

**CITY OF SCOTTSDALE
SEWER LIFT STATION DESIGN CRITERIA
February 2021 (Updated 01/25/2022)**

The purpose of this Sewer Lift Station Design Criteria document (design criteria) is to provide direction on Private Development projects related to the design of sewer lift stations that will ultimately be owned and operated by the City of Scottsdale (City). It is also recommended that the design of privately owned lift stations follow this design criteria in the event that the City is asked or required to assume responsibility for those stations in the future. Upgrades or modifications to existing sewer lift stations shall meet these standards to the extent practical. While this document provides general design guidelines, there are many site-specific conditions that may require additional or varying design criteria. The City reserves the right to modify or waive any design standard for a particular application. In addition, updates to regulations and City requirements may require modifications to these criteria. This design criteria shall serve as a general design template, and site-specific designs shall be reviewed and modified as required by the City. Any deviations from this criteria will require justification to and the written approval of the City's Water Resources Department (WRD) prior to construction. The reader shall also refer to the following standards for additional wastewater system criteria, including lift stations:

- City of Scottsdale Design and Policies Manual (DSPM), most recent version
- Engineering Bulletin Number 11, "Minimum Requirements for Design, Submission of Plans and Specifications of Sewage Works", published by the Arizona Department of Environmental Quality (ADEQ) and amended by Title 18, "Environmental Quality", from the Arizona Administrative Code (AAC)

1. GENERAL/DOCUMENTATION

1.1 Pre-Design Meeting:

- When a Private Development project requires a sewer lift station, a pre-design meeting shall be held with the developer, design engineer and WRD to determine the design parameters, including tributary area and site-specific criteria, and review any questions on the intent of this design criteria.

1.2 Project Documents:

- Basis of Design Report (BOD): The BOD shall be prepared, signed and sealed by an Arizona Registered Engineer. It shall be submitted to the City for review and approval and will include, at a minimum, the following:
 - Description of design criteria to be utilized other than this document,
 - Flow computations,
 - Wet well volume calculations,
 - Retention and pump cycling calculations,
 - Hydraulic analysis including friction and minor headloss calculations,
 - Calculated system curves with overlaid pump curves,
 - Water hammer (surge) protection analysis/ recommendations,

- Structural component description and calculations
 - Electrical, instrumentation, and process description, control description, and calculations,
 - Approach to corrosion, odor, and noise control,
 - Define site, right-of-way, and easement requirements,
 - Listing of permit requirements,
 - Geotechnical investigation,
 - Cost estimate based on unit costs for major elements of work following this design criteria.
- Design Drawings: Prepare design drawings that depict the proposed improvements and include detailed callouts, completed details, and horizontal and vertical control. Final drawings shall be signed and sealed by an Arizona Registered Engineer. Design drawings shall be in accordance with Chapter 7-1.501 from the City DSPM.
 - Specifications/Special Provisions: Prepare specifications in Construction Specifications Institute (CSI) 17 division format. Special provisions may be prepared in lieu of specifications with approval of the City. The specifications/special provisions shall address improvements that are not covered by Maricopa Association of Governments (MAG), City of Scottsdale Supplements to MAG Specifications and Details, or City standards and specifications. The specifications/special provisions shall also supplement or revise the MAG and City documents as required for the project and as approved by the City. Final specifications/special provisions shall be signed and sealed by an Arizona Registered Engineer and correspond to the design drawings submitted concurrently.
 - List of Required Construction Submittals: List of construction submittals with corresponding specification number requiring Engineer or City approval.

1.3 Approvals:

- Step 1: Water Resources Department Conceptual Design - Submit the BOD to the City WRD for review. Meet with the WRD to discuss review comments and obtain project approval from the City WRD prior to submitting detailed plans and specifications.
- Step 2: Water Resources Department Detailed Design - Submit the 30%, 60%, and 90% plans and specifications to the City WRD for review. Meet with the WRD after each submittal to discuss WRD review comments. Obtain approval from the City WRD prior to submitting each progressive submittal.
- Step 3: One Stop Shop - Along with written approval from WRD, submit 100% plans and specifications to the City's One Stop Shop. All applicable City departments, including the WRD, will review this submittal.
- Step 4: Maricopa County Environmental Services Department (MCESD) - Obtain the Approval to Construct (ATC) and Approval of Construction (AOC) permits from MCESD. The AOC permit shall be obtained after functional testing and prior to

system start-up. Copies of ATC and AOC documentation shall be provided to the City.

1.4 Operation & Maintenance Manuals: Provide Operation and Maintenance (O&M) Data in the form of instructional manuals. The O&M manuals shall first be reviewed by the design engineer. Once the O&M manuals have been approved by the design engineer, three sets of the O&M manuals shall be prepared and provided to the City WRD. Each set shall include two (2) hard copies and one (1) electronic copy of the provided materials. The City WRD shall review and approve the O&M manuals prior to final inspection and acceptance. O&M manuals shall include:

- Contact information for the Contractor, Engineer, and Local Supplier
- Engineer approved submittals
- Disassembly drawings
- Operating instructions
- Test data
- Maintenance recommendations and schedule
- Troubleshooting procedures
- Recommended spare parts
- Warranty terms and duration

O&M manuals will be provided for the following:

- All equipment and systems
- All valves and related accessories
- All instruments and control devices
- All electrical gear.

1.5 Shop Drawings: Shop drawings shall first be reviewed by the design engineer. Once the design engineer has approved a shop drawing, one (1) electronic copy shall be provided to the City WRD. The City WRD shall review and approve the shop drawing prior to the item being released for construction. Shop drawings shall include:

- Detailed design calculations with engineering seals as required
- Fabrication and installation drawings
- Equipment and/or component lists
- Performance graphs or curves
- Test data
- Applicable certifications
- Notes, highlights and explanations to the proposed changes to the Contract Documents

- 1.6** Project Record Documents: Prepare site “As-Built” drawings that are certified and sealed by an Arizona Registered Land Surveyor and/or an Arizona Register Engineer prior to start up. Two hard copies of the “As-Built” drawings shall be prepared and provided to the City WRD prior to final inspection and acceptance. One (1) electronic PDF and CAD copy of the “As-Built” drawings shall be provided in addition to the hard copies. In addition, each control panel shall have a copy of the panel as-built drawings located inside the panel itself. “As-Built” drawings shall be in accordance with Chapter 7-1.600 from the City DSPM.

2. SITE DESIGN

- 2.1** Ownership: The property on which a lift station is located shall be owned in fee by the City.

- 2.2** Size & Layout: The preferred size for a lift station site is 100 feet by 100 feet (0.2 acres). The minimum size for a new lift station site is 80 feet by 80 feet. In addition, the pumping capacity for a new lift station shall not be less than 40 gpm. Any new lift station sites smaller than the minimum size in this design criteria must be approved by WRD. The site shape is not required to be square, but the length of the long side should not be more than 2 times the length of the short side (e.g. 70 feet by 145 feet).

- 2.3** Location: Location considerations shall be made in accordance with Chapter 7-1.302.A from the City DSPM.

- 2.4** Ground Cover: Non-roadway surfaces with gradual slopes outside drainage areas shall be covered with 2” of $\frac{3}{4}$ ” minus decomposed granite or a crushed granite polymer section.

- 2.5** Roadway Surface: Access driveways located outside of the site shall be concrete or asphalt pavement designed for H20 loading. Interior roadway surfaces shall be 2” of $\frac{3}{4}$ ” minus decomposed granite over compacted aggregate base course (ABC) or crushed granite polymer section designed for H20 loading.

- 2.6** Grading & Drainage: Site grading, drainage, and detention/retention shall be in accordance with Chapter 4 of the City DSPM.

- The City may require a Drainage Report based on the site specific conditions and proposed improvements.
- Positive drainage shall be provided away from all structures and equipment.
- Drainage shall not be concentrated or conveyed in drive areas.
- Erosion control measures (rip-rap, road dips, etc.) shall be included for roadway surfaces and site outfalls.
- The inside diameters of proposed culverts shall not be less than 18-inches.
- Any off-site drainage shall be routed around the site’s walls.

- 2.7** Equipment Pads: All equipment shall be placed on concrete equipment pads. Pad elevations shall be a minimum of 6-inches above the drainage outfall elevation for the site. The drainage outfall may be a graded outfall or a pipe outfall. If it is a pipe outfall, pad elevations shall be a minimum of 6-inches above the top of pipe elevation.

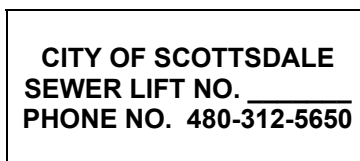
- 2.8** Above Ground Piping Pad: The above ground discharge piping shall be installed on pipe supports that sit on a concrete pad surrounded by a 6-inch curb. The pad shall slope towards a floor drain. The floor drain shall be a controlled opening and plumbed to the lift station's wet well. It will include a threaded cap with a 2" operation nut. The drain pipe shall be Schedule 80 polyvinyl chloride (PVC). Bollards shall be installed around the concrete pad to protect the discharge piping assembly. The above grade piping discharge pad's elevation shall be a minimum of 6-inches above the drainage outfall elevation for the site. The drainage outfall may be a graded outfall or a pipe outfall. If it is a pipe outfall, pad elevations shall be a minimum of 6-inches above the top of pipe elevation.
- 2.9** Water Service: Potable water service shall be provided onsite for maintenance/wash down hose bib(s), the emergency eyewash/shower, and landscape irrigation (if required). All services shall be metered and include a backflow prevention assembly. The meter and backflow prevention device are to be located adjacent to but outside the walls of the facility (see City of Scottsdale Standard Detail 2354). The site will include a 1-1/2" threaded wash down connection and a 3/4" hose bib. Both will include upstream ball valves for isolation and approved atmospheric vacuum breakers. Both shall be installed in an above ground location. At no time shall there be a connection between domestic water and the wet well or wastewater.
- 2.10** Wash Down Area: Provide a 10 feet by 10 feet concrete pad dedicated for wash down activities. The pad shall be surrounded by a 6-inch curb and slope towards a floor drain. The floor drain shall be a controlled opening and plumbed to the lift station's wet well. It will include a threaded cap with a 2" operation nut. The drain pipe shall be Schedule 80 PVC. Provide a hose bib at the wash down area.
- 2.11** Discharge Manhole: The interior of the manhole that the lift station's force main discharges to shall be lined with one of the coating systems described in Section 3.9. Coating inspection and warranty requirements described in Section 3.9 shall also apply to the discharge manhole. The force main's discharge outlet within the discharge manhole shall be configured per City of Scottsdale Standard Detail 2402.
- The force main piping within the discharge manhole shall be schedule 80 PVC. The force main shall transition from its primary material to PVC within 5' from the discharge manhole.
- 2.12** Exterior Coatings: All walls, enclosures, above ground piping, and equipment shall be coated to match natural surroundings.
- The City must approve coating colors prior to construction.
 - When the station is within a residential or commercial development, the proposed walls can match the finish or facade of the development wall with City approval.
 - Approved coating manufacturers: TNEMEC or approved equal.
- 2.13** Shade Canopies: Electrical and odor control equipment and tanks shall be covered by shade canopies. The shade canopies shall be installed on cast in place concrete foundations. The structures shall have a roof and three (3) sides covered by steel or aluminum panels and one side open for access. Shade canopy drawings and structural calculations (including any bearing slab and/or footing) shall be reviewed and sealed by an Arizona Registered Structural Engineer.

- Sizing and layout: The shade canopies shall be sized to accommodate all of the electrical or odor control equipment and provide enough space for code, operation, and maintenance required clearances. The height of the ceiling in the shade canopies shall provide sufficient vertical clearances from the top of all equipment. The layout of the equipment inside the enclosures shall be designed to provide enough space to walk around the equipment and open equipment doors and hatches, if applicable.
- When the shade canopy is over a tank, its design and calculations will include a tie-off ring above the tank for safety harnesses. The shade canopy frame and tie-off ring shall be designed to handle a 5,000 pound fall protection force. The design of the tie off ring shall conform to Occupation Safety and Health Administration (OSHA) standards.
- All roof and wall sections, especially those covering electrical equipment and control panels, shall be coated steel or aluminum. Fabric will not be accepted.
- Fiber reinforced plastic (FRP) panels shall be installed on applicable walls of chemical storage shade canopies for mounting equipment and protecting the enclosure from chemical exposure.
- Approved shade canopy manufacturer: Aluma-Line or approved equal.

2.14 Noise: Lift station sites shall not cause noise that exceeds a fifteen-minute average sound level of 45 decibels in residential areas and 60 decibels in commercial areas. An average sound level will be determined from 15 measurements performed with an American National Standard Institute (ANSI) S1.4-1971 Type 1 or Type 2 Sounds Level Meter using the A-weighting network. The instrument response shall be "slow" and measurements shall be made when wind velocity is less than five miles per hour. The location for measuring exterior sound levels shall be at the property line of the lift station, four to five feet (4' to 5') above ground level and at least four feet (4') from walls and other reflective surfaces.

2.15 Signs:

- Site Signs: Site address, lift station number, and phone number shall be posted outside the front of the site after construction completion. Signs shall have a green background with 2" white reflective lettering. The sign will be made of aluminum. Site signs shall read:



- Security Signs: Warning and no trespassing signs shall be posted outside the front of the site after construction completion. Warning and no trespassing signs shall also be posted on the outside of all perimeter walls. Signs will be evenly spaced along the perimeter walls with a maximum 100' spacing on each wall. There will be a minimum of one sign on each side of the site. Sign lettering and material shall match the site signs with a white background and black text.

- Safety Signs: Provide appropriate warning signage regarding confined space entry at the wet well, non-potable water, and other site-specific safety signs. Sign lettering and material shall match the site signs with a color scheme and letterings as required by applicable codes. Provide a National Fire Protection Association (NFPA) 704 Fire Diamond for each chemical stored on site on the chemical tank, the tank's shade canopy, and the site gate.

2.16 Access: Two vehicular access points into the site shall be provided or sufficient turn around space for required maintenance vehicles, fire trucks, and 40-ft long vacuum trucks shall be provided. Crane access shall be provided to the pumps, fueling access shall be provided to the generator, and chemical loading access shall be provided to the odor control equipment.

2.17 Walls, Gates, & Man Doors: The site shall be surrounded by an 8-ft high concrete masonry unit (CMU) wall. The cells of the wall shall be grouted solid. Include 16-ft wide rolling gates for vehicle access and a separate 3-ft wide man door. The man door should not be in the rolling path of the gate. Each access will be electronically keyed to City specification. Equipment height shall not exceed wall height without prior City approval, except the emergency beacon and the remote terminal unit (RTU) antenna. Gate and door security access shall be in accordance with the City Security and Safety team requirements. Include conduits and space for a future motorized gate operator. In addition, include conduits and space for future security equipment as described in Section 6.11.

2.18 Landscaping: There shall be no landscaping within the site. Trees are not allowed within 20' of the site walls. Low bushes can be placed between the site walls and the trees. Any landscaping installed around the site shall be self-sustaining after one year of installation.

3. PROCESS/MECHANICAL

3.1 Pumps & Motors: Each sewer lift station shall include a minimum of two (2) pumps sized in a one (1) duty + one (1) standby configuration (or n+1 for lift stations that require individual pumping capacities larger than 3,000 gpm). Design flows shall be calculated in accordance with the DSPM and in consultation with City WRD. Each pump shall additionally include a 35 gallons per minute (gpm) flow allowance above the peak calculated flow to account for the draining of residential swimming pools in the service area. If the lift station will serve an area with multi-family and/or commercial customers, the instantaneous flows for draining larger swimming pools shall be defined in the BOD and accounted for in the pump sizing. Each pump and its installation shall comply with the latest edition of the Hydraulic Institute Standards. The following list provides the submersible sewage pump requirements:

- Pump shall be of submersible type mounted on a cast iron discharge connection. The seal between the pump and discharge connection shall consist of a metal-to-metal contact between machined surfaces. Mating surfaces shall be machined and may be fitted with Nitrile rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit. Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression are prohibited. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

- Installation shall utilize two (2) 304L stainless steel rails, a 304L stainless steel upper guide rail bracket, and a 304L stainless steel intermediate guide rail brackets if required by the wet well depth. All rail mounting hardware shall also be 304L stainless steel, including the submersible lifting chain and shackles for pump removal. Rail brackets/mounts shall have a maximum spacing of 5’.
- Motors shall be National Electrical Manufacturers Association (NEMA) B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. Motors shall be inverter duty (variable frequency drive rated), 460 Volt (V), 60 Hertz (Hz), 3 phase (PH). Motor horsepower (HP) shall be sufficient so that the pump is non-overloading anywhere on its performance curve, from shut-off to run-out. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater. Motor cooling shall be achieved through the use of an integral cooling system, such as a cooling jacket. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The pumps and motors shall be provided and assembled by the same manufacturer, who takes unit responsibility. See Section 6.2 for motor controls, monitoring, and protection.
- Provide pump impellers capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. Impeller design shall be of Hard-Iron (American Society for Testing and Materials (ASTM) A-532 Alloy III A 25% chrome cast iron) and the leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction.
- Pump shall be equipped with stainless steel motor shafts. The pump and motor shaft shall be a single piece unit. The pump shaft shall be an extension of the motor shaft. Shafts using mechanical couplings are prohibited. Shaft sleeves are prohibited.
- Pump mixing valves are prohibited.
- Discharge Accessories: Pumps shall include a check valve located above ground. Acceptable check valve types are described in Section 3.6. All pump discharges shall also include a combination air release valve, restrained flexible couplings, pressure gauge and transmitter, and isolation plug valves. All accessories shall be rated for sewer service.
- Pump Tests: Provide factory hydrostatic tests, factory performance tests, factory motor tests, and field performance tests. All factory tests and test reports shall conform to the requirements and recommendations of the Hydraulic Institute Standards. Acceptance criteria shall be Grade 1U as defined by table 14.6.3.4 in Hydraulic Institute Standards 14.6.3.4.
- Coatings: Coat all interior and exterior ferrous metal surfaces of pump and motor with a high solids epoxy coating system. All coatings shall be rated for wastewater.
- Approved pump manufacturers: Xylem Flygt, Fairbanks Morse

3.2 Above Ground Piping: Above ground piping refers to the lift station’s discharge piping, including piping inside vaults. All discharge piping 3-inches and larger must be above ground and installed on pipe supports that sit on a concrete pad surrounded by a 6-inch curb. Bollards shall be installed around the concrete pad to protect the discharge piping assembly from vehicles. All

fittings and appurtenances shall be placed on the above ground discharge piping. Discharge piping with a 2-inch diameter can be installed above ground or inside a vault. Vault installations shall be approved by WRD and meet the requirements listed in Section 4.4. All discharge piping shall be installed at an elevation that ensures the above grade piping is filled with wastewater. The discharge piping shall also include an emergency bypass for portable pumps. The bypass shall be installed downstream of the pumps' check valves and upstream of the flow meter. It shall include a City approved threaded connection or camlock fitting.

- Sizing: The above ground piping should be sized such that the inside diameter of the piping maintains a velocity between 4 feet per second (ft/s) and 6 ft/s. The minimum pipe size shall be 2-inches.
- Material: Above ground piping material shall be as follows:
 - 2-inch: 304 stainless steel in conformance with ASTM A312.
 - 3-inch and larger: Ductile iron pipe lined with a ceramic epoxy lining in conformance with American Water Works Association (AWWA) M41, C110, C115, and C151.
 - The use of galvanized and black iron piping is prohibited.
- Coatings: Coat exterior surfaces of above ground ductile iron piping with an ultraviolet (UV) resistant, high solids epoxy coating system. Approved coating manufacturer: TNEMEC
- Linings: The interior of the above ground ductile iron piping shall be lined with 40 mils of ceramic epoxy. Approved ceramic epoxy manufacturer: Induron, TNEMEC.
- Bolts: Above ground bolts shall be zinc coated per MAG specifications or 316 stainless steel. If stainless steel bolts are used, provide isolation kits wherever dissimilar metals are in contact.

3.3 Wet Well Piping: Wet well piping refers to the lift station's piping inside the wet well.

- Sizing: The wet well piping should be sized such that the inside diameter of the piping maintains a velocity between 4 feet per second (ft/s) and 6 ft/s. The minimum pipe size shall be 2-inches.
- Pump Discharge Piping Material: Pressurized wet well piping material shall be as follows:
 - 2-inch: 304 stainless steel in conformance with ASTM A312.
 - 3-inch and larger: Ductile iron pipe lined and coated with a ceramic epoxy lining in conformance with American Water Works Association (AWWA) M41, C110, C115, and C151.
 - The use of galvanized and black iron piping is prohibited.
- Gravity Piping Material: Gravity wet well piping material shall be as follows:
 - 2-inch and larger: Schedule 80 PVC in accordance with ASTM D1785 and D2665.

- Coatings: Coat exterior surfaces of wet well ductile iron piping with ceramic epoxy. Approved ceramic epoxy manufacturer: Induron, TNEMEC.
- Linings: The interior of the wet well ductile iron piping shall be lined with 40 mils of ceramic epoxy. Approved ceramic epoxy manufacturer: Induron, TNEMEC.
- Bolts: Wet well bolts shall be 316 stainless steel. Provide isolation kits wherever dissimilar metals are in contact.

3.4 Below Ground Piping: Below ground piping refers to the lift station's yard piping between the above ground discharge piping and the lift station's offsite force main. All below ground piping shall be restrained.

- Sizing: The below ground piping should be sized such that the inside diameter of the piping maintains a velocity between 4 ft/s and 6 ft/s. The minimum pipe size shall be 2-inches.
- Material: Below ground piping material shall be as follows:
 - 2-inch through 4-inch: High-density polyethylene (HDPE) in accordance with ASTM D3350. The pressure selection for HDPE pipe shall account for temperature derating and account for minimum required test pressures. HDPE pipe design shall also adequately account for thermal growth and contraction between fixed points with adequate expansion/contraction fittings. Thrust collars shall be installed at all connections between new HDPE pipe and a structure, a different piping material, and an existing pipe. The detailed design shall include connection details and if the design is based the iron pipe sizing (IPS) or ductile iron pipe sizing (DIPS).
 - 6-inches and larger: HDPE in accordance with ASTM D3350 or fully restrained class 350 ductile iron pipe lined with a City approved cured-in-place pipe (CIPP) lining in accordance with AWWA M41, C110, C150, C151, C153 and MAG 750.
 - The pressure selection for HDPE pipe shall account for temperature derating and account for minimum required test pressures. HDPE pipe design shall also adequately account for thermal growth and contraction between fixed points with adequate expansion/contraction fittings. Thrust collars shall be installed at all connections between new HDPE pipe and a structure, a different piping material, and an existing pipe.
 - Below ground ductile iron piping shall be encased in a polyethylene protective wrapping to protect it from corrosion.
 - Design, installation, and testing of all CIPP installations shall be in accordance with ASTM F1216.
 - Lining system shall be InstituMain by Aegion or preapproved equal.
 - The lining system will have the same pressure rating as the piping it is installed within.

- The system shall be made up of two epoxy resin felt layers with epoxy resin fiberglass layer(s) between them. A liner coating that is designed for wastewater exposure will be included in the interior of the system.
- The maximum fitting angle within a force main with a CIPP lining shall be 22.5 degrees.
- The maximum shot length or liner pull length shall be 750'. Shots shall be joined using HDPE spools with a constant and peak pressure rating equal to or greater than the pipe being lined. Vertically, this joint shall not be placed in a high or low point within the force main profile. Horizontally, it shall not be within an intersection.
- The detailed design of a force main with a CIPP liner shall include the following:
 - Liner thickness, epoxy type, and pressure rating
 - Shot joint details and layout
 - Minimum pressurized liner experience criteria for contractors
 - Pull or insertion method
 - Cure method
 - Testing requirements
- All CIPP installations will be inspected by CCTV.
 - Galvanized and black iron piping is prohibited.
- Coating: The exterior of the below ground ductile iron piping shall be coated with a bituminous coating and wrapped in green polyethylene encasement per AWWA C105.
- Lining: The interior of the below ground ductile iron piping shall be lined with a City approved CIPP.
- Bolts: Below ground nuts and bolts shall be 304 stainless steel with isolation kits.

3.5 Force Main: The design of the lift station's discharge force main shall follow the guidance provided in Chapter 7-1.303 of the City DSPM.

3.6 Valves:

- Plug Valves: Eccentric plug valves shall be provided on the discharge of all pumps, outside the wet well and above ground. Install the plug valves horizontally so the plug rotates up 90° to open and the plug seat is facing downstream when closed. The plug valves shall be located downstream of the check valves. All valve materials shall be rated for wastewater and shall have a minimum of 40 mils of ceramic epoxy lining.

The plug valves shall have pressure ratings equal to or greater than the pipeline they are connected to. Approved manufacturer: DeZurik or approved equal.

- **Check Valves:** Full-port solids handling ball check valves shall be provided on pump discharges 8" and smaller, outside the wet well and above ground. Swing check valves are allowed for pump discharges greater than 8", and should also be installed outside the wet well and above ground. Alternative style check valves shall be submitted to the City for review for conditions where ball or swing check valves are not feasible, such as high-pressure or surge applications. All valve materials shall be rated for wastewater. All check valves (except for ball check) shall have a minimum of 40 mils of ceramic epoxy lining. Valves shall be of the type that begins to close as the forward flow diminishes and is fully closed at zero velocity. Valve shall permit flow in one direction only and close tightly, without slamming, when its discharge pressure exceeds its inlet pressure. Check valves shall have pressure ratings equal to or greater than the pipeline they are connected to. The design engineer shall verify that sufficient backpressure is available to close the check valve per manufacturer requirements. If sufficient backpressure is not available, special configurations shall be approved by WRD. Approved ball valve manufacturers: Flygt/HDL or approved equal. Approved swing check valve manufacturers: DeZurik or approved equal.
- **Air Valves:** All air valves shall be combination valves. Valves shall be provided on the discharge of all pumps before the check valves, outside the wet well and above ground. Valves shall be provided on the discharge of all pumps downstream of the flow meter and above ground. The design of the combination valves shall follow the guidance provided in Chapter 7-1.303.C of the City DSPM. On the lift station discharge piping, the combination valves will be installed before the check valves and at the end of the above ground piping before it drops below grade. All combination valve materials shall be rated for wastewater. The valves shall have pressure ratings equal to or greater than the pipeline they are connected to. Combination valve drain lines shall be routed to a drain that leads to the lift station wet well. All valves shall be 2-inches minimum in orifice size. The drain lines shall be PVC Schedule 80 with a UV protective coating. Approved manufacturers: ARI, Apco, Val-Matic, or approved equal.

3.7 Flow Meters: An ultrasonic flow meter with digital totalizers and solid state transmitters shall be provided on the lift station discharge. The flow meter shall have 4-20 milliampere (mA) outputs, prevention from memory loss during battery change out, one year battery life, and empty pipe detection that uses no external devices. The flow meter shall be sized to meet both low and high flow ranges per manufacturer recommendations. A minimum of 5 times the diameter upstream and 2 times the diameter downstream of straight pipe shall be provided on each side of the flow meter without any bends or obstructions. The location of the flow meter shall be easily accessible and visible within the site. The flow meter shall have a pressure rating greater or equal to the pipeline it is connected to, and shall be rated for wastewater. Ensure that the flow meter does not include HART/BTI card. COS SCADA does not use HART/BTI card. Approved manufacturer: Endress+Hauser Proline Prosonic 92F.

3.8 Hydropneumatic Tanks: Provide a transient analysis model for the lift station and the force main it pumps through to determine if transient forces require a welded steel hydropneumatic surge tank (hydro tank). If a tank is required, the model will be used to size the tank. The model results shall

be sealed by a professional engineer with current Arizona registration and included with the BOD submitted to the City.

- The tank shall be rated for a pressure that exceeds the high operational and transient pressures anticipated at the facility's discharge.
- Bladder surge tanks are prohibited.
- The hydro tank system shall include the following:
 - Air compressor: The air compressor shall be a two-stage simplex compressor suitable for use with wastewater, mounted on top of an 80-gallon receiver tank. The receiver tank shall include a ball check valve, pressure gauge, drain valve and pressure relief valve. Electric power supply shall be 460 V, 60 Hz, 3 Ph. The air compressor shall be rated for a pressure greater than or equal to the pressure relief setting for the hydro tank. The air compressor shall be located close to the hydro tank and be rated for outdoor use. The air compressor shall include a pressure switch and flexible connection. Approved manufacturer: Ingersoll Rand Series 2375 or approved equal.
 - Air Compressor Controls: Provide a compressor control system that will start and stop the compressor as required based on hydro tank level. Provide all control switches, pressure switches, auxiliary relays, magnetic motor starters, and other accessories required for control of the compressor. Starters shall be provided with factory set thermal overloads with a manual "Reset" push button. All control equipment for the compressor module shall be housed in a NEMA 4 control panel except for the low receiver pressure switch. Refer to Section 6.4 for details on controls.
 - Pressure Assembly: A pressure assembly shall be provided to aid in hydro tank level control and compressor operation. The pressure assembly shall be located on a stainless steel rack. The assembly shall include a pressure relief valve, pressure switch, pressure gauge, two solenoid valves, a quick connect for an external air source, a check valve, and isolation valves with true unions. The compressor shall be started and stopped based on individual set points configured in the pressure switch to pressurize the receiver tank. The pressure assembly solenoid valve shall be controlled to allow pressurized air into the hydro tank from the receiver tank based on wastewater level in the hydro tank. The pressure assembly air release solenoid shall open when the hydro tank experiences a low water level alarm. The air release solenoid valve shall be de-energized when level in the hydro tank rises above the low level alarm.
 - Accessories: The hydro tank shall include a tank isolation valve, a flushing connection located at the bottom of the tank, two connections for a future recirculation pump, 2" minimum pressure relief valve, combination air valve, dielectric fittings for dissimilar metals, a radar level transducer and a pressure transmitter with a display. The tank shall include two (2) hinged 30-inch manways on both ends of the tank. The bottom of the manways on the ends of the tank shall be located as close as possible to the bottom of the tank. An additional 24-inch manway shall be installed on top of the tank with a davit

arm. All tank connections will have a minimum diameter of 4". Smaller accessories will connect to the 4" connections using tapped blind flanges.

- All isolation valves shall be plug valves. All valves and accessories shall be rated for use in wastewater applications.
- Any electrical and instrumentation gear associated with the hydropneumatic tank shall be rated for a Class 1, Division 1 hazardous location or as appropriate with respect to its location with respect to the tank.
- Name Plate: A permanent name plate shall be provided that includes manufacturer name, working pressure at rated temperature, maximum allowable pressure, serial number, date of fabrication, thickness and tensile strength of shell and head steel.
- Steel legs shall be provided that are mounted to reinforced concrete foundations.
- Coatings and Linings: Coat exterior surfaces with a UV resistant, high solids epoxy coating system. Line interior surfaces with 100% solids ceramic epoxy coating system (70 mils dry film thickness minimum) specifically designed for wastewater immersion. Approved coating manufacturer: TNEMEC or approved equal.

3.9 Wet Well:

- The inlet gravity sewer pipe connection to wet well interior shall discharge into an internal drop bowl pipe system with stainless pipe supports and hardware. Approved manufacturer: RELINER/Duran Inc.
- Access Hatch: Provide a wet well access hatch made of aluminum, stainless steel, or another non-corrosive material rated for H-20 loading. The hatch shall include recessed handles, lifting assist struts, slam locks, automatic open arms, and recessed padlock assemblies. The hatch interior shall include an opening/release handle. The hatch opening and all of its accessories shall be sized to provide 6-inches around the footprint of both pumps or per manufacturer recommendations, whichever is greater. Provide a fall protection grating as described in Section 4.1. Approved hatch manufacturer: Bilco or approved equal.
- Interior Coating: The interior surface of the wet well shall include an underlayment and top coating using Raven 405, Neopoxy 5300, Sauereisen SewerGard No. 210, Somay Plasite 5371 or approved equal. The total minimum underlayment and coating thickness shall be 1/4". A manufacturer certified coating application technician with current certification shall apply the coating system. The coating shall be guaranteed free of defects and workmanship for a five-year period. The warranty shall be included in the site's O&Ms, and will cover material, coating replacement and or repair. After the protective coating has set hard to the touch, it shall be inspected with high-voltage holiday detection equipment. An induced holiday shall be applied to the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The test voltage will be confirmed with the coating manufacturer. All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or

another hand tooling method. After abrading and cleaning, additional protective coating material can be hand applied to the repair area. All touch-up/repair procedures shall follow the protective coating manufacturer's recommendations. A National Association of Corrosion Engineers (NACE) certified inspector shall inspect the surface preparation and coating applications. All inspection reports shall be submitted to the City after construction with the site's O&Ms.

4. SAFETY

4.1 Fall Protection:

- Hatch Grating: Provide a hinged fall protection grating system with the wet well access hatch. The grate shall be made of aluminum with a powder coat finish that is safety-yellow or orange in color. The grating system shall be equipped with stainless steel hardware. Approved manufacturer: Bilco or approved equal.
- Concrete Anchors (D-Rings): Provide at least two (2) recessed concrete anchors (D-rings) on the top of the wet well lid that are designed for use as an attachment for a personal fall arrest, restraint, work positioning, or rescue system. The concrete anchors shall conform to ANSI Z359 family of standards on fall protection, ANSI A10.32, and applicable local, state, and federal (OSHA) requirements. Approved manufacturer: DBI Sala or approved equal.
- Wet Well Handrails: Provide cores on the wet well lid surrounding the access hatch for a removable handrail system. The handrail system shall surround the access hatch on all four sides. It shall be made of aluminum and meet or exceed OSHA requirements. Protect all railing surfaces in contact with concrete or dissimilar metals from corrosion. Provide a location on one of the lift station's interior site walls to hang the handrails when removed. Provide plugs or caps for the cores when the railings are not in use.
- Wet Well Hoist: Provide a portable hoist and core mount sleeve on the wet well lid. The hoist shall be designed for manhole and confined space entry/retrieval. The hoist shall be provided with a manual winch and retractable lifeline. Approved manufacturer: Miller DuraHoist or approved equal. Provide plug or cap for the core when the hoist is not in use.

4.2 Emergency Eyewash and Shower: Provide an emergency eyewash and shower at the odor control areas. Provide a stainless steel showerhead and a stainless steel eyewash bowl. The emergency eyewash and shower drain line shall be plumbed to a drain that flows to the wet well. Provide insulation and aluminum jacket on all outdoor exposed piping. The emergency eyewash and shower shall be provided with an anti-scald valve, and flow switch connected to Supervisory Control and Data Acquisition (SCADA).

- Approved eyewash and shower manufacturer: Guardian

4.3 Labels and Coatings: All chemical piping shall be painted with a UV resistant coating that is compatible with the piping material being coated and the chemical being conveyed. The color of the chemical piping shall be approved by the City prior to application. All chemical piping shall

include chemical and flow direction labels. All tanks shall be labeled with the name of the chemical they store.

4.4 Vaults:

- Vault Openings: Provide enough clearance to allow for easy access to or from the ladder. Vault openings should line up with the sidewall on which the fixed ladder will be mounted. Vault openings shall open at least 90 degrees from horizontal, and should be able to be latched in the open position and padlocked when closed to prevent unwanted intrusion.
- Ladders: Provide a step through design or sidestep design fixed ladder. Alternating tread-type stairs, individual-rung stairs, ladder cages, and ladder wells are not allowed. The ladder shall be permanently attached to the vault, with a minimum perpendicular distance of 7" from the centerline of the rungs to the wall on which the ladder is mounted. Mount the ladder such that it has a pitch of 90 degrees or less and the top rung clears the edge of the opening by at least 7". The ladder shall be capable of extending at least 42" above the vault surface using grab bars or a ladder extension. All ladder materials shall be corrosion-resistant or protected against corrosion. Ladders taller than four (4) feet from a lower level, not including the 42" ladder extension, must be equipped with a ladder safety system. The safety system shall include a carrier, safety sleeve, lanyard, connectors, and body harness. The carrier shall be a flexible cable attached to the fixed ladder or immediately adjacent to it and constructed so that the lanyard connector can travel from 42" above the top rung to the bottom rung of the ladder. The ladder should also have:
 - A maximum intended load of 600 lbs. or greater
 - Rungs with a minimum clear width of 16 inches
 - Textured rungs to prevent employees' feet from sliding off
 - A clear width of at least 15 inches on each side of the ladder centerline to the nearest permanent object
 - A minimum perpendicular distance of 30 inches from the centerline of the steps or rungs to the nearest object on the climbing side. When unavoidable obstructions are encountered, the minimum clearance at the obstruction may be reduced to 24 inches if deflector plates are installed.
- Stairways: Provide standards stairs. Ship, spiral, and alternating tread-type stairs are only allowed with WRD approval. Stairways shall include:
 - Vertical clearance of at least 6 feet, 8 inches above any stair tread to any overhead obstruction, as measured from the leading edge of the tread
 - Uniform riser heights and tread depths between landings
 - Stairway landings and platforms that are at least the width of the stair and at least 30 inches in depth, as measured in the direction of travel

- Stairway landings and platforms where the swing of the door or gate does not reduce the platform's effective usable depth to less than 22 inches
- To be able to support at least five times the normal anticipated live load on each step, but never less than a concentrated load of 1,000 pounds applied at any point
- Handrails to provide employees with a handhold for support
 - Less than 44 inches wide requires at least one handrail
 - From 44 inches to 88 inches wide requires one handrail on each enclosed side
 - Greater than 88 inches wide requires one handrail on each enclosed side and one intermediate handrail located in the middle of the stair
- To be installed at angles between 30 to 50 degrees from the horizontal;
- To have a maximum riser height of 9.5 inches (24 cm);
- To have a minimum tread depth of 9.5 inches (24 cm); and
- To have a minimum width of 22 inches (56 cm) between vertical barriers.
- Platforms and Ramps: Each surface elevated above a lower level by 4 feet or more, must have either:
 - A guardrail system - a barrier erected along an unprotected or exposed side, edge, or other area of the working surface which prevents employees from falling to a lower level or
 - A safety net system; or
 - A personal fall protection system, (i.e. personal fall arrest, travel restraint, or positioning systems). To be determined by City Safety Coordinator.
 - Toeboards, a low protective barrier designed to prevent materials, tools, and equipment from falling to a lower level.
- Anchorage for Fall Protection: Anchorage requires a secure point of attachment for lifelines, lanyards, and deceleration devices. Anchorage points must be:
 - Designed and certified for 5,000 lbs. or greater
 - Overhead within 10 degrees of the entry point for which they will be used
 - Accessible without a ladder or other lifting device

5. ONSITE AND OFFSITE ODOR CONTROL

5.1 General: Odor generation at a lift station is a highly variable element of lift station design that is impacted by upstream discharges, hydraulic turbulence, upstream odor control chemical use, etc. The odor control systems discussed in this section are the standard systems used by the City.

Due to the variable nature of odor generation and odor mitigation alternatives, the City WRD shall be contacted for approval of the specific odor control concept. If no existing homes or planned development are located near the lift station and its discharge manhole, odor control measures may be limited to accommodations for future measures with the City's approval. Accommodations will include pads, conduits, water supply, injection points, drain piping from the pads to a manhole or the wet well and vaults for future chemical addition and/or biofilter odor control systems. Lift stations in all other areas shall provide the odor control equipment required by the City WRD.

5.2 Standard Systems and Locations:

- Onsite Odor Control: Provide an onsite chemical addition system with an injection point at the wet well and force main downstream of the flow meter. Refer to Section 5.3 for details on the injection points. Confirm with WRD whether an onsite biofilter system connected to the wet well will also be required for the lift station. The need for a biofilter system will depend on the lift station's collection area, drop, and proximity to homes.
- Offsite Odor Control: If an on-site biofilter odor control system cannot be connected to the station's discharge manhole, an offsite biofilter may be required near the manhole. If the offsite odor control system will be located within a new development, space shall be set aside for the installation of the system by the developer. If the offsite odor control system will be located within an existing development, coordinate with the City WRD to define where the odor control system should be located. All offsite equipment will be installed above grade in a small sound enclosure that is approved by the City Planning department. If offsite equipment is required to be installed below ground, the installation shall be approved by WRD.

5.3 Chemical Addition: Provide a ferrous chloride or sodium hypochlorite addition system onsite to control odors at the offsite force main discharge manholes.

- All chemical piping shall be chlorinated polyvinyl chloride (CPVC).
- An HDPE chemical tank shall be provided and placed in secondary containment (i.e. a second HDPE open container that can hold 110% of the tank's volume). The chemical tank shall be sized for a 30-day supply of chemical at the lift station's maximum demands. Approved tank manufacturer: Poly Processing, Snyder or approved equal.
- The tank will include the following accessories:
 - 30" manway equipped with an emergency pressure relief device
 - Fill connection
 - Overflow connection
 - Vent connection
 - Suction connection
 - Return line connection

- Reverse float liquid level gauge. The gauge shall be located as close as possible to the manway.
- Level transducer connection
- Drain with a shutoff valve on the bottom of the open container
- A chemical feed system shall be provided. The system shall consist of a pump cabinet and a control panel. Approved chemical feed system manufacturer: Flowrox, Watson Marlow or approved equal.
- At a minimum, the pump cabinet shall include the following:
 - Two metering pumps (n+1 where “n” can supply maximum design dose at the lift station’s maximum design flow).
 - Pump cycle timers
 - A calibration cylinder with the bottom set equal to the chemical tank bottom
 - Piping and valves
- The tank and packaged chemical feed system shall sit on a concrete containment area with a 6” curb. The vertical curb shall be tied into the slab and shall include a water stop. The tank shall sit on an elevated concrete pedestal with felt pad within the containment area. The containment area shall include a 2’ L x 2’ W x 3’ D sump. The sump shall be covered by FRP grating. Its drain will include a threaded cap with a 2” operation nut that can be opened from above the grate using a standard valve tool. Include an alarm float in the sump to notify the City of a leak. Approved float manufacturer: Roto-Float or approved manufacturer.
- Chemical pumps shall sit on a 30” minimum tall pedestal. The pedestal shall be made of concrete or a chemical and UV resistant material.
- The containment area, sump, pump pedestal, and CMU walls adjacent and below chemical piping shall be coated with a fiberglass mat reinforced mortar polyamine epoxy lining. A NACE inspector shall perform inspection and a holiday testing on the containment area coating system after application. Approved containment area coating system: TNEMEC.
- Install injection points into the wet well and on the force main, downstream of the flow meter. Install spare injection piping to both points. The injection point into the force main shall consist of an injection quill with a check valve feature and shutoff valve. The injection quill shall be rated for wastewater use. Injection into the wet well shall occur at an upstream manhole. If this is not possible, the injection piping shall penetrate the wet well’s lid or side wall. The injection piping from the chemical equipment to the manhole or wet well shall be 2” in diameter. It shall reduce to ½” as it penetrates the manhole or wet well. The injection line shall be connected to an interior drop bowl pipe system with stainless pipe supports and hardware. Approved manufacturer: RELINER/Duran Inc.

5.4 Biofilter System: Provide a biofilter odor control system for the lift station’s wet well and/or discharge manhole if determined necessary by WRD. Approved manufacturer: Bohn Biofilter

Corporation or approved equal. The biofilter system shall generally consist of the following components:

- A concrete biofilter basin
- A containment liner designed for safe containment of contaminated soils, liquids, or sludge
- A raised flooring system to support the activated soil media
- Gravel media base
- Activated soil media
- Connection to a foul air duct from the wet well and/or discharge manhole
- Air header, air dampeners, reuseable influent filter, and FRP air distribution piping with upstream and downstream test ports. All exposed piping and components shall be coated for UV protection.
- All buried air piping must drain to the wet well or manhole being served.
- A blower installed inside a weatherproof sound enclosure or located inside a vault. A vault installation must receive WRD approval.
- Irrigation system with programmable controller for moisture control of the activated soil media
- Drain piping plumbed to the wet well and/or discharge manhole

6. ELECTRICAL, CONTROLS AND INSTRUMENTATION

6.1 Power Distribution: Service voltage shall be 480/277V unless unavailable. In the event three phase (3PH) power is unavailable and single phase (1PH) 120/240V service is only available option, VFD's shall be utilized to generate 3PH power to allow use of 3PH pump motors. For new sites, total calculated load shall not exceed 90% of service panel or utility service rating.

- Service Entrance (SES): The SES shall be equipped with a Surge Protective Device (SPD) with a minimum surge rating of 240 kiloamperes (kA) per phase. A Power Quality Meter (PQM) is not required. Approved manufacturer: Square D or City approved equal.
- Lighting and Distribution Panels: Lighting and distribution panels shall be equipped with a SPD with a minimum surge rating of 80kA per phase. The panels shall have a minimum of 25% spare space and/or spare breakers for future use. Approved manufacturer: Square D or City approved equal.
- Transformers (480:120/240V, 1PH & 480:120/208V, 3PH): Transformers less than 15 kilo-volt-amperes (KVA) shall be 480:120/240V, 1PH. Transformers greater than 15KVA shall be 480:120/208V, 3PH. Transformers shall have a minimum 25% spare capacity for future use. Approved manufacturer: Square D or City approved equal.

6.2 Pump Control Panel:

- A single pump control panel shall be utilized to control all lift station pumps.
- Panel shall be equipped with a main disconnect switch.
- In addition to the main panel disconnect, each motor starter within panel shall be equipped with a circuit breaker based disconnect.
- Panel enclosure shall be NEMA 4 rated (NEMA 4X Stainless Steel if area deemed corrosive) that has minimum dimensions of 60" height x 36" width x 24" depth. All controls including indicator lights, elapsed time meters, selector switches and pushbuttons shall be located on a swingout panel located inside enclosure. Enclosure shall be equipped with a pad-lockable handle.
- Panel shall be equipped with a Hand-OFF-AUTO (HOA) selector switch and Start/Stop pushbuttons for each pump.
- An elapsed time meter shall be provided in association with each pump to provide local indication of totalized run-time.
- Motor/pump operation (i.e. start/stop control, pump alternation etc.) shall be controlled by RTU/SCADA and by relay/float logic contained within pump control panel.
- A monitoring relay shall be utilized in association with each pump to monitor for high temperature and leakage conditions. Relays shall be located inside pump control panel.
- All relays within pump control panel shall be equipped with light emitting diode (LED) based indicator lights to indicate when relays are energized.
- 'High High' and 'Low Low' backup float status shall be displayed locally at pump control panel via indicator light(s) and shall also be monitored remotely by RTU/SCADA.

6.3 Motor Starters:

- For pump motors that do not require speed control, Solid State Starters (SSS's) shall be utilized. Each starter shall be equipped with bypass contactors and shall be protected against electrical fault conditions in both ramp up/down and bypass modes. This would result in the use of an external electronic overload if SSS provided does not also provide protection after bypass contactor has been energized. Isolation contactor or shunt trip breaker shall be utilized whenever recommended by SSS manufacturer. Approved manufacturer: Benschaw or Allen Bradley SMC series. Typical I/O from each SSS based starter to be communicated to/from RTU/SCADA:
 - Run Status
 - Individual fault alarms (i.e. high motor temp., SSS fault, motor leak detection etc.)
 - In Auto Status
 - Start/Stop Command

- Remote Reset Command
- For pump motors that require speed control or where 1PH power needs to be converted to 3PH power, Variable Frequency Drives (VFD's) shall be utilized. VFD's shall be equipped with harmonic filters as to ensure compliance with IEEE 519-1992 based on a point of common coupling (PCC) being defined as bus where respective feed breaker is connected. VFD manufacturer shall be Toshiba or City approved equal. Typical I/O from each VFD based starter to be communicated to/from RTU/SCADA:
 - Run Status
 - Individual fault alarms (i.e. high motor temperature, VFD fault, motor leak detection etc.)
 - In Auto Status
 - Start/Stop Command
 - Remote Reset Command
 - Speed Control (4-20 mA)
 - Speed Feedback (4-20 mA)

6.4 Hydropneumatic Tank System (where required): Hydropneumatic tank system will be comprised of a hydropneumatic tank and an associated air compressor. Reference section 3.8 for additional system information/requirements.

- Air Compressor Monitor/Control: Custom control panel shall be designed/provided to control air compressor. Control panel shall start and stop air compressor based on pressure in respective receiver tank. In conjunction with the pressure switch, an intrinsically safe relay shall be utilized due to the classified environment in which it is installed. Typical I/O to be communicated to/from RTU/SCADA:
 - Run Status
 - In Auto Status
 - Fault/alarm
- Hydropneumatic tank monitor/control: Hydropneumatic level and pressure will be monitored by site PLC/RTU via a radar-based level transmitter and a pressure transmitter. In conjunction with each of these transmitters, an intrinsic barrier shall be utilized due to the classified environment in which the instruments will be installed. Utilizing these signals, the PLC/RTU will generate digital output, dry contact-based statuses and commands that will be sent to a custom hydrotank control panel that shall be designed/provided by design consultant. These statuses and commands shall be as follows:
 - Hydropneumatic tank 'High High' Level Alarm
 - Hydropneumatic tank 'Low Low' Level Alarm

- Remote reset command from SCADA to reset Hydropneumatic tank High-High and Low-Low Alarms
- Fill Valve Open Command
- Air Relief Valve Open Command
- The hydropneumatic tank control panel will communicate the following to PLC/RTU/SCADA:
 - Fill Valve HOA In Auto Position
 - Air Relief Valve HOA In Auto Position
 - High Pressure Alarm
- Hydropneumatic tank control panel shall be equipped with HOA selector switches that allow Fill and Air Relief valves to be controlled either manually (Hand position) or automatically by PLC/RTU (Auto position). Control panel shall also take hydropneumatic tank 'High High' and 'Low Low' level alarms from PLC/RTU and display associated alarm statuses via LED based indicator lights. Alarms shall be latched when detected and shall be reset either via a reset pushbutton on hydropneumatic tank control panel or via a remote reset command from PLC/RTU.

6.5 Chemical System:

- In association with the chemical treatment system, the following I/O shall be communicated to/from RTU/SCADA:
 - Run Status
 - Pump Select
 - In Auto Status
 - Fault/alarm
 - Remote Start/Stop

6.6 Biofilter System:

- In association with the bio-filter system, the following I/O shall be communicated to/from RTU/SCADA:
 - Run Status
 - Blower Fault (O/L)

6.7 Standby Power Systems: All new lift station sites shall be equipped with a standby power system unless otherwise directed by City. Standby power systems shall be comprised of a standby generator, Automatic Transfer Switch (ATS) and a day tank (if a sub-base style tank isn't utilized).

- Standby generators: Diesel based generator shall be utilized unless otherwise directed by City. Generator shall be sized to support operation of all site loads. Approved generator manufacturer: CAT, Kohler or Cummins.

- When sizing the generator, the following parameters/criteria shall be utilized:
 - Ambient temperature: 122° Fahrenheit (50° Celsius)
 - Maximum allowable voltage dip: 10%
 - Maximum genset load allowed: 80%
- The generator shall utilize a day tank or a sub-base style tank for fuel storage.
 - Tank shall be sized to support operation of generator for 12 hours minimum at full load.
 - Tank shall be equipped with a level transducer/transmitter capable of relaying tank level to RTU/SCADA via 4-20 mA output.
 - Tank shall be equipped with a leak detection alarm that is capable of being communicated to RTU/SCADA via a dry contact output.
- Generators shall be equipped with sound attenuating, weatherproof enclosures that limit sound levels to a maximum of 75 A-weighted decibel (dBA) at 23 feet (7 meters) as measured from center of generator or as required by any applicable noise ordinances, whichever is more stringent.
- Generator I/O to be communicated to/from RTU/SCADA:
 - Generator Run Status
 - Generator Fault
 - Generator In Auto
 - Generator Remote Start/Exercise Command
 - Generator Remote Reset Command
 - Tank – Leak Alarm
 - Tank – Fuel Level (4-20 mA)
- Automatic Transfer Switch (ATS): ATS shall be equipped with a window kit. Approved ATS manufacturer: ASCO or City approved equal. I/O to be communicated to/from RTU/SCADA:
 - ATS In Primary (Utility) Position
 - ATS In Backup (Generator) Position

6.8 RTU and SCADA:

- Programmable Logic Controller (PLC): PLC shall be Bristol Babcock ControlWave Micro. The PLC shall include the following items:
 - Power Supply Module: 396657-01-0 / CWM - SEG 40 - SEL 3
 - CPU: 396563-16-3S / CWM - SEG 30 - SEL 07

- 16pt. (isolated), 24VDC Digital Input cards: 396571-02-6 / CWM - SEG 60 - SEL 08
 - 16pt. (isolated), 24VDC Digital Output cards: 396572-02-02 / CWM - SEG 60 - SEL 11
 - 8pt. (isolated), Analog Input cards: 396604-03-0 / CWM - SEG 60 - SEL 15
 - 4pt. (isolated), Analog Output cards: 396603-01-7 / CWM - SEG 60 - SEL 18
- An operator interface terminal (OIT) is not required.
 - Radio(s): Licensed radio(s) shall be GE/MDS Orbit model MXNTL9CNW52NNS1F5DUNN MCR LN. Un-licensed radio(s) shall be GE/MDS Orbit model MXNTU91NW52NNS1F5DUNN MCR SS.
 - Ethernet Switch: Switch shall be industrial rated and shall be a CISCO 3300, 3500, 9200 or equivalent and currently supported CISCO switch series as approved by City.
 - Uninterruptable Power Source (UPS): Approved UPS manufacturer: LiebertGXT5 series (or current model), 1000VA. The UPS shall be equipped with a relay output card. The relay card shall be a Liebert model 'IS-RELAY' or City approved equal. If an approved equal is allowed it shall have a backup capacity capable of supporting operation of all connected loads for a minimum of 60 minutes. The following UPS alarm/statuses shall be monitored by RTU/SCADA:
 - UPS On Battery
 - UPS Low Battery Alarm
 - UPS Fault Alarm
 - UPS Summary Alarm
 - The RTU shall be equipped with redundant 24 volt direct current (DC) power supplies in conjunction with an associated redundancy module. Each power supply shall be monitored for failure via an individual alarm contact that is held closed whenever power supply is operable. Contacts shall be monitored by RTU/SCADA. Power supplies shall be as manufactured by IDEC or Phoenix Contact. Redundancy module shall be as manufactured by SOLA or Phoenix Contact.
 - The RTU cabinet shall be equipped with a temperature sensor/transmitter, which shall be monitored by RTU/SCADA via a 4-20 mA output. Sensor/transmitter shall be a Weed Instruments model 753 or equal.
 - Surge suppressors shall be provided in association with all analog inputs and outputs.

6.9 Telemetry: Contractor shall be responsible for completing any required field-based radio path surveys. Radio path survey(s) must account for planned development heights. Results of

survey(s) shall be summarized in report form and shall be provided to City for review and approval.

6.10 Instrumentation:

- Wet Well Level: Primary level monitoring shall consist of a level transducer within a stilling well. The level transducer shall be Endress+Hauser Waterpilot Model FMX21-345D6/101.
 - Backup level detection shall consist of floats. The floats shall be Roto-Float as manufactured by Anchor Scientific.
- Hydrotank Level: Shall utilize an Endress+Hauser Micropilot FMP52 radar based level transmitter.
- Pressure: Pressure transmitters shall be Endress+Hauser Cerabar S PMC51 or City approved equal.
- Flow: Flow meters shall be Endress+Hauser Proline Prosonic 92F.

6.11 Site Security: The design engineer shall coordinate site security requirements with Jeff Fritsch and Kerry Leib, the City's Security Coordinators, at the time of design. At a minimum, all hatches and gates shall be equipped with provisions to facilitate installation of future intrusion switches as indicated below. All equipment cabinets (i.e. RTU, lift station control panel, ATS) and generator doors shall be equipped with intrusion switches and shall be wired back to site PLC/RTU. Provisions shall be included to facilitate installation of future security cameras as indicated below.

- Future security panel provision(s): A minimum of a 36" deep x 36" wide housekeeping pad shall be installed for future security panel. The pad shall have at least 84" of clear space on the wall above the pad. Location of future security panel shall be confirmed with City Security Coordinator. All respective conduits shall be stubbed up within a 20" x 20" area.
- If the contractor is required to install a security cabinet, it must be a 24" x 24" cabinet with an AC unit and it must have a 20 AMP 4 plex power supply with a dedicated circuit breaker installed at the electrical panel.
- All security system related conduits shall have an inside diameter of 1" or larger.
- All underground conduits shall be schedule 80 PVC and shall be transitioned to galvanized rigid steel (GRS) conduits when routed above ground. GRS underground to above ground transitions shall be wrapped in 20 mil tape that extends a minimum of 18" above grade.
- All external security system related boxes shall be NEMA 3R rated.
- Intrusion switch provisions:
 - All exterior man doors into the site shall have a 6" x 6" NEMA 3R enclosure installed at hinge side of door. Two (2) 1" conduits shall be routed from each enclosure back to the location of the future security panel. The conduit runs shall be stubbed out of the ground a minimum of 18".

- All rolling gate site access doors shall have a 12" x 12" x 6" NEMA 3R enclosure installed. Three (3) 1" conduits shall be routed from each enclosure back to the location of future security panel. The conduit runs shall be stubbed out of the ground a minimum of 18".
- Where a hatch is installed, install one (1) 1" GRS conduit from location of future security panel to hatch access point. If more than one hatch is installed, provide a single 1" GRS conduit from location of future security panel to a 4x4 NEMA 3R box mounted adjacent to access point of nearest hatch. From this box route to other hatches in a series manner utilizing 1" GRS conduit.
- Where motorized rolling gates are utilized, install two (2) 1" conduits from location of future security panel to a location outside of site near entry gate as identified by City Security Coordinator. The conduit runs shall be stubbed out of the ground a minimum of 18".
- Security camera provisions:
 - Provisional conduits shall be routed from location of future security panel to locations identified in field by City Security Coordinator for future security cameras.
 - A provisional 1" conduit shall be routed from the site 120/240V (or 120/208V) distribution panel to the location of future security panel.
 - A provisional 1" conduit shall be routed from site's Network Communications cabinet to location of future security panel.
 - The number and locations of cameras and motion detectors shall be determined by City Security Coordinator prior to construction. No site will have less than two locations for security cameras and motion detection equipment. Most sites will have more.
- Sites with four walls shall have conduit runs stubbed out of the ground a minimum of 18" at the middle of each wall. These runs will be a minimum of one (1) conduit to each location.
- If an existing radio communication tower is on site, the contractor shall provide a 1" conduit run from the security cabinet to the base of the tower, stubbed up 18" from the ground.

6.12 Outdoor Lighting:

- All fixtures shall be LED based.
- Fixtures shall be rated for operation at a 50° Celsius ambient.
- Switch controlled fixtures shall be installed underneath shade structure to provide general lighting over electrical distribution and control panels.
- Lighting designs shall be in compliance with any applicable City or County lighting codes, ordinances and/or standards.

6.13 Grounding: A low impedance site grounding electrode system comprised of the following grounding electrodes shall be provided:

- UFER style ground in each major concrete pad/foundation (i.e. generator foundations etc.).
- A minimum of two (2) grounding rods mounted inside access/test wells.
- Grounding ring around generator pad.
- Ground conductor in each ductbank.

At a minimum, the following items shall be bonded to the grounding electrode system:

- Generator
- All major pieces of electrical equipment (i.e. service panel, step-down transformers, pump control panel etc.)
- RTU cabinet
- Antenna masts and lighting poles
- Shade structure (bond opposite corners)

6.14 Communications:

- Provide a Network Communications enclosure. Enclosure size and NEMA rating shall be confirmed with the City.
- Provide minimum 2" PVC conduit connection from the Network Communications enclosure to RTU/SCADA enclosure and 2" PVC conduit connection from Network Communications enclosure to Security panel.
- Provide minimum of two 2" PVC conduit connections from the Network Communications enclosure to a new communications pull box located in the right of way (ROW) outside the exterior perimeter of the site.
- Provide a minimum of two 2" PVC conduits from communications pull box located in the ROW outside the exterior perimeter of the site to the closest City communications network trunk line point of connection.
- Buried communication conduits shall be installed at a depth of not less than 48" below grade.
- Conduits associated with communications systems shall have a minimum bend radius of 36". Installation of additional pull boxes will be required to ensure that no conduit segment has a deflection greater than 180 degrees. Conduit warning tape indicating "Caution – Buried Communication Cable" shall be installed over the buried conduit. 2,500 lb rated detectable pull tape shall be inserted into all buried communications conduit.
- Pullboxes are required to meet ADOT's Standards and Specifications. #9 pull boxes, or approved equivalent shall be installed at all arterial/arterial intersections as well as end of project conditions. ADOT standard #7 pull boxes with extension

shall be installed at 660' intervals, and/or at points where communications conduit deflection may exceed 180 degrees and/or points of known or future City water/wastewater utility connection.

- Provide for minimum 48 strand fiber optic patch panel to be located in the Network Communications enclosure. Approved manufacture: Corning CCH, WCH, or City approved equal.
- Provide for a minimum 48 strand fiber optic fan out kit. Approved manufacturer: Corning.
- Ethernet Switch: Ethernet switch shall be provided and installed inside network communications enclosure by contractor. Switch shall be industrial rated and shall be a CISCO 3500, 9200 or equivalent and currently supported CISCO switch series as approved by City.
- Fiber optic communications cables shall be run continuous throughout the extent of the project limits. Full splicing of fiber optic communications cables mid-project will not be allowed.
- A 48 strand (minimum) single mode fiber optic cable (as manufactured by Corning) shall be installed between network communications enclosure and pull box located in ROW outside the exterior perimeter of the site. A minimum of 50' of slack coil shall be provided on each end.
- A 144 strand (minimum) single mode fiber optic cable (as manufactured by Corning) shall be installed between pull box located in ROW outside the exterior perimeter of the site and closest City communications network trunk line point of connection. A minimum of 50' of slack coil shall be provided on each end.

6.15 Control Description: Provide a detailed, written control description in the project's technical specifications. At a minimum, the control description shall include details on the following:

- General overview of major component processes.
- Alarms
- Inputs, Outputs & tag numbers
- Sequencing for initialization
- Sequencing for shutdown
- Level setpoints
- Descriptions of all operating modes (SCADA, PLC, Panel, etc.)

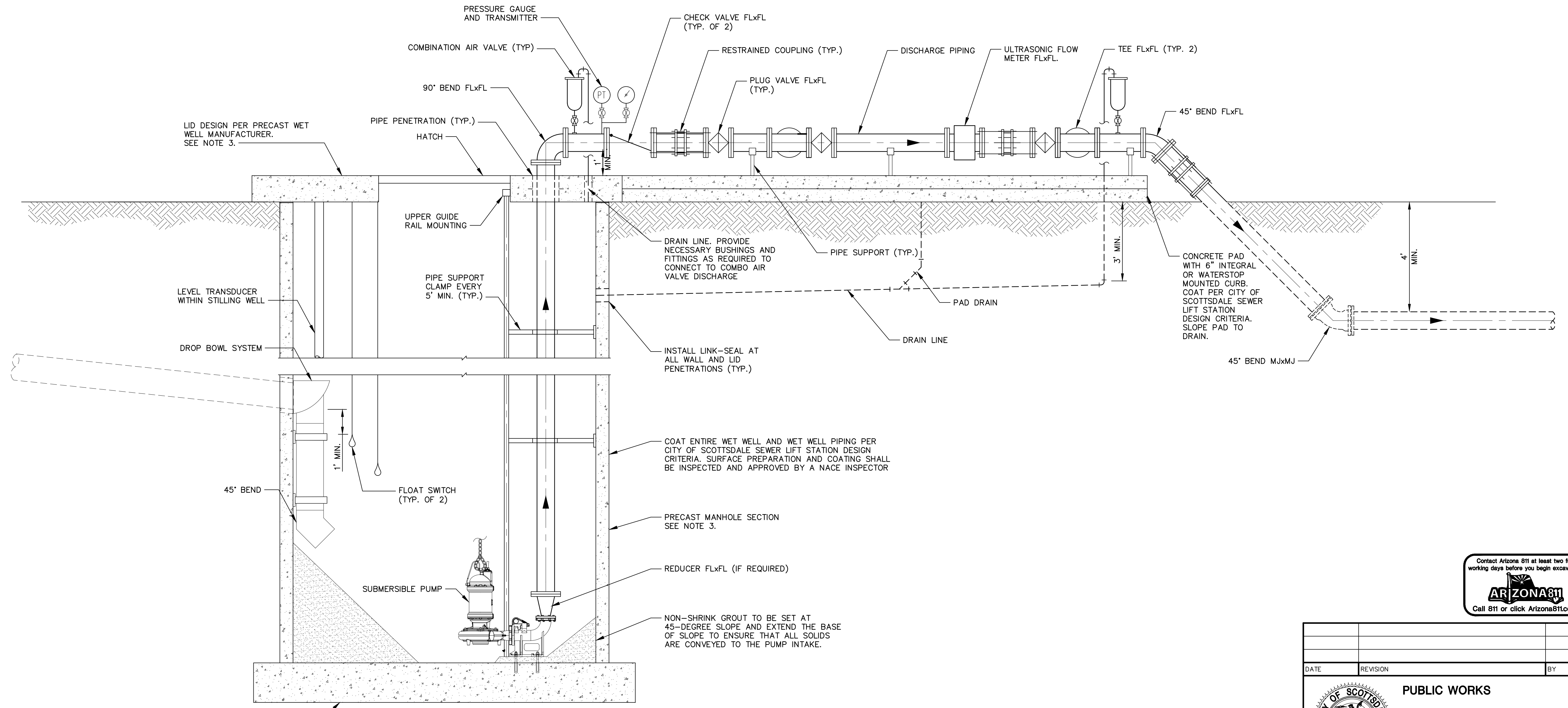
6.16 Miscellaneous:

- A NEMA 4X Stainless Steel junction/termination cabinet shall be installed adjacent to wet well.
 - Cabinet shall be utilized to transition all wet well equipment manufacturer cables to standard cabling for routing back to pump control panel and RTU.

- All cabling in cabinet shall be connected to terminal blocks.
- Seal-offs shall be installed on all conduits as they transition from wet well into cabinet. Seal off shall not be installed until the project has been approved by the City. Seal-offs shall not be poured with Chico cement.
- Minimum conduit size for power cabling shall be 2"
- Wiring for Floats and level transducer shall be routed in separate 2" conduits.
- A provisional 20A, GFCI, WP (while-in-use) duplex receptacle shall be provided adjacent to wet well to provide a convenient source of power for City's temporary custom made odor control system.

GENERAL NOTES:


1. DISCHARGE PIPING LAYOUT AND DESIGN WILL VARY ON A CASE BY CASE BASIS. THE LAYOUT PROVIDED IN THIS STANDARD DETAIL SHALL SERVE AS A GUIDE ONLY.
2. THE PIPES, FITTINGS, VALVES, WET WELL AND HATCH SIZES SHOWN IN THIS STANDARD DETAIL ARE FOR GRAPHICAL PURPOSES ONLY. THESE COMPONENTS SHALL BE DESIGNED BASED ON THE CITY OF SCOTTSDALE SEWER LIFT STATION DESIGN CRITERIA.
3. ALL PRECAST COMPONENTS MUST INCLUDE H-20 STRUCTURAL CALCULATIONS THAT ARE SEALED BY AN ARIZONA P.E. BEFORE THEY ARE DELIVERED TO THE CONSTRUCTION SITE.
4. SERVICE SADDLE ALLOWED ON DUCTILE IRON PIPE FOR EQUIPMENT MOUNTING, NO DIRECT TAP OR THREADED CONNECTIONS. STEEL PIPING SHALL HAVE FLANGED OUTLET.
5. ENGINEER SHALL VERIFY THAT SUFFICIENT BACK PRESSURE IS AVAILABLE TO CLOSE THE CHECK VALVE. IF ADEQUATE BACK PRESSURE IS NOT AVAILABLE, AN ALTERNATE PIPE CONFIGURATION WILL BE REQUIRED WITH CITY APPROVAL.

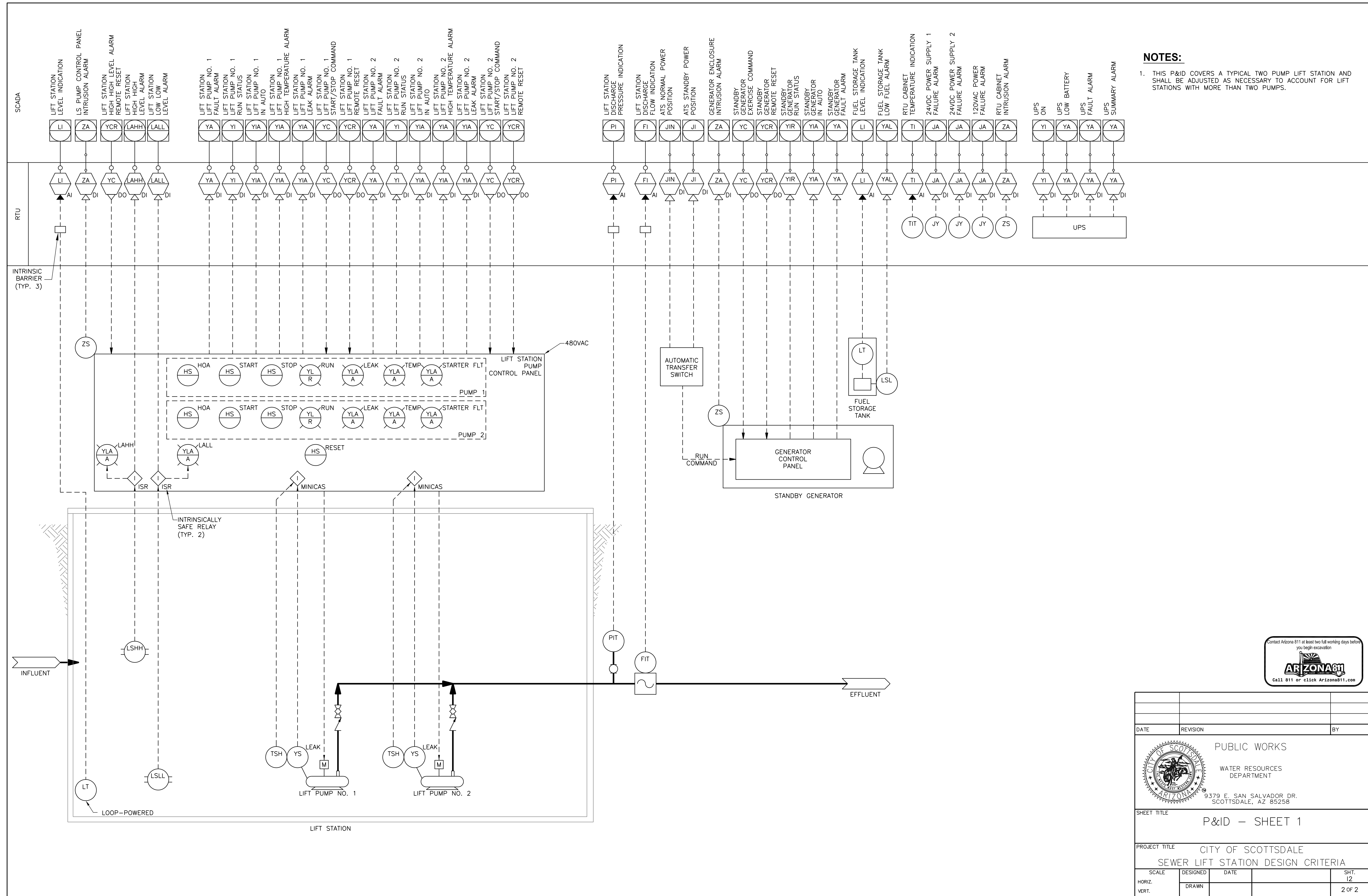


BASE DESIGN PER PRECAST WET WELL MANUFACTURER. SEE NOTE 3.

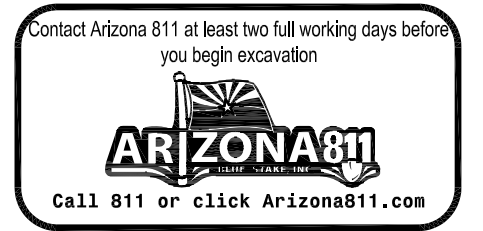
DISCHARGE PIPING PROFILE
SCALE: NTS




DATE	REVISION	BY
 PUBLIC WORKS WATER RESOURCES DEPARTMENT 9379 E. SAN SALVADOR DR. SCOTTSDALE, AZ 86268		
SHEET TITLE		
LIFT STATION DISCHARGE PIPING PROFILE STANDARD DETAIL		
PROJECT TITLE		
CITY OF SCOTTSDALE SEWER LIFT STATION DESIGN CRITERIA		
SCALE	DESIGNED	DATE
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		SHT. M2
		2 OF 2



NOTES:
 1. THIS P&ID COVERS A TYPICAL TWO PUMP LIFT STATION AND SHALL BE ADJUSTED AS NECESSARY TO ACCOUNT FOR LIFT STATIONS WITH MORE THAN TWO PUMPS.



DATE	REVISION	BY
 PUBLIC WORKS WATER RESOURCES DEPARTMENT 9379 E. SAN SALVADOR DR. SCOTTSDALE, AZ 85258		
SHEET TITLE P&ID - SHEET 1		
PROJECT TITLE CITY OF SCOTTSDALE SEWER LIFT STATION DESIGN CRITERIA		
SCALE	DESIGNED	DATE
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		2 OF 2