

## SANITARY SEWER PUMP STATION AND FORCE MAIN SPECIFICATIONS

1. SCOPE. All sanitary sewer pump stations and their associated force main(s) shall be designed, constructed, and tested in accordance with the North Carolina Division of Water Quality's Administrative Code and Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains, the Water and Sewer Authority of Cabarrus County's Standard Specifications for Wastewater Collection and Water Distribution Construction for Cabarrus County, and the City of Concord's Code of Ordinances (refer to Chapter 62). All sanitary sewer pump stations and their associated force main(s) shall provide the storage and pumping capacity as approved by the City of Concord Engineering Department. All designs shall be submitted to the City of Concord Engineering Department and the City of Concord Electric Systems Department (as needed) for review, evaluation, and permitting. Before a pump station is turned over to the City of Concord for acceptance of ownership and maintenance, a representative of the pump Supplier shall be present to meet with sewer maintenance and inspection personnel to perform system checks and startup operations.

Pumps furnished and installed under this section shall meet the requirements of the Hydraulic Institute Standards.

1.01. Acceptable Manufacturers. Submersible pump suppliers acceptable to the City of Concord Engineering Department include Fairbanks-Morse, Flygt, Myers, and Peabody-Barnes.

1.02. Submittals. Complete fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering materials, parts, devices, and accessories forming a part of the equipment furnished, shall be submitted in accordance with the submittals section. The data and specifications for each unit shall include, but shall not be limited to, the following:

### Pumps

- Name of manufacturer.
- Type and model.
- Rotative speed.
- Size of suction elbow inlet.
- Size of discharge elbow outlet.
- Net weight of pump and motor only.
- Complete performance curves showing capacity versus head, bhp, NPSH required, and efficiency.
- Data on shop painting.

### Motors

- Name of manufacturer.
- Type and model.
- Type of bearings and method of lubrication.
- Rated size of motor, hp.
- Temperature rating.
- Full load rotative speed.
- Net weight.
- Efficiency at full load and rated pump condition.
- Full load current.
- Locked rotor current.

### Control Panel and Components

- Name of manufacturer.
- Type and model.
- Dimensions and net weight of complete panel.
- Overcurrent characteristics and details of motor control.
- Liquid level sensors with mounting details and cable lengths, and pump controls.

PLEASE NOTE THAT THE REQUIREMENTS HEREIN STATED MAY BE MODIFIED AT THE DIRECTION OF THE CITY OF CONCORD ENGINEERING DEPARTMENT.

2. PUMPS. At a minimum, systems shall be duplex pumping systems that will be capable of comminuting solids into a liquid slurry for force mains of 2-inch or smaller or non-clog types capable of passing a 3-inch diameter object for force mains 4 inches or greater. Grinder-type pumps shall be used for design flows up to 100 gallons per minute. Non-clog-type pumps shall be used for design flows greater than 100 gallons per minute.

Submersible pumps shall be manufactured in accordance with ISO 9000 quality assurance standards and shall be UL listed. Pumps not manufactured to these standards shall not be considered compatible with the intended service and therefore not acceptable.

Pumps shall be designed to handle peak flow with a single pump. Motors shall be non-overloading over the entire pumping range. Pumping shall be designed to be 45 percent efficient at a minimum.

Pumps shall be furnished complete with mounting assembly and easy lift-out capability, internal piping and controls, accessories, and all else required for complete installation and operation as per manufacturer's requirements or these specifications whichever is more stringent. All lift-out rail systems shall be stainless steel Type 316. All lifting cables shall be adequately sized stainless steel with stainless steel clips. Chains shall not be allowed. Cables shall be supplied with 6 feet of slack. All exposed metal items, such as nuts, bolts, supports, etc., shall be made of Type 316 stainless steel or will have a protective non-corrosive coating. Internal piping shall be Type 316 stainless steel or ductile iron Class 50.

ALL PUMP SYSTEMS SHALL BE INTRINSICALLY SAFE EXCEPT AS SPECIFIED BY THE DIRECTOR OF ENGINEERING, THE DIRECTOR OF WASTEWATER RESOURCES, AND THE PUMP STATION COORDINATOR.

2.01. Painting. All iron and steel parts which will be in contact with the pumped liquid or submerged after installation, including the inside of the casing, the impeller, the discharge elbow, and the pedestal mount, shall be shop cleaned in accordance with the coating manufacturer's recommendations and painted with an epoxy coating system. The coating shall have a dry film thickness of at least 10 mils and shall consist of a prime (first) coat and one or more finish coats. At least 1 quart of the finish coat material shall be furnished with each pump for field touchup.

3. MOTORS. The motor and motor housing shall be designed for use in domestic wastewater. Industrial flows and flows containing components that are not domestic in nature or potentially damaging/explosive in nature shall not be accepted into City of Concord-maintained pump stations.

Motors shall be protected from water intrusion through the use of a sealed cable entry system utilizing stainless steel washers.

Moisture detection and telemetry shall be required on all pumps. Moisture detection shall be connected to a detection indicator alarm light on the control panel. Moisture detection shall cause motor shutdown.

Overheat detection and telemetry shall be required on all motors. Overheat detection shall be connected to a separate detection indicator alarm light on the control panel. Detection shall cause shutdown.

High-water detection and telemetry shall be required on all pump stations. High-water detection shall be connected to a separate detection indicator alarm light on the control panel.

The motor shall be protected from moisture intrusion from the pump's hydraulic end. Motors shall be a squirrel-cage induction motor, continuous duty NEMA Design B, at 40 degrees C ambient, and designed for at least six starts per hour. Motors shall have moisture resistant Class "F" (155 degrees C)

insulation. Motors shall have at minimum 1.25 service factor, shall be oil-filled, and shall be designed for continuous operation half-submerged for at least 24 hours under pump cut-off conditions, without exceeding the temperature rise limits for the motor insulation system. High efficiency motors should be used in all cases. Air-filled motors will also be an allowable alternative to oil-filled motors.

The motor and pump shall have a shaft of at a minimum 400 Series stainless steel that is completely isolated from the pump media by a mechanical seal. No other materials shall be acceptable for this application. Mechanical seals of tungsten carbide shall be provided when highly abrasive conditions are anticipated as determined by the City of Concord Engineering Department. Impellers shall be non-clogging in design and be secured from rotation on the shaft through the use of a shaft key or locking collet. Pump impellers shall be ASTM A48 Class 30B cast iron except in designated locations as determined by the City of Concord Engineering Department where pump impellers shall be ductile iron or Type 416 stainless steel as required for the specific application. Pump volutes shall be of, at a minimum, ASTM A48 Class 30B cast iron having a minimum Brinell hardness rating of 180. The volute shall be further protected from wear through the use of a replaceable wear ring. Lesser grades of cast iron or materials having a Brinell hardness rating less than 180 shall not be acceptable as compatible with the normal grit contaminate of the service. Lower seals shall be carbon to ceramic. Pumps shall be equipped with a plug on the outside of the oil chamber, in order to inspect lower seal condition. Bearing shall be lubricated per manufacturer's specifications and have a B-10 bearing life of at minimum 50,000 hours. B-10 bearing lives of less value shall not be accepted as compatible with the normal overall station life expectancies.

4. VALVES AND VALVING PIT. All plug valves and check valves shall be installed in a concrete valving pit with a City of Concord-approved cover OUTSIDE of the wetwell and inside the pump station lot. Plug valves shall be operated by a handwheel having an "open-left" stem operation. Check valves shall be of the lever weight reset type. All valves shall be manufacturer's recommended type unless otherwise detailed and approved by the City of Concord Engineering Department. There shall be an eccentric plug valve, with pipe nipple, flange, and pressure gauge installed on the force main side of the check and plug valves of the size and pressure required for the force main as an auxiliary pump feed in the event the existing pump station motors are inoperable. The Bauer quick-connect adapter provided for connection to an auxiliary pumping system shall be sized based on the peak design flow capacity of the pump station. The piping and valving arrangement shall be arranged in a horizontal alignment. Sign shall be posted stating "Confined Space".

Some pump station installations may necessitate the use of surge relief valves as determined by the City of Concord Engineering Department. If applicable, the surge relief valve shall be supplied with the pump station and located in the valve vault or an alternate location as approved by the City of Concord Engineering Department. Surge relief valves acceptable to the City of Concord Engineering Department include APCO, Golden Anderson, and Crispin.

All valve pit boxes shall be sized to provide 12-inch minimum overall clearance (top, bottom, sides) between the walls of the box and internal components. A 3" or 4" plug valve for the drain between the wet well and valve vault shall be required. The floor of the box shall be shaped/sloped to drain. All piping through the walls of the pit shall be of ferrous material. All valve pit boxes shall be set on a minimum of 18 inches of stone. Over-excavation areas below 18 inches shall be filled with concrete. Valve pit shall have a 6-inch minimum diameter vent.

5. WETWELL/STORAGE BASINS-MANHOLES. Wetwell/storage basins shall be designed and sized to accommodate wastewater flows expected to become tributary to the pump station for the entire project/development at build out. For regional pump stations, the design shall take into consideration the tributary area, potential growth in the area, and expected service life of the pump station. Wetwell/storage basins shall be design with an emergency storage capacity of 2-hours of peak flow in the event of pump failure. The required detention volume shall be measured between the pump-off elevation and six inches from the elevation where wastewater could escape to daylight (i.e. six inches below the wet well rim or six inches below the lowest upstream manhole, whichever is lower). Since this specification allows for wastewater storage for almost the full depth of the wet well, wastewater will be

allowed to back up in the sanitary sewer system. However, wastewater storage in the sanitary sewer system may not be counted toward the wetwell/storage basin 2-hour requirement. Deviation from this requirement shall be allowed only upon the prior approval of the City of Concord Engineering Department. The design Engineer must provide in writing a detailed explanation of all extenuating circumstances and design constraints before any modifications will be considered. Approval of staged capacities based on phased development may be allowed, but provisions, requirements, facilities, and costs shall be delineated and accounted for in the initial design. If staged capacity is under consideration, the design engineer shall furnish a development construction schedule that explains the construction sequence for time when additional capacity is added. Staged capacity projects shall not adversely effect the City of Concord's ability to operate the pump station.

The minimum size allowed for any wetwell shall be 6 feet in diameter.

In cases where a storage basin(s) is needed in addition to the wetwell, the storage basin diameter and depth shall be designed to match the wetwell, However, a larger storage basin may be required if greater storage is needed. Also, the storage basin shall be designed with a uniform cross section from top to bottom.

The term "Confined Space" shall be posted on a highly visible sign.

The bottom slab of the wetwell shall be set on a minimum of 18 inches of stone. All over-excavated areas over 18 inches below the wetwell bottom shall be filled with concrete.

Stations shall be designed to have only one wetwell inflow inlet. Pump station facilities shall be designed so that trash collection basket(s) and associated lift-out component(s) can be installed either in the wetwell or preferably a station lot manhole to catch non-comminutable items while passing sewerage. Baskets shall be located so that a minimum of 12 inches of sewer spillage will drop through the basket. Inlet pipe will stub 3 inches into the basket. When installed in manholes, the invert and bench arrangement shall be "form-fit" made to accommodate the basket assembly yet still provide sufficient slope to achieve sewer velocities of 2 fps. When installed in manholes, an access door assembly shall be utilized instead of a standard manhole cover.

Hoisting assembly(s) shall be provided for lifting the trash baskets and shall be located where specified by City maintenance personnel. This item shall be positioned so lifting will be direct and free. The steel sleeve for the hoist stanchion shall be cast in place and not drilled.

Concrete surfaces inside the wetwell shall be protected from sewer gas attack by a coating especially formulated to resist such attack (21 mils Koppers "300M" or approved equal). Said coating shall be installed having a smooth surface. Any coatings shall be cleaned from any area not supposed to have such coating. All joints in wetwell shall be grouted before any coating is applied. Wetwells shall be vented to the atmosphere and shall be screened to prevent vermin access. Vents shall be located as far as possible from maintenance work stations. Wetwells using an 8-foot diameter or larger manhole shall utilize a 6-inch minimum diameter vent. The top slab of the wetwell shall be core-drilled and fitted with a 6-inch or 8-inch (as specified by the City of Concord Engineering Department) HDPE suction pipe that extends from the pump-off elevation to 1 foot above the top slab. The top of the suction pipe shall be connected to a 90-elbow with a Bauer quick-connect adapter. A blind cap shall be provided to prevent vermin access through the suction pipe.

Support steps shall NOT be used in wetwell/storage basins.

When needed and approved, steps shall be protected from corrosion by use of non-corrosive material or approved protective non-corrosive coating. All exposed metal items, such as nuts, bolts, cables, supports, rails, etc., shall be made of non-corrosive materials or shall have a protective non-corrosive coating. Also, all such metal items shall be configured, covered, protected, or made so as to present non-sparking surfaces. The Supplier shall review this protection with the City of Concord Engineering Department for approval before installation.

Exceptions to this are manufacturer "package systems" that are approved for use by the City of Concord Engineering Department.

6. ACCESS HATCHES AND DOORS. Access doors/hatches to below ground pump station components shall be sized and located so as to provide easy and direct access for maintenance crews and equipment. Placement shall also factor non-interference with other station components and safety concerns as relating to working in close proximity when in the open position. As far as possible, all hatches and doors shall be located to avoid traffic loading.

Access doors and all appurtenances to the valve pit shall be of a heavy-duty aluminum or stainless steel type that is weatherproof and rated for either a 300 PSF live loadings or a H20 wheel loads from maintenance vehicles in potential traffic applications. Access frames and covers shall be provided with a continuous concrete anchor, as part of the one-piece extrusion. All access doors shall be mounted in such a way that concrete (or other material used for the basin) completely supports the bottom face of the frame, and the basin material shall be designed to support the hatch support loading. The frame shall be a self-draining channel with a 1-1/2 inch draining coupling located in the channel frame. The doors shall be provided with tamperproof fasteners. The doors shall open to 90 degrees and lock automatically in that position with a positive locking arm and a release handle. Doors shall close flush with the top of the frame, resting on a 1/2-inch minimum wide lip around the entire inside of the frame.

All accessory components of access hatches (hinges, handles, locking arms, etc.) shall be of manufacturer's recommendations and specifications to meet the required loadings and serviceability. All nuts, bolts, washers, and miscellaneous hardware shall be stainless steel Type 316. In no case shall carbon steel components be allowed that will present a rusting or sparking condition.

Any aluminum embedded in concrete shall be coated with bitumastic where directed by the City of Concord Engineering Department during station construction.

All access doors at the pump station facility shall be made as to be lockable. Elevation of the top of all accesses shall be at least 6 inches above final grade and installed level. Finished grade shall be such as to leave no voids under the top slab and shall be stable as to erosion potential.

7. CONTROLS. Controls for operation of the duplex pumping system shall be furnished by the Supplier of the pump station in accordance with the following requirements. All controls and accessories shall be of the pump manufacturer's model and type specified and approved by the City of Concord Engineering Department and the Cabarrus County Building Inspection Department. Controls shall be intrinsically safe.

7.01. Pump Control Panel. Each submersible pump system shall be furnished with pump control panel, control devices, and level switches as indicated on the Drawings and specified herein.

The control panel shall be designed to operate from a 240-, 120/208-, or 277/480-volt, 60-Hz, single- or three-phase external source. Terminals shall be provided for terminating up to #1/0 AWG size cable per phase. Panel shall be intrinsically safe.

7.01.01. Wiring. All internal device wiring shall be as normally furnished by the manufacturer. All interconnecting wiring and wiring to terminals for external connection shall be stranded copper, insulated for not less than 600 volts, with a moisture-resistant and flame-retardant covering rated for not less than 90 C. All wiring shall be in accordance with the National Electrical Code

Power distribution wiring on the line side of panel fuses shall be minimum 12 AWG. Secondary power distribution wiring and wiring for control circuits shall be minimum 14 AWG. Indicating light circuits shall be minimum 16 AWG. Wiring for ac power distribution, dc power distribution, and control circuits shall have different colors and shall agree with the color-coding legend on the system Supplier's panel wiring diagrams.

Terminal blocks for external connections shall be suitable for 12 AWG wire and shall be rated 30 amperes at not less than 300 volts. Terminal blocks shall be fabricated complete with marking strip, covers, and pressure connectors. Terminals shall be labeled to agree with identification shown on the Supplier's submittal drawings. A terminal shall be provided for each conductor of external circuits. All wiring shall be grouped or cabled and firmly supported to the panel. Not less than 8 inches of clearance shall be provided between the terminal strips and the base of vertical panels for conduit and wiring space. Not less than 25 percent spare terminals shall be provided.

The panel fabricator shall provide such additional circuits as required for proper operation.

7.01.02. Nameplates. Nameplates shall be provided on the face of the panel or on the individual device as required. Panel nameplates shall have approximate dimensions and legends consistent with the control descriptions included in the following paragraphs for each device, and shall be made of laminated phenolic material having engraved letters approximately 3/16-inch high extending through the black face into the white layer. Nameplates shall be secured firmly to the panel.

7.01.03. Cabinet. Cabinet shall be a custom-engineered enclosure, painted "Munsell green", suitable for mounting as indicated on the Drawings, which contain the system components indicated on the Drawings and specified herein as well being intrinsically safe. In all applications, unless specifically approved by the City of Concord Engineering Department, all controls, meters, and devices associated with the pump control system, shall be placed within the interior of this control panel enclosure. All circuits which are routed between backplate-mounted components within the enclosure shall be physically protected in flexible non-metallic conduit. The enclosure shall be 54" x 69" on 12" legs, NEMA rating shall be NEMA 3R waterproof, dustproof, and weatherproof or NEMA 4X, as specified by the City of Concord Engineering Department. Condensation protection space heaters with thermostat control shall be provided for enclosure internal temperature control as recommended by the manufacturer. The enclosure shall be fabricated from 12-gauge steel and shall be equipped with full-size gasketed doors with a three-point latch and stainless steel hinges. The doors shall be capable of being locked in an open position. The bottom of the cabinet shall be equipped with a screened louver with replaceable filter to facilitate ventilation within the panel; screen mesh openings shall be maximum 1/8 inch square to prevent insect and debris from entering the enclosure. The control panel enclosure shall include a non-corrosive aluminum backplate.

7.01.04. Motor Starters. The pump Supplier shall match the sizes of control power transformers, overload devices, heaters, and starters to the equipment furnished, as they may differ from the values indicated on the Drawings. Control power transformers shall have both primary leads fused, one secondary lead fused, and one secondary lead grounded.

One bimetallic, ambient temperature compensated thermal overload relay shall be provided in each phase lead. Each starter shall be provided with an external, manually reset push button for resetting the thermal overload relays. The external reset push buttons shall be accessible by opening the outer door of the control panel enclosure, and mounted on hinged interior panel front within the enclosure.

Each starter shall include auxiliary RUNNING status contacts wired to terminals for external connection by others for remote indication, plus one spare NO and one spare NC contact.

Each starter shall be provided with interlocking mechanism which, when the disconnect handle is moved to the "OFF" position, disconnects all external sources of power from the terminal blocks within the starter, such as external power across motor auxiliary status contacts.

A soft start shall be provided for all motors 5 HP and greater.

7.01.04.01. Three-Phase Starters. Three-phase starters shall be circuit breaker combination type consisting of three-phase, 60 Hz contactors with electronic adjustable overloads, a 120-volt ac coil, a dry type control power transformer where required, and a circuit breaker disconnect. Overload relay shall be

provided with one normally open dry contact. The contact shall close on motor overload and open when manually reset. Control power transformers shall be sized to handle all simultaneous loads. Starters shall be at least NEMA Size 1 or shall be sized as indicated on the Drawings.

Circuit breakers shall be 600-volt magnetic motor circuit protectors. If an inverse time thermal magnetic circuit breaker is used, the thermal characteristic shall be externally adjustable from the face of the breaker. Each breaker shall be manually operated with a quick-make, quick-break, trip-free toggle mechanism.

The complete three-phase starter shall have an interrupting rating of at least 14,000 amperes at 208 volts, and 25,000 amperes at 480 volts.

7.01.04.02. Single-Phase Starters. Single-phase starters shall consist of single-phase, 60 Hz contactors with thermal overloads and an integral or separately enclosed short-circuit protection device. Starters shall be at least NEMA Size O or shall be sized as indicated on the Drawings.

Integral short-circuit protection devices for single-phase starters shall be 120/240 volt, magnetic motor circuit protectors.

The short-circuit protection devices shall have an interrupting rating of at least 10,000 amperes at 120 volts, and 18,000 amperes at 240 volts.

7.01.05. Convenience Receptacle. A single 120-volt, 20-ampere, ground fault interrupting convenience receptacle shall be provided with the control panel enclosure. A step-down transformer to provide 120-volt power to the receptacle shall be provided as necessary. If the receptacle cannot be located within the control panel enclosure, then it shall be located on one exterior side of the control panel enclosure, within its own lockable access receptacle box, which shall be waterproof, dustproof, and weatherproof. Placement shall be in accordance with the City of Concord Engineering Department.

7.01.06 Area Light Control. A snap action switch shall be furnished and installed on the interior panel within the control panel enclosure. The switch shall be connected to a branch power circuit of minimum 15 amperes at either of 120- or 240-volt single phase, supplied from the control power transformer within the control panel enclosure.

7.01.07. Control Operation. Control operation shall correspond to the Drawings and as specified herein. The pumps shall be controlled in a typical duplex lead-lag manner. This includes automatic alternation on successive starts to include the standby pump, automatic failover in the event of a pump failure to start the standby pump, and override to start two pumps if level continues to increase.

HAND-OFF-AUTO pump mode selector switches shall be connected to allow manual start or stop of each pump and to select automatic operation of each pump under control of the level control system. Pump alternator shall be capable of being manually selected to alternate between pumps or individually select a pump to perform pumping duty in response to the level switch contacts of the level control system. In AUTO, pump controls shall also allow for an external RUN command, via telemetry system, to initiate pump operation.

Each pump unit shall be provided with a seal leakage and high temperature detection and alarm systems in the control cabinet for protection of each individual pump motor. A moisture-sensing device shall be provided in the stator housing for seal-leakage protection and, if necessary, a monitoring module shall also be provided within the control panel for alarm transmittal and motor shutdown. This monitoring unit shall be provided with necessary auxiliary relays and terminals for wiring of sensor leads and external alarm/control functions. Operating voltage power supply requirements required to interrogate the moisture sensing device within each motor shall be provided as necessary within the control panel enclosure.

Each three-phase motor shall be protected by a microprocessor-based motor protection relay. The relay shall protect against phase loss, phase reversal, voltage unbalance, and low voltage on any one or more phases, causing a shutdown of the pump if any such abnormality is detected. The relay shall re-activate after power line conditions return to an acceptable level. Trip and reset delays shall prevent nuisance tripping due to rapidly fluctuating power line conditions. The relay shall be "Motor Saver Model SP3" by SymCom, Inc., Time-Mark Phase Loss Relay, or equal. Motor protection relay shutdown alarm shall be connected to a separate detection indicator light on the control panel. A dry, resistive contact shall also be provided and wired by others for remote notification.

The level control system shall consist of an ultrasonic level transmitter and one level sensing "float" with cable and cable supports provided. The ultrasonic level transmitter shall be a Ohmart Vega Series 52 Ultrasonic Level Transmitter Model Number SON52KUAXYNN, Precision Digital Model 690 Universal Process Meter. NEMA 4x Front Panel, Model Number-PD690-3-18 or equal. This device will control the pump off, lead on, lag on and interface with RTU 4-20MA inputs to monitor wet well levels. The float shall be a weighted pear-shaped enclosure, hermetically sealed, housing a double-pole mercury switch. The switch shall be cushioned, mounted approximately at 65 degrees inclination from the enclosure main axis and connected to a special three-conductor cable. The cable shall be insulated and heavily sheathed with PVC for resistance to immersion, corrosion, and abrasion. The cable length shall be sufficient to extend into the handhole or junction box outside the pumping station and to allow the float to be set within 2 feet of the bottom of the pumping station.

Levels and alarms shall be as follows:

- a. All pumps OFF.
- b. Lead pump ON.
- c. Lag pump ON.
- d. High-water level alarm (detected by both the ultrasonic level transmitter and the float).

Level switch elevations shall be as indicated on the Drawings.

Contact interrogation voltage across the level sensing switches within the wetwell shall be 24 volts maximum to ensure compliance with intrinsically safe, explosion-proof requirements and shall be a Diversified Electronics ISR Module Part # ISO-120-ACE, 120-volt supply or equivalent. The control power transformer with 24-volt secondary voltage shall be furnished and installed within the control cabinet as necessary to interface with the level sensing switches.

Each control panel shall be equipped with heavy-duty, oil-tight pilot lights, reset buttons, common alarm acknowledge push button and selector switches as required, and mounted on an interior hinged panel door within the control panel enclosure. All operating controls and instruments shall be securely mounted in a logical manner and arrangement and such that any standard options offered by submersible pump manufacturer may be added in the field. All controls, pilot lights, selector switches shall be clearly labeled to indicate function.

Six digit elapsed time meters (non-reset type) shall be provided to indicate running time of each pump in "hours" and "tenths of hours". Green "Pump Running" indicator lights and elapsed time meters for each pump shall be mounted on the face of the interior hinged panel door.

Individual red alarm lights mounted on the hinged interior deadfront panel within the control panel shall be provided for the following alarms:

- Pump No. 1 Overload
- Pump No. 2 Overload
- Pump No. 1 Moisture Detected
- Pump No. 2 Moisture Detected
- Pump No. 1 Over Temperature
- Pump No. 2 Over Temperature

Pump No. 1 Phase Protection Trip  
Pump No. 2 Phase Protection Trip  
Wetwell High-Water Level

Any of the above alarms shall close a single-pole, double-throw relay with a dry, 120-volt ac rated resistive contact, wired to terminals for connection by others, for remote indication. In addition, any alarm will illuminate a flashing red vapor-tight alarm beacon and alarm horn. The alarm beacon shall be furnished with a minimum 60-watt lamp, located on the top of the control panel so as to be readily visible from the main road/street. The alarm horn shall be side mounted to the control panel enclosure and shall have minimum 103 dB at 10 feet distance from the panel. A Liebert UPStation GXT 2U, Model GXT2-700RT120, 700 VA, 490 watts capacity, 120VAC or equal uninterruptible power supply system shall be provided to operate the alarm beacon and alarm horn.

8. ELECTRICAL. Motor rated voltage shall be as follows unless indicated otherwise on the drawings:

- a. All single-phase pumps five horsepower or less shall be rated for 240 volts electric power. The motors shall be designed in such a way as to be able to operate with voltage levels 10 percent above or 10 percent below the nameplate rating indicated above.
- b. All three-phase pumps 5 to 10 horsepower shall be rated for 208Y/120 volts electric power, unless otherwise specified. The motors shall be designed in such a way as to be able to operate with voltage levels 10 percent above or 10 percent below the nameplate rating indicated above.
- c. All three-phase pumps greater than 10 horsepower shall be rated 277/480 volts from a three-phase external electric power supply. The motors shall be designed to be operational over a power supply voltage range of plus or minus 10 percent of the nominal voltage.
- d. Pumps requiring horsepower and voltage levels other than those specified above shall, on a case by case basis, be approved by the City of Concord Engineering Department, City of Concord Sewer Maintenance, and, where necessary, the City of Concord Electrical Engineer.

A soft start shall be provided for all motors 5 HP and greater.

Within the service area of the City of Concord Electric Systems, the City of Concord shall be responsible for providing single-phase power to the facility. However, in the event that three-phase pumps are specified, the Contractor or Developer will bear the burden of the cost differential between running single phase and three-phase power to the pump station site.

At both single- and three-phase service poles, a surge arrestor shall be furnished and installed within the service disconnect enclosure and connected to the incoming service conductors for surge protection.

An area light, minimum 100-watt, HPS lamp, with multi-tap ballast, shall be furnished and installed on a 30 foot, Class 5 Southern Yellow Pine wood pole, and installed at a location on the site designated by the City of Concord Engineering Department. The area light branch power supply shall originate within the pump control panel and shall be switch operated from the pump control panel. Conduit and branch power circuit conductors shall be routed from the pump control panel underground to a riser conduit along the exterior of the wood pole.

8.01. Auxiliary Power. An auxiliary standby power source connection shall be provided on the outside of the control panel mounting assembly in a separate receptacle cabinet that shall be at a minimum dust and weatherproof and shall be designed to be compatible with a standard and commercial auxiliary generator and its supply connection as detailed by these Specifications or by special notes in the construction Drawings. Final acceptance of the standby power source connection receptacle will be

made by the City of Concord Engineering Department as part of startup. Auxiliary standby power will be provided by the City of Concord unless directed otherwise.

Auxiliary power source connections will be rated to accept single-phase, 240 volt ( $\pm 10$  percent) or three-phase, 480 volt ( $\pm 10$  percent) from a standby power source.

For single-phase, 240-volt connections up to 3 horsepower motors, a 30-amp fusible, 125-250 volt, L14-30 NEMA receptacle shall be provided. For single phase, 240-volt connections for 5 horsepower motors, a 50 amp fusible disconnect CS style Leviton "6374-CR" flanged inlet receptacle shall be provided.

For three-phase, 208Y/120 volt, or 277/480 volt connection receptacles, a fusible disconnect of the required voltage and amperage with a Crouse Hinds "No. AR641 or AR642", 60-amp, 4-wire receptacle shall be provided. With pump motors 15 horsepower and over, a three-phase, 480-volt connection receptacle with fusible disconnect of the required voltage and amperage with a Crouse Hinds "No. AR2041", 100-amp, three-phase, 4-wire receptacle shall be provided.

For any 480-volt, 200-amp services, receptacles/services shall be specified on a case-by-case basis by the City of Concord Engineering Department.

All auxiliary power source connections are to be wired and installed with a fused, double throw safety switch with designated positions of NORMAL-OFF-STANDBY, where OFF is the center position, to prevent auxiliary power from backfeeding into the regular power supply system. Lockout provisions shall be furnished on the switch handle. The double throw safety switch shall be operable only after first opening the outer doors of the cabinet.

The standby power connection receptacle and its associated receptacle box shall be provided at a point close to and below the double throw safety switch on the outside of the enclosure cabinet as is convenient and approved by the Pump Station Coordinator.

All receptacles/receptacle boxes shall be dust and weatherproof, waterproof, and, where specified by City of Concord Engineering Department, explosion-proof.

If so directed by the City of Concord Engineering Department, the Developer/Contractor shall provide an auxiliary standby generator of the type specified by the City of Concord Engineering Department, together with all appurtenances, as part of the public acceptance of the pump station. If so required, this item shall have the capability for changing voltage. A selector switch on the control panel for allowing such changing of voltage will be supplied as part of the equipment. Placement and housing shall be specified by the City of Concord Engineering Department.

All required onsite generators shall become the property of City of Concord upon final acceptance of the pump station facility by the City of Concord.

## 9. MONITORING EQUIPMENT, SENSING EQUIPMENT, AND ALARMS.

As directed by the City of Concord Engineering Department, the monitoring and accessory equipment described below and the RTU described later shall be furnished within the control panel enclosure.

ALL ALARMS SHALL BE COMPLETE AND TESTED AT STARTUP.

9.02. Remote Telemetry Unit. Pump station monitoring equipment shall be Telemetric T646 Micro RTU or equal as approved by the City of Concord Engineering Department on a case-by-case basis Said RTU and hookup is to be mounted inside the control panel on a case-by-case basis as approved by the City of Concord Engineering Department. Hook-up No. 1 is to be connected to the high water alarms, Hook-up No. 2 is to be connected to the moisture seal indicators, and Hook-up No. 3 is to be connected

to the pump thermal alarms. Contractor is to contact the Pump Station Coordinator for specific details on indicator lights/switches as associated with these hook-ups.

9.03. Flowmeter. A sanitary sewer magnetic flow meter by ABB Automation or approved equal including controls and transmitter as specified by manufacturer. Flow meter size to be determined by size of force main, needs to be NEMA 4x, also needs to be flanged for easy installation or removal, flange class to be 150.

Micro Signal Converter to be enclosed in a NEMA 4x housing. Range setting to be fixed by meter size, have a flow rate display to be direct reading, totalizer to be read in gallons per minute Standard unidirectional flow direction. Power requirements to be 110.115/120 volts and have 4-20 ma outputs reading. Also required a surge protector to be mounted in control cabinet.

All cables, connectors, to be supplied by manufacturer and installed per manufacturer's recommendations. Also, any O & M manuals, software, training to be supplied.

**FLOWMETER MAY BE DELETED AT THE DIRECTION OF THE CITY OF CONCORD ENGINEERING DEPARTMENT ON A CASE-BY-CASE BASIS.**

10. INSTALLATION REQUIREMENTS. The enclosure cabinet shall be grounded with a shielded ground in accordance with local, state, and federal codes.

In parking lot or street right-of-way situations where there is no fencing, the control area shall be placed as far as possible from the travel lane and shall be protected, where noted and approved, by posts or bosses painted "reflective safety yellow". Placement shall not be over storm water piping or ditches or be in such close proximity to such as to present maintenance problems.

Control panels shall have two separate 2-inch conduits running from the control panel box to the wetwell. There shall be a watertight junction box provided on each conduit mounted to the outside of the enclosure cabinet for access to cables and cords. Motor control cords shall be placed in the right-hand conduit (facing the control panel access door) and the float control cables shall be placed in the left-hand conduit. Conduits shall be covered with an accessible metal enclosure where located externally from the main enclosure cabinet.

An additional conduit shall be routed from the control panel to the designated location of the area light, as described in the Electrical section of this specification.

All conduits shall be rigid galvanized steel.

Seal fittings shall be provided to prevent sewer gas from having an access pathway into the enclosure cabinet. These seal-offs shall be located at the enclosure cabinet below the junction box. In addition, duct seal shall be added to the conduit entries into the wetwell and into the bottom of the control panel enclosure.

Piping and conduit penetrations in wetwell/storage manholes and valve vaults shall be core-drilled in the field to facilitate orientation of piping entry and exit holes such that a straight installation of piping between the manhole and vault can be achieved without fittings. The pipe or conduit shall be sealed at the wall of the wetwell/storage manhole or valve vault with non-shrink grout.

The floor of the enclosure cabinet shall be located 2 feet above the 100-year flood elevation and is to be designed to be lockable to prevent access and/or use by unauthorized personnel.

All electrical work required for the installation of the pump station and associated connections to the power source shall be the responsibility of a licensed electrical Contractor.

All electrical hookups associated with the pump and controls inside the wetwell shall be the responsibility of the pump Supplier and the Contractor's electrician. All electrical connections inside the wetwell and in proximity to sewer gases shall be explosion-proof. All connections, receptacles, etc., that have the potential to be affected by moisture, dust, water, and weather shall be protected from such.

Installation of all utilities at the site, including power and telephone service, shall be coordinated with the City of Concord Engineering Department.

Erosion control measures meeting all NCDENR Division of Land Resources requirements shall be installed and maintained at the site during construction. At the completion of construction and at such time that the City of Concord Engineering Department determines that adequate permanent erosion control measures have been established, the Contractor shall remove the temporary erosion control measures and dispose them off site.

Adequate compaction of backfill around wetwell/storage manholes and valve vaults shall be achieved to prevent erosion around these structures after the pumping station facility is in service. Backfill materials shall be deposited in layers not to exceed 8 inches in uncompacted thickness and shall be compacted to at least 95 percent of maximum density at optimum moisture content as determined by ASTM D698. Compaction of structure backfill by rolling will be permitted, provided the desired compaction is obtained and damage to the structure is prevented. Compaction of structure backfill by inundation with water will not be permitted.

11. STATION LOT AND ACCESS REQUIREMENTS. As directed by the City of Concord Engineering Department, either the chain link fencing and gates described below or the wooden privacy fencing and gate described in the subsequent paragraph shall be provided at the pump station lot. All pumping station lots shall be deeded to the City of Concord or its successors, assigns, or designees.

11.01. Chain Link Fencing. Lots shall be enclosed by an 8-foot high chain-link security fence (all materials shall be Class I galvanized coated, 9 gauge mesh), ends twisted and barbed. Fencing shall be topped with three rows of outward facing barbed wire. Wire shall be 12-1/2 gauge galvanized line wire with four-point, 14 gauge barbs spaced 5 inches on centers. Bottom tension wire shall be 7-gauge spring coil wire with galvanized coating. End, corner, and pull posts shall be 2-1/2 inch O.D. galvanized coated. Top and line posts shall be 2-inch galvanized coated. All post footings shall be sloped to drain.

The access gates shall be a pair of 8-foot long, 7-foot high sections constructed of 2-inch O.D. pipe. Gates shall be equipped with a latch and hasp assembly and center post. Gate posts shall be 3-inch O.D. galvanized coated. A ground anchor cast in concrete shall be provided. All gates shall be factory fabricated and equipped with gate hold-backs. Panel shall have a horizontal brace center of fabric height. The location shall be coordinated and approved by the City of Concord Engineering Department.

11.02. Wooden Privacy Fencing. Lot shall be enclosed by wooden privacy fencing designed, fabricated, and installed by a supplier specializing in this type of fencing. If fence is to be used only for screening, height shall be as determined by the City of Concord Engineering Department, and fence shall be installed just outside chain link fencing. If fence is to be used for security (in lieu of chain link fencing), height shall be as recommended and designed by Supplier. Data and drawings of the proposed wooden privacy fencing shall be submitted to the City of Concord Engineering Department for review and approval.

Lumber used in the privacy fencing shall be pressure treated structural lumber (treated with chromated copper arsenate), redwood, or cedar. Post size, width of fencing panels, bracing, method of attachment, and finish coatings shall be as recommended by fence supplier. Post tops shall be bevel cut. Post bottoms shall be set in concrete and footings sloped to drain. Access gates shall be a pair of minimum 8-foot long sections designed to accommodate proper opening of interior chain link gates, if provided as

noted above. Gates shall slide open in a parallel direction to the fence and shall operate smoothly on a roller wheel system adequately designed to support the weight of the gate. Gates shall be equipped with a latch and hasp assembly on which locking hardware can be utilized by the City.

11.03. Vegetation Control. The entire site inside the fence shall be covered with an "anti-weed" fabric that prohibits the growth of vegetation yet allows rainwater to pass through. Covering shall be with 2 inches of crushed stone (ASTM C33, Gradation 67). This covering shall extend to 1 foot outside the fenced area.

FENCING MAY BE DELETED AT THE DIRECTION OF THE CITY OF CONCORD ENGINEERING DEPARTMENT IF ALL STATION COMPONENTS ARE SECURED AND LOCKABLE AND LOT IS IN A VISUALLY SENSITIVE AREA.

11.04. Yard Hydrant and Washdown Pad. A convenience yard hydrant (lockable) supplying potable water for a washdown capability shall be supplied by the Contractor inside the security fencing adjacent to the washdown pad. The water service line shall be a 3/4-inch or 1-inch line. The service line shall have a double check valve assembly backflow preventer per City of Concord specifications. The dimensions of the washdown pad shall be as indicated on the drawings but in no case shall be less than 3 by 3 feet square. A 4-inch curb/lip shall be poured as an integral part of the pad. The pad shall be 4-inches thick with wire.

11.05. Site and Access Road Requirements. All portions of the lot surface and access road to the facility shall be above the 100-year flood (FEMA and local) elevation.

Provisions shall be made to protect side slopes from flood erosion and wave action as necessary. Access service road shall have at a minimum a 4-inch compacted layer of ABC stone travel surface 12-foot wide. An access security gate and/or all weather travel surface may be stipulated by the City of Concord Engineering Department on an individual site basis.

The grade of the site access road shall be no more than 8 percent. A vehicle turnaround area shall be provided at the termination of the site access road. At the option of the City of Concord Engineering Department, the vehicle turnaround area may be omitted if the site access road length is less than 100 feet. If a vehicle turnaround area is provided, the turning radii used in layout of the area shall be sufficient to accommodate the largest vehicle expected to access the facility. All stations shall be accessible by either the electric utility's bucket truck or line truck.

11.06. Landscaping and Final Stabilization. Landscaping or screening requirements may be required by the City of Concord. Reference the City of Concord Unified Development Ordinance for specifics. Cost associated with this shall be the responsibility of the Developer/Contractor.

At sites with severe perimeter slopes, riprap shall not be used by the Developer/Contractor for final stabilization unless authorized by the City of Concord Engineering Department. Ground cover plants and/or shrubs as listed in Appendix 8 of the NCDENR Erosion and Sediment Control Planning and Design Manual shall be planted on these slopes. A list of proposed plant materials and planting densities shall be submitted by the Developer/Contractor to the City of Concord Engineering Department for review and approval.

11.07. Signs. Signs of the metal reflective type stating CITY OF CONCORD, PUMP STATION NUMBER (as given) PROBLEMS: CALL 704-920-5555 and the STREET ADDRESS shall be provided by the Contractor. Required specifics of said sign shall be provided by the City of Concord or as detailed. Cost shall be borne by the Developer.

12. FORCE MAINS AND AIR RELIEF/RELEASE VALVES. Minimum force main diameter shall be 4 inches without solids removal/handling facilities, such as mechanical bar screens, comminuter, or grinder-type pumps. Minimum force main diameter with solids handling/removal facilities shall be 2 inches.

Sanitary sewer force main piping shall be rated equal to water main piping standards or greater depending on pressure requirements. Ratings shall be reviewed and approved by the City of Concord Engineering Department. Consideration for erosion due to soil friction and chemistry shall be considered by relating to wall thickness.

Termination points for force mains shall be in such a manner as to prevent splashing action of the effluent in the receiving manhole.

Air relief (release, dual function, universal, air and vacuum, etc.) valves shall be vented into a 4-foot manhole cone section with riser ring and rim. The floor of the assembly shall be covered with a minimum of 4 inches of washed stone. The air jet shall be directed down onto a splash pad. Gate valve attachments shall be rotated to provide easy operation. The force main valves shall have stainless internals and trim. The assembly shall be secured by anchorage to the manhole wall to prevent flexing and vibration under surge.

Valve size(s) and orifice diameter shall be designed to fit the range of working pressure and discharge/intake of air relating to filling and draining operations. In no case shall required air capacity through the valve to relieve vacuum be less than 5 psi. Valves shall be positioned at all high points with elevation differentials 10 feet or greater and at spacings approximately 2,000 feet apart on long ascending or descending runs. All valves shall be capable of venting air or breaking vacuum.

Backflushing attachments are required on systems that are projected to remain in use more than 3 years if so designated by the City of Concord Engineering Department.

13. SPARE PARTS. The following shall be supplied on or before final inspection:

- a. two seal assemblies: top and bottom at impeller and at winding of motor;
- b. bearings: one complete set of bearings for each pump;
- c. three complete sets of: record drawings, O&M Manuals, copies of certified tests, inspection data, and termination schedule;
- d. level switches, one additional float (normally open type) with 30-ft of cable; and
- e. o-ring and gasket kit for pump motor and impeller housing.

14. STARTUP OPERATIONS. Upon construction installation of City of Concord-maintained sewer pump stations, startup operations and testing shall be conducted prior to final acceptance and release of sewer flows under the supervision of the City of Concord Engineering Department. At a minimum, a representative of the pump Supplier, a representative of the Contractor, a representative of the City of Concord Wastewater Resources Department's Pump Station Maintenance Division, and a designee of the Engineering Department's Construction Administrator will be present for startup testing.

A "City of Concord Pump Station Startup Check List" shall be completed and signed off in entirety before a facility shall be accepted by the City of Concord.