Standard Specifications for a Lift Station

NOT FOR CONSTRUCTION

San Miguel, California

December 2024

Prepared for: San Miguel Community Services District

STANDARD SPECIFICATIONS

LIFT STATION

Contents

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LIFT STATION

PART 1 LIFT STATIONS

1.01 OVERVIEW

A. GENERAL

1. This specification includes submersible pumps, motors, precast concrete wet well, precast concrete vault, manhole, piping, and related materials and equipment specified herein.
2. If the Engineer of Record determines, and the District agrees, that a lift station is required for a project, the lift station shall meet the following minimum design criteria, and shall be subject to preapproval by the District. The District discourages construction of new sewage lift stations. Lift stations will only be allowed under certain specific circumstances. The items discussed in this section and depicted in the Standard Details are minimum requirements; the District may have additional requirements depending on the specific application.
3. Each lift station shall be located outside of roadway right-of-ways. Each lift station shall be located on a separate lot dedicated to the District for this purpose.
4. Each lift station shall be sized to store (in combination with the supported collection system) a minimum of 3 hours of Peak flow.

B. QUALITY ASSURANCE

1. Pumping equipment shall be the product of a manufacturer having at least 5 years' experience in the manufacturing and installation of such equipment.
2. All pumping equipment furnished under this section shall be of a design and manufacture that has been used in similar applications.
3. Certified Pump Shop Test.
    a. Perform at factory before shipment.
    b. Operate pump to check for alignment, faulty equipment, piping leaks, seals, proper wiring and overall operation.
4. Pump Warranty
    a. The Pump Manufacturer shall warrant to the Owner the pumps and specified well station components against defects in material and workmanship for a period of 2 years from date of project acceptance. This warranty shall cover the cost of labor and materials, excluding removal and reinstallation costs, required to correct any warrantable defect.
5. Concrete work shall be performed in accordance with American Concrete Institute
6. Perform Work according to San Miguel Community Services District Standards.

C. SUBMITTALS

1. Pump Equipment.
    a. Submit the following information for the pump:
        i. Pump curve showing total dynamic head, flow rate, brake horsepower, shutoff head, net positive suction head, variable speed, and efficiency.
        ii. Motor data, including the manufacturer; the minimum guaranteed efficiency and power factor at full load, 3/4 load, and 1/2 load; locked rotor current in amps; full load current in amps; the motor speed in rpm; and mounting details.

b. Submit manufacturer's certified performance curves for review at least two weeks prior to shipping the units from the factory.

c. Certified Shop Test Reports.

i. Submit manufacturer's sample form for reporting performance shop test results at least 30 days before the tests. The test should contain the data presented in the sample form in ANSI/HI 14.6.

ii. Submit certified copies of shop test report at least 10 days before shipping equipment.

iii. Reports shall include:

1) Test log.

2) Description of test piping, equipment and setup.

3) Test procedure.

4) Certified performance curve.

5) Plot curve to be easily read at scales consistent with performance requirements.

d. Shop Drawings:

i. Product technical data showing compliance with specifications.

ii. Submit drawings showing fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering performance and materials of construction, power drive assembly, parts, devices, and other accessories.

iii. Submit dimensional drawings, showing materials of construction by ASTM reference and grade. Show linings and coatings.

iv. Construction details and materials of pump. Outline dimensions and weights.

v. Certified performance curves.

e. Operation and Maintenance Manuals, including detailed instructions on installation requirements, including storage and handling procedures.

f. NSF 61 certification of pump and motor.

D. WARRANTY

1. Manufacturer shall guarantee equipment against defects in material and workmanship for a period of two years from date of project acceptance.

1.02 PUMPING UNIT

A. GENERAL

1. Section includes submersible well pump(s), motor(s), power cable, and related materials and equipment specified herein.

2. Duplex pump system shall be designed and constructed to satisfactorily meet the site specific conditions and requirements. Engineer of Record shall provide the following information:

a. Elevation

b. Minimum Motor Efficiency (at 100% load)

c. Motor Horsepower (Minimum)

d. Maximum Pump Operating Speed

e. Nominal Discharge Diameter

f. Motor Starter Type

g. Motor Voltage/Phase/Frequency

h. Rated Current, Amperes (At 100% Load)

i. Pump Data:

j. Head, flowrate, and minimum efficiency at the shutoff point, the rated discharge, and two other points.

3. The submersible pump and motor shall be rated for continuous duty and shall be capable of pumping the specified flow range without surging, cavitation, or vibration.

4. The pump shall not overload the motor for any point on the maximum speed pump performance characteristic curve throughout the entire pump operating range. The service factor for the motor shall not be applied when sizing the motor.

5. To ensure vibration-free operation, all rotative components of the pumping unit shall be statically and dynamically balanced. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at all operating speeds is avoided. In any case, the amplitude of vibration as measured at any point on the pumping unit shall not exceed the limits set forth in the latest edition of the Hydraulic Institute Standards.

6. All parts of the pump shall be designed to withstand the stresses that will be imposed upon them during their handling, shipping, installation, and operation.

7. The completed unit, when installed and operating, shall be free of cavitation, vibration, noise, and oil or water leaks over the range of operation.

B. EQUIPMENT AND MATERIALS

1. Submersible Pump Design:

a. Pumps shall be of the non-clog, single-suction, centrifugal type, rated for continuous duty in a wet-pit environment, and shall be capable of pumping raw, unscreened sewage with fibrous material, and be capable of passing a minimum 3-inch solid (unless otherwise specified) at the specified flow ranges with the specified sump geometry and operating water levels without clogging, surging, cavitation, vibration, subsurface vortexing, or excessive surface vortexing. Provide a complete duplex pump system.

b. The pump, with its appurtenances and electric cable, shall be capable of continuous submergence under water without loss of watertight integrity to a minimum depth of 65 feet.

c. Pump curve shall be continuously rising and shall be free of dips and valleys from the design point to the shutoff head. 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 5 feet less than the minimum NPSH available at all points on the pump curve up to 120% of the rated discharge.

e. Design the pump and its components to operate continuously over a flow range of 70% to 120% of the rated discharge.

f. Manufacturers:

i. Hidrostal

ii. Flygyt

iii. Or Approved Equal.

2. Discharge Connections:

a. The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection or service. Sealing of the pumping unit to the discharge elbow shall be accomplished by a

simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. The entire weight of the pump unit shall be guided by no fewer than two stainless steel guide bars or stainless steel guide wire pressed tightly against the discharge connection elbow. No portion of pump shall bear directly on the floor of the sump.

3. Vibration:
    a. Impellers shall be balanced to Hydraulic Institute Standards (ANSI/HI 1.1-1.5).
4. Volute Casing:
    a. Casing shall be accurately machined to fit the mechanical seal and suction cover assemblies. Volute casing shall be Cast Iron. The volute shall have a tangential discharge nozzle. Provide a 3/4-inch drain with plug in the volute.
5. Impeller:
    a. Impeller shall be screw-centrifugal type and shall be cast in one piece and shall be statically and dynamically balanced, double-shrouded thrulet with smooth water passage to prevent clogging by stringy or fibrous materials and other matter found in normal sewage applications.
    b. The impeller shall be 450 Brinell hardness hi-chrome iron (ASTM A 532-CLIII, Type A1).
    c. The impeller flange or impeller shall contain a spiral groove on the rear face so that any solids in the sewage are discharged from the space between the backplate and the rear of the impeller.
    d. The geometry of the impeller vane and suction piece shall be conical, so any axial adjustment of the impeller will cause clearance between the impeller and suction piece to change uniformly along the entire length of the impeller.
6. Shafts:
    a. Shaft shall be Steel AISI 1045.
7. Pump Seal
    a. Provide each pump with a tandem mechanical shaft seal system. The upper of the tandem set of seals shall operate in an oil chamber located just below the stator housing. The upper set shall use carbon/ceramic faces. The lower of the tandem set of seals shall function as the primary barrier between the pumped liquid and the stator housing. This set shall consist of a stationary ring and a positively driven rotating ring, both of which shall be tungsten carbide and silicon carbide. Seals with both faces of similar materials, or seals with bonded, soldered or converted faces surfaces are not acceptable.
    b. Both the inner and outer seals shall be interchangeable with standard off-the-shelf, inch-size, John Crane mechanical seals (or similar).
    c. Each interface shall be held in contact by its own spring system supplemented by external liquid pressures. The seals shall require neither maintenance nor adjustment but shall be easily inspected and replaceable.
    d. Shaft seals without positively driven rotating members or conventional double mechanical seals with a common single or double spring acting between the upper and lower units requiring a substantial pressure differential to offset external pressure and effect sealing shall not be considered acceptable or equal to the dual independent seal system specified.
    e. The shaft sealing system shall be capable of operating submerged to depths of or pressures equivalent to a minimum of 65 feet. No seal damage shall result from operating the pumping unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication.
8. Oil Chamber:

a. Provide each pump with an oil chamber for the shaft sealing system. Design the oil chamber to assure that air is left in the oil chamber to absorb the expansion of the oil due to temperature variations. The drain and inspection plug, with positive anti-leak seal, shall be easily accessible from the outside.

9. Bearings:

   a. Each pump shaft shall rotate on two permanently lubricated bearings. The upper bearing, providing for radial thrust, shall be a single row, roller bearing. The lower bearing shall consist of one double row or two single row angular contact bearing(s) for combined axial and radial loads.

   b. Pump bearings shall be of the antifriction type designed to give 40,000 hours minimum life by L-10 calculations at maximum speed and operating load in continuous operation.

10. Cable Entry:

    a. Motor cable-entry sealing assembly shall consist of the following five components to ensure a positive, redundantly watertight seal:

       i. The sealing components shall be mechanically isolated from cable strains by a two-piece restraining clamp, which will securely grip the cable above the moisture-sealing components and bear any mechanical forces applied to the cable.

       ii. The cable moisture seal shall consist of an elastomer grommet, prevented from extruding past the cable by stainless-steel retaining washers on either side. The grommet shall be compressed tightly against the cable outside diameter (and the entry assembly inner diameter) by a screwed follower gland.

       iii. Each individual conductor shall be interrupted by a solid-copper isolation dam to prevent wicking of moisture through the conductor strands.

       iv. The cable insulation shall be sealed by an epoxy poured into the cable entry and totally encapsulating the stripped-back insulation and the individual copper dams. This poured epoxy seal shall also function as a redundant seal for the cable outside diameter.

       v. The cable free end shall be sealed from moisture-entry during shipping, storage, and prior to connection to the control panel by a plastic sleeve securely clamped over the cable end.

11. Mating Surfaces:

    a. Machine and fit mating surfaces of major parts with nitrile O-rings where watertight sealing is required. Machining and fitting shall be such that sealing is accomplished by automatic compression in two planes and O-ring contact made on four surfaces, without the requirement of a specific torque limit. Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered adequate or equal.

    b. Tolerances of parts shall be such that they allow replacement of any part without additional machining required to ensure sealing as described above. No secondary sealing compounds, greases, or other devices shall be used.

12. Cooling System:

    a. The motor cooling system shall consist of ambient cooling by radiation and convection to the surrounding space and conduction through the pump volute to the pumped fluid.

13. Electric Motors:

    a. Each pump shall be driven by a vertical, submersible squirrel cage induction motor, shell type design, housed in an air-filled, watertight chamber. The stator

winding and stator leads shall be insulated with moisture-resistant Class F insulation which will resist a temperature of 155°C, 40°C ambient plus 115°C rise, and designed for continuous duty, capable of sustaining a minimum of 10 starts per hour.

b. The stator shall be coated in Class F varnish and shall be shrink-fitted into the stator housing. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing shall be rejected.

c. The motor shall be sized to be non-overloading when the pump is operated at any point on the pump performance characteristic curve drawn through the design point and shall have a minimum service factor of 1.10. Motor service factor shall not be used in satisfying pumping requirement.

d. Equip the stator with thermal sensors embedded in the end coils of the stator winding to monitor stator temperature. Sensors are to be wired in series and open a protective circuit if winding temperatures exceed rated operating temperatures. Sensors must automatically reset when winding temperatures has cooled to a safe operating temperature.

e. Connect sensors and thermistor relays to the pump motor starter in such a manner that their signal can actuate an alarm or provide for immediate shutdown or both.

f. Each pump motor shall have a sensor to monitor moisture in the stator cavity. Provide a conductivity-sensitive relay for installation in the pump motor starter to trip an alarm if moisture content indicates a failure of the outer mechanical seal.

g. Listed driver horsepower is the minimum to be supplied.

   i. Increase driver horsepower if required to prevent driver overload while operating at any point of the supplied pump operating head-flow curve including runout.

   ii. When scheduled driver is a motor, increase motor horsepower if required to prevent operation in the service factor.

   iii. Make all structural, mechanical, and electrical changes required to accommodate increased horsepower.

h. Revolutions per minute: As specified in this Section.

i. Explosion proof motor that is UL or FM listed for NEC Class 1, Division 1, Groups C and D service, whether submerged or unsubmerged.

14. Motor Power and Control Cables:

    a. Pump motor power cables installed shall be made of a Hypalon or Protolon synthetic rubber-jacketed Type SPC multiconductor cable, suitable for submersible pump applications and heavy mechanical stresses.

       i. The power cable shall also be sized according to NEC and ICEA standards and also meet with P-MSHA approval or equivalent.

    b. Use a separate Hypalon or Protolon synthetic rubber-jacketed, Type SPC cable for temperature and moisture pilot protection signals.

    c. Cable Length: The minimum length of the cable shall be equal to wet well depth plus distance from wet well to Pump Power Panel plus 5 feet.

    d. All power and control conductors shall terminate at terminal blocks in the local control panel or junction box.

    e. Provide stainless steel cable and stainless steel wire braid sleeve to support power cable from underside of wet well roof slab or access frame.

15. Control/Protection Module:

a. Each pump shall be supplied with its own self-contained control/protection module to provide for the direct connection to all internal pump monitoring devices, including:

   i. Thermal protection: Provide automatic reset motor stator temperature detectors, 1 switch in each phase winding. If any detector is activated, the sensor shall activate an alarm and shut down the motor. The thermal detectors shall activate when the stator temperature exceeds 125 degrees Celsius.

   ii. Moisture detection: as indicated above.

b. The module shall signal an alarm condition if any of the internal monitoring devices is activated.

c. Install module in manufacturer supplied Pump Power Panel.

   i. Each pump shall contain its own protection module.

16. Materials of Construction

a. Materials of construction shall be as listed below:

Component	Material	Specification
Casing, volute, suction and discharge elbows	Closed-grained cast iron	ASTM A48, Class 30 (minimum)
Impeller and liner	450 Brinell hardness hi-chrome iron	ASTM A532, Class 3, Type A1
Shaft	Stainless Steel	AISI 1045

17. Factory Hydrostatic Testing:

a. Hydrostatically test casing and volute for 10 minutes minimum with water at one and one-half times the maximum design operating pressure.

18. Anchor Bolts, Nuts, and Washers:

a. Anchor bolts, nuts, and washers for pumps installed in wet wells shall be 316 stainless steel.

19. Spare Parts:

a. Provide the following spare parts for each model or size of pump:

Quantity	Description
1	Suction liner or wear rings for impeller and volute – whichever applies to the supplied pump unit.
2	Complete set of seals, primary and secondary
1	Sets bearing
2	Complete set of O-rings or gaskets - whichever applies to the supplied pump unit.
1	Impeller
1	Volute

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

20. Stainless steel nameplate mounted on casing. Nameplate to include:

a. Manufacturer.

b. Model number.

c. Serial number.

d. Rated head, FT.

e. Rated flow, gpm.

f. Pump speed.

C. EXECUTION

1. Factory Performance Testing

a. Each pumping unit shall be subjected to a laboratory performance test using the actual job driver. These tests shall be conducted at the manufacturer's plant prior to shipment. Conduct tests in accordance with ANSI/HI 11.6-2001. Include the hydrostatic test and vibration test. Certified test reports, in triplicate, shall be submitted to the OWNER.

b. No motor overload above nameplate rating will be allowed.

c. Deviations and fluctuations of test readings shall conform to ASME PTC 8.2, Table 2 or ANSI/HI 11.6, Acceptance Level "A."

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.

2. Paints and Coatings

a. Factory coat external surfaces of pump and motor with Epoxoline II Series N69 two part polyamidoamine epoxy coating system. Apply the coating system per coating manufacturer's instruction at the place of pump manufacture.

b. No internal coatings are to be applied to the hi-chrome abrasion resistant Impeller and liner.

3. Installation

a. Tensioning System

i. Attach cable bracket to the lip of the equipment opening. Use cast-in stainless steel bolts.

ii. Attach the flange discharge elbow to the floor of the wet well using cast-in stainless steel anchor bolts.

iii. Install the guide rail per manufacturer's recommendations.

iv. Provide and attach the stainless steel lift chain/cable combination.

b. A complete set of manufacturer's instructions covering storage, installation, operation, lubrication, and maintenance shall be available at the jobsite no later than the date other pumps are received.

c. Install per manufacturer's instructions.

d. CONTRACTOR to provide all new fittings, piping, conduit, wiring to make a complete installation.

e. Following completion of the installation and satisfactory start-up of the equipment, the CONTRACTOR shall, in the presence of the pump manufacturer's representative and the OWNER, operate the pump unit to check rotation and verify head/capacity.

i. The operation shall be free of vibration, noise, or cavitation.

ii. The pump unit's vibration levels shall be measured and recorded in opposing 90 degree planes for the full potential range of the pump unit's variable speed operation.

iii. Vibration amplitudes as measured at any point within the potential operating range of the pumping unit shall not exceed the limits set forth in the latest edition of the Hydraulic Institute Standards (HIS).

iv. All performance criteria for the pump unit shall be documented by obtaining concurrent readings showing motor voltage and amperage, pump discharge head, and pump discharge rate. Each power lead to the motor shall be checked for current balance and reported in writing to the OWNER.

v. In the event any of the pumping equipment fails to meet the above test requirements, it shall be modified or replaced and retested in accordance with the requirements of these specifications. If measured flows at the above tabulated pump heads are more than 5% below the flows obtained on the laboratory or factory test, adjust the impeller or provide new impeller or otherwise repair or replace the pumps or calibrate meters or pressure gauges.

vi. Assure that in the automatic mode each pump responds to its water level signal. Assure that each pump operates at a steady rate (±5% of set point) at any given water level.

f. CONTRACTOR to provide services of equipment manufacturer's field service representative(s) to:

i. Inspect pump equipment and motors.

ii. Supervise pre-start adjustments and installation checks.

iii. Conduct initial startup of equipment and perform operational checks as required to fully demonstrate pump function, and leak and temperature monitoring and protection.

iv. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by OWNER.

v. Instruct OWNER personnel for 4 hours at jobsite on operation and maintenance.

4. Field Testing

a. Bump motor to ensure that motor has been connected for proper rotation.

b. Perform field tests on each pump. Measure flows to confirm pumps operate at or above the design point.

c. If the measured flows at the above tabulated pump heads are more than 5% below the flows obtained on the laboratory or factory test, adjust the impeller or provide new impeller or otherwise repair or replace the pumps or calibrate meters or pressure gauges.

d. Assure that in the automatic mode each pump responds to its water level signal. Assure that each pump operates at a steady rate (±5% of set point) at any given water level.

e. Demonstrate that the pumping units, motors, and control system meet the following requirements:

i. The pumping units operate as specified without excessive noise, cavitation, vibration, and without overheating of the bearings.

ii. Automatic and manual controls function in accordance with the specified requirements.

iii. Drive equipment operates without being overloaded.

D. PERFORMANCE AND DESIGN CRITERIA

1. Pumps shall be capable of delivering the average daily flow in an efficient and economical manner.
2. The pump(s) should be designed to operate between 70% and 120% of the best efficiency point.
3. The lift station capacity shall be sufficient to meet peak wet weather flow with redundancy.

1.03 PRECAST CONCRETE WET WELL

A. GENERAL

1. This section pertains to the wet well. The wet well shall be precast, circular, and constructed of polymer concrete.

B. EQUIPMENT AND MATERIALS

1. Precast Concrete Wet Well
    a. Precast circular polymer concrete wet wells shall comply with ASTM C478. Design wet well to prevent flotation under the conditions of empty wet well and groundwater level from the wet well base to finish grade.
    b. Minimum wall thickness shall be 8-inches.
    c. Provide riser sections with bell and spigot/ship-lap design seamed with butyl mastic and/or rubber gaskets per ASTM C990.
    d. Precast top sections shall be flat slab. Provide an opening in the top section and install operation and maintenance hatch.
    e. Provide precast, reinforced base with a rubber gasket connection to the lower wet well section.
    f. Manufacturers
        i. Armorock, LLC.
        ii. Or Approved Equal.
2. Steps or Rungs
    a. Cast wet wells without steps or ladder rungs.
3. Design of Top Section and Precast Base
    a. Design loads shall be H-20 traffic rated.
    b. Polymer Concrete wet well sections, monolithic base components and related components shall be designed to conform to ASTM C478 as modified for polymer concrete.
        i. Polymer Concrete Mix Design shall consist of thermosetting resin, sand and aggregate. No Portland cement shall be allowed as part of the mix design matrix. All sand and aggregate shall be inert in an acidic environment.
        ii. Reinforcement – Shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 as applicable for polymer concrete design.
        iii. Thermosetting Resin – The resin shall have a minimum deflection temperature of 158° F when tested at 264 psi (1.820mPa) following Test Method D648. The resin content shall not be less than 7% of the weight of the sample as determined by Test Method D2584. Resin selection shall be suitable for applications in the corrosive conditions to which the polymer concrete wet well will be exposed.

iv. Each polymer concrete wet well component shall be free of all defects, including indentations, cracks, foreign inclusions and resin starved areas that, due to their nature and degree or extent, detrimentally affect the strength and serviceability of the component part.

v. Grouting: All materials needed for grouting and patching will be a polyester mortar compound provided by the manufacturer or an approved equal by the manufacturer.

c. Wet well shall be designed to resist uplift from groundwater.

4. Frames, Covers, and Access Hatches

a. Frames, covers and access hatches shall be H-20 traffic rated. The cover and access hatch shall seat firmly into the frame without rocking. Cast the frame into the top slab.

b. Frames, covers and access hatches shall be matchmarked in sets before shipping to the site.

c. Wet well access hatches shall have identification plates riveted or otherwise securely fastened to each respective door with the pumps labeled in 2-inch-tall letters stamped or otherwise indelibly marked.

d. Access hatches according to this specification.

5. Wet Well Section or Riser Joints

a. Joints shall be of the rubber-gasket type, requiring no field-applied sealant. Gaskets and joints shall comply with ASTM C443.

6. Pipe Connections for Inlet Piping

a. Connector shall provide a flexible, watertight seal between the pipe and polymer concrete structure. The connector shall assure that a seal is made between:

i. The connector and the structure wall by casting the connector integrally with the structure wall during the manufacturing process in a manner that it will not pull out during pipe coupling. The connector shall also be capable of being cast into a round structure by curving the connector in a manner that allows it to remain centrally located within the structure wall and perpendicular to the pipe. This configuration will result in no loss of seal or deflection of pipe entering a concrete structure.

ii. The seal between the connector and the pipe shall be made by the compression of the connector between the outside circumference of the factory installed smooth oversleeve of a corrugated pipe or the smooth surface of a traditional pipe and the interior hole opening of the structure. The connector shall be the only component to affect the seal between the pipe and structure.

b. The connector shall be made from materials that conform to ASTM C923.

c. The connector shall be sized specifically for the type of pipe being used and shall be installed in accordance with the recommendations of the manufacturer.

d. Manufacturers:

i. Kor-N-Seal 106/406 series

ii. Or approved equal

7. Wall Penetrations

a. Provide wall penetration.

i. Penetration seals shall use a modular, mechanical seal, consisting of rubber links shaped to continuously fill the annular space between the pipe and the wall opening.

ii. Hardware shall be type 316 stainless steel.

b. Manufacturers

i. Pipeline Seal & Insulator, Inc.:

ii. Link-seal Modular Seal

iii. Or approved Equal

8. Wet Well Subbase:

a. Aggregate subbase shall be crushed rock, or as directed in the site-specific soils report.

9. Geotextile Fabric

a. As directed in the site-specific soils report, or geotextile fabric shall be a Class B1 Subgrade Enhancement Geotextile conforming to Section 96-1.02 of the latest version of the Caltrans Standards.

b. Manufacturers:

i. Mirafi HP570

ii. Or approved equal

10. Concrete

a. Concrete: As specified in this document.

b. Cement for precast base shall conform to ASTM C150 and C595, Type 2.

c. Reinforcing steel shall be grade 60, per ASTM A615.

C. EXECUTION

1. Excavation

a. Perform all construction excavation for wet well, manholes, and structures, including hand digging, shoring, dewatering, asphaltic concrete removal, concrete removal, and grading necessary or required for construction.

b. The excavation shall include, without classification, the removal and disposal of all materials of whatever nature encountered that would interfere with the proper construction and completion of the required work.

c. Temporary excavation slopes shall comply with Cal-OSHA requirements for the soil types and conditions encountered. Refer to Sheeting and Shoring requirements.

d. Barriers shall be placed around all excavations and at such places as may be necessary to warn all pedestrian and vehicular traffic of such excavations.

e. Sheeting and Shoring

i. Sheeting and shoring shall be in accordance with the requirements of Section 1541.1 of the California Occupational Safety and Health Regulations (Cal/OSHA) Title 8 regulations.

ii. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

iii. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

iv. Design sheeting and shoring to be removed at completion of excavation work.

v. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

vi. Repair damage caused by settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

2. Backfilling

a. Backfill shall conform to the requirements of the site-specific soils report and at a minimum shall include the provisions of this section.

b. Backfill shall contain no material larger than 2 inches in size and be free from all deleterious matter.

c. Backfill shall be compacted to a relative compaction of 90%, or as specified by the Engineer of Record and approved by the District. The top 12 inches of the backfill shall be compacted to 95% compaction or as specified by the Engineer of Record and approved by the District.

d. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

e. Wrap geotextile fabric around Fill Type A1 prior to placing subsequent fill materials.

f. Maintain optimum moisture content of fill materials to attain required compaction density.

g. Compaction of backfill by jetting or flooding shall not be allowed.

h. Wet well and manholes shall be placed level on a minimum 2-foot thick bed of crushed rock, Type A2, wrapped in geotextile fabric.

i. Where crushed rock is used, it shall be tack rolled, wheel rolled, or compacted with a vibratory plate. Compaction testing of crushed rock is not necessary if the above procedures are used.

j. Backfill around wet wells with Fill Type S1 or S2 and compact to minimum 90%.

3. Installation

a. Base

i. Excavate for the wet well. If dry conditions are found, install aggregate base, minimum 1-foot thick, extending 18 inches beyond the wet well base. If wet and/or unstable soil conditions are found, install a crushed rock subbase, minimum 2-foot thick, extending 18 inches beyond the edge of the wet well base. The crushed rock base shall be completely encapsulated in geotextile fabric.

b. Set each precast polymer concrete wet well sectional unit plumb to make a watertight joint with the precast polymer concrete base or with the preceding sectional unit. Backfill, compact, and replace pavement.

c. Assemble sectional units so that the top slab conforms to the elevation determined by the wet well location as follows:

i. In Paved Areas: Top of slab shall be flush with the paving surface.

ii. In Shoulder Areas: Top of slab shall be flush with existing surface where it is in traveled way of shoulder and 0.1 foot above existing surface where it is outside limits of traveled way but not in unpaved open areas.

iii. In Unpaved Open Areas: Top of slab shall be 6-inches above the finished ground surface.

d. Backfill

i. Backfill and compact in accordance with this specification after successful completion of leakage testing.

4. Field Testing

a. Leakage Testing:

i. Perform testing before backfilling the wet well. Plug the pipes connected to the wet well. Fill the wet well with water to a point 1 foot below the top slab. Allow the wet well to absorb water for four hours, then refill to the original water level. Allowable leakage shall be zero, except that moisture or beads of water appearing on the surface of the joint will not be considered leakage. Duration of leakage test shall be four hours. If the allowable leakage rate is exceeded, repair or replace the wet well and retest.

D. PERFORMANCE AND DESIGN CRITERIA

1. Wet well shall be sized to maintain retention times less than 30 minutes unless odor control chemicals are added.

2. Wet well shall also be sized to keep the number of pump starts per hour below the manufacture specification.

1.04 PRECAST CONCRETE VAULT

A. GENERAL

1. This section pertains to the precast concrete vault which is downstream of the wet well.

B. EQUIPMENT AND MATERIALS

1. Precast Concrete Vault

a. Precast concrete vaults shall comply with ASTM C858 except as modified herein.

b. Design loads shall be in accordance with ASTM C857, except as modified herein. Traffic loads, unless otherwise stated, shall conform to Load Designation A-16 per Table 1. Soil lateral loads shall be as determined by ASTM C857 or loadings specified in the project soils report, whichever is greater. Alternate design by the strength design method shall include a load factor of 1.7 times the lateral earth or hydrostatic pressures.

i. Include the following load conditions in the design:

1) Vault roof removed while structure is backfilled to grade and subject to live and dead loads.

2) Vault roof in place and walls subject to simultaneous vertical and horizontal application of all live, impact, and dead loads. Include the case of an A-16 designated load placed directly above the wall.

ii. Design shall also comply with the following restrictions:

1) The maximum reinforcement ratio allowed is one-half the reinforcement ratio that would produce a balanced strain condition.

2) Earth pressure shall be converted to a horizontal pressure using either a coefficient of earth pressure at rest or a coefficient of active earth pressure as specified by the Geotechnical Engineer of Record.

3) Include a live load surcharge in the design of the walls.

iii. Design all vaults to receive the specified traffic loading.

iv. Precast vault construction shall be in the form of monolithic walls or horizontal wall sections; do not use panel walls.

v. Minimum wall thickness shall be 6 inches. Design knockout wall panels to accommodate loading pressures defined above.

vi. Design vault roof with removable and resealable panels for equipment access.

vii. Floor slab shall be precast concrete. Calculations for the floor slab design shall be included in the vault design submittal.

viii. Design joints using a butyl rubber sealant per ASTM C990.

ix. Design vault to resist uplift from groundwater, surface water or liquefaction. Assume full submergence of the vault. Prevent floatation using a combination of thicker walls, floor or roof. Vault interior dimensions and elevations of floor and roof shall be as determined by the Engineer of Record and approved by the District.

c. Manufacturers:

i. Brooks Products Inc.

ii. Utility Vault Company

iii. Structurecast

iv. Midstate Concrete Products

v. Or Approved Equal.

2. Sealants and Mortar

a. Butyl rubber sealing compound shall comply with ASTM C990. Mortar shall comply with ASTM C387, Type S or use grout complying with this specification.

3. Access Hatches

a. Provide traffic-rated access hatches per this specification.

4. Sump Covers

a. Steel, minimum 1/4-inch thick, galvanized per ASTM A123, unless otherwise as determined by the Engineer of Record and approved by the District.

5. Cement

a. Cement shall be ASTM C150, Type II.

6. Admixtures

a. Provide concrete admixtures as specified in this specification.

7. Crushed Rock Base

a. Crushed rock base material shall be Type A2, 1 1/2 inch Crushed Rock, per this specification.

8. Geotextile Fabric

a. Geotextile fabric shall be a Class B1 Subgrade Enhancement Geotextile conforming to Section 96-1.02 of the latest version of the Caltrans Standards.

b. Manufacturers:

i. Mirafi HP570

ii. Or approved equal

9. Filter Fabric

a. Filter Fabric shall be a Class B “Filter Fabric” conforming to Section 96-1 .02 of the latest version of the Caltrans Standards.

b. Manufacturers

i. Mirafi HP570

ii. Or approved equal

C. EXECUTION

1. Excavation

a. Refer to requirements for precast concrete wet well.

2. Backfill

a. Refer to requirements for precast concrete wet well.

3. Installation

a. Vault Base

i. Crushed rock subbase, completely encapsulated in geotextile fabric, shall be installed as shown on the Standard Details.

b. Sump Base

i. Excavate for the sump and install Type A5 permeable material per this specification and the Standard Details. The permeable material shall be completely encapsulated in filter fabric.

c. Sealing and Grouting

i. Fill joints between precast sections with either a butyl rubber sealing compound or mortar.

d. Set each precast concrete vault section plumb on a bed of sealant or cement mortar at least 1/2-inch thick to make a watertight joint with the concrete base and with the preceding unit. Point the inside joint and wipe off the excess mortar or sealant.

e. Backfill

i. Backfill and compact around the vault using fill as specified in this specification. Compact to 95% relative compaction, or as specified by the Engineer of Record and approved by the District.

1.05 POLYMER CONCRETE MANHOLES

A. GENERAL

1. This section pertains to polymer concrete manholes.

B. EQUIPMENT AND MATERIALS

1. Manhole and Structure Sections

a. Polymer concrete manhole sections, monolithic base sections and related components shall conform to ASTM C478 as modified for polymer concrete manhole design. Polymer concrete shall be cast in a polymer only facility and shall not be manufactured in a cementitious concrete facility.

b. Joints for Precast Manholes and Structures: In accordance with ASTM C913; set with Butyl rubber sealant. Rub'R Nek or approved equal. Inside of Joints shall be grouted with a polyester mortar compound.

c. Polymer Concrete Mix Design shall consist of thermosetting resin, sand, and aggregate. No Portland cement shall be allowed as part of the mix design matrix. All sand and aggregate shall be inert in an acidic environment.

d. Reinforcement – Shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 as applicable for polymer concrete design.

e. The wall thickness of polymer concrete structures shall not be less than that prescribed by the manufacturer's design.

f. Thermosetting Resin - The resin shall have a minimum deflection temperature of 158° F when tested at 264 psi (1.820 mPa) following Test Method D648. The resin content shall not be less than 7% of the weight of the sample as determined by test method D2584. Resin selection shall be suitable for applications in the corrosive conditions to which the polymer concrete manhole structures will be exposed.

g. Each polymer concrete manhole component shall be free of all defects, including indentations, cracks, foreign inclusions and resin starved areas that, due to their nature and degree or extent, detrimentally affect the strength and serviceability of the component part.

h. Grouting: All materials needed for grouting and patching will be a polyester mortar compound provided by the manufacturer or an approved equal by the manufacturer

i. Manufacturers:

i. Armorock, LLC

1) Manhole Diameter:

- 10-in and smaller sewer pipe – 48-in diameter
- 12-in and larger sewer pipe – 60-in diameter

ii. Or Approved Equal.

2. Cover

a. Product Description: Cast iron construction. Inside of frame shall be grouted.

i. Lid: 24” Clear Opening with a Blind Pickhole

ii. Lettered: “SANITARY SEWER”

b. Manufacturers:

i. South Bay Foundry

1) Model SBF 1900 BPH

ii. Or Approved Equal.

3. Configuration

a. Shaft Construction and Eccentric Cone Top Section: Reinforced precast Concrete pipe sections, lipped male/female joints, sleeved to receive pipe sections.

b. Shape: Cylindrical.

c. Clear Inside Dimensions: As determined by the Engineer of Record and approved by the District.

d. Design Depth: As determined by the Engineer of Record and approved by the District.

e. Pipe Entry: Furnish openings as determined by the Engineer of Record and approved by the District.

f. Steps: None.

g. Pipe Connection: Resilient water tight connector per ASTM C923, Kor-n-Seal 106/406 series with stainless steel wedge connector, or equal.

h. Concrete: Specified in this specification.

i. Grout: Specified in this specification.

4. Bedding:

a. If wet subgrade is encountered: Fill Type A2 as specified in this specification. Minimum 2-ft thick. With geotextile filter fabric wrap.

b. If dry subgrade is encountered: Class 2 Aggregate Base conforming to Section 26-1.02B of the State Specifications. Minimum 1-ft thick.

c. Geotextile fabric shall be a Class B1 Subgrade Enhancement Geotextile conforming to Section 96-1.02 of the latest version of the Caltrans Standards.

i. Manufacturers

1) Mirafi HP570

2) Or Approved Equal.

C. EXECUTION

1. Excavation

a. Refer to requirements for precast concrete wet well.

2. Backfill

a. Refer to requirements for precast concrete wet well.

3. Installation

i. Excavation and Backfill:

ii. Excavate for manholes and structures in accordance with this specification in location and to depth shown. Provide clearance around sidewalls of manhole or structure for construction operations, granular backfill and placement of geotextile filter fabric.

iii. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or structures in dry trench.

iv. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.

b. Cast-in-place base:

i. Where shown on plans pour concrete base around existing pipe, shape top of cast-in-place base with a ring to match mating surface of manhole barrel.

ii. Do not break existing pipe until manhole is coated, tested and ready for tie-over.

iii. Install manholes and structures supported at proper grade and alignment on crushed stone bedding as determined by the Engineer of Record and approved by the District.

iv. Backfill excavations for manholes and structures in accordance with this specification

v. Form and place manhole or structure cylinder plumb and level, to correct dimensions and elevations.

vi. Set cover frames and covers level without tipping, to correct elevations.

c. Manhole Installation

i. Lift precast manholes and structures at lifting points designated by manufacturer.

ii. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and manhole or structure remains clean.

iii. Set precast manholes and structures bearing firmly and fully on bedding in accordance with backfill and compaction requirements of this specification.

iv. Assemble multi-section manholes and structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer's recommendations. Lower, set level, and firmly position base section before placing additional sections.

v. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

vi. Joint sealing materials may be installed on site or at manufacturer's plant.

vii. Verify manholes and structures installed satisfy required alignment and grade.

viii. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.

ix. Cut pipe to finish flush with interior of manhole or structure.

x. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel.

1.06 ALUMINUM ACCESS HATCHES

A. GENERAL

1. These requirements apply to access hatches of the precast concrete wet well and the precast concrete vault.

B. EQUIPMENT AND MATERIALS

1. Access hatches shall be of the sizes and configurations determined by the Engineer of Record and approved by the District, or approved equal. Aluminum doors shall be anodized. Latch and lifting mechanism assemblies, hold-open arms and guides, and all brackets, hinges, pins, and fasteners shall be 316 stainless steel.

2. Operation of the hatches shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.

3. Covers: Shall be made of aluminum diamond pattern.

4. Hinges: Shall be specifically designed for horizontal installation and shall be through bolted to the covers with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.

5. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the covers when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed gusset support plate.

6. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the hatch and the latch release shall be protected by a flush, gasketed, removable screw plug.

7. Hardware:

a. Hinges: Type 316 stainless steel hinges and steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame.

b. Covers shall be equipped with a hold open arm which automatically locks the cover in the open position.

c. Covers shall be fitted with the required number and size of compression spring operators.

d. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.

e. Compression spring tubes shall be an anti-corrosive composite, all fasteners and hardware shall be Type 316 stainless steel material. Springs shall have an electrocoated acrylic finish for corrosion resistance.

8. Factory Finishes: Aluminum surfaces shall be provided with a Mill finish by the factory.

9. Locking Device:

a. Type 316 Stainless steel slam lock with key and threaded plug.

10. Manufacturers

a. Halliday Series H2R (Double-Leaf, reinforced to support AASHTO H-20 wheel load)

b. Bilco Type JD-AL H20 (Double Leaf)

c. Or approved equal

C. EXECUTION

1. Paints and Coating

a. Coat aluminum surfaces to be embedded or which will be in contact with concrete per System D-1 and per manufacturer's recommendation before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.

b. Where aluminum surfaces come in contact with dissimilar metals, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.

2. Installation

a. Coordinate access hatch installation requirements with Precast Vault manufacturer.

b. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.

c. Set frames and supports accurately in position when concrete is placed and support it rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar.

d. Coat aluminum surfaces to be embedded or which will be in contact with concrete per this specification, System D-1 and per manufacturer's recommendation before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.

1.07 PIPE AND FITTINGS

A. GENERAL

1. Section includes wet well piping, valve vault/above-grade piping, buried pressurized piping, and buried gravity-flow piping.

B. EQUIPMENT AND MATERIALS

1. Wet Well Piping

a. This pertains to piping which is in the wet well and conveys wastewater from the submersible pumps to the wet well wall. This piping will be periodically submerged in wastewater and exposed to sewer gasses. The wet well piping shall be stainless steel.

b. Stainless Steel Pipe and Fittings

i. General Service Piping:

1) Type:

- Welded: ASTM A312.

2) Schedule: 40S.

3) Grade: Type 316L.

4) Dimensions: ANSI B36.19.

ii. Fittings:

1) Type: Butt welding

2) Dimensions: Comply with ASTM A312.

3) Butt-Welding Fittings:

- Comply with ASTM A403.
- Grade: Type 316L.
- Class: WP; comply with ASME B16.9.

4) Flanged Connections: As determined by the Engineer of Record and approved by the District.

c. Accessories

i. Flange Gaskets:

1) Comply with ASME B16.5.

2) Nonmetallic Gaskets:

- Material: EPDM, nitrile, or chloroprene rubber.
- Comply with ASME B16.21.

3) Type:

- Flat-Face Flanges: Full face.

ii. Dielectric Fittings:

1) Flange insulation kit shall consist of Type E insulating gasket.

- Gasket shall be made of Phenolic.
- Insulating sleeve shall be Mylar, Phenolic or G-10.
- Washers shall be Phenolic or G-10.

2) Manufacturers shall be Lone Star Group, Drake Specialties or equal.

iii. Couplings

1) Couplings shall be stainless steel, compatible with stainless steel pipe, and shall accommodate angular deflection and gaps between pipe ends.

2) Manufacturers:

- Romac Industries, Inc. Armor Lock
- Or Approved Equal.

d. Fabricate piping sections and fittings in the shop. Pickle and passivate at the point of fabrication.

2. Valve Vault/Above-Grade Piping

a. This pertains to piping which is in the valve vault or above grade and will be periodically pressurized while the lift station is operational. This will convey wastewater.

b. This piping shall be one of the following:

i. Ductile iron pipe

ii. Stainless steel

c. Ductile Iron Pipe:

i. 3-inch through 12-inch: AWWA C151

ii. Lining of all ductile iron force main piping, valves, and fittings shall be U.S. Pipe Protecto 401 Ceramic Epoxy lining or approved equal. Ductile iron pipe lining shall be shop-applied in accordance with manufacturer's recommendations.

iii. Exterior Coating of exposed pipe and fittings shall be coating system C-1 per this specification.

iv. Rubber gasket joints for ductile iron pipe and fittings shall be styrene butadiene rubber, ethylene propylene rubber, or chloroprene, in accordance with AWWA C111.

v. Pressure Rating: As specified by the Engineer of Record and approved by the District.

vi. Fittings: Ductile Iron, AWWA C110. Compact fittings AWWA C153.

vii. Mechanical and Push-on Restrained Joints: AWWA C111, restrained.

viii. Flanged Joints: AWWA C115, restrained.

d. Stainless Steel

i. Refer to requirements of stainless steel wet well piping.

3. Buried Pressurized Piping

a. This pertains to piping which is buried and will convey pressurized wastewater.

b. This piping shall be one of the following:

i. Ductile iron pipe

ii. Polyvinyl chloride (PVC) pipe

c. Ductile Iron Pipe:

i. Refer to requirements of ductile iron above-grade piping.

ii. Unless otherwise specified, buried ductile iron pipe shall be coated with a bituminous coating in accordance with AWWA C151 and encased in polyethylene wrapping in accordance with AWWA C105.

d. PVC Pipe:

i. PVC Pressure Sewer Pipe and Fittings – 4-inch through 12-inch: AWWA C900, pressure class shall be as specified by the Engineer of Record and approved by the District.

ii. PVC pipe shall be Ductile-Iron Pipe size.

iii. PVC pipe shall be green in color.

iv. Joints for buried PVC shall be an integral bell manufactured on the pipe with internal joint restraint mechanism. The bell and coupling shall be the same or greater thickness as of the pipe barrel.

v. Deflection at the joint shall not exceed the maximum deflection recommended by the manufacturer.

vi. Fittings: Ductile Iron, AWWA C110. Compact fittings AWWA C153. Fittings shall be wrapped in polyethylene encasement in accordance with AWWA C105.

vii. Lining: Double thickness per AWWA C104.

viii. Coating: Bituminous Coating: Comply with AWWA C110.

ix. Mechanical and Push-on Joints: AWWA C111, restrained.

x. Manufacturers:

1) JM Eagle's Eagle Loc 900

2) Diamond Lok-21

3) Or Approved Equal.

e. Underground Pipe Markers

i. Plastic Ribbon Tape:

1) Manufacturer List:

- Pipemarker.com; Brimar Industries
- Kolbi Pipe Marker Co.
- Or Approved Equal

2) Brightly colored, continuously printed with "sewer" and colored green for sewer service.

3) Minimum 6 inches wide by 4 mil thick.

4) Manufactured for direct burial service.

ii. Trace Wire:

1) Electronic detection materials for all piping products.

2) 12 awg insulated solid copper clad steel core tracer wire with minimum 30 mil HDPE insulation coating.

3) Color shall be green for sewer service.

4) Break strength shall exceed 450-lbs.

5) Copperhead 1230-HS or equivalent.

4. Buried Gravity-Flow Piping

a. This pertains to buried piping which is upstream of and conveys wastewater into the wet well. Flow through this piping will be gravity driven.

b. Polypropylene Plastic Pipe: ASTM F2736, minimum pipe stiffness 46 psi per ASTM D2412.

i. Fittings: Polypropylene, ASTM F2736

ii. Joints: integral bell and spigot joint watertight per ASTM D3212 with two gaskets per ASTM F477.

iii. Bell: shall have a reinforced polymer composite band installed by the manufacturer.

iv. Tee: Three piece service connection with a rubber sleeve, PVC hub and stainless steel band as manufactured by Inserta Tee, or equal.

v. Manufacturer:

1) ADS, Inc.

2) ADS Sanitite HP Pipe

3) Or Approved Equal.

c. Underground Pipe Marker

i. Refer to requirements of buried pressurized piping.

5. Sleeve Couplings

a. General

i. Pressure: Couplings shall be designed for a working pressure not less than the design pressure of the pipe on which they are to be installed.

ii. Material: Couplings shall be made of ductile iron or steel. Ductile Iron components shall be a minimum grade of 65-45-12 ductile iron meeting the requirements of ASTM A536 of the latest revision. Steel components shall be carbon steel per ASTM A513 or A53 for 3" – 4" or ASTM A283C for 6" – 48".

iii. Hardware: Bolts nuts, and rods shall be rated at a minimum per Section 2.02F herein.

iv. Gaskets: Made from virgin Ethylene Propylene Diene Monomer Rubber (EPDM) compounded for water and sewer service in accordance with ASTM D2000, NSF 61 Certified.

v. Coating and Lining: All sleeve couplings shall be NSF61 certified. Coupling shall be coated and lined with an NSF 61 certified fusion bonded or liquid epoxy. Thickness of coating and lining shall be minimum 6 mils exterior and 15 mils interior.

b. Restrained Couplings

i. Joint restraint shall prevent axial separation of two plain ends of same or dissimilar materials, such as ductile iron, steel, PVC and/or High Density Polyethylene (HDPE) pipe. Restrain mechanism shall incorporate a plurality of individual actuating of the restraint devices.

ii. Restrained Joint Coupling shall be manufactured by Ebba Iron 3800 Mega-Coupling Model, Smith-Blair Pipe Lock Joint Restraint Coupling (470 Series), or equal be carbon steel per ASTM A513 or A53 for 3" – 4" or ASTM A283C for 6" – 48".

c. Transition Couplings

i. Transition couplings shall utilize compressible gaskets and meet the applicable requirements of AWWA C219. Transition couplings shall be manufactured by Romac, Smith-Blair, or approved equal.

ii. Couplings connecting asbestos cement pipe to ductile iron or PVC pipe shall be Romac Model XR501, Smith Blair Model Quantum/Omni Coupling, or approved equal.

iii. Couplings connecting steel pipe to PVC pipe shall be manufactured by Romac Model 511, Smith Blair Model Quantum/Omni Coupling, or approved equal.

iv. Transition couplings shall be installed with suitable thrust block restraints where applicable or as determined by the Engineer of Record and approved by the District.

6. Hardware

   a. Nuts and Bolts: Nuts and Bolts shall conform to the chemical and mechanical requirements of ASTM A307 Grade B, heavy hex, zinc plated. Bolt threads shall be lubricated with an approved anti-seize compound.

   b. Steel Rods, Bolt, Lugs, and Brackets: ASTM A36 or ASTM A307, Grade A Carbon Steel.

   c. Flange Gaskets: Flat Face flanges shall be provided with full-faced gaskets. Gaskets shall be non-asbestos, 1/8” thick, and be NSF 61 certified for potable water use. Non-asbestos gaskets shall be manufactured from Garlock, Tripac, or approved equal.

C. EXECUTION

1. Trenching

   a. Excavate subsoil required for utilities.

   b. Excavate width of trenches in accordance with County of San Luis Obispo Public Improvement Standards.

   c. Provide uniform and continuous bearing and support for bedding material and pipe.

   d. Do not interfere with 45 degree bearing splay of foundations.

   e. When Project conditions require it, provide sheeting and shoring to protect excavation as required by this section.

   f. When subsurface materials at bottom of trench are loose or soft, notify Engineer, and request instructions.

   g. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

   h. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

   i. Remove excess subsoil not intended for reuse from site.

   j. Stockpile excavated material in area designated on site.

2. Paints and Coatings:

   a. Coating System C-1: Exposed Metal

      i. Type: High-performance epoxy coat having minimum volume solids of 100%, with primer and intermediate coats as recommended by manufacturer.

      ii. Service Conditions: For use with all metal structures or pipes which are not buried including within the valve vault at the Lift Station.

      iii. Surface Preparation: SSPC SP-10.

      iv. Prime Coat: Polyamidoamine epoxy recommended by the manufacturer for overcoating with a high-performance epoxy finish coat. Apply to a thickness of 3 mils. Products: Tnemec Series N69 Hi Build Epoxoline II, Amercoat 370, Sherwin-Williams Copoxy Shop Primer, or equal.

      v. Intermediate Coat: Modified Aliphatic Amine epoxy if recommended by the manufacturer for overcoating with high-performance epoxy finish coat. Products: Tnemec Series 434 Perma-Shield H2S, or equal.

      vi. Finish Coat: Modified Polyamine or two component polycyclamine, 100% solid, no to low VOCs epoxy recommended by the manufacturer for overcoating a high-performance epoxy coating. Apply to a thickness of at least 2 mils. Products: Tnemec Series 435 Perma-Glaze, International

Enviroline 222, Amercoat 351, Sherwin-Williams Dura- Plate® 5800, or equal.

b. Coating System D-1: Metal in Contact with Concrete

i. Type: High solids epoxy or phenolic epoxy having a minimum volume solids of 80% (ASTM D2697)

ii. Service Conditions: Coat areas of aluminum grating, stairs, structural members of aluminum fabrications, in contact with concrete or carbon steel.

iii. Surface preparation: SSPC SP-1. Do not use alkali cleaning.

iv. Coating System: Apply three or more coats of Ameron 400, Tnemec Series 135, ICI Devoe Bar-Rust 233H, Sherwin-Williams Macropoxy B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or equal; 30 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.

c. All materials of a specified painting system, including primer, intermediate and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.

d. Deliver paints to the jobsite in the original, unopened containers.

e. Color Schemes:

i. Above ground pipelines and valves shall be painted or coated in the following colors:

1) Potable water: Blue

2) Recycled water: Purple (Pantone 512)

3) Sewer: Green

3. Installation

a. Wet Well Piping

i. Ream pipe ends and remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws is not permitted. Do not use carbon steel tools on stainless steel pipe or fittings.

ii. Bevel plain-end pipe.

iii. Thoroughly clean pipe and fittings before installation.

iv. Fabricate piping sections in the shop. Pickle and passivate at the point of fabrication.

v. Installation shall comply with ASME B31.3.

vi. Run piping straight along alignment, with minimum number of joints.

vii. Fittings:

1) Clean gasket seats thoroughly, and wipe gaskets clean prior to installation.

2) Install according to manufacturer instructions.

3) Bolting:

- Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight.
- Use torque wrench to tighten bolts to manufacturer instructions.

viii. Dielectric Fittings: Provide between dissimilar metals.

ix. Field Cuts: According to pipe manufacturer instructions.

x. Field welding is prohibited.

xi. Pipe shall be firmly supported with fabricated or commercial Type 316 stainless steel supports. Place supports at 10-ft spacing, max.

xii. Piping Laying Tolerance: 5/8 inch.

b. Buried Pressurized Piping

i. PVC Pipe:

1) Install buried PVC pipe according to AWWA C605.

2) Handle and assemble pipe according to manufacturer's instructions.

3) Contractor to obtain the desired horizontal and vertical alignment by use of fittings or bending the pipe per the manufacturers' recommendations for maximum deflection. Do not bend the pipe with machinery. Protect the joint from offset while bending the pipe. If bending the pipe within the manufacturers' recommendation is inadequate to meet the required alignment Contractor shall use fittings or high deflection couplings, as applicable.

4) Deflected joints shall not exceed 80% of manufacturers' allowable deflection

5) Install pipe to indicated elevations to within tolerance of 5/8 inches.

6) Install pipe with no high points, unless as otherwise determined by the Engineer of Record and approved by the District. If unforeseen field conditions arise that necessitate high points, install air release valves as directed by Engineer.

7) Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.

8) Prevent foreign material from entering pipe during placement.

9) Install pipe to allow for expansion and contraction without stressing pipe or joints.

10) Close pipe openings with watertight plugs during Work stoppages.

11) Install plastic ribbon tape continuous buried 12 inches above pipe line.

12) Install detectable warning tape 12 inches below finish grade, or between aggregate base course and subgrade in paved areas.

ii. Polyethylene Encasement

1) All buried Ductile Iron fittings, and all buried valves shall be encased with loose polyethylene film, unless otherwise stated on the plans.

2) Install according to AWWA C105.

3) Terminate encasement 3 to 6 inches aboveground where pipe is exposed.

4) Polyethylene encasement shall be colored green for sanitary sewer force mains.

c. Valve Vault/Above-Grade Piping

i. General

1) Installation shall be according to ASME B31.3.

2) Run piping straight along alignment, with minimum number of joints.

3) Fittings:

4) Clean gasket seats thoroughly and wipe gaskets clean prior to installation.

5) Install fittings according to manufacturer instructions.

6) Bolts:

7) Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight.

8) Use torque wrench to tighten bolts to manufacturer instructions.

9) Install fabricated fittings with flexible pipe couplings.

10) Provide required upstream and downstream clearances from devices as determined by the Engineer of Record and approved by the District.

11) Install piping with sufficient slopes for venting or draining liquids and condensate to low points.

12) Provide supports for exposed piping.

13) Provide expansion joints and pipe guides to compensate for pipe expansion due to temperature differences.

14) Dielectric Fittings: Provide between dissimilar metals such that galvanic cells causing corrosion are not developed.

15) Field Cuts: According to manufacturer instructions.

16) Finish primed surfaces as specified in this specification.

d. Buried Gravity-Flow Pipe

i. Install pipe in accordance with ASTM D2321.

4. Field Testing

a. Pressurized Piping

i. This pertains to all piping which will be pressurized during typical operations.

ii. Hydrostatic pressure test pressurized piping as follows:

1) Test Pressure: As specified by the Engineer of Record and approved by the District

2) Conduct hydrostatic test for at least two hours.

3) Test all piping, which include the force main and points of connection.

4) Slowly fill section to be tested with water; expel air from piping at high points. Install corporation stops at high points. Close air vents and corporation stops after air is expelled. Allow the pipeline to set for a minimum of 24 hours.

5) Refill the pipe, if necessary, and raise pressure to specified test pressure.

6) Observe joints, fittings, and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.

7) Correct visible deficiencies and continue testing at same test pressure for an additional one hour to determine leakage rate. Maintain pressure within plus or minus 5 psi of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.

8) The water necessary to maintain this pressure shall be measured by the amount of water withdrawn from a fixed vessel, such as a barrel.

9) Leakage shall not exceed the rate of 30 gallons per inch of diameter per 24 hours per mile of pipe.

10) When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

b. Gravity-Flow Piping

i. Deflection Testing

1) Test pipe for roundness after backfill in accordance with County of San Luis Obispo Standards Section 7.2.4.

ii. Air Pressure Testing

1) Sanitary Sewage Piping shall be air-pressure tested in accordance with County of San Luis Obispo Standards Section 7.2.4.

iii. Video Inspection

1) Newly constructed sewer mains, manholes, and appurtenances shall be video inspected with a continuous display of date, time and footage. Work will not be accepted if there is standing water or other debris.

D. DESIGN AND PERFORMANCE CRITERIA

1. Gravity Pipeline

a. Maintain a minimum velocity of 2 feet per second at Average Daily Flow and a maximum velocity of 10 feet per second at Peak Hour Wet Weather Flow.

2. Pressurized Piping

a. Maintain a pipe velocity between 3 to 4 feet per second.

1.08 VALVES

A. GENERAL

1. All valve interiors/exterior shall be fusion bonded epoxy coated (8 to 12 mils) with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550 (latest). Completed coating shall be free from all defects and shall be inspected by use of low voltage holiday detecting and non-destructive thickness gauges.

2. Where the manufacturer demonstrates in writing that it would be impossible to use the powder epoxy method without causing damage to the valve components, the use of a liquid epoxy will be permitted upon approval by the Owner.

3. The following valves are provided under this section:

a. Plug Valve

b. Swing Check Valves

c. Resilient Wedge Gate Valves

d. Air and Vacuum Valves

e. Buried Valve Boxes

f. Valve Accessories

g. Nuts, Bolts, and Gaskets

B. EQUIPMENT AND MATERIALS

1. Plug Valves

a. Manufacturers:

i. DeZurik

1) Series 100

ii. Or Approved Equal.

b. Resilient-Seated Eccentric Plug Valves: AWWA C517

i. Body: Cast Iron, ASTM A126, Class B

ii. Ends: Unless shown otherwise, connections shall be flanged.

iii. Valve Plug: Stainless Steel with resilient seating. Seating material shall be chloroprene, nitrile rubber, or ethylene propylene rubber suitable for sewage.

iv. Operation:

1) For valves above-grade and not enclosed in a structure: Operating Nut: 2-inch Square; open counterclockwise unless otherwise indicated.

2) For valves in enclosed spaces: Handwheel operated; open counterclockwise unless otherwise indicated.

v. Valve Bearing: Stainless Steel

vi. Sizes 12-inch diameter and smaller: pressure class as specified by the Engineer of Record and approved by the District.

2. Check Valves

a. Manufacturers:

i. APCO Series 6000 Convertible Swing Check Valve.

ii. APCO Series 8000 Flap Check Valve

iii. Or Approved Equal.

b. Check Valves: AWWA

i. Body: Iron body, bronze mounted with outside lever and weight.

ii. Disc: Ductile iron - epoxy coated.

iii. Disc Seat: Buna-N.

iv. Ends: Unless otherwise shown, connections shall be flanged.

v. Hinge Pins: Stainless steel.

vi. Pivot Shaft: Stainless steel 17-4PH.

vii. Convertible in the field from lever and weight to lever and spring, or air damped, or oil damped.

viii. Size 12-inch diameter and smaller: pressure class as specified by the Engineer of Record and approved by the District.

3. Resilient Wedge Gate Valve

a. Manufacturers:

i. Mueller Co. Series: A-2361, A-2362

ii. Clow Valve Company: Model 2638

iii. Or approved equal.

b. Resilient Wedge Gate Valves: AWWA C509

i. Resilient seats.

ii. Body, Operating Nut, Bonnet, Seal plate: Cast Iron, ASTM A126, Class B.

iii. Gate: Cast Iron, ASTM A126, Class B or Ductile Iron, ASTM A536, Grade 65-45-12.

iv. Stem: Non-rising bronze stem.

v. Operating Nut: 2-inch Square; open counterclockwise unless otherwise indicated.

vi. Ends: Flanged, mechanical joint or bell end connections.

vii. Coating: AWWA C550; interior/exterior.

viii. Sizes 12-inch diameter and smaller: pressure class as specified by the Engineer of Record and approved by the District.

4. Air and Vacuum Valves

a. Unless specified otherwise, air valves shall be combination air or combination air and vacuum valve (air, vacuum, and automatic release). They shall permit automatic escape of large quantities of air from pipeline when it is being filled, permit air to enter pipeline when it is being emptied, and allow accumulating air to escape while pipeline is in operation and under pressure.

b. Air and Vacuum Valves: AWWA C512

i. Body and Cover: Cast Iron ASTM A126 Class B or Ductile Iron ASTM A536 Grade 65-45-12

ii. Trim: Type 316 Stainless Steel

iii. Coatings: NSF61 certified liquid epoxy (internal and external)

c. Air valve inlets shall flanged or threaded as specified and outlets shall be threaded at the same nominal sizes as the inlets, minimum. Air valves shall be subjected to factory hydrostatic test at pressure equal to 150% rated working pressure with no harmful deflections or other defects.

d. Air valves shall be installed with a downward-facing bug screen.

e. Manufacturers:

1) Val-matic Model: 201C Combination Air Valves

2) ARI USA Model: D-040-C

3) Or approved equal.

5. Buried Valve Boxes

a. Valve Boxes shall be installed in accordance with County of San Luis Obispo Standards.

b. Valve Cans shall be 8-inch SDR35 PVC, one continuous piece with no joints.

c. Valve Box Caps for sewer service shall be cast-iron and marked with the word “SEWER” cast on the cap.

d. Valve Boxes shall be Christy G-5, or approved equal.

i. Valve Boxes shall be cast in a Class “A” PCC Collar, trowelled to street grade and allowed to cure for 48 hours prior to full traffic use. Dimensions shown on the plans.

6. Valve Accessories

a. Valve Box Aligner: High-strength, plastic device designed to automatically center valve box base and prevent valve box base from shifting off center during backfilling.

b. Valve Extension Stems: Where the depth to the top of the valve operating nut is greater than 4-feet provide valve extension stem to bring the operating nut to a

point 6-inches below the surface of the valve cover. Extension stems shall be 2 inch Fiberplas, or approved equal, with operating nut and centering ring, and shall be capable of withstanding a 300 foot-pound torque. The extension shall have an integral method for centering the operating nut and shaft on the valve box.

7. Nuts, Bolts, and Gaskets

   a. All fittings shall utilize 304 stainless steel bolts and nuts, unless otherwise specified, and shall have anti-seize applied to the threads during installation.

C. EXECUTION

1. Paints and Coatings

   a. Refer to the paints and coating requirements for pipe and fittings.

2. Installation

   a. Install in accordance with manufacturer's written instructions.

   b. CONTRACTOR shall coordinate with the valve manufacturer to ensure that all electrical connections and pressure supply lines necessary for proper valve operation and monitoring are installed prior to startup and testing.

   c. CONTRACTOR shall provide the services of a Manufacturer's representative to visit project Site for startup and initial setting valves. Manufacturer's representative shall provide a certification of proper installation documenting the correct installation of the valve.

1.09 CONTROLS AND INSTRUMENTATION

A. GENERAL

1. Instruments in wet well to be supported via cables tied off to stainless steel hooks. Once instrument elevation is set, use black nylon cable ties to prevent instrument from slipping off hook. Provide engraved phenolic tag, 2" red, round tag, with white letters, cable tied on cable near hook so each instrument is identified; "LT", "LSL", "LSH", "LSHH".

2. The following instruments are provided under this section:

   a. Flowmeter

   b. Hydrostatic Level Transducer

   c. Float Switches

   d. Pressure Gage

3. All instrumentation, controls, and data collection to be integrated into the District SCADA system.

B. EQUIPMENT AND MATERIALS

1. Flow Meter

   a. General

      i. Magnetic flowmeter system shall be of the low frequency electromagnetic induction type and produce an analog signal directly proportional to and linear with the liquid flow rate.

      ii. Cable from remote flow transmitter to flow tube shall be supplied with flow meter and shall be long enough to be installed without splicing.

      iii. Complete zero stability shall be an inherent characteristic of the flowmeter system. Flowmeter shall include low flow cutoff. Magnetic flow metering system shall include a metering tube, transmitter and flowmeter grounding rings.

b. Metering Tube

i. Flange Type Magnetic Flowmeter Element: In-line flow element with no constrictions in flow of fluid through meter consisting of metallic tube with ANSI B16.5, flanged ends for diameter and bolt drilling pattern. Class shall be as specified by the Engineer of Record and approved by the District. Flange material shall be compatible with the piping material and corrosion resistant. Provide stainless steel grounding rings.

ii. Electrode and Liner Materials: Fully compatible with process fluid; raw sewage flow. Liner shall be hard rubber. Electrodes shall be 316 stainless steel.

iii. Sewage Force Main Flow tube shall be diameter tube with size as determined by the Engineer of Record and approved by the District, NEMA 6P, Class 1 Div 2 rated.

iv. Ground Rings: Provide stainless steel grounding rings. Interconnect ground rings to flow tube electronics housing with #10 AWG ground wire. Connect ground rings to equipment grounding conductor or ground rod.

v. Cable: Furnish manufacturer cable to connect flow tube to remote flow transmitter. Contractor responsible to provide supplier with proper length, no splices.

c. Remote Microprocessor-Based Transmitter

i. Micro-processor type with local flow rate indication and local flow totalization indicator, scaled in engineering units.

ii. Transmitter to be remote mounted in Pump Power Panel.

iii. Zero Flow Stability: By power driven electrode shielding or automatic zero adjustment of direct current excited metering circuit.

iv. Provide with low flow cutoff configuration.

v. Power Supply: 120 VAC, or as otherwise specified by the Engineer of Record and approved by the District. Provide with cord and plug connection into enclosure mounted receptacle.

vi. Provide with 4-20 mA output for connections to PLC Panel.

d. System Accuracy, including Magnetic Flowmeter Transmitter: Within 0.5 percent of actual flow rate for 10-100 percent full scale where velocity is between 0.3 and 30 feet per second.

e. Flow metering system shall be hydraulically calibrated at a facility which is traceable to the National Institute of Standards and Technologies. The calibrations procedure shall conform to the requirements of MIL-STD-45662A. A real-time computer-generated printout of the actual calibration data indicating apparent and actual flows at 0, 20, 50, 80 and 100 percent of the calibrated range shall be submitted to the Engineer at least thirty (30) days prior to shipment of the meters to the project site.

f. Manufacturer:

i. Endress & Hauser Promag 53W with remote transmitter, flow tube, ground rings and manufacturer cable.

ii. Or Approved Equal.

2. Hydrostatic Level Transducer

a. The continuous level transducer shall be of the hydrostatic pressure type, suitable for raw sewage applications. The transmitter shall be comprised of PTFE coated elastomeric diaphragm in durable 316 stainless steel housing

with polyurethane cable. Cable length shall be sufficient from level transducer to PLC Panel without splicing.

b. Provide stainless steel cable hanger for level transducer.

c. Coordinate mounting of instrument within stilling well per approved instrument installation details and as determined by the Engineer of Record and approved by the District.

d. Probe:

i. The probe shall be installed in stilling well, rated for raw sewage, Class 1 Division 1 environment.

ii. Include sacrificial anode.

iii. Output: 4-20 mA, loop powered.

e. Manufacturers:

i. Measurement Specialties MEAS KPSI 700 with sacrificial anode, cable hanger, and vent filter.

ii. Blue Ribbon Model BC001 Birdcage Level Transducer. Provide with sacrificial anode, cable hanger, and vent filter.

iii. Or Approved Equal.

3. Pressure Switch

a. Section includes pressure switch for protecting the pump from high and low pressure. The pressure switch system shall consist of an adjustable pressure switch, and isolation valve.

b. Pressure switch device shall be provided with the following features: continuously adjustable span, zero and damping adjustments, integral indicators scaled in engineering units, solid state circuitry, two SPDT switches and 4-20 mA output. Range provided in model numbers below. Pressure display shall be 4-digit backlit LCD.

c. Pressure switch shall be 2 single pole double throw (SPDT) rated 5 amperes at 120 volt AC. Set points adjustable 0 to 100% of full scale. External LED switch indication for each relay on front panel. Manual or automatic reset.

d. Process wetted materials shall be 316 SS. Body material shall be 316 SS. Process connections shall be 1/4" NPT. The transmitter housing shall be rated NEMA 4X. Conduit hubs shall be cast integral with the instrument housing and shall be 1/2-inch NPT.

e. Power Supply: Provide 120 VAC to 24 VDC power source from 24 VDC power supply in Pressure Switch Enclosure for pressure switch.

f. Manufacturers:

i. United Electric Controls #H54-27

ii. Mercoid Series EDA Electronic Pressure Controller

iii. Or Approved Equal.

4. Float Switches

a. Float switches shall include mechanical switch encapsulated in waterproof floating ball, supported by flexible cable with weight. Switch shall be single pole double throw with contacts rated 100 VA up to 120VAC. Level switch system shall include stainless steel cable for securing of float switch, with weight on cable. Switches shall be mercury-free.

b. Switches shall be suitable for sewage wet well applications, Class 1, Division 1. Switch body shall be Teflon-coated stainless steel housing. Cord with CPE

jacket shall include fine strand, #16 AWG conductors plus ground, suitable for heavy flexing service.

c. Manufacturer cable length shall be provided to route to Pump Power Panel (LSL, LSH), or PLC Panel (LSHH). Bid to include a minimum 60 feet of cable length, although the Contractor is responsible for actual cable length required as dependent on conduit routing.

d. Switch configuration shall be as determined by the Engineer of Record and approved by the District.

e. Sewage wet well level switches shall include intrinsically safe barrier mounted in panel.

f. Float Switches shall be mercury free versions of Flygt ENM-10, or approved equal. Include float switch with weight, and sufficient cable lengths.

g. Float switches used as pump shut-offs shall be set to stop pump just above minimum suction levels as determined by pump supplier. Float switch trigger position shall be approved by the Engineer in field. Coordinate settings with City and Engineer. Label level transducer and float switches at hooks near top of wet well with engraved red phenolic tags as required within this section.

5. Pressure Gage

a. Pressure Gages: Pressure gages shall be provided where shown. In all locations where pressure may vary from below to above atmospheric head, compound gages shall be installed.

b. Gage Construction: Gages shall be industrial grade with type 316 stainless steel movement and stainless steel or alloy case or phenol case. Unless otherwise shown or specified, gages shall have a 4-1/2-inch dial, ½-inch threaded connection, a Type 316 stainless steel snubber adapter, and a shut-off valve. Gages shall be calibrated to read in engineering units, with an accuracy of ±1 percent of reading, and shall withstand pressures equal to 150 percent of the rated working pressure or vacuum without failure or damage to the gage. All gages shall be vibration and shock resistant. Ranges shall be such that one half of range is normal operating pressure.

c. Manufacturers

i. Ashcoft

ii. Foxboro

iii. Dwyer

iv. Or Approved Equal.

1.10 STANDBY GENERATOR AND TRANSFER SWITCH

A. GENERAL

1. This section includes:

a. Standby Generator

b. Automatic Transfer Switch

c. Automatic Controls

B. EQUIPMENT AND MATERIALS

1. Standby Generator

a. All lift station sites shall be equipped with a natural gas or liquid petroleum gas generator. Generators utilizing Liquid Petroleum Gas shall have a minimum of 500 gallon storage tank.

b. Permanent generator shall include a sound attenuating metal cover.

c. All generators must comply with all state and local air quality laws and regulations that are in effect at time of permitting.

2. Automatic Transfer Switch

a. The automatic transfer switch shall be an integral part of power service and motor control center, and shall be mounted and wired at the factory, including mounting and wiring of door-mounted accessories. The automatic transfer switch (ATS) shall be as manufactured by ASCO, Olympian, Russelectric, or equal. The ATS and accessories shall be UL listed and labeled and tested per UL Standard 1008 and comply with NEMA ICS2-447, NFPA 70, NFPA 99, and NFPA 110.

b. The ATS shall include all necessary control devices and circuitry for a complete and operable system capable of the following operations:

i. Supply normal (utility) power to the motor control center when normal power is available. Supply standby power from the standby generator set when normal power fails or is disconnected.

ii. Detect sustained loss or deterioration of "normal" power (power failure), signal the standby generator set to start and run when "normal" power fails, and when "standby" power from the generator is within proper limits of voltage and frequency, transfer to supply "standby" power to the motor control center.

iii. Detect sustained restoration of "normal" power within proper limits of voltage and frequency, and then retransfer to supply "normal" power to the motor control center.

iv. Provide dry contacts for connection to control panel to indicate normal power "on", loss of "normal" power, and "standby" power on.

3. Automatic Transfer Switch Ratings and Components

a. The ATS controls and accessories shall be rated for continuous (24-hour) duty as installed. The switch shall be an open transition, 3-pole, double-throw, having the "normal" and "standby" positions mechanically interlocked, with microprocessor controller to provide automatic operation and shall be suitable for application to an appropriate phase, wire, frequency, voltage system. The minimum continuous current rating shall be as determined by the Engineer of Record and approved by the District. The ATS shall be rated to withstand a short circuit current as determined by the Engineer of Record without parting of the switch contacts. The ATS shall be capable of manual operation under load.

b. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism.

c. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency. All main contacts shall be silver composition.

d. All switch and relay contacts, coils, springs, and control elements shall be serviceable or removable from the front of the switch enclosure without disconnection of drive linkages, power conductors, or control conductors.

4. Automatic Controls

a. Controls shall be solid-state and designed for a high level of immunity to power line surges and transients, demonstrated by test to IEEE Standard C62.41 and C62.45.

b. Solid-state undervoltage sensors shall simultaneously monitor both sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.

c. Automatic controls shall signal the standby generator set to start upon signal from the normal source sensor. Solid-state time delay start shall be adjustable and avoid nuisance start-ups. Battery voltage starting contacts shall be silver, dry type contacts factory wired to a field wiring terminal block.

d. The switch shall transfer when the emergency power source reaches the set point. Provide a solid-state time delay on transfer and operator adjustable.

e. The switch shall retransfer the load to the normal power source after a time delay retransfer and shall be operator adjustable. Retransfer time delay shall be immediately bypassed if the emergency power source fails.

f. Controls shall signal the engine-generator set to stop after a cool down time delay and shall be operator adjustable, beginning on return to the normal power source.

g. Power for transfer operation shall be from the source to which the load is being transferred.

h. Provide solid state exerciser clock to set the day, time, and duration of standby generator set exercise/test period. Provide a with/without load selector switch for the exercise period.

i. Front Panel Devices (Inside MCC NEMA 3R Wrap)

j. Provide control switches mounted on panel inside door front for:

i. Test: Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer.

ii. Retransfer: Momentary position to override retransfer time delay and cause immediate return to normal source, if available.

iii. Provide LED-type switch position and source available indicator lamps on the front of the transfer switch cabinet.

k. Auxiliary Contacts

i. One normally closed dry contact, which shall open when normal power fails for "power failure" signal to RTU shall be provided. One normally open dry contact, which shall close when the ATS is connected to the emergency source for "emergency power" signal to RTU shall be provided.

1.11 MOTOR CONTROL CENTER

A. GENERAL

1. This section includes requirements for the Motor Control Center.

B. EQUIPMENT AND MATERIALS

1. Ratings:

a. Rated 480VAC, 3 phase.

2. Motor Control Center (MCC) shall be in a NEMA 12 rated free-standing enclosure. MCC enclosure and all electrical equipment shall include a metal shade cover or building.

3. MCC shall provide Three Phase Power Failure Monitoring Relay with phase loss, low voltage, phase reversal and phase unbalance functions.

4. Provide surge protector device.

5. Transformer KVA, voltage, and number of phases shall be as determined by the Engineer of Record and approved by the District. Transformers shall be NEMA TP-1 and EPA Energy Star compliant meeting all locally recognized energy efficiency requirements. Construct transformer in accordance with ANSI C89.2, NEMA ST 20, and UL Standard 506.

6. Provide dead front, bolt-on type circuit breaker, safety type panelboards per NEMA PB 1. Provide with copper bus bars. Panelboard shall mount in the MCC.
7. Manufactures:
    a. Tesco Controls, Inc.
    b. Or Approved Equal.

1.12 CONCRETE

A. GENERAL

1. This section pertains to cast-in-place concrete.

B. EQUIPMENT AND MATERIALS

1. Concrete Materials
    a. Cement: ASTM C150, Type II - Moderate
    b. Membrane Curing Compound: ASTM C309, Type 1D, Class A.
2. Admixtures
    a. Concrete shall contain an air-entraining admixture conforming to ASTM C260.
    b. Concrete shall contain a water-reducing admixture conforming to ASTM C494, Type A. It shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations.
    c. Pozzolan Admixture: Where specified, provide concrete containing pozzolan admixture conforming to ASTM C618 Type F max 15% by weight.
    d. Do not use any admixture that contains chlorides or other corrosive elements in any concrete. Admixtures shall be nontoxic after 30 days.
    e. Manufacturers:
        i. BASF Construction Chemicals - Building Systems.
        ii. Euclid Chemical Company (The); an RPM company.
        iii. Sika Corporation.
        iv. Or approved equal
3. Accessories
    a. Bonding Agent: Polyamid cured epoxy.
        i. Manufacturers:
            1) Euclid Chemical Company (The); an RPM company.
            2) QUIKRETE.
            3) Sika Corporation.
            4) Or approved equal.
    b. Form Release Agent
        i. Form release agent shall effectively prevent absorption of moisture and prevent bond with the concrete. Agent shall be nonstaining and nontoxic after 30 days.
        ii. For steel forms, release agent shall prevent discoloration of the concrete due to rust.
4. Joint Devices and Filler Materials

a. Joint Filler Type A: ASTM D994; Asphalt impregnated fiberboard or felt, 1/4 inch thick; tongue and groove profile.

5. Concrete Mix

a. Select proportions for normal weight concrete in accordance with ACI 301 Method

b. Provide concrete to the following criteria:

Material and Property	Measurement
Compressive Strength (28 day)	4,000 psi, unless otherwise stated in Contract Documents
Minimum Cement Content	500 lbs per cubic yard
Cement Type	ASTM C150
Aggregate Type	Normal weight
Aggregate Size (maximum)	3/4 inch
Slump	3 inches plus 1 inch

c. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Engineer.

i. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.

ii. Do not use calcium chloride nor admixtures containing calcium chloride.

iii. Use set retarding admixtures during hot weather.

iv. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing.

d. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94.

e. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

C. EXECUTION

1. Installation

a. General:

i. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

ii. Verify substrate surfaces are ready to be cured.

b. Preparation:

i. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

ii. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

iii. Remove debris and ice from formwork, reinforcement, and concrete substrates.

iv. Remove water from areas receiving concrete before concrete is placed.

c. Form Tolerances

i. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the District.

d. Formed Openings

i. Openings shall be of sufficient size to permit final alignment of pipes or other items without deflection or offsets of any kind. Allow space for packing where items pass through the wall to ensure watertightness. Provide openings with continuous keyways and water stops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated in the typical structural details. Reinforcing shall be at least 2 inches clear from the opening surfaces and encased items.

e. Placing Concrete

i. Place concrete in accordance with ACI 301.

ii. Notify testing laboratory and District minimum 24 hours prior to commencement of operations.

iii. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not disturbed during concrete placement.

iv. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

v. Separate slabs on grade from vertical surfaces with 3/4 inch thick joint filler.

vi. Deposit concrete at final position. Prevent segregation of mix.

vii. Place concrete in continuous operation for each panel or section determined by predetermined joints.

viii. Consolidate concrete.

ix. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

x. Place concrete continuously between predetermined expansion, control, and construction joints.

xi. Do not interrupt successive placement; do not permit cold joints to occur.

f. Concrete Finishing

i. Provide formed concrete surfaces to be left exposed with broom finish from soft bristled broom.

g. Curing and Protection

i. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

1) Protect concrete footings from freezing for minimum 5 days.

ii. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

iii. Cure concrete in accordance with ACI 308.1.

1.13 GROUT

A. GENERAL

1. This includes specifications relating to the following:

a. Portland cement grout.

b. Rapid curing epoxy grout.

c. Non-shrink cementitious grout.

d. Epoxy deep pour precision grout

B. EQUIPMENT AND MATERIALS

1. Portland Cement Grout Materials

a. Portland Cement: ASTM C150, Type I and II.

b. Water:

i. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:

1) Corrosion of steel.

2) Volume change increasing shrinkage cracking.

3) Efflorescence.

4) Excess air entraining.

c. Fine Aggregate:

i. Washed natural sand.

ii. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.

iii. Free from injurious amounts of organic impurities as determined by ASTM C40.

d. Mix:

i. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.

2. Rapid Curing Epoxy Grout.

a. Manufacturers:

i. L&M Construction Chemicals, Inc.

ii. Sika Corporation.

iii. Or approved equal.

b. Rapid Curing Epoxy Grout: High strength, three component epoxy grout formulated with thermosetting resins and inert fillers. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids and alkalies.

Property	Test	Result
Compressive Strength	ASTM C579	12,000 psi at 7 days
Tensile Strength	ASTM C307	2,000 psi minimum
Coefficient of Expansion	ASTM C531	$30x10^{-6}$ in per degree F
Shrinkage	ASTM C827	None

3. Non-Shrink Cementitious Grout

a. Manufacturers:

i. L&M Construction Chemicals, Inc.

ii. QUIKRETE.

iii. Sika Corporation.

iv. Or approved equal.

b. Non-shrink Cementitious Grout: Pre-mixed ready for use formulation requiring only addition of water; non-shrink, non-corrosive, non-metallic, non-gas forming, no chlorides.

c. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Type D non-shrink grout:

Property	Test	Time	Result
Setting Time	ASTM C191	Initial	2 hours (Approx)
		Final	3 hours (Approx)
Expansion			0.10% - 0.4% Maximum
Compressive Strength	CRD-C621	1 day	4,000 psi
		7 days	7,000 psi
		28 days	10,000 psi to 10,800 psi

4. Epoxy Deep Pour Precision Grout

a. Manufacturers:

i. Five Star DP Epoxy Grout

ii. Or approved equal.

b. Epoxy Deep Pour Precision Grout: Expansive, chemically resistant, non-shrink, low exothermic epoxy system for machinery grouting.

c. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Type D non-shrink grout:

Property	Test	Time	Result
Coefficient of Expansion	ASTM C531		17 x 10^{-6} in/in/°F
Compressive Strength	ASTM C579 B	1 day	11,000 psi
		7 days	14,000 psi
		28 days	15,500 psi

5. Curing

a. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or with use of wet burlap method.

C. EXECUTION

1. Installation

a. Preparation

i. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

ii. Rough concrete lightly, but not enough to interfere with placement of grout.

iii. Remove foreign materials from metal surfaces in contact with grout.

iv. Align, level and maintain final positioning of components to be grouted.

v. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

b. Formwork Installation

i. Construct leakproof forms anchored and shored to withstand grout pressures.

ii. Install formwork with clearances to permit proper placement of grout.

c. Mixing

i. Portland Cement Grout:

1) Use proportions of 2 parts sand and 1 part cement, measured by volume.

2) Prepare grout with water to obtain consistency to permit placing and packing.

3) Mix water and grout in two steps; pre-mix using approximately 2/3 of water; after partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing 2 to 3 minutes.

4) Mix only quantities of grout capable of being placed within 30 minutes after mixing.

5) Do not add additional water after grout has been mixed.

6) Capable of developing minimum compressive strength of 3,600 psi in 48 hours and 7,000 psi in 28 days.

ii. Mix and prepare rapid curing epoxy grout in accordance with manufacturer's instructions.

1) Capable of developing minimum compressive strength of 10,000 psi in 48 hours and 12,000 psi in 28 days.

iii. Mix and prepare non-shrink cementitious grout in accordance with manufacturer's instructions.

1) Capable of developing minimum compressive strength of 4,000 psi in 24 hours and 10,000 psi in 28 days.

iv. Mix grout components in proximity to work area and transport mixture quickly and in manner not permitting segregation of materials.

d. Placing Grout

i. Place grout material quickly and continuously.

ii. Do not use pneumatic-pressure or dry-packing methods.

iii. Apply grout from one side only to avoid entrapping air.

iv. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

v. Thoroughly compact final installation and eliminate air pockets.

vi. Do not remove leveling shims for at least 48 hours after grout has been placed.

e. Curing

i. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

ii. After grout has attained its initial set, keep damp for minimum of 3 days.

1.14 EARTHWORK

A. GENERAL

1. This section includes:

a. Aggregates for earthwork

b. Soils for Earthwork

B. EQUIPMENT AND MATERIALS

1. Course Aggregate Materials

a. Coarse Aggregate Type A1 3/4 in Crushed Rock: Conforming to the most recent year Standard Specifications for Public Works Construction Standard 200-1.2.

b. Coarse Aggregate Type A2 1-1/2 in Crushed Rock: Conforming to 2022 State Specifications Section 19-3.02D, minimum 90% fractured faces, with the following gradation:

Sieve Size	Percent Passing
2-inches	100
No. 50	0 to 100
No. 100	0 to 8
No. 200	0 to 4

c. Aggregate Type A5 (Permeable Material): Shall be “Class 2 Permeable Material” conforming to Section 68-2.02 of the latest version of the State Specifications. The aggregate shall have a minimum sand equivalent value of 75, with the following gradation:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	90 to 100
3/8 inches	40 to 100
No. 4	25 to 40
No. 8	18 to 33
No. 30	5 to 15
No. 50	0 to 7
No. 200	0 to 3

2. Soils For Earthwork

a. Subsoil Type S1 (Select Import): Should be predominantly granular and meet the following criteria:

i. Expansion Index of less than 20.

ii. Free of all deleterious material.

iii. Contain no particles larger than 4 inches in the largest dimension.

iv. Contain less than 25 percent gravel (at least 75 percent passing No. 4 sieve)

v. R-vale of at least 50 as determined by California Test 301.

vi. Any import fill should be tested and approved by the District prior to delivery to the site.

b. Subsoil Type S2 (Native Material):

i. Excavated and re-used material.

ii. Screened and graded.

iii. Free of lumps and rocks larger than 2 inches.

iv. Free of all deleterious material.

END OF SECTION