

**CITY OF NAPLES**  
**PURCHASING DIVISION**  
**CITY HALL, 735 8<sup>TH</sup> STREET SOUTH**  
**NAPLES, FLORIDA 34102**  
**PH: 239-213-7100    FX: 239-213-7105**

**ADDENDUM NUMBER 3**

<small>NOTIFICATION DATE:</small>  <b>10/22/13</b>	<small>BID TITLE:</small>  <b>Public Works Pump Station Improvements</b>	<small>BID NUMBER:</small>  <b>049-13</b>	<small>BID OPENING DATE &amp; TIME:</small> <small><b>NEW</b></small> <b>11/01/2013 2:00PM</b>
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**THE FOLLOWING INFORMATION IS HEREBY INCORPORATED INTO,  
AND MADE AN OFFICIAL PART OF THE ABOVE REFERENCED BID.**

**NOTE: The Bid Opening Date has been changed to 2:00 PM local time on Friday, November 1, 2013.** This time extension will NOT include additional written requests for information. Written comments may be submitted; however questions will no longer be entertained.

**The following clarifications are issued as an addendum identifying the following changes for the referenced solicitation:**

Questions Submitted

Specification 432150 – Vertical Turbine Pumps

1. Page 432150-10 Pumps P-1 and P-2 primary design requires 89% efficiency in review only one manufacturer appears to meet this condition. We would like to offer Patterson pump who has the following design: 16,000 GPM at 23 FT 81.7 % Efficiency, 21,000 GPM at 17FT 85.4 % efficiency and 24,000 GPM 12.5 FT at 73.5% efficiency. Are these design flows acceptable to offer a competitive selection to the named manufacturer?

**Answer – the proposed design flows are acceptable; however the motor horsepower cannot exceed 125 HP and must conform to Section 432150 with any changes defined herein. Patterson will be an acceptable substitute.**

2. Page 432150-10 Pumps P-1 and P-2 are mixed flow or Hydro foil designs. They must operate within the minimum stable flow of their design curves. Will these pumps when operated at full speed only operate between 23 FT and 12.5 FT or respectively 16,000 GPM and 24,000 GPM at full speed?

**Answer – Yes.**

3. Page 432150-9 and 10 Pumps P-1 and P-2 Spare parts. Not all pump manufacturers use liners, some use diffuser cases. Is a spare diffuser case acceptable?

**Answer – A spare diffuser case is acceptable.**

4. Page 432150-3 Pumps P-1 and P-2, 2.02 Motor, and Page 7, 2.13, page 9. 2.16 E. To meet these requirements will the engineer revise specifications to include “The motors shall have a refined balance for all vertical pumps supplied”?

**Answer – Provide refined balance on vertical motors, vibration limits as follows:**

	Refined
Number of poles	Velocity (IPS-PEAK)
2	0.10
4	0.08
6	0.08
8	0.06
10	0.05
12	0.04
14	0.04

5. Page 432150-3 Pumps P-1 and P-2, 2.01 C. These are mixed flow pumps the named (specified) manufacturer curves, when taken to shut off head at zero flow, have dips and or valleys. Please advise if this is acceptable.

**Answer – Acceptable.**

6. Page 432150-3 Pumps P-1 and P-2 2.01 D. requires 10 FT NPSHR less than minimum available at all points on the curve. Up to 120% of flow rate at BEP. What is the minimum and maximum NPSHA?

**Answer –The NPSHA is approximately 41 to 44 feet at the suction bell.**

7. Page 432150-6 Pumps P-1 and P-2 2.09 C. required bowl wear rings, these may not be applicable? Spare parts call for Liners? May we provide a liner or diffuser case?

**Answer – A stainless steel liner or diffuser case is acceptable.**

8. Page 432150-8 Pumps P-1 and P-2 2.14 A. The table calls for material 316SS for bowl wear ring. These type pumps usually support liner or diffuser cases. These items are typically cast iron. Is cast iron liner or diffuser case acceptable if wear rings are not provided?

**Answer –Provide a Stainless steel, ASTM A743, Grade CF-8M or CA-15 or ASTM A276, Type 410 liner or diffuser.**

9. Page 432150-14 Pumps P-1 and P-2 3.04 G. The vibration readings will be non-conclusive as temporary mounts and piping are used in factory testing. These are better suited for installation testing in field on actual installation and operation design conditions. The torsional lateral analysis should provide adequate information to determine frequency. Does the engineer require factory vibration readings?

**Answer – Delete factory vibration testing, the field vibration testing is required.**

10. The Peerless pump model 18PL specified in section 3.01, C Jockey Pump/Pump Data can only achieve a guaranteed efficiency of 78% at the 5,625 gpm capacity demand point.

**Answer – The proposed efficiency is acceptable, however the motor horsepower shall not exceed 25 HP.**

11. Section 3.04 Factory Performance Tests - Item I: Mixed Flow and Axial Flow pumps should be given a specific submergence test in lieu of operating the performance test at minimum submergence. Please clarify if this submergence test is required here.

**Answer – The minimum field submergence field is approximately 6.5 feet above the suction bell.**

12. Section 3.04 E Specifies an extremely expensive testing setup requiring the job control panel to be shipped to the pump manufacturer's facility for witnessed testing and each pump to be put through 4 full HI performance tests. Please clarify that this is required for the pumps specified herein.

**Answer – Yes, this test is required, however the job control panel is not required; the factory can use a shop VFD.**

13. Section 1.02, L - Please clarify the specific resonance test required for this project.

**Answer – The testing is defined in paragraphs 2.12, 2.13 and 2.16.**

14. Section 2.01, C - Mixed Flow and Axial flow pumps are never continuously raising from the design point to shut off. Please remove this requirement from the specifications or clarify that the pump curve shall be free of dips and valleys within the HI preferred operating range for mixed flow and axial flow pumps.

**Answer – The requirement will be revised to read: the pump curve shall be free of dips and valleys within the preferred operating range.**

Specification 412123 – Belt Conveyors

15. Item 1.01 (pg. 412123-1) states that "Both bar screens, screenings belt conveyor, and control panel shall be furnished by a single supplier". However the conveyor manufacturer named does not manufacture screens. Please confirm conveyor manufactures may quote independently of the screen manufacturer.

**Answer – The design intent was to have manufacturer A build the screens, manufacturer B build the conveyor, and equipment vendor C to supply the screens and conveyor to the Contractor as one package. Section 444333 indicates the bar screen control panel will include the starter and related control circuitry for the conveyor. For bidding purposes the conveyor manufacturer may quote independently of the screen manufacturer, however, the screens, conveyor, and control panel shall be provided as one package.**

16. Keystone Manufacturing is a primary manufacturer of these type conveyors in the United States with installations well over five years in Florida. Keystone would like to be a named manufacture offering competitive bid.

**Answer – Keystone will be an acceptable substitute.**

17. We are unaware of CEMA designated idlers with stainless steel rolls as specified in Item 2.04 MATERIALS OF CONSTRUCTION (pg. 412123-2). Also the term specified for "Bottom wheels" is not a standard term. We offer that the reference to "carry idlers" and "Return idlers" in the "Component" category be revised to "carry idler frames" and "Return idler brackets", keeping the stainless steel specification. We also recommend that the "Bottom wheels" be deleted and replaced with "Carry and return idler rolls" and that the material be specified as "polyethylene". Please advise if this acceptable?

**Answer – Acceptable.**

18. We recommend that the first sentence of Item 2.07.C (pg. 412123-3) be revised/updated to read "Idlers will include 3/4" diameter shafts and double sealed ball bearings". Please advise if this acceptable?

**Answer – Double sealed ball bearings may be provided in lieu of tapered roller bearings.**

19. We recommend that the "3/16" nominal fiberglass reinforced plastic" return belt cover specified in Item 2.08 (pg. 412123-3) be revised to "#16 ga. type 304 stainless steel". The operators who have to work on these may find them uncomfortable to work with when required. Please advise if this acceptable?

**Answer – Acceptable, provide a 16 gauge type 304SS return belt cover.**

20. Item 2.10 (pg. 412123-4) has both vulcanized and mechanical belt splices specified. We recommend that the mechanical splice in Item C be deleted and that Item B be revised to read "Belt shall be vulcanized endless in the field by the conveyor manufacturer". Please advise if this acceptable?

**Answer – Delete reference to endless belt, provide type 316SS mechanical belt splice.**

21. We recommend that the motor be direct connected to the reducer eliminating the V-belt and sheave input drive. We offer that the first sentence of Item 2.16.A (pg. 412123-4) be revised to read "The motor shall be direct connected to an AGMA, Class II, helical gear shaft mount reducer to provide 80 FPM belt speed" The second sentence can be deleted. This will assist in belt control, alignment and less maintenance. Please advise if this acceptable?

**Answer – Direct drive may be provided in lieu of v-belts.**

22. Please consider the motor overload protection be updated. Item 2.17.A (pg. 412123-5) should be deleted and Item B should be revised to read "An electronic motor overload protection trip relay shall be provided for the conveyor drive motor. The overload trip relays shall be mounted in the control panel controlling the conveyor system. Trip relays shall have an adjustable 30% to 130% load current setting, an adjustable start-time trip delay of .0 to 20 seconds to allow momentary overload at start-up, and an adjustable overload, or shock time, setting of .2 to 3 seconds. When the drive motor exceeds the preset load current setting for a time period exceeding the preset shock time, the relay shall initiate the emergency shut-down sequence." Please advise if this acceptable?

**Answer – Acceptable, delete slip clutch and torque switch, however the motor overload circuitry shall be located in the bar screen control panel per Section 444333 part 2.06.**

23. The V-belts can be deleted from the spare parts in Item 2.20.A (pg.412123-6). Please advise if this acceptable?

**Answer – No, drive shall be direct or belted.**

24. Concerning Specification 412123, Belt Conveyors, and Section 2.02 Paragraph B notes that the conveyor is to have a "chain and sprocket drive" while in Specification Section 2.16 Paragraph A the drive is noted as "v-belts and sheaves". In addition, in Specification Section 2.17 Paragraph A it is noted to utilize a "shear pin and slip clutch arrangement". These are two (2) different types of arrangements. We can use a slip clutch with the v-belt drive but cannot use a shear pin with a v-belt drive. However, with the chain and sprocket arrangement the shear pin and slip clutch can be provided as specified. Please clarify which type of drive is required to be provided here.

**Answer – Drive shall be direct or belted; delete references to clutch, shear pin, and chain drive; the overload system will be overload relays as indicated above.**

25. Concerning Specification 412123, Belt Conveyors, Section 2.04 component chart noted a belt thumper. There is no belt thumper required for this conveyor. The belt cleaning is noted in Specification Section 2.12 Belt Cleaner, of which we will provide a dual blade spring tensioned belt cleaner, which is more industry standard for this application. Please confirm that this is acceptable.

**Answer – Acceptable, delete reference to belt thumper.**

26. Concerning Specification 412123, Belt Conveyors, Section 2.7 Par C, notes speed switch to be NEMA 7, there is no classification for Safety Stop Switch (Spec 2.18) or on the motor. The auto lube noted in Spec 2.19 is rated as 4X, which is not explosion proof. Our question for clarification is: "Is the conveyor in a classified area where the electrical components need to be "explosion proof" construction.

**Answer – Drawing E-101 states "areas within 36" of any opening to channel, or screen is classified as class 1, division 2. Locate all electrical items outside the 36" area." Provide NEMA 4X components and TEFC motor. However if any of electrical devices are located within 36 inches of the wet well openings, provide explosion proof components.**

#### Specification 444333 – Mechanically Cleaned Vertical Bar Screens

27. Schreiber Water Technologies would like to offer an, influent, fine, open channel, climbing type bar screen as a competitive alternate to the rake mechanism and type specified.

The design process of the specification shall be met regarding fluid treatment and removal and mechanical integrity. The design however shall be a climber type screen able to be removed from the fluid stream, contain self-cleaning devise and the ability to service chain in situation without removing entire screen. Please advise if this acceptable?

**Answer – Schreiber Water Technologies will not be an acceptable substitute.**

28. We would like to submit "Aqualitec "for consideration as a pre-approved manufacturer for the mechanically cleaned Bar Screens & Conveyor reference your specification 444333-2 required on the subject job.

**Answer – Aqualitec will not be an acceptable substitute.**

29. Concerning spec section 444333 – Mechanically Cleaned vertical bar Screens, Section 2.04.B: The highest differential available is 24" for free standing 180" high bars. Please confirm that this is acceptable or the bar height must be reduced to 145" in order to achieve full differential.

**Answer – Provide 145" high bars, the high water level alarm will be lowered in the station to accommodate the lower bars.**

30. Concerning spec section 444333 – Mechanically Cleaned vertical bar Screens, Section 2.04.E: Section specifies that grease fittings should be at the operating floor. However, section 2.08 specifies that a lubrication system should be supplied for the drive bearings which if required must be separate due to the different grease intervals for the chain lubrication and drive bearing lubrication. We recommend removing the auto lubrication system for the drive bearings only and keeping the manual grease lines run down to the side of the machine with a header at operator level -5' from the floor, as the drive bearing grease interval is once per month.

**Answer – Delete the drive bearing auto lubrication systems and extend the grease fittings with 316SS lines to within 3 to 5 feet of the floor. The chain auto lubrication systems are still required.**

31. Concerning spec section 444333 – Mechanically Cleaned vertical bar Screens, Section 2.05 Sprockets: We would like to request that the sprocket material be changed from 304SS to coated cast iron sprockets.

**Answer – Provide sprockets manufactured from ASTM A240 or A276 304SS.**

#### Specification 444331 – Motorized Self Cleaning Strainers

32. As per our pre-bid meeting this morning, we are enclosing our Tekleen Q# 44670 with our filter submittals, filter cut sheet, installation layout and a short reference installation list for this project. Our factory agent in Florida, Mr. Robert Janis 863-646 4548 will be following on this project. We are looking forward to serving your water filtration needs.

**Answer – Tekleen will be an acceptable substitute. However, if selected, the Contractor will be required to submit to the Engineer detailed drawings showing the necessary civil, mechanical, electrical, structural, and instrumentation changes to incorporate the substitutive equipment.**

#### Specification 010100 – Summary of Work

33. Specification section 010100 Summary of Work page 161 1.02 3. Last sentence requires the contractor to provide bypass pumping as an alternative to the owner. Could the engineer / owner explain in more detail the bypass system requirements?

**Answer – If the Contractor chooses to provide bypass pumping in lieu of multiple station shutdowns, provide the following at a minimum:**

**Provide the necessary pumps, conduits, and other equipment to divert the flow of storm water around the pump station in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flows that might occur during periods of rainstorms. These flows are estimated to be:**

- **Minimum Flow: 0 gpm.**

- **Maximum Flow: 21,000 gpm**

**Furnish the necessary labor and supervision to set up and operate the pumping and bypassing system. A “setup” consists of the necessary pumps, conduits, and other equipment to divert the flow of storm water around the pump station, from the start to finish of work performed in the pump station. Pumps and equipment shall be continuously monitored by a Contractor-supplied equipment maintenance person capable of starting, stopping, refueling, and maintaining these pumps during the bypass operation.**

**Engines and pumps shall be equipped with a control panel to provide automatic starting and stopping based on the water level located in the manhole where the storm water is being drawn. Provide level transducers and floats. Control panel shall include an auto dialer to call the Superintendent to notify him of a high water condition and/or if the pumping equipment has tripped.**

**Pumps shall be diesel powered.**

**See Section 330134 for bypass pumping Specification.**

#### Specification 405020 – Instrumentation Equipment

34. In Specification Section 405020 - Instrumentation Equipment, the Keller America Level Gage specified model #81355 is not available in titanium construction but is available in stainless construction. Please clarify if this is acceptable or whether the model number should be changed.

**Answer – Stainless steel construction is acceptable.**

35. In Specification Section 405020 - Instrumentation Equipment, the Keller America level gauge specified model #81355 is not available with 0.125% accuracy, but is available in either 1% accuracy or 0.5% accuracy. Please clarify which of these would be acceptable.

**Answer – Provide 1% accuracy.**

36. In Specification Section 405020 - Instrumentation Equipment, please clarify what the pressure range should be for the specified level transmitter.

**Answer – Provide 0 to 15 PSI pressure range.**



37. In Specification Section 405020 - Instrumentation Equipment, the Keller America Level Gage specified is not available with internal span adjustability. Please confirm that this is acceptable.

**Answer – Acceptable.**

38. In specification section 405020 - Section 2.05 specifies a diesel fuel oil tank level sensor/transmitter that does not seem to be used anywhere in the job scope. Please clarify whether this is required for this project.

**Answer – The diesel fuel tank level sensor will be installed in the existing fuel tank to transmit level to the SCADA system.**

### General Questions

39. Is there a soil report if so can it be made available to the contractor for the area of the new ASR Pump force main?

**Answer – No, a soil report is not available.**

40. We would like the opportunity to bid Florock Resinous Flooring as an equal to the products specified for the above named project (see Subject). Please advise where and to whom I can send a submittal packet for approval.

**Answer – Sorry, there is no scope for flooring in the Public Work Pump Station Improvements project.**

41. What is the engineer intent as to stopping the storm sewer flow through the 72" RCP while the new gates are installed? Can the existing stop logs remain in place temporary before demo and move the new gates closer to the center of the pump station to accomplish this activity.

**Answer – Yes, the slide gates can be moved closer to the center of that station so the stop logs can provide isolation, however concrete will need to be removed from the deck to allow for the new gate locations and the new dimensions would need to be coordinated with the screen vendor to confirm adequate spacing. Alternatively, the Contractor may cofferdam each channel one at a time; coffer damming will allow work to be performed in one channel while the other channel remains online. Also, the Contractor may bypass pump, as described above, which will provide unrestrictive access to the pump station. This response shall be construed as engineering suggestions and not procedures of construction.**

42. Other than the manual bar rack is there any other equipment that is salvaged to the owner.

**Answer – Yes, all equipment marked for demolition shall be returned to the Owner as described in Section 024100. The manual bar rack shall remain at the pump station site while the rest of the demolished equipment is transported to the Owner's yard.**

43. Regarding Addendum No.2, will the gpm requirements be dropped from the qualifications?

**Answer – No.**

44. How many copies of the bid are to be submitted? 1 original, 1 copy and 1 pdf copy on CD? Or 1 original, 4 copies and 1 pdf copy on CD? Other than the manual bar rack is there any other equipment that is salvaged to the owner.

**Answer: Submit one (1) original signature and one (1) copy of your original bid proposal / document AND a Windows© compatible PDF of the original document on a CD that is clearly labeled.**

45. Will a “thumb” drive be acceptable in replacement of the CD?

**Answer: Yes, if clearly labeled / marked.**

### **Item 2: Changes to Specifications**

1. The following entries to the main TOC of the project manual (please note these are entries are missing in the main TOC however were included in the original project manual):
  - a. “017000 Contract Closeout”
  - b. “409210 Electric Motor Actuators for Slide Gates”
  - c. “402076 Stainless Steel Pipe”
  - d. “400560 Air Release and Vacuum Relief Valves”
2. Add the following entries to the main TOC and Divider pages, these are new Specifications:
  - a. “330134 Pump Station Bypass Pumping”
3. Modify Section 405020 to include provisions noted in Attachment A.

### **Item 3: Changes to Drawings**

1. Remove the word “Proposed” from the title of the following drawings: C-102.
2. Drawing C-501, detail 8, note no.4, change “XXXXXX” to “400500”.
3. Drawing D-302
  - a. Grid 3D – add “Note 7” to the three dimensions locating the screens and conveyor, and add “7. Dimension shall be verified with the screen manufacturer.” to the sheet notes.
  - b. Grid 5D – “16-ST5-1” shall read “36-ST5-1”.
  - c. Grid 5A – “9” See Note 4” shall read “9” See Note 3”.
  - d. Grid 4A – Add a vertical dimension from the bottom of the submersible pump to the floor, the dimension shall read “6 ½” See Note 3”.
4. Drawing D-303, grid 3C, add label “10 STS-1” to the pipes located inside of the wet well.
5. Electrical and Instrumentation – Delete two of the four auto lubrication panels. Conduit, wire, and I/O shall remain as spares.
6. Drawing G-005
  - a. Revise P-1 and P-2 efficiency to “85”
  - b. Revise P-3 efficiency to “78”
  - c. Revise CVN-1 Drive type to “Belt or Direct”

**ATTACHMENTS**

Attachment A – City of Naples Control Panel Standards (New)  
Section 010100 (Revised)  
Section 330134 (New)  
Section 405020 (Revised)  
Section 405040 (Revised)  
Section 412123 (Revised)  
Section 432150 (Revised)  
Section 443331 (Revised)  
Section 444333 (Revised)  
Attachment B – Pre-Bid Attendees List

**###**

**Attachment A**

121102

121104

**SECTION XXII  
WASTEWATER LIFT STATION  
CONTROL PANEL - GENERAL**

**PART 1 • GENERAL****1-01 DESCRIPTION**

- A. The lift station control panel shall be supplied containing all the electrical and mechanical equipment necessary to provide for the operation of two (Duplex) electrical submersible pumps as specified in the standard drawings. The panel shall be a regulator type and provide a high level alarm system and emergency power provisions which can be utilized manually in case of main power failure.

Systems that may require more than two pumps will require special design, coordination, and approval from the City Utility Engineer.

**1-02 QUALITY ASSURANCE**

Comply with the applicable codes, standards, rules and regulations published by IEE, ANSI, NEC, National Electric Safety Code and Nema Standard IC-1 Industrial Control.

**1-03 SUBMITTALS**

Shop drawings shall be submitted showing layout materials and components for lift station control panels as shown in the City Utility Standard Drawings..

**PART 2 - PRODUCTS (See Section XXIV)****2-01 GENERAL**

- A. The standard duplex control panel shall be NEMA 3, 4, or 4X as required by location; Type 304, 14 Gauge Stainless Steel or Aluminum, with continuous welds on all seams. Rolled lip shall be provided around three sides of the door and around all sides of the enclosure opening. A neoprene gasket attached with oil resistant adhesive and held in place with stainless steel retaining clips shall be installed around the door. A drip edge shall be provided across the entire leading edge of the enclosure top. A 3-point door locking system shall be provided for the main enclosure door(s). All hardware except the print pocket shall be stainless steel. The pocket shall be aluminum or HD Plastic held in place with treaded studs welded to the interior of the outer door. No penetrations shall be allowed through the exterior of the door. An Aluminum sub-panel(s) shall be provided to hold the components for the controls.

All components and materials utilized in the assembly of the control panels shall have a U.L. Listing. The overall panel assembly does not require a U.L. Certification due to the field installation will modify the panel and negate the certification. The control panel (ICP – Industrial Control Panel) shall be clearly

labeled with the proper ICP Short Circuit Current Rating as required by NEC Article 409. These labels shall be attached to both the exterior and interior doors of the ICP.

- B. Mounted on the exterior of the enclosure shall be a generator receptacle and a high level alarm light. All parts mounted to the enclosure shall be secured with Type 304 stainless steel hardware. All exterior mountings or penetrations to the top or sides of the enclosure shall be gasketed with a high quality weather resistant material.
- C. The sub-panel(s) shall contain a main circuit breaker, emergency circuit breaker, motor circuit breakers, control circuit breaker, duplex receptacle breaker, across the line magnetic motor contactors, VFD's (Variable Frequency Drives), control voltage breaker and (where applicable). The main and emergency breaker shall be interlocked to assure only one breaker can operate at one time; 460 VAC systems will require a CPT Control Power Transformer 460VAC to 120VAC – breaker protected; 120VAC to 24VAC, .075KVA, breaker protected secondary transformer, plug-in 8 pin and 11 pin relays with indicating LED, float switch backup system, Devar Inc. Level Controller with Pressure Transducer, plug-in solid state phase monitor, flasher unit, ground lugs and the necessary terminal strips and plugs to allow for easy removal of the sub-panels. All control wiring shall be color coded per IPCEA (minimum 18 colors) or numbered, size 14 AWG, rated for 300 V, 80 degrees C, stranded, tinned copper with PVC insulation. The inner dead front door shall be constructed of .080", 3003 aluminum. The dead front shall be formed into a pan with a 3/4" break around the perimeter and shall be mounted on an .063" aluminum continuous aircraft hinge with a stainless steel pin. The dead front shall be fastened to the enclosure and hinge with stainless steel screws. The dead front shall be supported on the vertical break opposite the hinge with a continuous support and shall not depend on breakers or other components. The outer door shall contain a self storing wind resistant rod.

The dead front shall contain breaker knock-outs for protrusion of the breaker handles. If required and shown on the drawings, mounted on the dead front there shall be level lights, pump run lights, elapsed time meters, level controller, and HOA switches.

- D. Each control panel shall be provided with a breaker protected phase monitor and surge protection to insure protection for each pump circuit.
- E. The panel shall be provided with a panel convenience light to illuminate the interior of the panel at night. The switch/relay for this light shall be supplied and mounted as shown in the detailed drawings.
- F. The duplex ground fault protected (20Amps) outlet shall be mounted in the sub door of the panel.
- G. Each 460 VAC control panel shall have a control power transformer, where required as indicated, to provide 460 VAC to 120 volts single phase A.C. control power. Both legs of the primary shall be protected by a thermal magnetic 2 pole circuit breaker as manufactured by the Square D Company, one leg of the secondary of the control power transformer shall be protected by a thermal

magnetic circuit breaker as manufactured by the Square D Company, the other leg shall be grounded. The capacity of the control transformer shall be adequate to operate all the control devices in the circuit to include power for controls, lighting, receptacle, etc. as required per location; with a minimum capacity of 3.0 KVA.

## 2-02 WIRING

- A. All wiring shall be neatly laced or shall be installed in plastic Panduit raceways. The raceways shall be sized so that not more than 80% of the design capacity is used. There shall be a minimum of 1.5" clearance between all raceways and components throughout the entire panel.
- B. All terminations to external devices shall terminate on terminal blocks with insulated spade terminals, unless enclosed screw lug terminals are provided.
- C. All control wiring shall be color coded (minimum 18 colors) or numbered, individually labeled. size 14 AWG (minimum) rated for 300 Volts, 80 C, stranded tinned copper PVC insulated.
- D. A wiring and circuit schematic sized 11 inches by 17 inches shall be permanently affixed to the interior of the enclosure door. The schematic shall be extruded vinyl homopolymer laminate or approved equal. Also included in door shall be a print pocket to be mounted at start up. A plastic or aluminum warning sign with legend "DANGER-HIGH VOLTAGE" with voltage specified and shall be mounted on the exterior main panel door. The warning sign design and colors shall be in accordance with OSHA specifications and must be affixed to door without screws or rivets. (No holes to be drilled in exterior door).

## 2-03 NAME PLATES

Each switch, circuit breaker, indicating light, push button, meter, relay, etc., shall have an engraved laminated plastic color coded nameplate mounted above for proper identification; **Red** for alarm, **Black** for Power and **Blue** for level and controls. Letters shall be a minimum of 1/4 inch in height.

## 2-04 OPERATION

- A. The standard control function provides for the operation of the lead pump under normal conditions. As the flow decreases, pumps will be cut off at the elevation shown on the plans. In the event of a malfunction or a flow that exceeds the capacity of the pumps, a high level alarm light will be excited to indicate alarm conditions and also send this alarm signal to the RTU. The alarm light shall release only with the correction of the high level condition.
- B. Reference the project drawings for level controls operations. Refer to specified controller and other associated equipment. The Level Controller shall insure pump back-up guarantee and also distribute almost equal pump time to each of the pumps.

- C. In the event of phase reversal, loss of any phase, or low voltage of any phase, the normally open contacts through the phase monitor will close and provide a signal to the RTU for alarm. The phase monitor shall automatically reset upon removal of any and all of the above conditions.

## 2-05 SPECIAL

- A. The above panel requirements describe a 230 Volt, 3 Phase Power available, 3 Phase panel complete as above described. This shall apply in all cases, however, in special cases where only 230 Volt, 1 Phase Power is available to the pump station, the following changes and additions are necessary:
1. Systems with pumps rated above 20HP, shall be 460 Volt, 3 Phase only.
  2. The plug in phase monitor will be changed to accommodate a 230 VAC or 460 VAC power source as required, which will monitor all legs.
  3. No single phase systems allowed.
  4. All Duplex Control Panels shall be provided with VFD Motor Controllers (per current City specifications) wired so that the motor leads can be easily moved to the contactor, with the VFD controller removed from the circuit, and the pump can be operated from the contactor; in the event of a VFD controller complete failure.

## PART 3 – EXECUTION

### 3-01 INSTALLATION

- A. Control panels shall be installed at the lift station sites as specified on the drawings, which shall be pre-approved by the City Utilities Engineer.
- B. All work shall be accomplished/supervised in a neat and workmanlike manner by a certified master electrician holding a current competency card and registered with the State of Florida. The Contractor shall adhere to all OSHA Regulations and all City Safety Policies and Procedures.
- C. Electrical work shall be coordinated so as not to interfere with or delay other construction operations.
- D. Contractors shall do all necessary cutting, sleeving, excavating and backfilling for the installation of the equipment and the restoration thereafter.
- E. The Contractor shall install all equipment and control devices furnished by equipment manufacturers with their equipment and complete wiring in accordance with manufacturer's recommendations and approved wiring diagrams. Any Owner furnished equipment will be connected by the Contractor, including all necessary cords and plugs.
- F. The ends of all conduits shall be carefully reamed free from burrs after threading and before installation. All cuts shall be made square. All joints shall be made up

A stainless steel or aluminum NEMA 3, 4, or 4X as required by location, junction box (see drawings: sized for required installation – minimum size 18”X18”X8”D – approved by City Utility Engineer), or approved equal; with specified terminal strips for liquid level sensors, transducers, control cables, and pump leads, as shown in detailed drawings. Pending site specific clearances; the J-Box may be sized wider than 18” to allow for larger wire sizes and proper spacing of wire to terminal blocks. Lug type terminal blocks shall be installed for pump leads, sized a minimum of one size larger than the pump wires. Fill conduit bottom with silicone sealant. Box minimum height shall be 12 inches above wet well top elevation. “WYES” seal fining kit (one for each conduit required) complete with sealant by manufacturer mounted in accordance with lift station drawing. Myers Hubs shall be utilized at the bottom of panel and top of j-box with AL or S.S. nipples attached to WYES. This junction box shall be supplied by the panel manufacturer, factory wired and installed prior to shipment to the designed site.

NOTE: If J-Box mounting creates a shipping hazard, field mounting can be performed as long as all connections and wires are neat, secure, tested, and labeled properly.

### 3-14 CONDUIT

- A. For all above ground conduit and installation, and from junction box into panel, refer to Specification, SCHEDULE 80 PVC CONDUIT, SECTION XXV.
- B. For all below ground conduit and installation and from junction box to wet well, refer to Specification. PVC CONDUIT, SECTION XXVI.

### 3-15 SPLICES

Splices shall not occur in raceways, panels, or conduits. All wires should be connected/terminated to specified terminals. Any exceptions shall be approved by the City Utility Engineer and conform to the following: All splices for conductors No. 12 through No. 8 AWG solid or stranded shall be made with "Scotchlock" spring connectors or the pressure wire type. For wire larger than No.8, splices shall be made with "OZ" Type "XW" or "" as appropriate to the splice being installed. Equal fittings of Brundy and Penn Union may be used. Tape shall be equal to Scotch No. 33 plastic over splice and filler tape on splices shall be equal to "Scotchfill". All Scotchlock splices in handholes shall be dipped in Glyptol for waterproofing.

### 3-16 PERMITS

All required permits and inspection certificates shall be obtained and paid for by the Contractor and provided to the Owner at the completion of his work.

### 3-17 START-UP

The start-up must be witnessed by designated City staff. The manufacturer shall provide all necessary instruments and special apparatus to conduct any test that may be required to insure that the system is error free. A written start-up report will be furnished to Owner within 30 days from start-up.



## SECTION 010100 SUMMARY OF WORK

### PART 1 - GENERAL

#### 1.01 Work Under This Contract

1. Work under this contract includes the following:
  - a. The intent of the project is to replace two existing catenary bar screens and one conveyor system with new mechanically cleaned vertical bar screens and conveyor system; replace the existing stop logs with new stainless steel motorized slide gates; replace the existing stormwater jockey pump with a new vertical mixed flow jockey pump and VFD; provide two new main stormwater pumps and VFD's; provide and install new pump control panel, electrical and instrumentation systems, and SCADA upgrades.
  - b. As a bid alternate a new owner furnished submersible pump and VFD will be installed and a screening filter system (strainers) and twelve inch diameter HDPE force main to ASR well #2 will be constructed.
2. The principal components of this project include the followings:
  - a. Complete demolition work including, but not limited to, existing mechanical bar screens, manual bar rack, conveyor system, grit removal system, stop logs, jockey pump, control panels, RTU and antenna, and related electrical as indicated.
  - b. Furnish and install two new mechanically cleaned bar screens, conveyor system and related electrical, controls and instrumentation, and SCADA provisions.
  - c. Furnish and install four new motorized slide gates within influent channels.
  - d. Replace the existing stormwater pumps with two new main stormwater pumps and one new jockey pump; furnish and install new pump control panel, electrical, control and instrumentation systems, and SCADA upgrades.
  - e. Furnish and install security video cameras, DVR system, and security alarm system.
  - f. Complete miscellaneous work as required to complete the pump station upgrades.
  - g. As a bid alternate, install a new submersible ASR pump and VFD (pump and VFD to be owner furnished), and furnish and install a new screening filter system (two strainers) and twelve inch diameter force main to ASR well.

## 1.02 Sequence of Construction

1. The Public Works Pumping Station shall remain in service at all times. Continued operation of the pump station is required during construction of the improvements. There are three areas of construction as follows:
  - a. Replacement of the pumping equipment, electrical and controls.
  - b. Installation of the automatically cleaned bar screens, conveyor, electrical and controls and slide gates.
  - c. Installation of the ASR pump, screening filter system (strainers) and discharge main as a bid alternate.
  
2. There is no limitation on the sequence of these main areas of construction and construction sequencing will be the responsibility of the contractor. However, there are limitations on the progression of work within each area of construction. The limitations are described below.
  
3. Replacement of Existing Pumping Equipment and Controls – Both main stormwater pumps must stay online throughout the duration of the project; only one pump can be taken out of service at a time when the replacement pump is ready to be installed. Two of the three pumps must be operational at all times. To accomplish this, the contractor shall install the new electric service, pump control panel, VFDs and RTU prior to removal of any pumping equipment. The contractor shall install and successfully test each pump before moving to the next pump replacement. The existing pump controls will be removed once all the pumps have been installed. Temporary shutdowns for up to 3 days weather permitting will be permitted for removal of existing pumps and installation of new pumps in the wet well. A temporary shutdown will be permitted for each pump. The contractor shall submit to the Engineer/Owner for review a detailed sequence of construction two weeks before the planned shutdown. These shutdowns must be coordinated with the Engineer and the City at least 48 hours in advance. As an alternative the Contractor shall provide provisions for bypass pumping at no additional cost to Owner. [Refer to Section 330134 for bypass pumping requirements.](#)
  
4. Installation of Automatically Cleaned Bar Screens and Slide Gates – The existing manual bar rack must remain in place until the two new mechanical screens are fully installed. Since there are two influent channels and bar screens, the Contractor will be permitted to work on only one mechanical bar screen at a time. The existing stop logs will be used to isolate the existing mechanical bar screens if feasible. The first screen will be removed and a new screen installed along with conveyor system. The Contractor shall try to limit the time period required for the bar screen to be offline, however no specific restrictions are needed since flow is maintained through the second channel. Upon completing installation, start-up and testing, the second bar screen will be replaced.

The existing stop logs will be replaced with mechanically operated slide gates one channel at a time. Since two influent channels are available no specific restrictions are needed, however the Contractor should limit the period of time each channel is offline.

5. Installation of ASR Pump, Filtration Units, and Discharge Main (Bid Alternate) – The existing grit pump/removal system must be demolished in order to accommodate the new ASR pump. A temporary shutdown of up to 3 days weather permitting will be allowed for this demolition work. This shutdown must be coordinated with the Engineer and City at least 48 hours in advance. Only the work within the wet well has specific restrictions for maintain flows through the pump station. In addition, the screening filter system must be fully installed, tested and operational before allowing any flows to the ASR Well.

### 1.03 Coordination

1. Coordinate with Owner during construction of the project. Normal operation of the existing systems will remain uninterrupted during the construction until the project is completed and accepted by the Owner.
2. Coordinate with all permitting authorities, acquire inspections and meet permit requirements.
3. Coordinate with utility companies in connection with providing the various utility services to the project.
4. The City of Naples is pre-purchasing various equipment associated with this project. The Contractor shall be responsible for coordinating with the City to have this equipment available for installation per the project schedule.

### 1.04 Special Procedures

1. The Contractor shall be responsible for the following:
  - a. Locating, before excavation, blocking and protecting, all underground utilities including pipelines, conduit, duct cables, tanks, etc.
  - b. Keeping a record of the locations of all valves, fittings, etc. which are installed as part of the work, or which are discovered

### 1.05 Disturbed Areas

1. Restore all areas disturbed by construction to a condition at least equal to the pre-construction condition including, but not limited to, all landscaping, driveways, roads, fences, traffic control devices, and other improvements. Maintain ingress and egress to all properties adjacent to the construction and minimize inconvenience to abutting property occupants.

#### 1.06 Contractor's Superintendent

1. The Contractor shall have a superintendent on site at all times while work is being performed by the Contractor or subcontractor(s). The superintendent does not have to be on site during maintenance of the Contractor's equipment. The Contractor's superintendent shall have at least 5 years experience with this type of work and speak fluent English.

#### 1.07 Storage and Protection

1. All materials, supplies, and equipment intended for use in the work shall be suitably stored by the Contractor to prevent damage from exposure, admixture with foreign substances, vandalism, or other cause. Manufactured items shall be stored in a manner as recommended by the manufacturer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

# DRAFT - NOT FOR CONSTRUCTION

## SECTION 330134 PUMP STATION BYPASS PUMPING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

This section includes materials, equipment, and operational requirements for temporarily bypassing stormwater around a pump station in which work is to be performed.

#### 1.02 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions, Section 013300, and the following.
- B. Submit a written plan describing type of pump(s) to be used for bypass pumping at least 14 days before the application.
- C. Provide description of procedures and list of equipment for level control to ensure stormwater overflow prevention.

### PART 2 - MATERIALS

#### 2.01 PUMPS AND OTHER EQUIPMENT

- A. Any sump pumps, bypass pumps, trash pumps, or other type of pump which pumps sewage/water or any type of material out of the manhole shall discharge this material into another manhole upstream of the pump station. Under no circumstances shall this material be discharged, stored, or deposited on the ground, swale, or open environment.
- B. Provide the necessary pumps, conduits, and other equipment to divert the flow of stormwater around the pump station in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flows that might occur during periods of rainstorms. These flows are estimated to be:
  1. Minimum Flow: 0 gpm.
  2. Maximum Flow: 21,000 gpm.
- C. Furnish the necessary labor and supervision to set up and operate the pumping and bypassing system. A "setup" consists of the necessary pumps, conduits, and other equipment to divert the flow of stormwater around the pump station, from the start to finish of work performed in the pump station. Pumps and equipment shall be continuously monitored by a Contractor-supplied equipment maintenance person capable of starting, stopping, refueling, and maintaining these pumps during the bypass operation.

# DRAFT - NOT FOR CONSTRUCTION

- D. Engines and pumps shall be equipped with a control panel to provide automatic starting and stopping based on the water level located in the manhole where the stormwater is being drawn. Provide level transducers and floats. Control panel shall include an auto dialer to call the Superintendent to notify him of a high water condition and/or if the pumping equipment has tripped.
- E. Pumps shall be diesel powered.

## PART 3 - EXECUTION

### 3.01 METHOD

- A. Bypass the stormwater around the pump station being repaired. Plug the influent line to the pump station and pump stormwater flow from the upstream manhole into the manhole downstream of the pump station. Provide pumps, piping, and other equipment to accomplish this task.
- B. Obtain all permits.

### 3.02 SURCHARGING STORMWATER MAINS

- A. The stormwater will be allowed to surcharge the stormwater mains.
- B. Where the stormwater flow is blocked or plugged, take sufficient precautions to protect the public health. Protect the existing stormwater mains and sewers from damage.
- C. No stormwater shall overflow any manholes, storm inlets, or any other access to the mains
- D. The Contractor is required to observe the local weather conditions and be prepared to immediately start bypass pumping if a rain event is on the horizon.

### 3.03 TRAFFIC CONTROL

Ensure that pumps, piping, and hoses that carry stormwater are protected from traffic. Traffic control shall be performed in accordance with Section 015070.

END OF SECTION

## SECTION 405020 INSTRUMENTATION EQUIPMENT

### PART 1 - GENERAL

#### 1.01 Designations of Components

In these specifications and on the plans, all systems, meters, instruments, and other elements are represented schematically and are designated by numbers, as derived from criteria in ISA standards. The nomenclature and numbers designated herein and on the plans shall be employed exclusively throughout shop drawings, data sheets, and the like. Any other symbols, designations, and nomenclature unique to a manufacturer's standard methods shall not replace those prescribed above, as used herein, and on the plans.

#### 1.02 Signal Characteristics

Wherever possible and feasible, components shall be of electronic solid-state design and systems shall utilize the same signal characteristics throughout each and all of the several systems; transmission signals shall be 4 mA to 20 mA. The combined power supply and transmitter loops shall, when tested with appropriate precision resistors, present a voltage signal of 1- to 5-volt DC. Signal isolators shall be provided where required.

### PART 2 - MATERIALS

#### 2.01 Liquid Level Transmitter--Submersible

1. The submersible all-~~stainless steel~~~~titanium~~ pressure transmitter shall provide an electrical 2-wire d-c current signal proportional to the pressure applied to the unit's diaphragm-sensing element. The pressure sensing element shall be diffused silicon semiconductor with a process media operating temperature range of  $-4^{\circ}\text{F}$  to  $140^{\circ}\text{F}$ . Provide the pressure transmitter with the following features:
  - a. Waterproof cable with internal vent to atmosphere rated for transmitter suspension up to 300 feet.
  - b. Conduit adapter, cable/conduit junction box.
  - c. Cable strain relief, clamp.
  - ~~d. Internally adjustable span.~~
  - e.d. Anti-clog attachment.
  - f.e. A separate suspension cable for transmitters suspended over 20 feet.

2. Accuracy of the pressure transmitter shall be ~~±0.1251~~±0.1251% of calibrated span with a range of 0 to 15 PSI.
3. The liquid level transmitter shall be that manufactured by Keller America Corporation, Model Level Gage 81355.

## 2.02 Tipping Bucket Rain Gauge

1. The Tipping Bucket rain gauge shall collect rain water passed through a debris-filtering screen funneled into one of two tipping buckets inside the gauge.
  - a. Collector diameter 7.87 in.
  - b. Weight 6.4 lbs.
  - c. Switch – Momentary reed (proximity).
  - d. Output – 0.1 second switch closure.
  - e. Accuracy - ±0.5% at 0.5 in./hr  
±2% at 2 in./hr
  - f. Sensitivity – 0.01 inches.
2. The rain gauge shall be constructed entirely of stainless steel.
3. The rain gauge shall be manufactured by Sutron Co., model no. 5600-0425-6 with drain kit, model no. 6661-1137-1 or equal.

## 2.03 Float Switch

1. Submersible float chemical resistant polypropylene casing with a firmly bonded electrical cable shall be permanently connected to an enclosed mercury free switch.

The entire assembly shall be encapsulated to form a completely water-tight and impact-resistant unit. UL listed for pilot duty and industrial control equipment.

Cable – 600 volt Type STO #18

The float switch assembly shall be manufactured by Anchor Scientific, Inc.

2. Model Type SE or approved equal.

## 2.04 Temperature Sensor

1. Wall mount temperature sensor/transmitter shall be RTD type.
2. Wall mount temperature sensor shall be manufactured by Omega.



3. Model no. EWS-RTD with EWS-TX wall mount temperature transmitter.
4. Provide Conduit box mounting bracket/wall plate adaptor kit model no. WES-MB and PSR-24S Power Supply.

#### 2.05 Diesel Fuel Oil Tank Level Sensor/Transmitter

1. Level sensor/transmitter shall replace existing clock gauge on top of existing tank.
  - a. Stem material – 316 stainless steel.
  - b. Mounting Material – 316 stainless steel.
  - c. Operating Temperature – 40°F to +230°F.
  - d. Length – To suit depth of tank.
  - e. Input Voltage 10 – 40 VDC.
  - f. Output signal 4 – 20 mA.
2. Level sensor shall be manufactured by Gems Sensors. Model no. XT-800, Type 3 mounting, Float model no. 156790 or approved equal.

#### 2.06 Door Alarm Security

1. Contractor shall provide building entrance with an intrusion alarm system.
  - a. Surface mounted magnetic door contact to alarm on entry.
  - b. Alpha numeric key pad to arm/disarm.
  - c. All equipment shall be NEMA 1 rated.
  - d. Contractor shall provide complete system as required to suit by a qualified security system contractor and approved by engineer.

#### 2.07 Pressure Switch

1. Pressure switches shall be Type 316 stainless steel bourdon tube type actuating an enclosed, metal contact snap-action switch. Switch shall have separate set point and reset point adjustments. Adjustment of the switch set points and viewing of the set point indicator shall be accomplished without having to gain access to the interior of the unit. Pressure switch range and number of switch contacts shall be as indicated in the drawings. [Provide cleanout-type, continuous-duty type diaphragm seals.] Enclosure shall be watertight NEMA 4. Provide Ashcroft pressure switch Model B4-64-S-XHX-600# or equal.

## 2.08. Electromagnetic Flow Meter

- 1) Electromagnetic Flow Meter shall be electromagnetic type flanged tube meter with sealed housing for 150 PSI working pressure. The meter shall be a 10 inch Ultra Mag™ MODEL UM06 with a digital indicator having a range of 0 to 150 and shall be equipped with a 9 digit digital totalizer reading in units of GPM and shall be accurate within 0.5% of actual flow.
- 2) Meter Tube (sensor) shall be fabricated stainless steel pipe and use 150 lb. AWWA Class “D” flat face steel flanges (UM06). The internal and external of the meter tube shall be blasted and lined with a NSF approved fusion bonded epoxy UltraLiner™, applied by the fluidized bed method. Meter tubes shall have a constant nominal inside diameter offering no obstruction to the flow. Electrodes shall be 316 stainless steel.
- 3) Mag Shield shall be welded to the tube providing a completely sealed environment for all coils, electrode connections and wiring harness capable of NEMA 6P/IP68 operation.
- 4) Signal Converter shall be pulsed DC coil excitation type with auto zeroing. The converter shall indicate direction of flow and provide a flow rate indication and a totalization of flow volume for both forward and reverse directions. Both forward and reverse totalizers shall be electronically resettable. The flow meter converter shall be microprocessor based with a keypad for instrument set up and LCD displays for totalized flow, flow rate engineering units and velocity. The converter shall power the flow sensing element and provide galvanically isolated dual 4-20mA outputs. It shall be possible, in the test mode, to easily set the converter outputs to any desired value within the range. The 4-20mA scaling, time constants, pipe size, flow proportional output, engineering units and test mode values shall be easily set via the keypad and display. Four separate fully programmable alarm outputs shall be provided to indicate empty pipe, forward/reverse polarity (normally open/close), analog over-range, fault conditions, high/low flow rates, percent of range and pulse cutoff. The converter shall periodically perform self-diagnostics and display and resulting error messages. All set up and data and totalizer values may be protected by a password. The converter shall be integrally mounted or remotely mounted up to 200 feet from the sensor, and shall be supplied in a sealed IP67 rated enclosure. Calibration will be completed at the manufacturer's location in accordance with customer supplied application-based requirements.
- 5) Grounding Rings models which use grounding electrodes.
- 6) Service & Support: Supplier must have flow calibration laboratories and personnel to perform testing and certify calibration. Personnel must also provide instruction or training as required assuring meters are supported and maintained throughout the guarantee period.

- 7) Volumetric Testing of all meters must be performed and approved prior to shipment. The complete meter assembly and signal converter must be wet accuracy tested and calibrated. The test facility must be rigorously traceable to an accuracy of  $\pm 0.15\%$  with the National Institute of Standards and Technology. If desired, the test shall be witnessed by the customer or their selected agent. A copy of the certified accuracy test record must be furnished at no charge to the customer.
- 8) One Manufacturer shall make all meter sizes and styles required for this contract. The meters shall be manufactured and tested in the U.S.A.

END OF SECTION

## SECTION 405040 PROGRAMMABLE LOGIC CONTROL SYSTEM

### PART 1 - GENERAL

#### 1.01 Description

This section includes requirements for materials, testing, and installation of a control system. The control panel shall conform to the City control panel standards, see Attachment A, and the following.

The PLC control system shall operate in accordance with the Control and Instrumentation diagram in the bid drawings. An overview of this operation is offered here for clarification. The Pump Controller Panel, which will herein be referred to as PCP will use a programmable logic controller to operate the pumping system controlled by wet well levels using analog signals from the level transmitter specified herein located in the pump station wet well.

The PCP will control the operation of four pumps; Main Pumps No.1 and No.2, Jockey Pump, and ASR Pump (P-1, P-2, P-3, and P-4); installed in the pump station. This system will operate on an ASR, Jockey, lead, lag, cycle and the PCP shall alternate pumps P-1 and P-2 on each cycle.

As the wet well level increases to above a set depth, the ASR pump (P-4) will turn on and will operate through a variable frequency drive to maintain an operator set flow rate to ASR Well No.2. As the level continues to rise above a second depth setpoint, the jockey pump (P-3) will turn on and will operate through a variable frequency drive to maintain a constant level in the wet well. Further as the level continues to rise a third depth setpoint, the main pump (P-1 or P-2) will turn on and will operate through a variable frequency drive to maintain an operator set speed. Further as the level continues to rise a fourth depth setpoint, the second main pump (P-1 or P-2) will turn on and will operate through a variable frequency drive to maintain an operator set speed.

The ASR pump only can run when ASR Well No.2 is in recharge mode, a pump run signal will be provide from Golden Gate WWTRF via Comcast.

If both Strainers fault (FLT-1 and FLT-2), shutdown ASR pump (P-4).

When a second main pump is called to run, shutdown and lockout the Jockey and ASR (if running) pumps prior to starting the second main pump.

The PCP shall provide discrete output to the RTU for monitoring. The entire schedule list of inputs for the VFD shall be translated into a common input which must be communicated back to the RTU unit along with indication for each pump. The PCP must also communicate to all the VFD's to provide a speed command.

The PCP shall also provide pump running status to the bar screen control panel as indicated in the Control and Instrumentation diagram so that the bar screen and conveyor system shall be running at all times that any of the pumps in the system are running.

The PCP will incorporate an incoming power surge protector manufactured by EDCO Model HSP121-bt.

Incoming & outgoing analog signals shall use EDCO 642 signal surge protector

#### 1.02 Backup Relay Control Logic System Description

Control system shall have a float back up system consisting of (2) floats, relay logic and timing as necessary to perform a systematic start up of (2) pumps 1 & pump 2 in case of PLC, Level Indication Transducer, and/or other failures. Upon activation of the high level float, the back-up relay control logic will signal the VFD for pump 1 & pump 2 to actuate pump 1 immediately and initiate an adjustable timer. Upon time-out of this setting, pump #2 will turn on. Both pumps shall remain on until the low float off level of the wet well has been reached.

#### 1.03 Quality Assurance

Control system shall be manufactured by GS Phillips or Approved Equal.

### PART 2 - MATERIALS

#### 2.01 Designations of Components

In these specifications and on the plans, all systems and other elements designated by numbers, as derived from criteria in ISA standards. The nomenclature and numbers designated herein and on the plans shall be employed exclusively throughout shop drawings, data sheets, and the like. Any other symbols, designations, and nomenclature unique to a manufacturer's standard methods shall not replace those prescribed above, as used herein, and on the plans.

#### 2.02 Programmable Logic Control System

1. A fully integrated programmable logic control system shall be furnished as specified in this section. The programmable logic control system hardware shall be intelligent process control units with analog and discrete I/O for process interface.
2. The a-c power of the control system will be 120-volt +/-10% a-c, 60 hertz, single phase derived from line power. The system shall be designed to operate satisfactorily from 0 °C to 60 °C ambient temperatures for the PLC.

## 2.03 Programmable Logic Controller (PLC)

The PLC shall be a 16-bit programmable logic controller microprocessor-based stand-alone device. It shall be a process and logic controller designed for industrial environments. It shall be capable of a mix of logic, timing, counting, computation, library of preprogrammed subroutines, and PID loop control capabilities necessary for the unit process application.

The PLC shall come complete with chassis, central processor, memory, power supply, interconnecting cables, and discrete and analog I/O interfaces.

The logic and variable memory shall be read/write RAM. All RAM shall have integral battery backup that will maintain the memory for a minimum of six months upon a utility power failure. The logic and variable memory shall have a sufficient ladder logic location for programming all specified functions plus 25% spare memory.

The PLC shall have the following features:

1. Logic Control: The PLC shall be capable of performing the same functions as conventional logic systems including on delay timers, off delay timers, counters, and drum sequencers.
2. Compare Function: The PLC shall perform the compare function that compares two integers or floating point numbers for less than, equal to, greater than, and not equal to. The programmed function shall energize when true and de-energize it when false.
3. Move Function: The PLC function shall move an integer or floating point value from one memory location to another memory location when an internal permissive is enabled.
4. Math Function: The PLC shall be capable of performing addition, subtraction, multiplication, and division on integer or floating point numbers.
5. Analog Controllers: The PLC processor shall perform all the functions of the conventional three-mode (PID) analog controller. The controller shall perform proportional only control, proportional plus reset, and proportional plus reset plus derivative and integral only control. The controller shall be the conventional three-mode controller.

The PLC shall be able to generate PID loops with a minimum sample time of 1.0 seconds. PID tuning constants shall have the following adjustable range:

Proportional Gain	0.0% to 99.99%
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Reset Time	0.01 to 999.99
------------	----------------

	minutes
Derivative Time	0.00 to 999.99 minutes

6. Time Proportional Control (TPC): The PLC processor shall be capable of modulating a valve by using time proportional control. When the process variable is above set point, the controller shall pulse a discrete output on/off, closing the valve. When the process variable is below set point, the controller shall pulse a second discrete output on/off opening the valve. When the set point and process variable are equal and within dead band, both discrete outputs shall be off. The controller "on" pulse time shall proportionally increase as the error between process variable and set point increases. A PLC preset cycle timer shall monitor and reset the controller's "on" time intervals. The controller set points shall be accessed via the SCS.
7. Time-of-Day Clock: The PLC shall have an internal time-of day clock/calendar running independently of the CPU.
8. PLC System Alarm: The PLC processor shall monitor the internal operation of the PLC system for failures. If a failure is detected, the system shall shut down and freeze all inputs and outputs in their last states until the error is cleared. As a minimum, the following failures shall cause the PLC to shut down:
  - a) Memory failure.
  - b) Memory parity error.
  - c) I/O cycle failure.
  - d) Operating system error.
9. Input/Output: The PLC discrete input 16-channel modules shall be 24-volt DC or 120-volt AC and have noise filters or use other techniques to reject short-time constant noise and 60-Hz pickup.
  - a) The PLC discrete output modules shall be relay type, 120-volt AC, or 24-volt DC solid-state drivers suitable for operating control relays. Each discrete output module shall include fuses and fuse blown indicators. Relay module is preferred and shall be used when a single normally open contact is required.
  - b) The PLC analog inputs shall be suitable for accepting 4 mA to 20 mA from either 2- or 4-wire transmitters. The input power shall be from an external 24-volt DC power supply. The analog to digital converter shall have a 12-bit minimum resolution with an overall accuracy of 0.5% at 60 °C.

- c) Discrete PLC I/O modules shall have individual LED status lights for each I/O point. All discrete and analog modules shall have terminal blocks for termination of the I/O wires. Individual I/O points shall be capable of withstanding low energy common mode transients to 1,500 volts. Each PLC mounting base shall provide a minimum capability of 16 analog I/O and 64 discrete I/O. The PLC shall be capable of communicating with up to 1,000 remote I/O points on a single 15,000-foot data link.
10. Unused I/O: Provide PLCs with the following minimum unused pre-wired I/O for future facility expansion:
- a) Analog Inputs: 3.
  - b) Analog Outputs: 2.
  - c) Discrete Inputs: 15.
  - d) Discrete Outputs: 5
11. I/O Termination: provide a pre-fabricated cable and interface module for each I/O module wiring. The system shall be by the PLC manufacturer.
12. Each PLC shall be able to communicate to an Ethernet network.
13. The PCP PLC shall contain an Industrial 5 – 8 point Ethernet switch.
14. The PLC shall be Automation Direct, 205 Series.

#### 2.04 Media Converter

- 1. The Fiber-to-Copper Ethernet media converter shall convert 10BaseT to 10BaseFX. Media converter shall be in full compliance with standards set forth by IEEE 802.3.
- 2. Media converter shall meet the following specific requirements:
  - a) Operation: Full and Half Duplex, Auto-Negotiation, Autocross and Link Pass Through
  - b) Interface (hardwire): RJ-45 10BaseT port
  - c) Interface (fiber): Duplex ST-type 10BaseFX port
  - d) Operating Temperature: 0°C to 50°C (-25°C to 65°C for field units)
  - e) Operating Humidity: 5% to 95% (non condensing)
  - f) Fiber Segment Length: 1.2 miles



- g) Fiber Wave Length: 850 nm
  - h) MTBF: 54,000 hours minimum (tested per MIL-HDBK-217F) or 130,000 hours minimum (tested per Telcordia SR-332, Issue 1). All tests include power supplies.
3. Field Converters: Provide an AC/DC power supply for each converter, as required. Media converter shall be a Model E-TBT-FRL-05 (HT) as manufactured by Transition Networks Inc, or equal.
  4. Media converters for interfacing with PLCs supplied with the packaged systems will be furnished by WWTP SCADA Contractor. The converters will be installed by package suppliers. The “packaged” PLCs are as follows:
    - a) PLC-1 in MultiDisc Fine Screen – Section 444332.
    - b) PLC-3 in ACTIFLO System – Section 444337.

#### 2.05 Ethernet Switch (Field Cabinets)

1. Ethernet switch shall be DIN-rail mountable. Ethernet switch shall be in full compliance with standards set forth by IEEE 802.3. Switch shall have five Ethernet ports, as minimum. LEDs on each port shall indicate link data rate and activity status. A power LED shall indicate that power is applied to the.
2. Ethernet Switch shall meet the following specific requirements:
  - a) Operation: 10/100 Mbps, Full and Half Duplex, Auto-Negotiation
  - b) Switching Properties: Store & Forward
  - c) Number of MAC addresses: 1024
  - d) Up to 1.0 Gb/s Maximum Throughput
  - e) Minimum of 64K of message memory
  - f) Interface: RJ-45 10/100BaseTX ports
  - g) MDIX Auto Cable Sensing
  - h) Operating Temperature: -20 °C to 60 °C
  - i) Operating Humidity: 10% to 95% (non condensing)
  - j) MTBF: 100,000 hours minimum

3. The Ethernet switch shall be Contemporary Control Systems Mod. EISK5-100T, B&B Electronics Mod. IASW5P, Moxa Technologies Mod. EDS-205, or equal.

## 2.06 Operator Interface (OI)

1. An operator interface shall be a panel mounted electronic assembly that allows bi-directional communication between the programmable logic controller and the operator interface device.
2. Screens shall be configured using an off-line PC based software package that runs in the Windows environment. Each display screen shall consist of graphic representations of legend plates, push buttons, pilot lights, numeric data displays, numeric data entry buttons, bar graphs, time displays, text displays, selector switches, illuminated push buttons, counter/timer numeric preset and increment/decrement buttons. In addition, the unit shall be capable of displaying bit map graphics. Graphics can be created using any software that produces standard .bmp files. Applications shall be downloaded to the operator interface device and stored in flash memory.
3. The unit shall be capable of displaying text messages that can be triggered by the status or values of bits or numeric variables in the programmable logic controller. In addition, the unit shall be capable of accepting and displaying text messages that are stored in programmable controller as ASCII strings.
4. The unit shall have the following features:
  - a) Resolution: 800 x 600 pixels and 16-bit color graphics.
  - b) Display: 10-inch
  - c) Communications: Ethernet and serial ports
5. A communications driver shall be provided with the editing software.
6. All cables for communication between the unit and the PLC shall be provided along with a cable for serially interfacing the device with a personal computer.
7. The operator interface device shall be a C-More 10" color, TFT, 64K, NEMA 4X, IP 65 with Ethernet and USB as manufactured by Automation Direct, or equal pre-approved at least 2 weeks prior to bid time.

## 2.07 Level Transmitters – Submersible

1. The control supplier shall be responsible for providing (5) five liquid level transmitters by KELLER AMERICA or pre-approved equal as specified below.

2. The submersible all-~~stainless steel~~~~titanium~~ pressure transmitter shall provide an electrical 2-wire d-c current signal proportional to the pressure applied to the unit's diaphragm-sensing element. The pressure sensing element shall be diffused silicon semiconductor with a process media operating temperature range of  $-4^{\circ}\text{F}$  to  $140^{\circ}\text{F}$ . Provide the pressure transmitter with the following features:
  - a) Waterproof cable with internal vent to atmosphere rated for transmitter suspension up to 300 feet.
  - b) Conduit adapter, cable/conduit junction box.
  - c) Cable strain relief, clamp.
  - d) ~~Internally adjustable span.~~
  - e) Anti-clog attachment.
  - f) A separate suspension cable for transmitters suspended over 20 feet.
3. Accuracy of the pressure transmitter shall be  ~~$\pm 0.1251\%$~~  of calibrated span, with a range of 0 to 15PSI.
4. The pressure transmitter shall be that manufactured by Keller America, Level Gage model no. 81355.

## 2.08 Spare Parts

1. The Contractor shall furnish to the Owner all necessary spare parts of components required to maintain the system. Prior to final acceptance of work, the Contractor shall provide a spare parts listing of all necessary spare parts and quantities for review by the Owner's Representative. The spare parts shall include the following minimum requirements:

<u>Part Description</u>	<u>Quantity</u>
a) PLC Power Supply	1 each
b) CPU and Memory Module	1 each
c) Analog Input Module	1 of each type
d) Discrete Input Module	1 of each type
e) Analog Output Module	1 of each type
f) Discrete Output Module	1 of each type

2. The Contractor shall deliver to the Owner all the required spare parts upon final acceptance of the work. The spare parts shall not be used as replacement parts during the guarantee period.

#### 2.09 Enclosures

1. The PCP/PLC enclosure shall be NEMA 4X 304 stainless steel.
2. Enclosures shall be suitable for mounting against a wall.

### PART 3 - EXECUTION

Refer to Section 405000.

END OF SECTION

## SECTION 412123 BELT CONVEYORS (STRAIGHT TYPE)

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

This section includes materials and installation of belt conveyors, both reversible and nonreversible. The bar screen supplier/manufacturer is also responsible for design and operation of the screens belt conveyor. Both bar screens, screenings belt conveyor, and control panel shall be furnished by a single supplier. The mechanically cleaned vertical bar screen is specified in Section 443333.

#### 1.02 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions, Section 013300, and the following.
- B. Submit dimensional drawings. Show relationship between conveyors and the equipment feeding them, such as screens, and other items.
- C. Submit manufacturer's catalog data and detail drawings showing all conveyor parts and described by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type. Show coatings. Identify each conveyor by tag number to which the catalog data and detail sheets pertain.

#### 1.03 MANUFACTURER'S SERVICES

Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

- A. Two labor days to check the installation and advise during start-up, testing, and adjustment of the equipment.
- B. One labor day to instruct the Owner's personnel in the operation and maintenance of the equipment.

### PART 2 - MATERIALS

#### 2.01 MANUFACTURERS

Conveyor units shall be manufactured by the Custom Conveyor Corporation, Keystone, or engineer approved equal.

## 2.02 CONVEYOR DESIGN

- A. Conveyor systems shall consist of single integral units for horizontal pickup runs and elevation runs.
- B. Conveyors shall consist of single integral units containing supports, tubular frame, drip pan, belt, motor, gear reducer, ~~chain, sprockets,~~ and splash guards.
- C. Comply with ASME B20.1.
- D. Maximum belt speed shall be 80 fpm.

## 2.03 FRAMES

Frames shall consist of channel-shaped side stringers, tied and braced.

## 2.04 MATERIALS OF CONSTRUCTION

Materials of construction for the conveyor shall be as follows:

Component	Material	Specification
Pulleys, carry idlers <del>frames, return idler brackets,</del> skirtboards, steel belt cleaners, frame, rollers, shafts, drip pans, guards, adjustable motor bases, all-thread for motor bases, expanded metal guards, splash guards, <del>and</del> take-up assemblies, <del>and thumper assembly</del>	Stainless steel	AISI Type 304 or 304L
<del>Carry and Return idlers</del> <del>rollers</del>	<del>Stainless steel</del> Polyethylene	<del>Stainless steel: AISI Type 304</del>
<del>Bottom wheels</del>	<del>Stainless steel</del>	<del>Stainless steel: AISI Type 304</del>
Grease fittings	Stainless steel	AISI Type 303
Screws, keys, bolts, nuts	Stainless steel	AISI Type 316

## 2.05 STRUCTURAL DESIGN AND SUPPORTS

Design frame supports with stiffeners and top flanges, anchor bolts, and lifting system per the following requirements:

- A. Wind Design Parameter--Conform to Florida Building Code 2010:
  1. Ultimate Wind Velocity, mph: 180.
  2. Risk Category: III.

3. Exposure Category: C.

- B. Weight, W: Weight of conveyor system plus 60 pounds per linear foot load on belt.
- C. An unreinforced concrete housekeeping pad above the reinforced concrete structural slab shall not be considered to have structural value in the design of the anchor bolts. Tension and shear values for drilled or epoxied anchor shall be FBC approved.

2.06 PULLEYS

- A. Head pulleys shall be minimum 16 inches diameter, 304 SS construction with tapered compression type hubs mounted on 304 SS shafting supported by 2 3/16" diameter min. self aligning bearings. The head pulley will have 3/8" thick vulcanized neoprene legging to prevent belt slip.
- B. The tail pulley shall be 14" minimum diameter 304 SS construction with tapered compression type hubs mounted on 1 15/16" diameter 304 SS shafting supported by protected screw take-ups with 12" take up length minimum. The take ups will include stainless steel adjusting rods with brass bearing capture nuts.

2.07 IDLERS

- A. Belt will be supported on the carrying run by CEMA, 20 degrees troughed idlers on 4'-0" centers except at the load points on 1'-6" centers, and return runs on CEMA idlers at maximum spacing of 10'-0".
- B. Idler rolls are to be 304 SS construction and supported from the frame by 304 SS brackets.
- C. Idlers will include 3/4" diameter shafts and tapered roller bearings with controlled greasing. Shaft seals will be multi-passage labyrinth with a positive wiper and an outer shield constructed as established by CEMA. In lieu of tapered roller bearing, provide double sealed ball bearings.

2.08 FRAME

Belt conveyor frames and supports will be constructed of 304SS structural members with spreaders, sized as required to limit deflection to 1/250 at the longest support span. Top of the channel frames will be covered with 3/16" nominal "Fiberglass Reinforced Plastic" 16 gauge type 304SS return belt cover to prevent product spillage onto the return run of the belt.

2.09 SKIRTING

Conveyor will be provided with continuous 10 gauge 304 SS skirt with an adjustable 3/8" thick neoprene seal strip at the belt to guide and control the product and 10 gauge 304SS splash plates at load areas

## 2.10 BELTING & SPLICE

A. Provide two-ply nylon or polyester carcass belting with minimum 1/8-inch-thick top and minimum 1/16-inch bottom. Belt shall have a minimum overall width of 24 inches. Design the belt for a minimum working tension of 220 pounds per inch of width.

~~B. Belt shall be vulcanized endless in the shop~~

~~C.~~ B. Connect belt ends with a mechanical splice. With the exception of the connecting pin, install the fastener kit prior to shipment. Metallic components of the belting shall be Type 316 stainless steel.

## 2.11 BELT TAKE-UP

Provide a screw-type take-up at the foot terminal of the conveyor, with 12-inch travel, designed to provide proper belt tension. The take-up shall be guided to maintain take-up shaft normal to belt centerline. Furnish expanded metal guards around take-up.

## 2.12 BELT CLEANER

Provide belt scraper at discharge end of nonreversing conveyors.

## 2.13 GUARDS

Furnish Conveyor with OSHA style guards at all "nip points" and motor driven rotating components, specifically including motor drive and tail pulley and head pulley guards. Guards will be constructed of epoxy coated steel. (OSHA Safety Yellow).

## 2.14 DRIP PAN

Return run of the belt will be provided with a 14 gauge 304 SS drip pan 6" wider than overall belt width with water tight flanged connections in 10'-0" maximum lengths. 3" dia nipple drain will be located as shown on the drawings. The drip pan will be installed to serve as a guard for the return run of belting.

## 2.15 MOTOR

Provide a motor and gear reducer to drive the belt. Motor shall be nonreversing for pickup and discharge units. Motor shall be 3Hp, 3 ph, 60 Hz, 460V as listed in the subsection on "Service Conditions."

## 2.16 GEAR REDUCER

A. AGMA, Class II, helical gear shaft mount reducer assembly with V-belt and sheave reducer input drive, or the motor shall be directly connected to the reducer input drive to provide 80 FPM belt speed. Complete with FRP OSHA style V-belt guard. The thermal rating shall equal or exceed the mechanical rating. Spiral bevels shall be heavy-duty,



right-angle construction, using only case-hardened, matched, and lapped gears. Spiral bevels shall be manufactured to AGMA Quality 10 level per AGMA 2009 and 2011.

- B. Drive housings shall be either steel (ASTM A36 or A108) or cast iron (ASTM A48, Class 30 or higher) and shall be fully stress relieved prior to machining. Drive housings shall be pressure tested. Drives shall be test run at the factory for one hour while filled with oil.
- C. Minimum AGMA rating shall be 1.5 for continuous 24-hour-per-day service.
- D. Provide two antifriction bearing assemblies. One assembly shall be free to float within the frame to carry radial thrust only. Design the other bearing assembly to carry both radial and axial thrust. Bearings may be either ball or tapered roller type. Bearing life shall be a minimum of 20,000 hours per the AFBMA B-10 rating.
- E. Bearings shall be oil lubricated.

#### 2.17 DRIVE OVERLOAD CONTROL SYSTEM

~~A. An electronic motor overload protection trip relay shall be provided for the conveyor drive motor. The overload trip relays shall be mounted in the control panel controlling the conveyor system. Trip relays shall have an adjustable 30% to 130% load current setting, an adjustable start-time trip delay of .0 to 20 seconds to allow momentary overload at start-up, and an adjustable overload, or shock time, setting of .2 to 3 seconds. When the drive motor exceeds the preset load current setting for a time period exceeding the preset shock time, the relay shall initiate the emergency shut-down sequence. This electronic motor overload circuitry shall be located in the bar screen control panel per Section 444333 Part 2.06. Provide each drive with a shear pin and slip clutch to protect the drive in the event of overloading.~~

~~B.A. Provide a torque overload switch.~~

~~B. Provide a zero speed switch, NEMA 74X, 120V, 5 amp magnetic disc and sensor with mounting hardware for location at the non driven pulley.~~

#### 2.18 SAFETY SWITCH

Provide cable-operated **NEMA 4X** safety stop switch equipped with positive safety lock complete with 3/32-inch orange vinyl coated, 7x7 preformed stainless steel aircraft-type cable on all accessible sides of conveyor belt.

#### 2.19 AUTOMATIC LUBRICATION SYSTEM

- A. Belt conveyor manufacturer shall provide one (1) centralized lubrication system for all lubrication points located within the limits of the belt conveyor. The lubrication system shall be manufactured by SKF Model KFGS or equal. The lubrication system shall include 316 SST flexible grease lines and 120VAC NEMA 4X stainless steel control

panel. Conveyor manufacturer shall determine the pump capacity and number of grease points.

- B. Provide dry contact for a general fault alarm.
- C. Mount automatic lubrication system near conveyor with 304 SST unistrut.

## 2.20 SPARE PARTS

- A. Provide the following spare parts for each conveyor unit:

Quantity	Description
1	Reducer Seal Kit
2	V belts
<del>48</del>	<del>Carry and Return rollers</del> <del>Carry Idlers</del>
<del>4</del>	<del>Return Idlers</del>
10 Feet	Belting
4	Belt splice kits

- B. Pack spare parts in a wooden box; label with the manufacturer's name and local representative's name, address, and telephone number; and attach list of materials contained within.

## PART 3 - EXECUTION

### 3.01 SERVICE CONDITIONS

- A. Performance conditions and design data shall be as shown below.
- B. Conveyor Tag Number: CNV-1

Type	Integral pickup, nonreversing
Capacity	875 CF/Hr
Service	Outdoors environmental temperature range of 32°F to 100°F
Elevation	10 feet above mean sea level
Relative Humidity	0% to 100%
Motor Type (per Section 262650)	4AEM
Motor Horsepower (minimum)	3
Motor Voltage	460, 3 phase
Material Carried	Storm Water Screenings

### 3.02 WELDING

Welder qualification shall comply with AWS D1.6. Welding rod and electrodes shall comply with AWS A5.4. Bare wire shall comply with AWS A5.9 Welds shall be continuous along the full length of contact of adjoining members. Do not use skip or spot welding.

### 3.03 PAINTING AND COATING

Coat motor, gear drive, and guards per Section 099000, System No. 10. Apply the specified prime at the place of manufacture. Apply intermediate and finish coats in field. Color of finish coat shall be grey. Do not coat stainless steel.

### 3.04 FIELD TESTING

Operate the belt conveyor for a minimum of 24 consecutive hours to assure proper installation. Check for binding, sticking, and overloading, and repair all malfunctions. Simulate conditions to initiate automatic screen operation, and verify that the controls are operating normally. Test motor per Section 262650.

### 3.05 CONTRACT CLOSEOUT

Provide in accordance with Section 017000.

### 3.06 WARRANTY

The equipment shall be warranted for three (3) years commencing from date of substantial completion.

### 3.07 CERTIFICATION

Provide a written certification from the equipment manufacturer that each pumping system has been properly installed according to the Contract Documents and the manufacturer's recommendations, and that the equipment is operating normally. Make all necessary corrections and adjustments including but not limited to parts, labor, or freight at no additional cost to the Owner.

END OF SECTION

## SECTION 432150 VERTICAL TURBINE PUMPS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

This section includes materials, testing, and installation of propeller or mixed flow pumps in sumps for water service.

#### 1.02 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions, Section 013300, and the following.
- B. Submit dimensional drawings.
- C. Submit manufacturer's catalog data and detail drawings showing all pump parts and described by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type. Show linings and coatings. Identify each pump by tag number to which the catalog data and detail sheets pertain.
- D. Submit pump manufacturer ISO-9001 certification per Article 2.01A. As an alternative, provide a letter from the pump manufacturer accepting warranty responsibility for the entire pump, motor, and baseplate unit.
- E. Show shaft diameter and bearing spacing. Submit calculations showing shaft critical frequency and determination of bearing spacings. Show calculated bearing life.
- F. Submit pump curves on which the specified operating points are marked. Show efficiency and brake horsepower for the selected pump curve. Include moment of inertia of the complete pump unit including driver, impeller, and liquid pumped. Show required submergence and NPSH.
- G. Submit descriptions of casting repairs and repair procedures that will be used to repair casting defects in bowls, diffusion vanes, suction bells, and impellers. Do not proceed with repairs until the Owner's Representative has reviewed the proposed repairs and repair procedures. After the repairs have been performed, submit report describing the repairs for record purposes.
- H. As part of the field test procedure for the pumps, record measurements for impeller adjustment at the top of shaft and total radial shaft deflection (shaft runout) above the stuffing box or seal chamber.
- I. Submit manufacturer's sample form for reporting performance test results at least two weeks before the tests. The test form should contain the data presented in the sample form in Section 6 of the ASME PTC 8.2 or ANSI/HI 2.6 or API 610, Annex M.

- J. The pump shall be tested with job motor, do not correct test results for speed.
- K. Submit manufacturer's certified performance curves for review at least two weeks prior to shipping the units from the factory. Show pump total head, torque, brake horsepower, pump efficiency, required submergence, and required NPSH. Provide copies of the data recorded during the test and methods of data reduction for determining certified test results.
- L. Submit report on results of factory resonance test and modal shape signature results.
- M. Submit motor data per Section 262650.
- N. Submit manufacturer's requirements for pump alignment limits.
- O. Submit a finite element analysis (FEA) lateral dynamic analysis and torsional dynamic analysis per ANSI/HI 9.6.4-2000, paragraph 9.6.4.2.2. Include the effects of the pumped liquid per ANSI/HI 9.6.4, paragraph 9.6.4.2.1.
- P. Submit detailed drawings and data showing the following information for each size and model of pump:
  1. Design, dimensions, configuration, and wall thicknesses of nozzles.
  2. Connection details of nozzles to discharge head.
  3. Wall thickness of pump discharge heads. Include designs and dimensions of supporting or reinforcing gussets, if used.
  4. Design and dimensions of discharge baseplate, including plate thickness and method of attachment of baseplate to discharge head.
  5. Wall thickness and diameter of pump column.
  6. Dimensions and thicknesses of bowls.
  7. Pump column lengths between flanges or couplings.
  8. Shaft diameters and support spacings.
  9. Size of motor and method of mounting to pump discharge head.
  10. Weights of the above-mentioned components.

### 1.03 DEFINITIONS

- A. Terms shall be as defined in ANSI/HI 2.1-2.5 for vertical pumps and API 610, tenth edition, Section 3. If there is a discrepancy in definitions between the two publications, the definitions given in ANSI/HI 2.1-2.5 shall govern.

B. Additional terms are defined below:

Submergence: Vertical distance in feet between the pumping water level and the bottom of the suction bell.

1.04 MANUFACTURER'S SERVICES

Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

- A. Four labor days for each service listed in the subsection on "Service Conditions" to check the installation and advise during start-up, testing, and adjustment of the equipment.
- B. One labor day to instruct the Owner's personnel in the operation and maintenance of the equipment.

PART 2 - MATERIALS

2.01 PUMP DESIGN

- A. Equipment for the pumps, including discharge heads, shafting, columns, motors, bases, and anchor bolts, shall be provided as a complete unit by the pump manufacturer in an ISO 9001 certified facility or by a pump manufacturer accepting warranty responsibility for the complete pump unit. Pump units assembled by entities other than the pump manufacturer will not be acceptable.
- B. Each pump shall be capable of at least a 10% head increase at normal operating conditions by installing a larger impeller or an impeller of different hydraulic design.
- C. Pump curve shall be continuously rising and shall be free of dips and valleys ~~from the design point to the shutoff head~~ within the preferred operating range. The shutoff head shall be at least 120% of the head that occurs at the design point.
- D. The NPSH required shall be at least 10 feet less than the minimum NPSH available at all points on the pump curve up to 120% of the flow at the BEP.
- E. Design the pump and its components to operate continuously over a preferred operating range (POR, as defined in ANSI/HI 9.6.3-1997) of 70% to 120% of the flow at the BEP.

2.02 MOTORS

- A. Motors shall be vertical high thrust, solid shaft. Motors shall be as further described in the subsection on "Service Conditions." For pumps with mechanical seals and hollow shaft motors, provide steady bushings.

- B. The driver motor thrust bearing loading shall include the total pump lineshaft downthrust. Design the motor bearings to withstand any momentary total upthrust equivalent to at least 30% of the maximum downthrust developed.
- C. Motors shall have a refined balance on all vertical pumps, balance all vertical motors to the vibration limits shown below.

	<u>Refined</u>
<u>Number of poles</u>	<u>Velocity (IPS-PEAK)</u>
<u>2</u>	<u>0.10</u>
<u>4</u>	<u>0.08</u>
<u>6</u>	<u>0.08</u>
<u>8</u>	<u>0.06</u>
<u>10</u>	<u>0.05</u>
<u>12</u>	<u>0.04</u>
<u>14</u>	<u>0.04</u>

### 2.03 COUPLINGS AND COUPLING GUARDS

- A. For solid shaft motors, comply with API 610 (tenth edition), paragraphs 6.2.2, 6.2.3, 6.2.6, 6.2.7, 6.2.14, and 8.3.8.2. Provide four-piece flanged adjustable spacer type couplings between the motor and pump shafts. Coupling shall be steel. The spacer shall be of sufficient length to permit the removal of the seal and sleeve without disturbing the driver. Provide coupling guards conforming to OSHA requirements.

### 2.04 DISCHARGE HEADS OR MOTOR STANDS

- A. Provide a fabricated steel discharge head or motor stand. The discharge head or motor stand shall have bolted register or rabbet-fit connections for the motor. Discharge head or motor stand shall have connections for the pump column and shall support the loadings which it imposes as well as contain the pump pressure.
- B. Equip the discharge head for enclosed lineshaft pumps with a tube tensioning device to apply and maintain proper tension to the shaft enclosing tube. Apply tension to the shaft enclosing tube through internal or external threads in the top tube.
- C. Design columns and discharge heads for 150% of the pump discharge pressure (suction pressure plus pump differential pressure) at shutoff.
- D. Access to the seal chamber or stuffing box or tube tension device shall be through windows placed 90 degrees from the discharge. Fit handholes and/or windows with Type 316 stainless steel expanded metal guards per OSHA requirements. Provide hinged or removable Type 316 stainless steel guards.

- E. Design fabricated steel discharge head or motor stands to be aesthetically compatible with the mounted motor and with adjacent pumping units. Where the motor is smaller in horizontal dimension than the discharge pipe, shape a skirt to transition between the two masses. Where the motor is larger than the discharge head or motor stands, a skirt of approximately motor diameter dimension shall enclose the discharge head or motor stands so as to provide an adequate-appearing support.
- F. The discharge shall be flanged, having a pressure rating as shown in the subsection on "Service Conditions."
1. Class 125 or 150 flanges shall comply with AWWA C207, Class D.
  2. Class 300 flanges 48 inches and smaller shall comply with AWWA C207, Class F.
  3. Class 300 flanges larger than 48 inches shall be fabricated to the dimensions of ASME B16.1, Class 250.
  4. Flanges shall be flat face.
  5. Groove welds shall be full penetration welds. Fabricated flanges shall be welded both inside and out.
- G. Provide for lifting the heads by means of lifting eyes that are capable of sustaining the weight of the complete unit less the motor.
- 2.05 SEAL CHAMBERS OR STUFFING BOXES FOR OPEN LINESHAFT PUMPS
- The design of the seal chambers or stuffing boxes shall provide space and clearance for removal and service for any of the following types of packing or seals per Section 432102 without moving or disconnecting the motor: A, B, D, E, F, G, I.
- 2.06 LUBRICATION
- A. Pumps shall have enclosed lineshafts as shown in the subsection on "Service Conditions." Enclosed lineshaft pumps shall have external potable water lubrication connections and supply lines for the lineshaft bearings. Provide leakage collection receptacle in the pump head. Provide 1-inch, standard weight (ASME B36.10) steel drain line to drain the water from the collection receptacle to a 1-inch threaded connection on the pump base back into the sump or can.
  - B. Shaft enclosing tube shall be Schedule 80 with 5-foot maximum length sections. Design enclosing tube such that it protects the lineshaft, supports the shaft bearings, and provides watertight gravity lubrication to each lineshaft bearing.
- 2.07 COLUMN PIPE
- A. The column pipe joints shall be flanged and bolted to the discharge head or motor stand and to the pump bowl assembly and shall have register fits at each end. Material shall be



as listed in the subsection on "Pump Materials of Construction." Provide enclosing tube retainers fabricated into the top of each column section at a maximum spacing of 5' intervals.

- B. Top and bottom column pipe sections shall not exceed 5-foot length.
- C. Column pipe joints shall be flanged for columns 6 inches and larger and threaded or flanged for smaller sizes.

## 2.08 SHAFTS AND BEARINGS

- A. Support the shafting by bearings at intervals so that the first natural frequency of the rotating assembly is at least 30% above the maximum operating speed. Calculate and size the shaft diameter for the pump shutoff head and the maximum horsepower conditions.
- B. For metal or rigid bearings, support the shafting at intervals per API 610, paragraph 8.3.6, with a maximum spacing of 5 feet.
- C. The bearing spacing for the column sections shall not exceed 5 feet.
- D. Tolerance on the shaft diameter, with the shaft rotated on centers, shall not exceed 0.003-inch TIR. Shaft runout on the stuffing box or seal chamber face and at the impeller shall not exceed 0.005-inch full indication movement. The shaft stiffness shall limit the total deflection under the most severe dynamic conditions over the allowable operating range of the pump, with the maximum impeller diameter installed, to 0.005 inch at the primary seal faces or at the stuffing box faces.
- E. Pump shafts shall be machined or ground and finished throughout their entire length. The total indicated runout shall not exceed 0.003 inch per foot of length. Total runout shall not exceed 0.005 inch over total shaft length. The pump shaft shall be in one piece unless otherwise approved by the Owner (because of total shaft length or shipping restrictions).
- F. Shaft couplings shall be of the key and thrust-ring types or other nonthreaded design. Thrust rings, cap screws, and keys where used shall be Type 410 stainless steel.

## 2.09 BOWL ASSEMBLY

- A. Each bowl assembly shall consist of the bowl, impeller and impeller shafting, and bearings. Bearings shall be sleeve type located above and below the impeller. Bearings (other than sleeve type) shall have an AFBMA L-10 life of at least 20,000 hours at any specified flow condition excluding the shutoff head. Impellers or propellers shall be dynamically balanced.
- B. Pump bowls shall be of the material listed under the subsection on "Pump Materials of Construction." Bowls shall be sufficiently rigid to prevent adverse changes in bearing alignment and to maintain the running clearance of wear rings. Bowls shall be flanged

with male and female rabbets or registers for joining to the suction bell and the discharge column. Waterways and the diffusion vanes shall be smooth and free from nodules, bumps, and dips.

- C. Provide the bowls with a renewable ~~wear ring liners or diffuser~~ adjacent to the impeller, made of stainless steel ~~or bronze~~ as indicated under "Pump Materials of Construction." Wear rings and running clearances shall not exceed 0.002-inch clearance per inch of diameter.

## 2.10 SUCTION BELL

The suction bell shall have, as an integral part, vanes supporting a central hub in which the bottom bearing is carried below the impeller. The outer suction bell entrance shall be at least the size of the maximum pump bowl dimension and as much larger as is practical. Maximum entrance fluid velocity shall not exceed 6 fps at the specified maximum flow. The contour between the outer edge and the impeller suction eye shall be smooth, continuous, and bell shaped.

## 2.11 IMPELLERS

Pump impellers shall be of the enclosed or semi-open or mixed flow type impeller or propeller type made of the material listed in the subsection on "Pump Materials of Construction" and shall be cast in one piece. Machine impellers to fit the contour of the bowl and hand file in the waterways. Attach impellers to the shaft in such a manner that they cannot become loose under any operating condition or under reverse rotation. Provide for adjustment of the axial position of the impeller at the spacer coupling connection so that proper clearance between bowls and impellers may be maintained.

## 2.12 VIBRATION AND RESIDUAL UNBALANCE

- A. The maximum vibration levels shall not exceed those shown in Figures 9.6.4.13 and 9.6.4.14 in ANSI/HI 9.6.4-2000. Maximum residual unbalance in rotors shall not exceed that shown in Figure 9.6.4.15B in ANSI/HI 9.6.4.
- B. At any operating speed, the ratio of the pump's natural reed frequency to the pump's rotating speed ( $f/N$ ) shall be less than 0.8 and greater than 1.3. A factory resonance test shall demonstrate the motor/discharge head structure's natural reed frequency. Obtain a modal shape signature with an FFT analyzer and submit to Owner's Representative for review.
- C. The Contractor shall require that the pump manufacturer determine whether the infinite mass and rigidity described in ANSI/HI 9.6.4-2000, paragraph 9.6.4.5.2 is applicable to the service conditions in this project and to select the appropriate analytical method to determine the critical speed and resonant frequencies of the pump system. At a minimum, the pump system shall include the bowls, impellers, lineshaft diameters, lineshaft bearing spacing, column diameter and wall thickness, the design of the discharge stand or motor stand with discharge nozzle, and the baseplate and soleplate dimensions (length, width, and thickness).

### 2.13 TORSIONAL ANALYSIS

Perform a finite element torsional analysis per API 610 (tenth edition), Section 5.9, on pumps having: (1) an electric motor driver 600 horsepower and larger, (2) an engine driver 300 horsepower and larger, or (3) any variable speed pump having a driver 75 horsepower and larger. For the purposes of design, a dangerous critical speed shall be defined as one that produces a torsional stress exceeding 3,500 psi.

### 2.14 PUMP MATERIALS OF CONSTRUCTION

- A. Materials of construction shall conform to the requirements listed below. Materials of construction for components not listed below shall conform to API 610, Annex H, Material Class I-2.

Component	Material
Pump shafts and couplings	Stainless steel, ASTM A276, UNS Grade S410 couplings, with ASTM A582, UNS Grade S416 shafting
<del>Bowl wear rings</del> <u>Liner or Diffuser Case</u>	Stainless steel, <u>ASTM A743, Grade CF-8M or CA-15</u> or ASTM A276, Type 410.
Bearing enclosing tube retainers (fabricated integral)	Carbon steel, ASTM A283, Grade B.
Tube bearings	Bronze; see paragraph B below.
Tube bearing	Bronze; see paragraph B below.
Propellers	Aluminum Bronze, ASTM B148, Grade 958
Pump bowls and suction bell	Cast iron, ASTM A48, Class 30 or ductile iron, ASTM A536.
Bowl bearings	Bronze; see paragraph B below.
All parts made of fabricated steel including discharge head or motor stand	Carbon steel, ASTM A283, Grade B or C; ASTM A36; or ASTM A53, Grade B.
Column pipe and shaft enclosing tube	Carbon steel, ASTM A283, Grade B or C, or ASTM A53, Grade A or B.
Mounting plate	Carbon steel, ASTM A283, Grade A or B or ASTM A36.
Flanges	ASTM A105, A181, or A182.
Bolts and nuts for discharge heads, column pipe flanges, and bowl flanges.	Bolts shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M. Nuts shall be Type 316 stainless steel conforming to ASTM A194, Grade 8M.
Stuffing box gland parts	Bronze; see paragraph B below.

Gland bolts and nuts	Stainless steel, Type 316.
Any bronze components in contact with water	See paragraph B below.

- B. Bronze shall have the following chemical characteristics:

Constituent	Content
Zinc	7% maximum
Aluminum	2% maximum
Lead	8% maximum
Copper + Nickel + Silicon	83% minimum

## 2.15 STRAINERS

Provide suction strainers on the inlet to each pump as stated in the subsection on “Service Conditions.”

## 2.16 SOLEPLATE AND ANCHOR BOLTS

- A. The Contractor shall assign the design and construction of the pump (including bowls, column, and discharge head), motor and supporting stand, and baseplate and soleplate system to the pump manufacturer. The pump manufacturer shall design and construct an integrated system to comply with the specified restraint, deflection, vibration, and critical speed criteria.
- B. Provide a steel soleplate for deck-mounted pumps to be permanently grouted in place. The thickness and bolting to the discharge head base shall be sufficient to restrain the discharge head against the discharge pressure at shut off head or any other pump operating condition and provide sufficient rigidity such that the pump and baseplate system meets the specified lateral vibration and critical speed criteria. Machine the soleplate topside to mate with a fully machined base of the discharge head.
- C. Provide vertical leveling screws spaced for stability on the outside perimeter of the soleplate. Locate the leveling screws adjacent to anchor bolts to minimize distortion during the process of installation. These screws shall be numerous enough to carry the weight of the baseplate, pump, and drive train components without excessive deflection, but in no case shall fewer than six screws be provided. Sandblast the grout contact surfaces of the soleplate in accordance with SSPC SP-6, and coat those surfaces with a primer compatible with epoxy grout.
- D. Provide anchor bolts of sufficient quantity and size to restrain any pump operating condition. The anchor bolts shall conform to ASTM A193, Grade 8M with nuts conforming to ASTM A194, Grade 8M.

- E. Provide a lateral dynamic finite element analysis (FEA) per ANSI/HI 9.6.4-2000, paragraph 9.6.4.2.2 and including the lateral analysis described in API 610 (tenth edition), Annex I. The analysis shall include the pump, the baseplate, the soleplate, the attachment of the baseplate and soleplate to the deck or floor, and the foundation. The analysis shall demonstrate that the pump baseplate and soleplate thicknesses and the associated hold-down bolts are sufficiently embedded in the concrete base and foundation to provide the degree of infinite mass and rigidity described in ANSI/HI 9.6.4-2000, paragraph 9.6.4.5.2.

## 2.17 SPARE PARTS

- A. Provide the following spare parts for each model of pump:

Quantity	Description
One	Bowl wear liner <u>or diffuser case</u>
Two sets	Bowl bearings
Two sets	Enclosing tube line bearings
One	Shaft coupling
Two	Mechanical seals (for pumps specified to have mechanical seals)

- B. Pack spare parts in wooden boxes; label with manufacturer's name and local representative's name, address, and telephone number; and attach list of materials contained therein.

## PART 3 - EXECUTION

### 3.01 SERVICE CONDITIONS

- A. Pump hydraulic performance characteristics shall be as shown below.
- B. Pump Tag Numbers: P-1 and P-2 (Main Pumps)

Location	Public Work Pump Station
Type of discharge	Surface
Service	Outdoors environmental temperature range of 32°F to 100°F
Elevation	10 feet above mean sea level
Relative humidity	0% to 100%
Fluid temperature range	50°F to 100°F

#### Pump Data

Capacity (gpm)	Pump Total Head (feet) <sup>(1)</sup>	Minimum Bowl Efficiency (%)
16,000	23	<u>82.81</u>
21,000 <sup>(2)</sup>	17	<u>89.85</u>
24,000	12.5	<u>84.73</u>
<sup>(1)</sup> Pump manufacturer to add for pump internal friction losses, such as in columns and discharge heads. <sup>(2)</sup> Design point.		

Liquid pumped	Storm Water
Maximum pump speed	505 rpm
Minimum submergence available	11 feet
Motor horsepower (maximum)	125
Motor type	4AEHMTV
Variable speed drive required per Section 262923	Yes
Minimum shaft diameter	2.44 inches
Maximum enclosing tube diameter	4.0 inches
Pump lubrication	Enclosed lineshaft
Minimum discharge connection size	36 inches
Minimum column size	36 inches
Minimum column wall thickness	0.375 inch
Discharge flange rating	Grooved End
Type of packing or seals per Section 432102	F
Bearing lubrication	Water
Suction strainer	No
Antivortex suction bell	Yes
Pump manufacturers and models	Peerless Hydro-Foil 36 MF-1; Fairbank Morse; <u>Patterson</u> ; or Engineer approved equal

C. Pump Tag Numbers: P-3 (Jockey Pump)

Location	Public Work Pump Station
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Type of discharge	Surface
Service	Outdoors environmental temperature range of 32°F to 100°F
Elevation	10 feet above mean sea level
Relative humidity	0% to 100%
Fluid temperature range	50°F to 100°F

### Pump Data

Capacity (gpm)	Pump Total Head (feet) <sup>(1)</sup>	Minimum Bowl Efficiency (%)
4,500	16	74
5,625 <sup>(2)</sup>	11	<del>80</del> 78
6,750	5	60
<sup>(1)</sup> Pump manufacturer to add for pump internal friction losses, such as in columns and discharge heads. <sup>(2)</sup> Design point.		

Liquid pumped	Storm Water
Maximum pump speed	1180 rpm
Minimum submergence available	11 feet
Motor horsepower (maximum)	25
Motor type (per Section 262650)	4AEHMTV
Variable speed drive required per Section 262923	Yes
Minimum shaft diameter	1.5 inches
Pump lubrication	Enclosed lineshaft
Minimum discharge connection size	16 inches
Minimum column size	16 inches
Minimum column wall thickness	0.375 inch
Discharge flange rating	Grooved End
Type of packing or seals per Section 432102	F
Bearing lubrication	Water
Suction strainer	No

Antivortex suction bell	Yes
Pump manufacturers and models	Peerless Hydro-Foil 18 PL; Fairbank Morse; <u>Patterson</u> ; or Engineer approved equal

### 3.02 WELDING PROCEDURE AND WELDER QUALIFICATIONS FOR PUMP CONSTRUCTION

Welding shall comply with the ASME Boiler and Pressure Vessel Code, Section IX. Provide full penetration welds. Open seam butt welds are not permitted.

### 3.03 CASTINGS FOR BOWLS, DIFFUSION VANES, SUCTION BELLS, AND IMPELLERS

- A. Surfaces of steel, stainless steel, iron, and bronze castings shall be free of adhering sand, scale, cracks, and hot tears as determined by visual examination. Other surface discontinuities shall meet the requirements of MSS SP-55-2006, Table 1 and Annex A. Mould-parting fins and remains of gates and risers shall be chipped, filed, or ground flush.
- B. If the visual examination reveals defects, repair the castings or provide new castings. Defects may be repaired by welding, provided the welder qualification and welding procedures are in accordance with the ASME Boiler and Pressure Vessel Code, Section IX. Provide post-weld heat treatment per the cited material specification or per the ASME Boiler and Pressure Vessel Code, Section VIII.
- C. Iron castings may be repaired by plugging within the limits of the cited material specification. The holes for plugs shall be carefully examined, using liquid penetrant, to determine that all defective material has been removed.

### 3.04 FACTORY PERFORMANCE TESTS

- A. Each pumping unit shall be subjected to an Owner (and/or Owner's representative) witnessed laboratory performance test; travel and accommodations shall be paid by Contractor. Conduct tests in accordance with the ASME PTC 8.2 or ANSI/HI 2.6, using the actual job driver. The performance test shall be equivalent to ANSI/HI 2.6.
- B. No motor overload above nameplate rating will be allowed at any flow up to 120% of the flow at the BEP.
- C. Deviations and fluctuations of test readings shall conform to ASME PTC 8.2, 1.11 (Type A) or ANSI/HI 2.6, paragraph 2.6.5.4.1.



- D. Measure flow by the “Capacity Measurement by Weight,” the “Capacity Measurement by Volume,” or the “Capacity Measurement by Venturi Meter, Nozzle, or Thin Plate Orifice” methods in ASME PTC 8.2 or ANSI/HI 2.6.
- E. For pumps in variable speed service, conduct a test manually adjusting the speed for each pump such that the pump output is 50%, 60%, 80%, and 100% of the maximum capacity specified..
- F. Perform tests and record data, including head, flow rate, speed, and power at a minimum of seven points. These points shall include shutoff, minimum flow, midway between minimum flow and design flow, design flow, 120% of design flow, and maximum flow.

~~G. Take vibration readings at design flow at each test speed.~~

~~H.G.~~ Performance tests shall be “full-scale.” The complete pump, including column and discharge elbow, shall be used. Measuring devices shall have been calibrated within the previous year.

~~H.H.~~ Conduct tests preferably at the same minimum submergence that will be realized in the field.

~~H.I.~~ Locate the pressure tap for head measurement not less than 10 pipe diameters downstream from the discharge elbow of the test pump.

~~K.J.~~ Should results of the full-scale tests indicate, in the opinion of the Owner’s Representative, that the pumps will fail to meet any of the specified requirements, the Owner’s Representative will notify the Contractor of such failure. The manufacturer shall thereupon, at no expense to the Owner, make such modifications and perform additional tests as may be necessary to comply with these specifications.

~~L.K.~~ Perform a hydrostatic test on discharge head and column per ANSI/HI 2.6, paragraph 2.6.4.

### 3.05 PAINTING AND COATING

- A. Line and coat interiors and exteriors of pump columns, shaft enclosing tube, discharge heads, bowl assemblies, and suction bells with fusion-bonded epoxy per Section 099761. Apply coating at factory. Do not coat stainless steel or bronze pieces.
- B. Color of coating shall be light gray.

### 3.06 SHIPMENT AND STORAGE

- A. Prepare equipment for shipment including blocking of the rotor when necessary. Identify blocked rotors by means of corrosion-resistant tags attached with stainless steel wire. The preparation shall make the equipment suitable for six months of outdoor storage from the time of shipment, with no disassembly required before operation, except for inspection of bearings and seals.

- B. Identify the equipment with item and serial numbers and project equipment tag numbers. Material shipped separately shall be identified with securely affixed, corrosion-resistant metal tags indicating the item and serial number and project equipment tag numbers of the equipment for which it is intended. In addition, ship crated equipment with duplicate packing lists, one inside and one on the outside of the shipping container.
- C. Pack and ship one copy of the manufacturer's standard installation instructions with the equipment. Provide the instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the jobsite and before start-up.
- D. Store and protect pumps per API 686 (first edition), Chapter 3, paragraphs 1.4 through 1.9, 1.15, 1.17, 1.20, and 1.21 and as described below.
- E. Coat exterior machined surfaces with a rust preventative.
- F. The interior of the equipment shall be clean and free from scale, welding spatter, and foreign objects.
- G. Provide flanged openings with metal closures at least 3/16-inch thick, with elastomer gaskets and at least four full-diameter bolts. Install closures at place of pump manufacture prior to shipping. For studded openings, use all the nuts needed for the intended service to secure closures.
- H. Provide threaded openings with steel caps or solid-shank steel plugs. Do not use nonmetallic (such as plastic) plugs or caps. Install plugs at place of pump manufacture prior to shipping.
- I. Clearly identify lifting points and lifting lugs on the equipment or equipment package. Identify the recommended lifting arrangement on boxed equipment.
- J. Wrap exposed shafts and shaft couplings with waterproof, moldable waxed cloth or volatile-corrosion-inhibitor paper. Seal the seams with oil-proof adhesive tape.
- K. If electric motors are stored or installed outside or in areas subject to temperatures below 40°F or are exposed to the weather prior to permanent installation, provide the manufacturer's recommended procedures for extended storage. Provide temporary covers over the motor electrical components. Provide temporary conduits, wiring, and electrical supply to space heaters. Inspect electrical contacts before start-up.

### 3.07 PUMP INSTALLATION

- A. Install equipment horizontal and vertical within 0.002" per foot tolerance and according to the manufacturer's written instructions and the contract documents. Confirm that pumps are set to meet the vertical alignment requirements established by the manufacturer.
- B. Check to ensure that pump baseplates or soleplates have been provided with vertical leveling screws, as opposed to shims or wedges. Do not use shims and wedges.

- C. Provide the manufacturer's recommended lubricants and operating fluids and verify that each piece of equipment contains the amount recommended by the manufacturer.
- D. Provide threaded caps for protection of nuts and bolt threads per Section 400500 on the bolts and nuts of the column pipe flanges and bowl flanges.
- E. Verify that the installed pump is fully self-supporting before bolting pipe flanges, so that no strain is imparted on the flanges, pipes, or pipe supports from the pump assembly. Adjust the position of the pump assembly so that the pump discharge flanges are plumb and aligned with the adjacent pipe flanges. Do not use temporary shims or jacking nuts for leveling, aligning, or supporting equipment. Provide final grouting of the pump assembly base according to Section 036000.
- F. When the alignment is correct, tighten the foundation bolts evenly but not too firmly. Then grout the unit to the foundation. The leveling pieces may be grouted in place. Do not tighten foundation bolts until the grout is hardened a minimum of 48 hours after pouring.
- G. Provide continuous protection of the installed equipment from the elements, dust, debris, paint spatter, or other conditions that will adversely affect the unit's operation until such time as the equipment is scheduled for start-up testing.
- H. Pump supplier's startup technician shall sign a Certificate of Proper Installation (COPI) after a site visit to confirm tolerances have been met after pump installation. Startup shall begin until contractor submits signed COPI form in to the engineer and owner for their approval to move forward with startup.

### 3.08 MOUNTING AND ALIGNMENT OF VERTICAL SOLID SHAFT DRIVERS

- A. Before mounting the driver on the discharge head/driver stand, check the register fit, if furnished, and the mounting face on the driver for acceptable tolerance on runout and squareness, respectively, using a dial indicator mounted on the driver shaft. See ANSI/NEMA MG-1. Next, check the squareness of the face of the driver coupling half, mounted on the shaft with a tight fit and seated against a split ring, using a dial indicator on a firm base.
- B. With the driver bolted to the discharge head, mount a dial indicator on the driver shaft above the coupling half and sweep the bore of the stuffing box. If excess runout exists, some adjustment can be made at the driver mounting fit and the stuffing box mounting fit. Before installing any additional coupling parts, check the driver for correct rotation, as given in the manufacturer's installation instructions.
- C. Next, mount the pump half coupling, shaft adjusting nut, and coupling spacer if applicable, and raise the impeller in accordance with the manufacturer's instructions. Then secure the coupling bolts. Make a final check of the shaft runout below the pump half coupling with a dial indicator. If the runout is within acceptable tolerances, check the tightness of the driver hold-down bolts. If dowels are used to secure the driver

location, then redoweling is required after disassembly/reassembly, since tolerance buildup in the multiple vertical joints results in alignment variation.

### 3.09 FIELD TESTING

- A. Bump motor to ensure that motor has been connected for proper rotation prior to coupling pump.
- B. Conduct vibration level tests with pumps operating at their rated capacity. Adjust or replace pumps that exceed the maximum vibration levels.
- C. Assure that each solenoid valve on the seal water supply line opens and closes when its respective pump starts and stops. Start and stop each pump twice and verify that the pump/solenoid interlock functions.
- D. Assure that each pressure switch will shut down the pump if potable water pressure is lost.
- E. Demonstrate that the pumping units, drivers, and control system meet the following requirements:
  1. The pumping units operate as specified without excessive noise, cavitation, vibration, and without overheating of the bearings.
  2. Automatic and manual controls function in accordance with the specified requirements.
  3. Drive equipment operates without being overloaded.

### 3.10 CONTRACT CLOSEOUT

Provide in accordance with Section 017000.

### 3.11 WARRANTY

The equipment shall be warranted for three (3) years commencing from date of substantial completion.

### 3.12 CERTIFICATION

Provide a written certification from the equipment manufacturer that each pumping system has been properly installed according to the Contract Documents and the manufacturer's recommendations, and that the equipment is operating normally. Make all necessary corrections and adjustments including but not limited to parts, labor, or freight at no additional cost to the Owner.

END OF SECTION

## SECTION 443331    MOTORIZED SELF-CLEANING STRAINERS

### PART 1 - GENERAL

#### 1.01    DESCRIPTION

This section includes materials and installation of pressurized, in-line, motorized, automatic self-cleaning strainers.

#### 1.02    SUBMITTALS

- A.    Submit shop drawings in accordance with the General Conditions, Section 013300, and the following.
- B.    Submit manufacturer's catalog data and descriptive literature for equipment. Submit dimensional and system layout drawings. Show materials of construction described by specification (such as AISI, ASTM, SAE, or CAA) and grade or type. Include connection points with orientation, coatings, appurtenances, anchor bolts, and tie-down equipment and hardware. Identify each strainer by tag number to which the catalog data and detail sheets pertain.
- C.    Submit electrical schematic and wiring diagrams showing wiring, controls, interlocks, and terminals. Label each terminal, showing which control or electrical power wire connects to which terminal. Submit manufacturer's catalog data for electrical equipment and enclosures.
- D.    Manufacturer's Services

Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

- 1.    Two labor days to check the installation and advise during testing, start-up, and adjustment of the equipment.
- 2.    One labor day to instruct the Owner's personnel in the operation and maintenance of the equipment.

### PART 2 - MATERIALS

#### 2.01    MANUFACTURERS

Strainer shall be as manufactured by Amiad Filtration Systems, S.P. Kinney, R.P. Adams, Tekleen, or Engineer pre-approved equal.

## 2.02 STRAINER DESIGN AND OPERATION

- A. The automatic strainer design shall be for the continuous straining of water with internal intermittent backwash that is performed while water continues to pass downstream. When backwash is required, a backwash valve opens and an internal mechanism is engaged to perform the backwashing function. During backwash, a reverse flow of a portion of the strained water dislodges and transports the collected solids to the backwash outlet. The volume and pressure of the reverse water flow required and the duration of backwashing per cycle shall be clearly documented in order to determine a total backwash water quantity per cycle. The internal mechanism shall be driven by an electrical gear motor which slowly rotates a cleaning arm, a drum, or suction scanning device to backwash the entire straining tube, media, or screen.
- B. A differential pressure switch and/or backwash initiation timer shall signal the locally-mounted control panel to initiate the backwash cycle. The differential switch shall also provide visual indication of strainer condition, or else inlet and discharge gauges shall be included to provide a visual indication of strainer condition. The local control panel shall also provide a means of manually initiating a backwash cycle for test and maintenance purposes.

## 2.03 MATERIALS OF CONSTRUCTION

- A. Materials for the filter design, and shop fabrication and inspection, shall be selected such that the maximum allowable working pressure shall be at least 100 psi. Perform hydrostatic test in shop to ensure filter body meets this criteria. Test pressure shall be 130% of the design pressure defined in the performance data for this application, or the MAWP defined above, whichever is greater.
- B. Provide one 8-inch (minimum) flanged access hole in the side of the filter to allow for removal of large debris during routine maintenance. If alternative methods of large solids removal are utilized, manufacturer shall document the method by which these solids can be removed.
- C. Materials of construction shall be as follows:

Component	Material
Body	Carbon steel
Screen or Strainer Media	Type 316L stainless steel
Cleaning Mechanism	Type 316L stainless steel
Shaft	Type 316 stainless steel
Seals	Synthetic Rubber, Teflon

## 2.04 BACKWASH

- A. As the flushing valve opens, a reversal of flow shall occur, flushing the suspended particles from the screen. This reversal of flow shall be caused only by a pressure differential between the interior of the strainer body and atmosphere.
- B. The flow reversal shall be focused on a limited portion of the straining media such that the entire surface area of the straining media is not backwashing at one time. Strainer design shall include features which increase the effectiveness of the flow reversal on the focused backwash. These features shall be documented and highlighted in the equipment submittal.
- C. Strainer sizing shall be such that normal intermittent backwashing shall occur at the manufacturer's recommended intervals, but shall not be designed for continuous backwashing under normal conditions.

## 2.05 INLET AND OUTLET FLANGES

Strainer inlet and outlet flanges shall conform to ASME B16.1 (Class 125) or B16.5 (Class 150). Provide flat-face flanges.

## 2.06 DRAIN OPENINGS

Provide a drain outlet on both the "clean" and "dirty" sides of the screen.

## 2.07 DRIVE GEAR

- A. Provide manufacturer's standard worm-style reducing gear drive system. Motor and drive shall be provided as a matched unit. All strainer units of the same size shall utilize the same manufacturer and size of gear drive system and motor.
- B. Do not use shear pin protection for overloading of the motor or reducing gear assembly.

## 2.08 BOLTS, NUTS, AND GASKETS FOR FLANGES

Fasteners shall be shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M, Class 2, for bolts and ASTM A194, Grade 8M, for nuts.

## 2.09 CONTROL PANEL AND CONTROLS

- A. Control panel and controls shall be in accordance with Section 409510. The strainer supplier shall furnish a local control panel complete with all hand switches and local indicators. If strainer supplier's standard control panel materially meets the intent of the above specification section, then differences shall be identified and highlighted during submittal for review by the Engineer. If strainer supplier's standard control panel does

not materially comply with the above named specification section, then a control panel that meets the above specification section shall be supplied.

- B. The strainer supplier shall be responsible for a complete working filter system that can be operated automatically and manually from the local control panel. Strainer supplier shall demonstrate that they can provide ongoing support for all components included in the complete working filter system, including the local control panel, backwash valve, and strainer instrumentation (such as switches and gauges).
- C. The control panel supplied as part of a complete control system for the strainer system shall include internal wiring, circuit breakers, motor starters, overload relays, switches, and controls. The strainer system shall come from the manufacturer completely wired and ready for installation, subject only to individual connections between the local control panel and the strainer equipment. Sufficient termination means such as terminal boxes or junction boxes shall be provided on the strainer equipment to facilitate electrical connection between the local control panel and the strainer equipment.
- D. Mount all electrical control components into one local control panel for both strainers. Local control panel enclosure shall be constructed in conformance with NEMA Type 4X electrical enclosures unless indicated otherwise. Fabricate enclosure of Type 316 stainless steel having a minimum thickness of 0.075 inch (14 gauge). Operator interface may be provided on the enclosure door or on an internal deadfront door. Alarm and indicator lights shall be visible on or from the outside of the enclosure door.
- E. Control panel logic shall be relay based, using appropriate mounting techniques for relays, timers, and other devices (such as DIN rail and sockets). PLC's and proprietary microprocessor-based controllers shall not be utilized. Provide two dry-contacts for a general fault signal (one for each strainer).

## PART 3 - EXECUTION

### 3.01 SERVICE CONDITIONS

- A. Strainer performance conditions and design data shall be as shown below.
- B. Equipment Tag Number: FLT-1 and FLT-2

Location	Public Works Pump Station
Service	Outdoors environmental temperature range of 32°F to 100°F
Elevation	10 feet above mean sea level
Relative humidity	0% to 100%
Fluid temperature range	50°F to 100°F
Strainer Inlet/Outlet Size	10 inch



Screen Size	200 micron
Motor Horsepower (Minimum)	0.5
Motor Type per Section 262650	4AEM
Motor Voltage	460, 3 phase
Design Pressure	100 psig
Water Rate of Flow, Minimum/Maximum	1,000 to 1,340 gpm
Maximum Pressure Loss at Maximum Flow	<1 psi (clean screen) 7 psi (triggers backwash)
Manufacturers and Models	Amiad EBS 10000 , S.P. Kinney, R.P. Adams, or equal

### 3.02 FABRICATION, ASSEMBLY, AND ERECTION OF AUTOMATIC STRAINERS – GENERAL REQUIREMENTS

- A. Strainers shall come from the factory preassembled and tested, ready for installation by the Contractor. Any items shipped loose that must be field-mounted (such as the gear drive system) shall require only standard tools and construction installation techniques. Assembly instructions, drawings, and details shall be included with the shipment.
- B. Any proprietary or special installation requirements unique to the strainer equipment shall be performed by the equipment manufacturer's representative under the supervision of the Contractor, and shall be coordinated with the Contractor.

### 3.03 SHOP HYDROSTATIC PRESSURE TESTING

- A. After completion of fabrication, pressure test each strainer as outlined in paragraph 2.03.A above. The duration of the test shall be at least one hour. When subjected to the above hydrostatic test pressure, the strainer shall show no leaks.
- B. Repair any leaks or other defects in strainers, after which the entire strainer shall again be tested until it shows no leaks or other defects.
- C. Provide documentation from the manufacturer that certifies that each strainer unit passed the hydrostatic test.

### 3.04 PAINTING AND COATING

- A. Line the interior of carbon steel bodies per Section 099000, System No. 7.
- B. Coat the exterior of carbon steel bodies per Section 099000, System No. 10.
- C. Alternatively, line and coat bodies with fusion-bonded epoxy per Section 099761.

### 3.05 SHIPMENT AND STORAGE

- A. Prepare equipment for shipment including blocking of the shaft or drum when necessary. Identify blocked shafts or drums by means of corrosion-resistant tags attached with stainless steel wire. The preparation shall make the equipment suitable for six months of outdoor storage from the time of shipment, with no disassembly required before operation, except for inspection of bearings and seals.
- B. Identify the equipment with item and serial numbers and project equipment tag numbers. Material shipped separately shall be identified with securely affixed, corrosion-resistant metal tags indicating the item and serial number and project equipment tag numbers of the equipment for which it is intended. In addition, ship crated equipment with duplicate packing lists, one inside and one on the outside of the shipping container.
- C. Pack and ship one copy of the manufacturer's standard installation instructions with the equipment. Provide the instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the jobsite and before start-up.
- D. Coat exterior machined surfaces with a rust preventative.
- E. The interior of the equipment shall be clean and free from scale, welding spatter, and foreign objects.
- F. Provide exposed flanged openings (on uncrated or open-crated equipment) with metal closures at least 3/16-inch thick, with elastomer gaskets and at least four full-diameter bolts. Provide closures at the place of manufacture prior to shipping. For studded openings, use all the nuts needed for the intended service to secure closures.
- G. Provide exposed threaded openings (on uncrated or open-crated equipment) with steel caps or solid-shank steel plugs. Do not use nonmetallic (such as plastic) plugs or caps. Provide caps or plugs at the place of manufacture prior to shipping.
- H. Clearly identify lifting points and lifting lugs on the equipment or equipment package. Identify the recommended lifting arrangement on boxed equipment.
- I. Wrap exposed ferrous shafts and shaft couplings with waterproof, moldable waxed cloth or volatile-corrosion-inhibitor paper. Seal the seams with oil-proof adhesive tape.
- J. If electric motors are stored or installed outside or in areas subject to temperatures below 40°F or are exposed to the weather prior to permanent installation, provide the manufacturer's recommended procedures for extended storage. Provide temporary covers over the motor electrical components. Provide temporary conduits, wiring, and electrical supply to space heaters. Inspect electrical contacts before start-up.

### 3.06 EQUIPMENT INSTALLATION

- A. Do not install unsupported piping and conduits on the strainers. Install piping and conduit hangers and supports as shown in the drawings to minimize piping-applied strain on the equipment.
- B. Ensure that fluid passages of strainers are free from dirt, foreign objects, and other contamination.
- C. Do not use duct tape and plastic for covering the ends of pipe flanges. Use a solid metal cover with rubber gasket to cover flanged openings during installation. These metal covers shall remain in place until the piping is connected to the equipment.
- D. Verify that the installed equipment is fully self-supporting before bolting pipe flanges, so that no strain is imparted on the flanges, pipes, or pipe supports from the equipment. Adjust the position of the equipment so that the flanges are plumb and aligned with the adjacent pipe flanges. Do not use temporary shims or wedges for leveling, aligning, or supporting equipment.
- E. Provide continuous protection of the equipment from the elements, dust, debris, paint spatter, or other conditions that will adversely affect the unit's operation until such time as the equipment is scheduled for start-up testing.
- F. Provide the manufacturer's recommended lubricants in the drive units, bearings, and other mechanical equipment.

### 3.07 FIELD TESTING

- A. Operate each motorized strainer for 24 hours during which time no repairs shall be required. Verify that strainer drive mechanism functions without binding or sticking. Verify that the drum rotates smoothly without binding or vibrating.
- B. Measure the amperage drawn by each motor. The amperage shall not exceed the rated amperage stated on the motor data plate. Repair, replace, or realign motors and drives if the motors or drives bind, stick, or overload.
- C. Actuate the backwash system at least three times during the test period. Verify that the backwash mechanism backwashes the straining media completely through each cycle. Verify that the backwash piping system does not clog or overflow during repeated backwashes.

### 3.08 LABELING AND MARKING

Provide a tag for each unit bearing the tag number. See Section 400775.

### 3.01 CONTRACT CLOSEOUT

Provide in accordance with Section 017000.

### 3.02 WARRANTY

The equipment shall be warranted for three (3) years commencing from date of substantial completion.

### 3.03 CERTIFICATION

Provide a written certification from the equipment manufacturer that each strainer system has been properly installed according to the Contract Documents and the manufacturer's recommendations, and that the equipment is operating normally. Make all necessary corrections and adjustments including but not limited to parts, labor, or freight at no additional cost to the Owner.

END OF SECTION

**Attachment B**

**City of Naples**  
**NON-MANDATORY PRE-BID**  
**049-13 Public Works Pump Station Improvements - ITB**  
**October 9, 2013 10:00 AM Local Time**

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City of Naples  
NON-MANDATORY PRE-BID  
049-13 Public Works Pump Station Improvements - ITB  
October 9, 2013 10:00 AM Local Time

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**City of Naples**  
**NON-MANDATORY PRE-BID**  
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**October 9, 2013 10:00 AM Local Time**

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**City of Naples  
NON-MANDATORY PRE-BID  
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October 9, 2013 10:00 AM Local Time**

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