30 and 31 for operation on PVM type variable frequency drives (VFD).

17. The heat sensing units shall be connected to trip or stop the motor if over-temperature is sensed. Single phase motors, if City approved, may have one sensing unit.

18. The pump and motor bearings shall be heavy duty ball type (single row upper and double row lower) with a minimum B10 bearing life of 50,000 hours for radial and thrust bearings while operating across the entire hydraulic range of the pump. Single row lower ball bearings or sleeve lower bearings shall not be acceptable. Bearings shall be lubricated for life at the manufacturing facility.

19. The power cord shall be SOOW or W, oil and water resistant 600 volt, 90 degrees Celsius, UL and CSA approved and sized for amperage per NEC ratings at the rated temperature of the cable for intermittent/continuous duty. The motor and sensing cords shall be double protected with a compression fitting in the cord cap and an epoxy potted area that seals each conductor at the power/sensing cord entry to the pumping assembly. Each individual lead shall be stripped down to the bare strands of wire at staggered/offset intervals and each wire individually separated. This area of the cord cap shall then be filled with an epoxy potting compound. The cord leads shall be connected to the motor leads with a terminal block or extra heavy connectors. The cord cap shall be bolted to the motor housing and sealed with a nitrile O-ring.

20. If the motor is to be installed with VFD speed control, the shaft shall have a grounding ring unless otherwise approved by the City. The shaft current mitigation technology shall protect bearings from stray shaft currents by providing a low impedance path to ground, drawing the currents safely away from the bearings.

21. Solids handling pumps/motors shall be Hydromatic or Fairbanks to be similar to other pumps in the City wasterwater system for maintenance purposes. Alternate pumps must exist in the City system to be considered.

C. Chopper Submersible Wastwater Pumps and Motors

1. General

a. Submersible chopper pumps shall be specifically designed to pump waste solids at heavy consistencies without plugging or dewatering the solids.

b. Materials shall be chopped/macerated and conditioned by the pumps as an integral part of the pumping action.

c. The pumps must have demonstrated the ability to chop through and pump high concentrations of solids such as plastics, heavy rags, grease and hairballs, wood, paper products and stringy materials without plugging, both in tests and field applications.

d. The submersible pump/motor assembly shall be removable and replaceable without dewatering or entering the wet well.

e. Chopper pumps shall be manufactured by Vaughan Co., Inc. Montesano, WA to be similar to other pumps in the City wastewater system for maintenance purposes.

f. The project specific requirements for the pumps and motors shall be as indicated in Part 3.

2. Details of Pump Construction

a. Casing and back pull-out plate

i. Pump casing shall be of volute design, spiraling outward to the Class 125 flanged centerline discharge (3-inch minimum).

ii. Back pull-out design shall incorporate jacking bolts for accurate adjustment of impeller-to-cutter bar clearance.

iii. Casing and backplate shall be ductile cast iron with all water passages to be smooth and free of blowholes and imperfections for good flow characteristics.

iv. A pressure tap shall be included on or near the discharge flange.

v. Backplate shall include a replaceable Rockwell C 60 alloy steel cutter adjustable for 0.005 – 0.050 inch clearance to cut against the rotating impeller pump-out vanes for removing fiber and debris.

b. Impeller

i. Shall be semi-open type with pump-out vanes to reduce seal area pressure.

ii. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings, with a set clearance between the impeller and cutter bar of 0.015 – 0.025 inch cold.

iii. Impeller shall be cast alloy steel heat treated to minimum Rockwell C 60 and dynamically balanced.

iv. The impeller shall be keyed to the shaft and shall have no axial adjustments and no set screws.

c. Cutter Bar Plate

i. Shall be recessed into the pump bowl and shall contain at least 2 shear bars extending diametrically across the intake opening to within 0.010 – 0.030 inch of the rotating cutter nut tooth, for the purpose of preventing

intake opening blockage and wrapping of debris at the shaft area.

ii. Chopper pumps utilizing individually mounted shear bars shall not be acceptable.

iii. Cutter bar shall be cast alloy steel or alloy steel heart-treated to minimum Rockwell C 60.

d. Cutter Nut

i. The impeller shall be secured to the shaft using a cutter nut, designed to cut stringy materials and prevent binding using a raised, rotating cutter tooth.

ii. The cutter nut shall be cast alloy steel heat-treated to minimum Rockwell C 60.

e. Upper Cutter

i. Shall be threaded into the back pull-out adapter plate behind the impeller, designed to cut against the pump-out vanes and the impeller hub, reducing and removing stringy materials from the mechanical seal area.

ii. Upper cutter shall be cast alloy steel heat-treated to minimum Rockwell C 60.

iii. The upper cutter teeth are to be positioned as closely as possible to the center of the shaft rotation to minimize cutting torque and nuisance motor tripping.

iv. The ratio of upper cutter cutting diameter to shaft diameter in the upper cutter area of the pump shall be 3.0 or less.

f. Shafting

i. Pump shafting shall be heat-treated alloy steel.

ii. The pump shaft shall be directly coupled to the motor shaft with a bolt and keyway.

g. Pump Painting

i. The pump but not the motor shall be factory painted.

ii. The pump exterior shall be degreased.

iii. Pump exterior shall be coated with epoxy at 5 to 8 mils dry film thickness (dft).

h. Nameplate

i. A stainless steel nameplate shall be attached to each pump.

ii. Nameplate shall provide:
1. Manufacturer's model number
2. Pump serial number
3. Rated capacity in GPM (at mid-curve)
4. Head in feet (at mid-curve)
5. Rotation speed in RPM (nominal full speed)
6. All other pertinent data

3. DETAILS OF MOTOR CONSTRUCTION
a. Sizing
i. The submersible motor shall be sized for non-overloading conditions.
ii. Motor shall have a 1.15 service factor
iii. Motor horsepower, nominal rotation speed, frame, and power supply shall be as indicated in Part 3.
b. Rating
i. The submersible motors shall be UL and CSA listed and suitable for Class 1 Group C & D, Division1 hazardous locations.
ii. Rated for 15 minutes' operation in air with Class F insulation.
iii. Motor shall be inverter ready.
c. Seals
i. Motors shall be equipped with tandem independently mounted mechanical seals in oil both with dual moisture sensing probes.
ii. Moisture probes shall be connected to indicate water intrusion.
iii. The inner and outer seals shall be separated by an oil filled chamber.
iv. The oil chamber shall act as a barrier to trap moisture and provide sufficient time for a planned repair shutdown.
v. The oil shall also provide lubrication to the internal seal.
vi. The inner seal shall be a standard UL listed John Crane Type 21 or equal, with carbon rotating faces and ceramic stationary faces.
vii. The outer seal construction shall be designed for easy replacement.
viii. Outer mechanical seal shall be 316 stainless steel metal bellows type with silicon carbide faces.
ix. Seal shall be positively driven by set screws.
x. Elastomers shall be Viton.

d. Temperature Sensor

i. Motor shall include two normally closed automatic resetting thermostats connected in series and imbedded in adjoining phases.
ii. The thermostats shall be connected per local and state requirements and the National Electric Code to maintain hazardous location rating and to disable motor controls (starter, VFD, etc.) if overheating occurs.

e. Motor Materials
i. Motor frame and ends shall be cast iron with lifting lugs.
ii. Motor shaft shall be 416 stainless steel.
iii. External hardware shall be 300 Series stainless steel.
iv. Power and control cables shall be butt spliced and sealed in non-wicking epoxy.
v. All machined fits shall be O-ring sealed.

f. Power and Control Cable
i. Power and Control Cables shall be of a length required, minimum per Part 3.

ii. Cables shall be rated for 600 volts and 90 degrees Celsius.

iii. Cables shall have oil and water resistant insulation jacket.

D. PUMP MOUNTING, DISCHARGE, AND REMOVAL

1. A separate mounting base, discharge connection, and removal system assembly shall be furnished and installed for each pump. The assembly shall include pump carrier or guide bracket and pump discharge connection by pump manufacturer and guide rail brackets. The discharge connection shall include a 90-degree elbow. The pump base and discharge connection shall provide a leak proof metal to metal connection at the pump outlet.

2. The mounting base and discharge connection unit shall be cast iron designed to mount directly on and bolted to the wet well floor. The pump supplier shall furnish or recommend required drill-in anchor bolts. The discharge connection shall have a standard 125-pound flat face flange as specified in AWWA C115. The unit design shall be such that the pump discharge connection is made without the need for any bolts, nuts, or gaskets. The unit shall provide for automatic pump connection alignment when the pump is lowered vertically into place on the guide rails secured by the unit assembly. There shall be no need for operating personnel to enter the wet well for pump removal or installation.

3. All fasteners shall be stainless steel including anchor bolts, flange bolts, and guide bracket bolts.

4. The base/connection/removal assembly shall be painted as required for pumps.

5. Pumping assemblies shall be raised and lowered on two guide rails. The guide rails shall be 2-inch schedule 40 type 304 or type 316 stainless steel pipe. The lower end of the guide rails shall be secured to the pump base/connection/discharge assembly. The upper end of the guide rails shall be secured to the top of the wet well by double stainless-steel brackets with rubber pipe retainers and lift chain hook. When the guide rail length must exceed 20 feet from the base assembly to the upper guide rail bracket, intermediate guide rail brackets are required. The intermediate guide rail bracket shall be fabricated of stainless steel and include a stainless-steel U-bolt and nuts for attachment to the vertical discharge pipe. The intermediate bracket shall maintain straight guide rail alignment.

6. Each pump shall have a stainless-steel bail. A stainless-steel chain of adequate strength shall be connected to the bail to unseat the pump and lift the pump from the wet well. A "grip eye" shall be provided for grabbing the chain. The top of the chain shall be secured to the upper guide rail bracket hook.

7. Pump removal from the wet well shall be accomplished using an existing City owned truck mounted extendable davit crane and winch. The pump station site shall provide for vehicle access to the wet well.

E. PUMP TESTING

1. All pumping assemblies shall be visually inspected to confirm that they were built in accordance with the specification as to horsepower, voltage, phase, RPM and hertz. The motor windings shall be meggered to test for insulation defects. The motor shall be allowed to run dry to check for proper rotation and RPM. Each volute shall be hydrostatic tested to insure casting integrity.

2. When specified in the Special Provisions or Part 3, submersible pump assemblies shall be performance tested prior to shipping. Performance testing shall include measuring, at the nominal motor speed, the capacity, head, brake horsepower, and efficiency to establish compliance with the anticipated performance as submitted to the City. The Standards of the Hydraulic Institute (HI) shall govern the performance testing and reporting. The performance testing shall be certified by the manufacturer and two (2) copies submitted to the City for each pump.

F. PUMP ASSEMBLY WARRANTY

1. The pumping assembly manufacturer and/or supplier shall provide a written warranty against defects in material and assembly for a period of 24 months from the date of project start-up.

2. If the manufacturer's standard warranty duration time differs from those stated in F-1. above, the manufacturer or supplier shall include any and all costs associated with extending the duration as specified. The pumping assembly warranty shall include field labor, travel costs, removal/reinstallation costs, and delivery to and return from appropriate service/repair facilities. (without City Staff involvement)

3. The extended warranty shall cover the pumping assemblies without regard to the manufacturer of the control panel or electrical power components. However, the extended warranty will not cover pump or motor damage caused by the electrical components or controls if electrical/control items are furnished by others. The pump manufacturer shall supply any over-temperature and seal failure sensing and control components to the control panel manufacturer or provide a written approval of such components furnished by others to assure pump/motor warranty coverage.

4. The supplier shall provide required startup reports and information on the controls and electrical components.

5. No warranty coverage beyond the 24 months is required.

2.03 WET WELL AND VALVE VAULT

A. WET WELL

1. The wet well shall be a 72-inch inside diameter (or larger if required for depth or detention) precast concrete manhole with the base cast integrally with the lower segment of side wall. Base reinforcing shall extend into the sidewall. The base shall be extended beyond the sidewall exterior to counteract flotation (8" minimum). Areas inside the wet well not needed for pump/base installation shall be filled with concrete at a 1.5 vertical to 1.0 horizontal slope to form a hopper bottom to direct solids to the pump inlets. See project drawings.

2. Comply with SUDAS Section 6010 and City Supplemental Specifications.

3. The sidewall shall have "B" wall per ASTM C76 and shall have adequate reinforcements for project loadings. Sidewall joints shall have confined gasket and shall have external wrap.

4. The wet well sidewall shall have a butt top (plain end) for the installation of an aluminum cover/lid.

5. No steps are to be installed in the wet well.

6. Inlet pipe connections shall utilize A-Lok, Z-Lok, or PSX Direct Drive boots. Pressure pipe connections to the wet well and valve vault shall be Z-Lok, PSX Direct Drive, or City approved alternate.

B. WET WELL TOP

1. The wet well top shall be fabricated of 6061-T6 aluminum tread plate and have structural support members as required for the 6-foot (or larger) inside diameter.

2. The wet well top shall support 150 PSF and a 300-pound concentrated load.

3. Top fabrication must be coordinated with the wet well layout to avoid interference with pump removal and trash basket removal. See the project drawings and consult the City Engineer and the design engineer.

4. Top shall provide for upper pump guide rail support that has stainless steel hooks for pump removal chains and power and sensing cords, and brackets for level transducer and probe. The top shall be USF Fabrication, Inc. BPC or equal for the wet well diameter specified/shown with two doors and wire/cable opening in fixed section.

5. The wet well top doors shall open independently. Neither door shall bear on the adjacent door for support. Each door shall have a drop handle and padlock staple of aluminum or stainless steel. Hinges and fasteners shall be stainless steel. The fixed segment of the top shall be bolted to the plain end top of the precast concrete sidewall.

6. All fasteners including anchor bolts for the fixed segment shall be stainless steel. All aluminum in contact with concrete shall be thoroughly painted with a suitable bituminous coating. The fixed top segment is to have a cut out for the power and sensing cords.

C. TRASH BASKET

1. A trash basket when required by DNR design standards shall be Haliday Series B1A, USF Fabrication Debris Basket, or City approved equal.

2. The basket, bail, guide rails with lower stop, and attachment standoff brackets shall be aluminum. Fasteners and lift chain shall be stainless steel.

3. The trash basket assembly shall be designed for the wet well wall (diameter) shown on the drawings. The basket shall accommodate influent sewers up to 12-inches diameter. Larger influent sewers shall require special basket designs as approved by the City Engineer.

4. The trash basket shall have 2-inch diameter openings at 3-inch centers. The basket shall include a drop bottom for ease of cleaning. The basket shall be 28-inches high, 18-inches wide, and 8-inches deep. The bottom shall be installed 9 to 12 inches below the influent pipe flow line. The contractor shall coordinate the location (end) of the influent sewer relative to the trash basket to ensure solids capture and basket removal.

5. The trash basket guide rail attachment brackets shall be bituminous painted where in contact with concrete.

6. All hardware (fasteners, clip, hinges, mounting anchor bolts, etc) for the trash basket and guide rails shall be stainless steel.

7. The City of Dubuque has a truck mounted davit crane suitable for lifting the trash basket. The pumping station site shall provide for vehicle access to the wet well.

D. VALVE VAULT

1. The valve vault shall be a 72-inch inside diameter (larger if required for meter or air release valve) precast concrete manhole with the base cast integrally with the lower section of sidewall. Base reinforcing shall extend into the sidewall. The base shall be extended beyond the sidewall exterior to counteract flotation (8" minimum). The integral valve vault base shall include a concrete-encased electrode (UFER) for a grounding connection. See the project drawings. The valve vault floor shall be field placed to provide for installation of the 15-inch diameter (or square) by 5-inch deep sump and floor slope at 2% minimum.

2. Comply with SUDAS Section 6010 and City Supplemental Specifications.

3. The sidewall shall have "B" wall per ASTM C76 and shall have adequate reinforcements for project loadings. Sidewall joints shall have confined gasket and shall have external wrap.

4. Valve vault top shall be a precast concrete slip-over joint flat-top with a cast-in aluminum hatch.

   a. An aluminum hatch shall be integrally cast into the valve vault flat-top with corners as close to the inside diameter as possible.

   b. The top shall also have a precast hole for the bypass pumping connection piping (4.80" or 6.9" diameter). Precast company shall coordinate with the contractor.

5. Valve Vault Hatch:

   a. The valve vault shall have a 36" by 36" aluminum hatch (USF Fabrication APS 300 or equal).

   b. The hatch shall have a drop handle, automatic hold-open arm, stainless steel hinges, padlock staple, and stainless-steel fasteners.

   c. Aluminum in contact with concrete shall be thoroughly bituminous paint coated.

   d. The hatch shall be located above the ladder with the hinges opposite the ladder.

6. Valve Vault Ladder:

   a. An aluminum ladder conforming to OSHA requirements shall be installed for access to the valve vault below the hatch opening.

b. The ladder shall provide for 18-inch clear width between side rails.

c. The ladder shall have one (1) safety extension at the center of the ladder.

d. The ladder with safety extension shall be by USF Fabrication or City approved equivalent.

e. The ladder shall be attached to the floor and to the wall (with standoffs per OSHA). Aluminum in contact with concrete shall be bituminous paint coated.

f. Anchor bolts and any assembly hardware shall be stainless steel.

g. The contractor shall coordinate with the manufacturer so that the top of the ladder is as close to the top of the structure as possible but not interfere with the valve vault hatch.

2.04 PIPING

A. PUMP DISCHARGE TO FORCE MAIN

1. The wet well and valve vault piping from the pump base elbow to the force mains connection shall be ductile iron pipe with flanged fittings and buried fittings (per AWWA C153) or cast couplings (in the wet well or buried). Minimum size is 3 inch for chopper pumps and 4 inch for other pumps.

2. Pump discharge and valve vault piping shall be flanged joint Class 53 ductile iron pipe (DIP) per AWWA C151.

3. Flanged fittings for pump discharge piping shall be cast iron or ductile iron per AWWA C110.

4. Flanged joints shall be 125-pound flat face per AWWA C115 and have full face gaskets and stainless-steel assembly bolts/nuts. Pipe flanges shall be solid cast iron or ductile iron. Flange gaskets shall be SBR unless nitrile is required in the Special Provisions or Part 3.

5. The interior of DIP and fittings shall have an interior lining of ceramic epoxy paint.

6. Buried DIP and MJ fittings shall be polyethylene wrapped per AWWA C105.

B. PAINTING DIP AND FITTINGS

1. The interior of the DIP and fittings (flanged and MJ) shall be coated with ceramic epoxy. The exterior of flanged DIP and fittings shall be coated with polyamide epoxy. Epoxy coated DIP and fittings exposed to sunlight shall be top-coated with aliphatic acrylic polyurethane.

2. Ceramic Epoxy

    a. The ceramic epoxy shall be Tnemec Series 431 Perma-Shield PL or Protecto 401.

    b. The pipe and fittings manufacturer(s) or the pipe fabricator shall provide for ceramic epoxy lining by an applicator approved/certified by the paint manufacturer to have sufficient training and experience. Applicator shall perform surface preparation and coating application in full compliance with the coating manufacturer's requirements.

    c. Surface Preparation: Unless otherwise approved by the City Engineering Department surface preparation shall be as follows:

        1. All internal surfaces of ductile iron pipe and fittings shall be delivered to the application facility without asphalt or any other protective lining on the interior surface. All oils, small amounts of asphalt paint, grease, and soluble deposits shall be removed in accordance with NAPF 500-03-01 Solvent Cleaning prior to abrasive blasting.

        2. Pipe Interior: Uniformly rotary abrasive blast using angular abrasive material to a NAPF 500-03-04 Internal Pipe Surface condition, full removal of annealing oxide layer. Interior surfaces shall be free of all dirt, dust, annealing oxide, rust, mold, coating, or other foreign matter. Any area where rust reappears before lining application shall be reblasted. Surface shall have a minimum angular anchor profile of 3.0 mils per ASTM D4417, Method C.

        3. Fittings Interior: Uniformly abrasive blast using angular abrasive material to a NAPF 500-03-05 Fittings Blast Clean #1 condition, no staining. The interior surface shall be free of all visible dirt, dust, annealing oxide, rust, mold, coating or other foreign matter. Reblast areas where rust reappears prior to lining application. Surface shall have a minimum angular profile of 3.0 mils per ASTM D4417, Method C.

        4. Comply with pipe manufacturer's and paint manufacturer's recommendations for bell and exterior pipe surface preparation

    d. Application:

        1. The ceramic epoxy lining shall be applied within 8 hours of abrasive blasting.

2. The lining shall be applied when the surface and ambient temperature is above 50-degree Fahrenheit and 5 degree above dew point.

3. The ceramic epoxy lining shall have a nominal dry film thickness (DFT) of 40 mils in one or more coats. The maximum DFT in joints (bells and 6 inches of pipe exterior for joints and couplings) shall have 6.0 to 10.0 mils of coating as approved by the pipe/fittings manufacturer(s). Flange faces shall not be coated.

4. Coating procedures shall comply with the coating system manufacturer's recommendations regarding number of coats, maximum DFT, minimum and maximum recoat time, joints, etc.

5. Touchup and repair shall be done with ceramic epoxy, touchup kits, or joint compound per lining/coating manufacturer's recommendations. Field touchup and repair shall be done by experienced workers and under supervision of the coating manufacturer.

6. The blast profile shall be tested prior to coating application. Wet film thickness shall be measured at least once per 100 square feet. Dry film thickness shall be checked per SSPC-PA2. The interior lining of all DIP and fittings shall be tested for pin-holes and holidays with a non-destructive 2500-volt test. Any defects found shall be repaired prior to shipment.

7. The date of application of the lining shall be marked on the DIP and fittings and records maintained by the applicator.

8. The pipe and fittings manufacturer(s) shall supply a written certification that the applicator has met lining specification requirements.

3. Polyamide Epoxy

a. Exposed DIP and flanged fittings in the wet well and valve vault shall be painted with two coats of polyamidoamine epoxy, Tnemec Series N69 Hi-Build Epoxoline or approve alternate. Painting shall conform to paint manufacturer's recommendations.

b. DIP and fittings shall have surface preparation per National Association of Pipe Fabricators NAPF 500-03 by a qualified person or entity obtained by the pipe fabricator.

c. DIP and fittings shall be primed with 3.0 to 5.0 mils DFT of polyamidoamine epoxy by a qualified applicator obtained by the pipe fabricator.

d. Field repair of failed coating or rusty areas shall include SSPC-SP11 Power Tool Cleaning to bare metal and painting with 4.0 to 6.0 mils DFT of polyamidoamine epoxy. If primer is more than 60 days old the entire surface shall be scarified.

e. Field applied topcoat shall be 3.0 to 5.0 mils DFT of polyamidoamine epoxy after piping assembly. Field applied topcoat color shall be as selected by the City.

f. Flange hubs and faces shall be sealed using a clear non-silicone caulk after paint cure.

4. Aliphatic Acrylic Polyurethane

a. DIP and fittings that are exposed to sunlight in exterior locations shall be painted with one coat of aliphatic acrylic polyurethane over the two coats of polyamide epoxy.

b. The aliphatic acrylic polyurethane shall be Tnemec Series 73 Endura Shield or approved alternate compatible with the shop applied primer and the field applied topcoat.

c. The polyurethane coating shall be 2.0 to 3.0 mils DFT. Color selected by City.

C. FORCE MAIN PIPING

1. Force main pipe shall be cast iron O.D. DR 18 PVC per AWWA C900. The force main PVC pipe shall have a green color. Minimum size 4-inch. Minimum force main velocity in-service shall be 3.0 feet per second.

2. Force main pipe shall have push-on joints per AWWA C900 (ASTM D3139 joints and ASTM F477 gaskets) and restrained joints as necessary. Restrained joints in PVC pipe shall be integral and internal to the pipe bell, Eagle Loc 900 or equal; or may be by use of a joint harness, EBAA 1500TD or 1600TD with HSLA bolts, rods and nuts; or Romac 611; or equal. Restrained joints for fittings in PVC force mains shall be mechanical joint wedge type retainer gland, EBAA Series 2000PV, Tyler-Union domestic Series 2000, or Romac RomaGrip for PVC. Joint restraint shall conform to ASTM F1674. Harnesses shall be polyethylene wrapped.

3. Force main fittings shall be compact ductile iron per AWWA C153 with mechanical joints per AWWA C111. Fittings shall have a ceramic epoxy lining for pumping station DIP and fittings. All fittings shall be polyethylene wrapped per AWWA C105. Mechanical joint tee bolts shall be high strength low alloy steel with flouropolymer coating (Cor-Blue). Gaskets shall be SBR unless nitrile is required in the Special Provisions or Part 3.

4. Install tracer wire with tracer wire stations at both ends of the force main and at 500-feet intervals along the forcemain. Tracer wire access stations shall be Mini-Test Station by C.P. Test Services or approved alternate. Install traffic rated

valve or cleanout box when access station is installed in streets or sidewalks. Tracer wire systems do not require ground rods.

5. Refer to Section 4010 and Section 5010 of SUDAS specifications and City Supplemental Specifications. The requirements of this specification section shall govern.

D. MISCELLANEOUS PIPING

1. PVC Piping: PVC piping for drains, air release, etc. shall be installed where shown on the drawings.

    a. PVC pipe shall be schedule 80 per ASTM D1785 made of materials conforming to ASTM D1784.

    b. PVC fittings shall be schedule 80 per ASTM D2467.

    c. Joints in PVC piping shall be solvent cemented socket and plain end with cement per ASTM D2564.

    d. Joints shall be cleaned, primed, and cemented according to ASTM D2855. Primer shall conform to ASTM F656.

    e. Do not thread PVC pipe. Cement NPT by socket fittings to pipe.

2. Brass/Bronze Piping: Brass/bronze piping for drains, air release, sample ports, instrument connections, etc. shall be installed where shown on the drawings.

    a. Brass pipe and nipples shall be schedule 40 and conform to ASTM B687.

    b. Brass/bronze fittings shall be class 150 and comply with ASME B16.15.

    c. Joints shall be NPT per ANSI B1.20.1.

3. Stainless Steel Piping: Stainless steel piping for drains, air release, sample ports, instrument connections, etc. shall be installed where shown on the drawings or as required in Part 3.

    a. Stainless steel pipe and nipples shall be schedule 40 and conform to ASTM A312, Type 304 or as otherwise indicated in the Special Provisions or Part 3.

    b. Stainless steel fittings shall be class 150 and comply with ASTM A351.

    c. Joints shall be NPT per ANSI B1.20.1.

4. Un-Restrained Couplings: Couplings used to join plain-end pipes without thrust restraint shall have ductile iron center rings and end rings.

    a. Gaskets shall be SBR unless nitrile is required in the Special Provisions or Part 3.

b. Coupling bolts shall be Type 304 stainless steel unless Type 316 is required in the Special Provisions or Part 3.

c. The center ring shall have a 5-inch length for 4-inch to 8-inch pipe diameters.

d. The center ring and end rings shall have a fusion bonded epoxy coating.

e. Cast couplings shall be Romac Style 501 or USA made approved alternate.

5. Restrained Couplings: Restrained couplings shall be installed when thrust restraint is required. See drawings.

a. Restrained couplings shall be Romac Alpha or USA made approved alternate; or MJ sleeves with wedge type retainer glands, Cor-Blue or SST T-bolts, and nitrile gaskets.

b. Restrained couplings or restrained mechanical joint sleeves shall be installed in buried horizontal piping between the wet well and valve vault and elsewhere as shown or approved. Sleeves shall be polyethylene wrapped.

c. Retainer glands for DIP shall be EBAA Series 1100 Mega lug, Romac Roma-Grip, domestic Tyler Union Series 1000 Tuf-Grip or approved equal. Retainer glands for PVC pipe shall be EBAA 2000PV, Romac Roma-Grip for PVC Pipe, or domestic Tyler Union Series 2000 Tuf-Grip for PVC pipe or approved equal.

d. Retainer glands shall be epoxy or polyester coated by the manufacturer.

e. Sleeves shall be short body and comply with AWWA C153. Sleeves shall have ceramic epoxy lining.

6. Flange Adapter: Flange adapters may be installed in locations shown on the drawings and where approved by the City.

a. Flange adapters should be avoided in wet wells but are suggested for meter connection piping.

b. Flange adapters shall be made of ductile iron with gripping wedges and torque limiting actuating screws. The entire assembly except flange bolts shall be coated with fusion bonded epoxy. Flange bolts shall be type 304 stainless steel.

c. Flange adapters shall be EBAA Series 2100 Mega-Flange or City approved alternate. If set screw type flange adapters are approved, the set screws must be hardened stainless steel. Flange bolts shall be stainless steel. The adapter shall be epoxy coated.

7. Tapping Saddles: Tapping saddles shall be installed for pipe drainage, instrument connections, and as shown on the drawings.

    a. Single strap saddles shall be installed for connections to DIP unless double strap saddles are required in the Special Provisions, Part 3, or on the drawings.

    b. Tapping saddles shall have nylon coated saddles and stainless-steel strap(s) attached with stainless steel studs, nuts, and washers.

    c. Single strap tapping saddles shall be Romac Style 101NS or approved USA made alternate. Double strap tapping saddles shall be Romac Style 202NS or approved USA made alternate.

8. Pipe Support: Valve vault piping including the flow meter shall be supported from the floor by flange supports or saddle supports at locations shown on the drawings and approved by the City. A minimum of three supports are required in each valve vault.

    a. Floor pipe supports shall be fabricated of Type 304 stainless steel. Floor support extension pipes shall be Type 304 or 316 stainless steel. Anchor bolts shall be stainless steel.

    b. Floor flange supports shall be Standon Model S89 and floor saddle supports shall be Standon S92, or City approved USA made alternate.

9. Bypass Pumping Connection: A hose connection for bypass pumping shall be installed to above the valve vault top at each lift station. The bypass pumping connection shall include a piping connection in the valve vault, a gate valve, DIP, flanged fittings, piping drain assembly, and a portable pump hose connection.

    a. Connection Size: The bypass pumping connection shall be 4 inch (minimum) for station design flows of 135 GPM to 300 GPM and 6 inch for station design flows of 300 GPM to 650 GPM. Connection shall be 8 inch if required by City for larger design flows.

    b. Location: The center of the hose connection shall be horizontal and located 18 inches above the valve vault top.

    c. Hose Connection: The hose connection shall include a companion flange for NPT, an aluminum or stainless steel schedule 40 pipe nipple (4" long for 4 inch pipe and 6" long for 6 inch pipe), PT Couplings coupler by female NPT (4" Part 40D, 6" Part 60D), PT Coupling dust plug (4" Part 40W, 6" Part 60W), and PT Coupling security chain (4" & 6" Part S51).

    d. Painting: Paint bypass ductile iron piping above and below valve vault top as required in painting section of these specifications.

    e. Pipe Opening: The opening in the concrete valve vault top around the DIP shall be covered with an aluminum plate (3/16" minimum thickness),

sealed to the DIP and concrete with non-silicone caulk, and secured with stainless steel fasteners to the concrete.

f. Bypass Piping Drain: A drain connection shall be installed in the bypass DIP above the isolation gate valve. Drain connection shall consist of a 2-inch NPT outlet single or double strap tapping saddle, stainless steel 2" nipple, bronze ball valve, and stainless-steel street elbow.

2.05 VALVES

A. GATE VALVES

1. Gate valves shall be 4-inch minimum resilient seat type for solids handling pumps and 3-inch minimum for chopper pumps and shall conform to AWWA C509 or AWWA C515.

2. The gate valves shall have 125-pound flat face flange piping connections per AWWA C115 with stainless steel flange bolts and nuts.

3. Gate valves shall comply with the following:

   a. Non-rising stem

   b. Minimum 200 PSI working pressure rating

   c. O-ring shaft seals

   d. Interior and exterior epoxy coating per AWWA C550

   e. Hand-wheel operator

   f. Stainless steel valve assembly bolts (bonnet, stuffing box, and hand-wheel)

   g. Valves shall open left, counter-clockwise (CCW)

B. BRONZE BODY BALL VALVE

1. Bronze body ball valves shall be installed for air release valve installation, piping drain, etc. as shown on the drawings.

2. The bronze body ball valves shall include:

   a. Two-piece design, quarter turn

   b. Full size port

   c. NPT connections

   d. RPTFE seats and stem seals/packing

   e. Chrome plated solid brass ball

f. Brass stem, brass retainer and gland

g. Stainless steel nut and handle

h. Stem extension or stainless-steel tee handle if necessary to clear piping or valves, etc.

3. Bronze body ball valves shall be Apollo 77C-A with noted options, or City approved alternate.

C. PVC BALL VALVES

1. PVC ball valves with 18-inch stem extensions shall be installed for valve vault drain back to wet well. PVC ball valves shall be installed at other locations as shown on the drawings or approved by the City.

2. PVC ball valves shall comply with the following:

a. Double union (or single union in vault drainage sump)

b. Quarter turn operator

c. Full port (schedule 80 PVC)

d. EPDM O-rings

e. PTFE ball seats

f. Solvent cement socket to pipe connections

3. The ball valves shall be Spears True Union 2000, Spears Single Entry, or City approved alternate. The stem extension shall be Spears BVSE2 with schedule 80 PVC extension or City approved alternate.

D. CHECK VALVES

1. Pump discharge check valves shall be resilient flexible disc type

a. Check valves shall comply with AWWA C508.
b. Minimum size shall be 4-inch for solids handling pumps and 3-inch for chopper pumps.
c. The check valves shall have a disc closure assist device or accelerator as required by these specifications.

2. Flexible disc check valves shall comply with the following:

a. Piping connections to be 125-pound flat face flange, full face gaskets per DIP, and stainless-steel flange bolts.

b. Working pressure rating of 250 PSI

c. Ductile iron body and cover (ASTM A536)

d. Flow area equal to connected nominal pipe size

e. Nylon reinforced disc of Buna-N or EPDM fully encapsulating a steel disc installed at 45 degrees from valve centerline

f. Stainless steel cover attachment bolts and washers

g. Backflow actuator of bronze and/or stainless steel

h. Epoxy coated valve interior and exterior

3. Flexible disc check without closure assist device shall be Val-Matic Swing-flex Series 500BF or Kennedy Kenflex Figure 506.

4. Closure assist/accelerator device shall be included when required by the City Engineer. Criteria may include:

a. When more than one pump can operate at the same time

b. The force main length is greater than 400 feet

c. The static head (wet well level to force main discharge) in less than 25 feet

d. Force main velocity is greater than 6 feet per second

5. Flexible disc check valve with closure assist device shall be Val-Matic Surgebuster Series 7200BF or Kennedy Kenflex Figure 508 with one buckling springs. All other requirements of items 1 and 2 shall apply to check valves with closure assist device

E. AIR RELEASE VALVES

1. Air release valves shall be installed at force main high points to provide:

a. Air release at pump startup

b. Air release under pressure

c. Vacuum relief

d. Surge control

2. Air release valves (ARV) shall be USA made Vent-Tech by International Valve or City approved alternate. The ARV shall be Vent-Tech Model SWG for minimum 3.0 PSI line pressure and SZG for 0 PSI line pressure.

3. When ARV is installed in a valve vault, the top shall have a female NPT outlet (trophy top). If ARV is installed in an independent manhole, the ARV shall have a Series C screened outlet. The ARV shall comply with the following unless otherwise required/approved by the City:

    a. 2-inch male NPT inlet
    b. 3 to 145 PSI pressure rating for Model SWG and 0 to 145 PSI pressure rating for Model SZG, up to 145 degrees Fahrenheit temperature rating

    c. 1-inch side port connections with full port stainless steel ball valves per ARV manufacturer

    d. 2-inch full port bronze isolation valve, with stem extension if necessary for handle to clear ARV body

    e. Model SWG to be constructed of 304L and 316L stainless steel and Model SZG to constructed of all 316L stainless steel

4. Independent manhole shall be constructed per SUDAS and City Supplemental Specifications with the following modifications:

    a. Manhole vented to non-traffic area

    b. Off-center sump in sloped floor for pump out

    c. Force main centerline at least 2-feet above floor

    d. A-Lok, Z-Lok, or Direct Drive boot for force main pipe

5. Force main piping for ARV shall be DIP and cast iron or ductile iron fittings (lined as required for value vault piping), and:

    a. DIP shall be flanged by plain-end or plain end by plain end with flange adapter

    b. Fittings shall be a flanged tee with minimum 4-inch branch and tapped (2" NPT) branch blind flange, full face gaskets, stainless steel flange bolts

    c. 2-inch brass or stainless-steel nipple for isolation valve installation

    d. Secure or brace ARV to structure with stainless steel support and anchor bolts

    e. Install a flange floor pipe support, see Section 2.04 – D-8

6. ARV outlet piping shall be at least one size larger than the ARV outlet and shall be schedule 80 PVC in the valve vault, above the valve vault, above the manhole, buried and for remote vent.

a. Vent outlet shall consist of a PVC U-bend (or 2-90-degree bends) and a stainless-steel outlet assembly and screen by Vent-Tech, or approved equal

b. Manholes in traffic areas shall have a vent installed in a non-traffic area, horizontal pipe shall be 3.5 feet deep

c. Remote vent shall be marked with a Rhino fiberglass 3 rail green marker post including a "sewer force main" decal

2.06 FLOW METER

A. MAGNETIC FLOW METER

1. A magnetic flow measuring system shall be installed to measure the discharge from the lift station.

2. Magnetic flow metering system shall be a Rosemount 8750W system to be similar to those in service at the WRRC and include a submersible flow tube and remote mount transmitter.

3. Power supply is to be 120 volts, 60 hertz.

4. System output shall be 4 to 20 mA for flow rate in GPM and scalable pulse to indicate total volume pumped in units of gallons.

5. Accuracy shall be 0.5% of rate over velocity range of 1 to 30 feet per second (FPS).

B. FLOW TUBE

1. Flow meter tube shall be constructed of:
   a. Type 304 stainless steel sensor pipe

   b. Carbon steel flanges (150-pound per ANSI)

   c. Carbon steel coil housing

   d. PTFE lining (minimum 0.125" thickness) with liner protectors

   e. Two type 316L stainless steel flush electrodes

2. The flow tube and electrical cable and conduit connections shall be IP 68 (NEMA 6P) submersible rated (33 feet for 48 hours).

3. The flow tube shall be painted for submersible application. Painting shall include:

a. SSPC-SP10 near white metal abrasive blast cleaning of all carbon steel and SSPC-SP1 solvent cleaning of all surfaces

b. Coat with a two-component high build coal tar epoxy paint with 16 to 24 mils dry film thickness (DFT); semi-gloss finish; black color; and free from missed areas, foreign materials, sags, runs, or chips

c. Rosemount ordering code V1

4. Two 316L stainless steel ground rings shall be installed (one on each end of the flow tube) and properly connected.

5. The flow tube shall have sufficient combination cable to reach the location of the remote wall mounted transmitter without splices. Length determined by contractor (50 feet minimum). Cable shall be sealed to provide IP 68 rating.

6. One segment of DIP with flanged ends having a length the same as the flow tube shall be furnished by the project owner and kept at the WRRC to allow flow tube removal and repair.

7. Flow tube shall have five pipe diameters of straight pipe upstream and two pipe diameters downstream.

C. TRANSMITTER

1. The transmitter for the magnetic flow metering system shall be a remote wall mounted microprocessor-based unit capable of receiving and processing flow signals from the flow tube (0.04 to 39 FPS range).

2. Transmitter shall include a local operator interface to display flow rate (GPM) and volume (gallons) and operation or fault information in English.

3. The transmitter shall include 4 to 20 mA flow rate signal output and flow volume signal (pulse) output for connection to a lift station monitor and potential City SCADA system,

D. TRANSMITTER ENCLOSURE

1. If the transmitter is not installed in an enclosed heated structure or in a heated lift station control panel, the transmitter shall be installed in a separate heated NEMA 4X stainless steel or aluminum enclosure. The enclosure shall have sufficient size to house the transmitter (9.01" wide, 12.02" high, and 4.3" deep per Rosemount), accommodate all conduit connections, and the heater.

2. Enclosure shall be Pentair Hoffman or Hammond enclosure and heater:

a. Hoffman SST A20H1606SSLP

b. Hoffman aluminum A20H106ALL

c. Hoffman heater DAH1001A

d. Hammond SST 1418N4SSC6

e. Hammond aluminum 1418N4ALC6

f. Hammond heater FLHTF125A115

g. Electrician may request City approval for alternate enclosure (manufacturer, size, etc.).

3. Enclosure shall have:

a. Back plate for transmitter mounting

b. Lugs or flanges for enclosure mounting to rack

c. Room for all connections including power, sensor/signal cable, ground, outputs to monitor, etc.

2.07 LEVEL MEASUREMENT

A. GENERAL

1. The liquid level in the wet well for pump control (start/stop) and alarms shall be sensed by a submersible level transmitter. A Multi-Trode system shall provide for redundant high-level alarm and redundant low-level alarm with redundant stop for all pumps.

B. SUBMERSIBLE LEVEAL TRANSMITTER

1. Submersible level transducer shall be for operation on low current with intrinsic safety barrier in the pump control panel. Transducer shall be UL/FM/CSA approved for use in hazardous areas.

2. The submersible level transducer shall comply with the following:

a. Constructed of 316 stainless steel with non-fouling and protective flange

b. Accuracy of 0.5% of full scale or better

c. 0 to 10 PSI (0 to 23 feet) range

d. Power supply of 12 to 24 volts DC

e. 4 to 20 mA output of liquid level
f. minimum 40 feet of cord length, unit cord support, including breather vent tube end filter

g. Temperature compensation

h. Kellems stainless steel cord grip

3. Submersible level transducer shall be Blue Ribbon Model BC001 Birdcage, Dwyer PBLTX-10-40, or City approved alternate.

C. Multi-Trode System

1. A Multi-Trode system shall be installed for redundant high-level alarm, low-level alarm with redundant all pumps stop, and system active indication. Multi-Trode system shall be UL and CSA approved.

2. The Multi-Trode system shall include:

a. Sensor probe shall be constructed of PVC with stainless steel sensors and PVC cable.

b. Unless a longer length is required for the application, the probe shall be 60-inches long with sensors at 6-inch spacing. If sufficient to avoid splices, the cable length shall be 33-feet, otherwise longer. The probe and cable model code are 1.5/10-10 for noted probe and cable.

c. Stainless steel probe mounting bracket kit with integrated cleaning squeegee (model code MTAK 1)

d. Intrinsically safe barrier to limit current to the probe in the wet well (model code MTISB)

e. A controller to have probe inputs and provide outputs for redundant high-level alarm, low level alarm with a redundant all pumps stop, and an indication of back up level sensing active.

f. Ten-year warranty.

D. Control/Monitoring Levels in Wet Well

1. The minimum wet well level (pumps stop and redundant pumps off) shall maintain substantial submergence of the pumps and motors to provide for cooling.

2. The submersible level transducer system shall provide for the following levels:
   a. Pumps stop
   b. Lead pump start
   c. Lag pump start
   d. High level alarm
3. The Multi-Trode system shall provide for the following levels:
   a. High level alarm (same as transducer)
   b. Low level alarm (6-inches below transducer pumps stop level)

c. Redundant pumps stop (same as Multi-Trode low level alarm)
d. Multi-Trode active (6-inches below the Multi-Trade redundant stop level)

4. The distance between lead pump start and pumps stop shall provide for a minimum 1.0 to 1.5 minutes of pump run time. Examples are:
   a. 1.0 feet in a 6 ft. wet well at 150 GPM
   b. 2.0 feet in a 6 ft. wet well at 350 GPM
   c. 3.0 feet in a 6 ft. wet well at 600 GPM.

2.08 ELECTRICAL

A. VALVE VAULT LIGHTING

1. Lights shall be installed in the valve vault. The lights are to be controlled by a switch located in the valve vault near the access hatch.

2. The valve vault lights shall comply with the following:

   a. LED

   b. 3000 lumens total from 2 or more fixtures

   c. 4000K or greater color temperature

   d. NEMA 4X or IP65 rated

   e. UL 1598 listed

   f. For 120-volt 60 hertz single phase power supply

   g. Minimum 70 lumens per watt

   h. Vapor tight aluminum or non-metallic housing

   i. Frosted globe with guard

   j. 5-year warranty

3. The valve vault light fixtures shall be:

   a. Econolight LED-FXVTJ20/840/MV-WM or CM (ceiling/wall mount)

   b. Hubbell VTC-5K-G-U-(X or W)—G-G (ceiling/wall mount)

   c. Cree C-VT-B-(SMCL or SMWL)-19L-50K-GR

   d. City approved alternate

B. CONDUIT AND WIRE

1. Conduit: Conduit systems installed in the valve vault and underground shall be PVC with expansion fittings installed above ground surface. Conduit systems installed entirely above the ground surface shall be aluminum. All conduit systems shall be waterproof and weatherproof NEMA 3R or better. Minimum 1/2-inch for single phase and 3/4-inch for three phase.

2. Rigid Non-Metallic Conduit (RNMC): RNMC systems shall comply with the following:

    a. NEMA standards and UL 651, Carlon or equal

    b. Gray schedule 80 PVC for conduit, fittings, couplings, adapters, support straps, clamps, elbows, etc.

    c. Mounting fasteners for light fixtures, device boxes, clamps, covers, straps, etc. shall be stainless steel

    d. Toggle switch cover, Carlon E98TSCN-CAR or equal

    e. Receptacle cover, in-use, Carlon E9UDVHMG or equal

3. Rigid Aluminum Conduit (RAC): RAC systems shall comply with the following:

    a. UL 6A listed and manufactured per ANSI C80.5

    b. NPT conduit and device joints

    c. Boxes, extensions, and covers shall be aluminum with stainless steel fasteners

    d. Boxes, extensions, covers, etc. shall be Bell/Taymac/Hubbell or equal; in-use GFCI cover to be Taymac MX3200; and single switch cover to be Bell 5121-0

    e. Mounting fasteners and cover fasteners shall be stainless steel

    f. Supports and clamps for RAC shall be aluminum with stainless steel fasteners

    g. With City approval, aluminum core liquid-tight flexible metallic conduit (LFMC) may also be installed, LFMC shall have IP66/IP67 rating and be Anaconda Type EFL, Titan AEF, or equal

4. Power Wire: Power wire shall be copper per ASTM B3 with THHW, THWN-2, or XHHW insulation and comply with the following

    a. 90 degree Celsius and 600 volt minimum unless otherwise required or approved by the City

b. Wire size as indicated on the drawings and/or as required by NEC and City Codes

c. Minimum 14 gauge for 15-amp circuit breakers and 12 gauge for 20 amp breakers

d. 12 gauge and 14-gauge copper wire may be solid or stranded, larger sizes to be stranded

5. Control Wiring: Control wiring shall be as required/recommended by the equipment and/or control system manufacturer or provider. Control wiring shall include:

a. Twisted shielded pair cable

b. Multi-conductor meter cable

c. Instrument signal cable

d. Ethernet cable

e. Proper gauge for required length of run

C. GROUNDING SYSTEMS

1. The grounding system shall comply with NEC and City Codes and include ground rods and a UFER ground. Grounding system shall comply with the following:

a. Ground rods to be 5/8-inch diameter by 10 feet or longer/larger if required by NEC

b. Ground rods to be steel with 10 mil copper coating

c. Ground connections shall be bonded without the use of threaded fastener clamps

d. UFER ground shall be a concrete encased electrode installed in the valve vault base

D. SWITCHES

1. Switches: Switches for lighting control shall be single pole with ground and comply with the following:

a. Commercial specification grade

b. 15-amp, 120-volt, toggle type, side wired

c. For mounting in PVC or cast aluminum weatherproof/waterproof boxes with external operator

d. Single pole switches shall be:

1. Leviton CS115-2GY
2. Eaton CS115GY
3. Legrand CS15AC1-GRY
4. Or equal or alternate color

E. RECEPTACLES

1. Receptacles: All receptacles shall be GFCI or protected/fed by a GFCI. One GFCI receptacle is required in a cast aluminum box with in-use cover, adjacent to the pump control panel. A duplex GFCI receptacle or one fed by a GFCI receptacle shall be installed in the valve vault.

2. GFCI Receptacles: GFCI receptacle shall comply with the following:

a. 20-amp, 120 volt, NEMA 5-20R duplex configuration, commercial grade or better

b. self-test

c. 20-amp feed through

d. UL 498 and UL 943

e. weather resistant

f. GFCI receptacles shall be:
1. Leviton GFNT2-GY
2. Legrand PT2097 GRY
3. Eaton WRSGF20GY
4. Or approved equal or alternate color

3. Duplex Receptacles: Duplex receptacles shall comply with the following:

a. 20-amp, 120 volt, NEMA 5-20R duplex configuration, commercial grade or better

b. Back and side wired with grounding screw connection

c. UL498

d. Duplex receptacles shall be:
1. Leviton BR20-JGY
2. Eaton BR20GY
3. Legrand CR20-GRY
4. Or equal or alternate color

F. MAIN BREAKER

1. A main breaker with neutral assembly shall be installed as the service entrance and shall isolate the lift station electrical system. The main breaker shall comply with the following:

    a. UL listed and CSA certified, meet NEMA standards

    b. Thermal magnetic or electronic trip

    c. Handle lockout with owner padlock

    d. NEMA 3R painted steel enclosure with padlock hasp

    e. Interrupting rating sized per available power company fault current, minimum 25 kA at 208 or 240 volts 3 phase, and 18 kA at 480 volts 3 phase

    f. Breaker shall be 80% or 100% rated based on anticipated equipment duty (continuous or intermittent); 90 degree Celsius wire required for 100% rated breaker

    g. Main Breaker shall be Schneider Electric (Square D) Power Pact, H frame (150A) or J frame (250 A), or larger if required or City approved alternate if with local supplier

    h. Main breaker supplier shall calculate arc fault current from power company data and contractor input, Contractor shall install warning sign on exterior of enclosure

G. SURGE PROTECTION

1. Surge protection shall be installed at the main breaker. Surge protection shall comply with the following:

    a. Type 2, load side of main breaker

    b. UL 1449

    c. Rated for system voltage, e.g. 120/208 volts three phase wye; 277/480 volts three phase wye

    d. NEMA 3R enclosure mounted adjacent to main breaker

    e. Isolation breaker for surge protection is not mandatory

    f. Leviton 32120-DY3 for 120/208 volts 3 phase wye, Leviton 32277-DY3 for 277/480 volts 3 phase wye, or City approved

H. DOUBLE THROW SWITCH

1. A double throw switch shall be installed for manual transfer from the normal electrical supply (power company) to a portable standby generator supply. Double throw switch shall comply with the following:

    a. Amp rating equal to or greater than main breaker

    b. 240-volt rating or greater for 208 volts or 240 volts power supply, 600 volts rating for 480 volts power supply

    c. 3 pole, non-fused, solid neutral, 4 wire

    d. NEMA 3R enclosure, painted steel, with enclosure lock and mechanism lock plate

    e. Schneider Electric DTU (Series F) for 100 amps and DTU (Series E for 200 amps at 240 volts; DTU (Series F) for 100 amps and 82000 (Series E) for 200 amps at 600 volts; General Electric; or City approved alternate if with local supplier

I. STATIONARY PLUG FOR GEN-SET

1. A stationary plug shall be installed at or adjacent to the double throw switch for connection of a City owned portable standby generator. Design engineer shall coordinate with WRRC staff.

2. The stationary plug for a 120/208-volt 3 phase service for up to a 20-horsepower motor, shall match the existing City generator connection and cord and shall be as follows:

    a. 100-amp, style 1 case ground, 4 wire, 4 pole for 120/208 volt 3 phase power

    b. Stationary plug shall be Appleton Powerlite ADJA 1044-RS, reverse service in mounting box

    c. Stationary plug assembly shall accommodate an Appleton ACP 1044CD-RS receptacle

    d. Connect stationary plug ground to electrical service ground

3. Consult the WRRC staff and City Engineering Department for larger pump motors and/or alternate power supply.

J. JUNCTION BOX ABOVE WET WELL

1. A junction box shall be mounted with the bottom at least 3 feet above the top of the wet well for air gap and vent. The junction box shall provide for connections and wire runs of the pump power, pump sensing, and level sensing cords and cables. All low current device cords (level probe and

submersible transducer) shall be isolated from power cords by a metal barrier in the junction box.

2. The junction box shall comply with the following:

    a. Stainless steel or aluminum

    b. Minimum size 12" wide by 12" high by 6" deep or as necessary for making all connections to and in the junction box

    c. Wiring terminals on a back plate for making and removing connections

    d. Hinged door with hasp for padlocking and clamps as necessary

    e. NEMA 3R or 4X enclosure

    f. Mounted to top of wet well cover (concrete and aluminum) using aluminum or stainless-steel framing strut and stainless-steel bolts and accessories

    g. Removable (split) perforated (3/4" holes at 2" centers) aluminum or stainless-steel cable/cord guard from the top of the wet well to the bottom of junction box, size of guard to match junction box size

    h. Cable/cords to the wet well shall be connected to bottom of junction box with water tight rubber gasketed cord grip connectors of stainless steel or aluminum that will allow for removal

K. VALVE VAULT FLOOR WATER LEVEL MONITORING

1. A non-mercury float switch or sensor (low current) shall be installed in the valve vault near the floor to sense water level. The narrow range float or sensor shall activate a relay and a panel light. The relay shall provide contacts for a monitor connection to avoid submergence of the flow meter for an extended period.

L. ELECTRICAL EQUIPMENT SUPPORT RACK

1. A metal free standing rack shall be installed to support electrical equipment, including:

    a. Self-contained metering or instrument metering with C.T. cabinet

    b. Main breaker with surge protective device

    c. Double throw switch with gen-set plug

    d. Flow meter transmitter enclosure

e. Pump control panel with exterior GFCI receptacle (if not City approved free standing)

f. Lift station monitor/alarm if not mounted inside pump control panel

g. Step down transformer if not mounted inside pump control panel

2. The rack shall be constructed of the following:

   a. Two or three 4.5-inch O.D. schedule 40 galvanized steel pipe (ASTM A53, grade A or B) with plain ends and galvanized slip over top caps

   b. Concrete filled 12-inch diameter by 4.5-foot-deep vertical wall hole (couplings may be embedded in concrete)

   c. Horizontal 304 stainless steel metal framing channels or struts (B-Line, Unistrut, or equal) with 304 stainless steel fittings

   d. Stainless steel fasteners for struts to posts and equipment to struts

   e. Plastic strut end caps

3. The electrical equipment support rack shall be constructed similar to the Alliant Energy steel post construction free standing meter structure with the following modifications:

   a. Two posts shall be mounted at a maximum spacing of 57.0-inches center to center for 5-foot struts

   b. Three posts shall be mounted at a maximum of 58.5-inches center to center for 10-foot struts

   c. Struts may be installed on both sides of the posts if access and clearance is provided

   d. Post tops may be 6 to 7 feet above the ground surface if operating devices are at code height

   e. Struts and fittings shall be stainless steel

   f. All strut fasteners shall be 316 stainless steel

   g. Posts shall be 4 -inch nominal (4.5" O.D.) galvanized schedule 40 steel

   h. Grounding clamp to be Brundy C-4 (with bronze or stainless-steel hardware) or approved alternate

i. Alternate configurations of rack(s) may be as proposed by the contractor and if approved by the City

2.09 PUMP CONTROL PANEL

A. GENERAL

1. A pump control panel shall be furnished and installed to provide automatic operation of the lift station. The pump control panel shall comply with the following:

a. National Electric Code and City Code compliance

b. Requirements of UL Standard 508A including a serialized label in panel

c. For power supply indicated on the drawings and/or Part 3 of this specification section

d. Submittal shall include a custom system schematic drawing for power distribution and control, solid state control components shall include a description of operation

e. The control panel supplier or manufacturer must obtain approval of the City for use of alternate and/or "equivalent" components prior to City bid or contractor selection for private projects

f. Label control panel exterior with name of station and power supply (volts, phase, wires)

g. The pump control panel shall be designed, manufactured, and tested by SJE Rhombus, TLC Controls, Jetco, or City approved alternate

B. ENCLOSURE

1. The pump control panel enclosure shall be NEMA 3R constructed of Type 304 stainless steel or aluminum. Panel shall be rack mounted with brackets or free standing with legs, when approved by the City. The control panel enclosure shall comply with the following:

a. Dead front door(s) shall have continuous hinges(s), three-point latch, padlocking handle or hasp, stainless steel door stop kit and no door clamps (unless otherwise approved by the City)

b. Inner hinged door for control device mounting plus openings for operation of components (breakers, overload reset, etc.)

c. Condensation heater with thermostat

d. Weatherproof exhaust fan with thermostat and intake if control panel includes a power supply transformer, soft starters, and/or VFD's

e. GFCI receptacle in weatherproof box on panel exterior by manufacturer or adjacent to panel by electrician

f. Mount free standing panel on 8-inch thick concrete pad with slab opening or sleeves for PVC conduits, 12-inches wider and 12-inches longer than panel, reinforced (#4 deformed bar at 12-inches on center each way in center of slab)

C. INNER DOOR CONTROL DEVICES

1. Operating and indicating devices shall be mounted on the inner door. Devices shall include:

a. Three position selector switch for each pump (hand-off-auto, HOA), with low level float cut-off in hand and auto

b. Non-resettable mechanical run time meter (RTM) for each pump (hours and tenths)

c. LED indicating lights (press-to-test) for:

1. Green pump running

2. Red pump over-temperature

3. Red pump seal failure

4. Red wet well high level

5. Red wet well low level

6. Red valve vault water

d. LED wet well level indication over operation range, digital in feet and tenths or percentage (with range label)

e. Seal failure reset push-button

f. Over-temperature reset push-button

g. Rigid plastic nameplates to identify devices with 1/8-inch-high letters/numerals (or larger) including power distribution items

D. POWER DISTRIBUTION COMPONENTS

1. Power distribution components in the pump control panel shall include:

a. Main circuit breaker matching the breaker as specified in segment 2.08-F of this section (except the separate enclosure is not required) or alternate panel isolation method as may be approved by the City, provide off lock-out
b. Individual pump circuit breakers as specified in segment 2.08-F of this section (except the separate enclosure is not required), provide off lock-out
c. Each pump shall have a NEMA style (FVNR) magnetic starter, Schneider Electric Class 8536 with solid-state overload relay protection, Schneider Electric Motor Logic SSOLR; or City approved alternate if with local supplier
d. One pole circuit breakers (Schneider Electric QO/QOB or equal) shall be installed in the control panel for single phase loads:

    1. Flow meter (15A)

    2. Receptacles/lights (20A)

    3. Condensation heater or enclosure heater(10/15A)

    4. Station monitor and future SCADA system (15A)

    5. Control function as necessary (10/15A)

E. CONTROL SYSTEM INPUT

1. The pumps shall be operated on the basis of the wastewater level in the wet well. That level is to be sensed by a submersible level transducer and level probe (high level and low level with redundant pumps stop). See segment 2.07 of this section.

2. The transducer shall provide level measurement to the pumping control.

3. The level probe shall provide for alarm indication and redundant low level stop for all pumps.

4. The control panel shall include intrinsic safe barrier(s) for transducer and probe.

5. A 3-phase voltage monitor shall be installed in the control panel to sense supply power (on control panel main breaker load side). Voltage monitor shall be Littelfuse Model 460 or equal installed to notify operators of power problems or failure.

F. PUMPING CONTROL FUNCTIONS

1. Level: The pumping control system shall sense the wastewater level in the wet well and indicate the level on the panel inner door (percent or feet).

a. Control panel shall provide power supply and intrinsic safety barrier(s) for transducer and probe

2. Pumps: The control system shall start and stop the lead and lag pumps based on noted or City approved liquid levels (field adjustable), according to the following:

    a. Lead and lag pumps shall alternate after each cycle

    b. Lag pump shall run only if lead pump is not functioning, unless otherwise approved by City

    c. Pump running light and RTM shall be activated/deactivated

    d. Motor overloads shall be set at Class 10

3. Level Alarms: If the wet well level reaches high level or low level, the designated alarms shall be activated:

    a. Panel high and low alarm lights shall be activated with automatic reset

    b. Contacts shall close for lift station monitor notification

    c. Low level alarm shall act as a redundant pump stop in auto or hand switch position

4. Over-Temperature: Control panel shall provide for pump over-temperature shut down coordinated with all pump manufacturer's requirements including use of equipment provided by or approved by the pump manufacturer.

    a. Control panel shall activate pump over-temperature light

    b. Contacts shall close for lift station monitor notifications

    c. Over-temperature monitoring, alarm, and shut down shall maintain pump warranty

    d. Over-temperature shall have a manual reset

5. Seal Failure: The control panel shall monitor the presence of water in the pump seal chamber utilizing equipment provided by or approved by the pump manufacturer.

    a. If water is sensed, the panel seal failure light shall be activated (no pump shut down unless City approved)

    b. Contacts shall close for lift station monitor notifications

    c. Seal failure monitor and alarm shall maintain pump warranty

d. Seal failure shall have a manual reset

6. Valve Vault Water Sensing: Control system shall monitor the water level on the floor of the valve vault with a float switch or approved alternate.

    a. If water is sensed on the floor, the panel light shall be activated

    b. Contacts shall close for lift station monitor notification

    c. Alarm shall have automatic reset

7. Alarms and Status: Control panel shall function to provide for all status and alarm notifications and data logging by lift station monitor, except for flow meter if the transmitter is not installed in the control panel. See segment G of section 2.09.
    a. Control panel shall provide for contacts/connections for a potential City installed SCADA system.

G. LIFT STATION MONITOR

1. The lift station monitor shall be Omni-Site, Inc. Crystal Ball Cellular Lift Station Monitor, Model CB-PM-120 (NEMA 1 enclosure) if mounted in the control panel enclosure or Model CB-EN-120 (NEMA 4X enclosure) if mounted exterior to the pump station control panel. Control panel shall provide power for monitor.

2. The monitor shall sense pump station status, alarms, and data; notify operating personnel; and log data inputs.

3. The lift station monitor shall have the following functions and sources:

    a. Station power from 3 phase voltage monitor contacts

    b. Wet well high level from contacts in control panel(light)

    c. Wet well low-level alarm from contacts in control panel (light)

    d. Station flow rate from flow meter analog output (GPM)

    e. Station pumped volume from flow meter pulses (gallons\

    f. Pump 0ver-temperature from contact in control panel (lights)

    g. Pump running from contacts in control panel connected to starter auxiliary contacts (lights and RTM's)

    h. Pump seal failure from seal failure sensing relay contacts (lights)

    i. Pump failure from panel contacts (light)

j. Valve vault floor water from contacts in control panel (light)

4. The lift station monitor shall not function as a backup pump controller unless appropriate equipment, connections, and programming are specified or City approved.

5. Monitor shall send status, alarms, and data to memory card and to designated web site for logging. Logging shall include:
   a. All alarms
   b. Flow rate versus time
   c. Volume pumped per 24-hour period
   d. Pump running versus time
   e. Total run time per 24-hour period

6. The monitor shall have 600-volt UL type MTV or AWM wiring of required current carrying capacity installed in PVC conduit and/or bundled and secured.

PART 3 EXECUTION

3.01 PROJECT SPECIFIC INFORMATION (To be indicated by lift station designer herein or an attached pages)

A. MINOR LIFT STATION GENERAL INFORMATION

1. Station location:
2. Project owner:
3. Design Engineer (name. PE#):
4. Organization:
    a. address:
    b. phone and email:

B. POWER COMPANY INFORMATION

1. Power company name (Alliant, MVEC):
2. Contact person:
3. Contact Person's Phone:
4. Power supply (voltage, phase, wires):

C. PUMP REQUIREMENTS FOR LIFT STATION

1. Pump inlet/outlet size (inches):
2. Pump design discharge rate (GPM):
3. Pump total dynamic head TDH at duty point (feet):
4. Pump rotation speed (RPM):
5. Duty point efficiency (%):
6. Duty point power (HP):
7. Maximum power of selected pump curve (HP):
8. Name of pump manufacturer/model number/impeller size:
    a. Alternate 1:
    b. Alternate 2:

9. Factory pump performance testing if required by City (yes/no):

10. Epoxy pump and base painting if required by City (yes/no):

D. MOTOR REQUIREMENTS FOR LIFT STATION

1. Name plate horsepower (HP):

2. Full load efficiency (%):

3. Oil filled motor (yes/no):

4. Air filled motor if City approved (yes/no):

E. VALVE VAULT BASE UFER GROUND

1. Shown on drawings (yes/no):

F. PIPING INFORMATION FOR LIFT STATION

1. Exposed DIP & fittings exterior fabricator primer painting required (yes/no):

2. Exposed DIP & fittings exterior field painting required (yes/no):

3. DIP & flange fittings interior painting required (yes/no):

4. MJ fittings interior painting required (yes/no):

5. MJ gasket material (SBR, nitrile):

6. Flange gasket material (SBR, nitrile):

7. Restrained pipe length on drawings (yes/no, where):

8. Unrestrained coupling gaskets/bolts (SBR/Nitrile; 304/316):

9. Saddles (single/double strap):

G. VALVE VAULT FOR LIFT STATION

1. Valve vault lighting (yes/no):

2. Valve vault receptacle (yes/no):

H. TRASH BASKET

1. Required (yes/no):

2. Shown on drawings (yes/no):

I. DESIGN CALCULATIONS
   1. The lift station design engineer shall submit design calculations to the City for review

   2. Design engineer shall respond to all City questions and provide additional information upon request

3.02 WET WELL AND VALVE VAULT INSTALLATION

A. EXCAVATION: Wet well and valve vault installation shall be as indicated on the project drawings and per applicable SUDAS manhole installation requirements and City Supplemental Specifications. The excavation shall be dewatered as necessary for installation and backfill compaction. The contractor shall provide a safe excavation per OSHA, which may include flatter side slopes, trench boxes, sheeting, etc.

B. STONE BASE: The wet well shall be installed on a 12-inch-thick compacted crushed stone base placed on undisturbed soil/rock (for leveling, uniform support, possibly drainage). The valve vault shall be installed as required for the wet well, if the support soil is undisturbed. If the soil below the valve vault has been disturbed due to wet well installation, compacted crushed stone shall be placed to the elevations required. Compact base/foundation stone to 95% of standard Proctor density or an appropriate relative density. Crushed stone shall be Class I material per City Supplemental Specifications to SUDAS.

C. LEVEL/PLUMB: The wet well and valve vault shall be installed with the sidewall vertical/plumb and the base level within pre-casting tolerances.

3.03 PIPING CONNECTIONS

A. SEWER: The influent sewer shall be connected to the wet well using a resilient connector. The sewer connection shall be water tight.

B. FORCE MAIN: The pressure/force main connections to the wet well and to the valve vault and from the valve vault shall be by use of resilient connectors. The pressure/force main connections shall be water tight.

C. SUDAS: Resilient connections shall comply with applicable portions of SUDAS.

D. ELECTRICAL: Electrical conduit connections into the wet well are prohibited. Electrical conduit penetration through the valve vault wall shall be sealed water tight. Electrical conduits shall be assembled to provide water tightness.

E. VAULT DRAIN: A valve vault drain shall be installed as shown on the drawings. Valve vault and wet well wall penetrations shall be sealed water tight with resilient connectors or rubber compression bushings. A PVC ball valve with a true union connection(s) shall be installed in the valve vault sump. An extended operator shall be installed to allow the operator to open the valve and drain the valve vault. The drain piping from the valve vault to the outlet in the wet well shall be water tight and air tight to prevent gases from entering the valve vault.

3.04 WET WELL AND VALVE VAULT PIPING

A. LAYOUT/PAINTING: The piping in the wet well, from the wet well to the valve vault, in the valve vault, and to the force main connection shall be as shown on the drawings. Exposed pipe, fittings, accessories, etc. made of iron shall have surface preparation and be primer painted and finish painted.

B. FLANGED JOINTS: Ductile iron pipe shall be installed with flanges parallel and not force-fit. The full-face flange gasket shall be uniformly compressed by the stainless-steel flange bolts. If approved by the City Engineer, minor flanged joint deflections shall be accomplished using flange adapters.

C. STANDARDS: Flanged piping shall be installed in accordance with suggested procedures in the appendices of AWWA C110 (fittings) and AWWA C115 (joints), and the manufacturer's recommendations.

D. FLANGE SEALING: Flange faces, and hubs shall be sealed with a clear non-silicone caulk after assembly and any field painting.

E. PVC JOINTS: Joints in PVC piping shall solvent cemented except where NPT or flanged connections are necessary. Solvent cement joints shall be cleaned, primed, and cemented per the requirements of ASTM D2855. The solvent cement, primer, and cleaner shall be handled in accordance with ASTM F402 and the recommendations of the pipe/fittings/valves manufacturer(s). Pipe ends shall be cut square, de-burred, and slightly rounded. Solvent cement joints shall be made by a trained and experienced worker at the required temperature and shall not be moved until the joint has set per ASTM D2855 and the recommendations of the manufacturer.

F. PVC NPT JOINTS: NPT joints in PVC piping shall be made by solvent cement socket by threaded adapter. The PVC pipe shall not be threaded. Pipe joint paste or thread sealing tape shall be used per the recommendations of the adapter fittings manufacturer.

G. PVC FLANGE JOINTS: Flanged joints in PVC piping shall be made using a flange by socket adapter and shall have full face 1/8-inch-thick gaskets as recommended by the PVC flange manufacturer. Install flat washers under all bolt heads and nuts. Flange bolts/nuts/washers shall be stainless steel.

H. PVC ACCESSORIES: Unions, couplings (restrained as necessary), flanges, true union ball valves, etc. shall be installed as shown on the drawings and as required to provide for equipment removal, pipe cleaning, damaged pipe replacement, etc.

I. BRASS/STAINLESS STEEL PIPING: Brass or stainless-steel pipe, nipples, and fittings shall be installed where shown on the drawings or for connections as required. Carbon steel pipe and nipples shall not be installed. Generally brass and stainless-steel pipe shall be 2-inch size or smaller and have NPT joints.

J. THREAD SEALING: NPT threads shall be sealed with pipe thread tape or a sealing compound approved for brass pipe or stainless-steel pipe; or approved for PVC threaded adapters and the attached equipment or item (i.e. service saddle, valves, etc.).

3.05 COUPLINGS, TAPPING SADDLES, AND FLANGE ADAPTERS

A. COUPLINGS: Couplings shall be installed at locations shown on the drawings. Couplings shall be restrained if thrust could separate the plain end pipes. Couplings in the vertical wet well piping do not require restraint. Horizontal pipe couplings between the wet well and valve vault and for the pressure/force main connections shall be restrained.

B. TAPPING SADDLES: Tapping saddles shall be used for connections to DIP for drainage and other purposes, as shown on the drawings. DIP shall not be directly tapped unless shown or approved by the City Engineer. Tapping saddles shall have NPT outlets. Seal NPT joints with sealing tape or compound.

C. FLANGE ADAPTERS: Flange adapters as specified shall be installed at locations shown on the drawings. Flange adapters may be installed at other locations if approved by the City Engineer. The flange adapters shall be installed per the recommendations of the manufacturer including gasket lubrication and placement, flange alignment and bolting, anchoring assembly, etc.

D. PIPE ENDS AND ALIGNMENT: Pipe ends shall be cut or machined square, de-burred and slightly rounded to prevent gasket damage in couplings or flange adapters. Couplings and flange adapters shall not be used to correct misaligned pipe unless approved by the City Engineer.

3.06 PIPING PAINTING

A. CITY REQUIREMENTS: The exterior of the DIP and flanged fittings shall be painted. The exposed interior of the DIP and fittings (flanged and MJ) shall be painted. Stainless steel, brass, and PVC piping and valves shall not be painted. Factory finished items such as couplings, tapping saddles, pipe supports, gate valves, check valves, air release valves, etc. shall not be painted unless otherwise required in the Special Provisions or in this Part 3 (3.01). Damage to factory coatings shall be repaired per the manufacturer or as approved by the City Engineer.

B. SURFACE PREPARATION: Surface preparation for the exterior of DIP and flanged fittings shall be completed by the pipe fabricator and accomplished by trained and experienced workers. Surface preparation for the interior of DIP and fittings (MJ and flanged) shall be completed by an entity certified by the paint manufacturer.

C. PRIMING: The exterior of DIP and flanged fittings shall be primed by/for the pipe fabricator. Factory finished items shall be primed/painted with epoxy, polyester, or flouropolymer. Any item that does not have a fully factory finish or fabricator applied epoxy primer shall receive a barrier coat of epoxy prior to top coating and shall be applied per the recommendations of the paint manufacturer.

D. TOP COAT: The field applied topcoat shall be applied after piping assembly and if possible after pressure testing. The topcoat color shall be selected by the City.

E. AMBIENT CONDITIONS: Painting shall be completed (applied and cured) during periods when the temperatures (ambient and surface) and humidity conditions are within the recommendations of the paint manufacturer. It may be necessary to heat and dehumidify the wet well and valve vault during paint application and curing.

F. OTHER PAINTING REQUIREMENTS

1. Properly ventilate areas during paint application and cure to handle.

2. Mask off or protect areas that are not to be painted, including concrete walls, factory finished items/piping other than DIP and flanged fittings, fixed ladders, pumps, guide rails, level control items, etc.

3. Refer to system requirements in Part 2 for field painting and touchup requirements.

4. Mix and thin coatings according to the recommendations of the paint manufacturer.

5. Comply with the recommendations of the paint manufacturer for pot life, application procedures and equipment, cure time to handle and recoat, etc.

6. The painter shall perform quality control inspections including wet film thickness and dry film thickness (DFT) measurements, temperature and humidity monitoring, film characteristics observation (final coat shall have a uniform smooth finish), curing time control for any recoating (e.g. film thickness deficiency), etc.

7. The City may also inspect the painting for specification compliance, including uniformity of coating, dry film thickness, surface preparation, etc.

3.07 MISCELLANEOUS INSTALLATIONS

A. TRASH BASKET: The trash basket shall be installed according to the recommendations of the manufacturer. The drop bottom basket shall be placed in front of, centered on, and below the influent sewer. The basket shall be raised from and lowered to the collecting position on non-binding rails by a stainless-steel chain. All fasteners shall be stainless steel.

B. BASKET LIFTING: The trash basket shall be lifted and lowered using a City truck mounted davit crane.

C. VALVE VAULT DRAIN: The valve vault drain piping shall convey water from the valve vault to the wet well and be installed as indicated on the drawings. The

valve vault shall have a 15-inch diameter or 15-inch by 15-inch square, by 5-inch deep sump. The valve vault floor shall be sloped to the sump (2% minimum).

D. DRAIN VALVE: A PVC single or double union ball valve is to be installed on the drain pipe in the sump. The valve installation shall allow for valve removal for flushing the pipe and replacing the valve.

E. PIPE SEALING: The drain pipe shall be sealed in the valve vault wall with rubber sleeves, boots, or donuts. Flexible couplings (2 minimum) are to be installed on the drain piping between the valve vault and the wet well. The drain pipe shall be sealed in the wet well wall with a Z-Lok or boot. A vertical section of drain pipe shall be attached to the line from the valve vault and extended down to terminate below the low alarm level in the wet well to minimize the potential for sewer gases in the valve vault.

F. DRAIN ATTACHMENT: The vertical drain pipe section shall be attached to the wet well wall with stainless-steel clamps/brackets using stainless steel fasteners.

G. JUNCTION BOX ABOVE WET WELL: A junction box shall be mounted with the bottom 36-inches above the top of the wet well (fixed segment opening). This junction box shall serve for making electrical connections to electrical wires and cables from the wet well, including pump power cords, pump sensing cords, level probe, and level sensing transducer. All low current device cords (probe, transducer, seal failure as appropriate, and heat sensor as appropriate) shall be isolated from power cords by a metal barrier in the junction box (same material as box). Wiring shall be connected to terminals installed on a back plate. A removable cable guard shall be installed from the top of the wet well to the bottom of the junction box. Cables/cords to the wet well shall be connected to the bottom of the junction box with water tight rubber gasketed cord connecters/grommets (aluminum or stainless steel) that will allow for cord removal.

H. FLOW METER: The flow meter shall be installed as required for a segment of DIP and include the ground rings. Flange bolts shall be stainless steel. Electrical connections shall maintain IP68 rating. Comply with meter manufacturer's recommendations (5 pipe diameters upstream and 2 downstream).

I. PIPE SUPPORT: Install pipe support in the valve vault to secure discharge piping from movement, avoid stress on joints, and maintain piping alignment. Longer flange bolts may be necessary for flange supports. Unless otherwise approved, the pipe support base plate shall be bolted to the valve vault floor with stainless steel anchor bolts. Support extension pipes shall be vertical.

J. BYPASS PIPING: The bypass connection piping shall be installed as required for DIP and flanged fittings. Bypass piping shall be supported by other piping and pipe floor supports. The bypass piping drain shall be installed directed toward the drainage sump.

K. THRUST RESTRAINT: Force main piping and fittings thrust restraint shall be accomplished by joint restraint (push-on and mechanical joints). The thrust

restraint shall be adequate for the force main test pressure of 150% of the pump total dynamic head or 50 PSI (per SUDAS), whichever is greater. Restrained mechanical joint fittings and PVC joint harnesses shall be polyethylene wrapped per AWWA C105.

3.08 PUMPING ASSEMBLY INSTALLATION

A. AS RECOMMENDED: The pumping assembly including the submersible pump and motor, pump discharge connection, and base elbow shall be installed according to the recommendations of the pump manufacturer and as shown on the drawings.

B. BASE ELBOW: The base elbow shall be installed level and firm using stainless steel anchor bolts. The anchor bolts shall be as recommended by the pump manufacturer or supplier. The pump guide rails shall be installed plumb at a uniform separation distance with a top support and intermediate support if over 20 feet in length.

3.09 ELECTRICAL

A. GENERAL: The electrical work shall consist of all procedures necessary for a complete and functioning code compliant wastewater pumping facility. Electrical requirements are shown on the drawings and indicated in PART 2 PRODUCTS. Contractors/electricians shall discuss electrical requirements with the supplier of pumps, meter, monitor, and controls.

B. SERVICE: Electrical work shall include the electrical service as required by the power company. This may include primary underground conduit and trenching, concrete transformer pad, secondary underground conduit with wire, self contained meter socket or CT metering cabinet and meter socket, etc. The contractor/electrician shall review the service requirements of the power company. The City will pay any power company fees for the electrical service on City projects. The power company may be Alliant Energy or Maquoketa Valley Rural Electric (MVEC).

C. NEC/CITY CODE: All secondary electrical work shall comply with NEC as adopted by and amended by the City of Dubuque. The contractor shall obtain an electrical permit from Building Services, but the City fee will be waived for City projects. Coordinate inspections with the City electrical inspector.

D. STANDARDS: All materials shall be new and shall comply with applicable standards including UL, ASTM, NEMA, IEEE, NEC, NECA, ANSI, NFPA, or other acceptable industry standards. All work shall be completed by and/or supervised by a licensed electrician.

E. LABELS: Circuit breakers, starter resets, switches, lights, controller interface etc. in the control panel shall be labeled. Remote devices such as main service breaker, flow meter, lift station monitor, manual transfer switch, etc. shall be labeled. Labels shall be engraved plastic name plates with 1/8-inch high letters fastened or cemented in place, unless otherwise approved.

F. CONDUITS: Underground conduits shall be installed at a minimum 24-inch depth with sweep bends. Field heating and bending PVC conduit is acceptable provided the interior is not distorted. Control and signal wire/cables shall be installed in conduits separate from power wire conduits. Conduits in the valve vault shall be surface mounted PVC. Flexible liquid tight conduit shall be installed for connections to meters and any equipment in the valve vault. Maintain flow meter IP rating when connecting conduits. Install conduit and wire per NEC requirements as may be modified by City code. Joints in PVC conduit shall be made using couplings and integral bells and solvent cement to provide water tight joints. An expansion joint fitting shall be installed in RNMC (PVC conduits) just above the ground surface for all connected conduits.

G. WIRE: Install wires and cables in dry conduits using suitable pulling grips and lubricants.

H. GROUND: Install a minimum of two ground rods and a UFER ground at the service entrance per NEC requirements. Do not ground to the valve vault piping because of the connection to the PVC pressure/force main. Grounding conductor size per NEC. Do not install grounding conductor in metal conduit.

I. TESTING: All wiring shall be tested for shorts and grounds with a megohm meter and any defects corrected. The resistance to ground shall be tested to assure service grounding.

J. LIGHTING: Install light fixtures uniformly spaced in the valve vault. Install the light switch in a PVC box with an external operator in the valve vault near the entry hatch and top of the ladder to allow illumination prior to entry. A convenience receptacle is to be installed exterior to the control panel for maintenance equipment. A receptacle in the valve vault is also required.

K. LOCKOUTS: Install circuit breaker lockouts (if not done by others) as required, including service entrance main breaker, control panel isolation breaker/device, all pumps, and dry transformer. Subsequent to placing the pumping facilities into operation, install City furnished padlocks on control panel, double throw switch, main breaker, and other exterior mounted enclosures. Use temporary locks during construction.

L. UFER GROUND: A concrete-encased electrode for grounding (UFER ground) shall be installed in the extended valve vault base and connected to the system ground. Refer to the detail at the State of Iowa Electrical Inspection website and any detail on the drawing. The contractor shall be responsible for coordinating the UFER ground installation and connection with the precast concrete supplier.

M. LEVEL TRANSDUCER: The submersible level transducer cable may be spliced in the junction box with a metal barrier. The vent and vent screen shall be in the junction box. Intrinsic safe barriers (current limit) shall be installed in the control panel for the level transducer.

N. LEVEL PROBE: A level probe shall be installed in the wet well for backup to the primary level sensing and pump control system (level transducer). Refer to Section 2.07C Multi-Trode System. The level probe system shall function to

provide a secondary high alarm and a low alarm with redundant pumps stop. The level probe system controls and intrinsic safe barrier shall be part of the lift station control panel.

1. Probe shall be hung in wet well per the manufacturer's recommendations using the mounting bracket kit specified. Bracket shall be mounted with stainless steel anchor bolts.

2. The probe shall be installed without splice or connections in the wet well. Splices in the junction box above the wet well should be avoided.

O. ALUMINUM ISOLATION: Aluminum shall be isolated from concrete (heavy coating, stainless steel or rubber washers, rubber sheet, etc.).

P. SURGE PROTECTION: A surge protective device (SPD) shall be installed on the load side of the service entrance breaker and connected to the system ground. An isolation breaker is not mandatory.

3.10 TESTING AND STARTUP

A. PRESSURE TESTING: Piping between the pump discharge through the valve vault and the force main shall be pressure tested per SUDAS and AWWA C600 and AWWA C605.

1. Test pressure shall be 150% of the pump duty point head or 50 PSI whichever is greater.

2. A plate or plug shall be installed and secured to the base elbow in the wet well.

3. The check valve shall be open during pressure testing.

4. The test monitoring may be at the bypass hose connection or drain connection, the base elbow, or the force main discharge (pressure adjusted for elevation difference). Do not remove plugs in valves for pressure testing connection.

5. Force main outlet shall have a tapped and restrained cap with valve for air release and/or testing unless otherwise approved by the City.

6. Pressure testing shall include the flow meter and air release valve(s).

B. PUMP STARTUP: The pump supplier shall provide startup services. The minimum time on-site (excluding travel) shall be 8 hours with 4 hours for checking installation and 4 hours for operator training. Additional time shall be provided without charge to the City if the pumping station does not operate properly during startup and training. The contractor shall assist in startup providing water/wastewater for pumping, electrician for coordination, etc.

1. The pump supplier shall provide two copies of a Submersible Wastewater Pump Association (SWPA) startup report and check list subsequent to the on-site startup, to the City Engineer.

C. AIR RELEASE VALVE STARTUP: The ARV supplier or manufacturer's representative shall visit the project site for ARV startup and operator maintenance training.

1. ARV is to be pressure tested when the piping is tested (open isolation valve).

2. If ARV must be isolated to pass pressure test, the ARV representative shall repair/adjust the valve to prevent pressure loss and leakage.

3. Repaired/adjusted valve shall be retested independent of the piping using air pressure and lower side port valved stem (at maximum valve pressure rating).

4. ARV discharge piping shall be filled with water and checked for leaks. Repair/replace discharge piping if leakage is detected.

5. Representative shall provide 2 copies of a startup report to the City Engineer.

D. METER STARTUP: A trained representative of the meter supplier or manufacturer shall provide at least two (2) site visits at 4 hours each for meter installation verification, calibration, startup, and operator training.

1. Representative shall perform measurements of wet well pump drawn-down time for a gross verification of pumping rate.

2. The flow rate signal and volume pulse signal outputs shall be verified.

3. The connections for the lift station monitor shall be checked for proper installation.

4. Representative shall provide two (2) copies of a startup report to the City Engineer.

E. LEVEL SENSING STARTUP: The supplier(s) of the submersible level transducer and the probe shall provide or arrange for startup of the level sensing items in conjunction with the control panel startup.

1. Transducer shall be checked for suitable installation depth and non-turbulent location.

2. The transducer shall be calibrated to provide liquid depth to the control panel including the level indication on the panel inner door.

3. Installation of probe shall be checked to verify activation levels are as required on the drawings unless otherwise approved by the City Engineer.

4. Provide 2 copies of startup report(s) to the City Engineer as part of control panel startup report.

F. CONTROL SYSTEM STARTUP: The control system and the lift station monitor supplier(s) and/or manufacturers shall provide installation verification, calibration, startup, and operator training.

1. The minimum time on-site shall be two 8-hour days properly coordinated with the contractor and City staff.

2. The controls and monitor startup may be performed essentially at the same time as the pump startup if all systems are ready for operation.

3. The suppliers or manufacturers shall coordinate with the contractor and City regarding the power supply and the cellular phone service.

4. Two (2) copies of a startup report shall be furnished to the City Engineer.

END OF SECTION