

## 4.0 Pump Station Specifications

### 4.1. General Standards.

- a. *Safety.* All pump station equipment, panels, and controls must be intrinsically safe, i.e., equipment and wiring must be incapable of releasing sufficient electrical or thermal energy to cause ignition of gases.
- b. *Submittals.* Complete fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering materials, parts, devices, and accessories shall be submitted to the City. Developer/Contractor shall submit 4 set(s) of shop drawings. Shop drawings shall include equipment descriptions, specifications, dimensional and assembly drawings, parts lists, and job specific drawings. The data and specifications for each unit shall include, but shall not be limited to, the following:
  1. Pumps.
    - (a) Name of manufacturer.
    - (b) Type and model.
    - (c) Rotative Speed
    - (d) Size of suction elbow inlet.
    - (e) Size of discharge elbow outlet.
    - (f) Net weight of pump and motor only.
    - (g) Complete performance curves showing capacity versus head, brake horsepower (bhp), net positive suction head (NPSH) required, and efficiency.
    - (h) Shop paint.
  2. Motors.
    - (a) Name of manufacturer.
    - (b) Type and model.
    - (c) Type of bearings and method of lubrication.
    - (d) Rated size of motor (horsepower).
    - (e) Temperature rating.
    - (f) Full load rotative speed.
    - (g) Net weight.
    - (h) Efficiency at full load and rated pump condition.
    - (i) Full load current.
    - (j) Locked rotor current.

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3. Cabinet, Controls, and Components.
    - (a) Name of manufacturer.
    - (b) Type and model.
    - (c) Dimensions and net weight of complete panel.
    - (d) Overcurrent characteristics and details of motor control.
    - (e) Liquid level sensors with mounting details, high-water float cable lengths, and pump controls.
  4. Comminutor
    - (a) Name of manufacturer.
    - (b) Type and model.
    - (c) Dimensions and net weight of complete panel.
    - (d) Overcurrent characteristics and details of motor control.
  5. Standby Generator or Auxiliary Pump
    - (a) Name of manufacturer.
    - (b) Type and model.
    - (c) Dimensions and net weight of complete panel.
    - (d) Overcurrent characteristics and details of motor control.
    - (e) .Pump Capacities: Pump Curve, Total Dynamic Head, etc.
  6. Hoist & Jibs
    - (a) Name of manufacturer.
    - (b) Type and model.
    - (c) Dimensions and weight limits.
    - (d) Overcurrent characteristics and details of motor control.
    - (e) Dimensions and structural drawings of the foundation pillar.
- c. *Delivery, Storage and Handling.* The equipment shall be packaged in containers constructed for normal shipping, handling and storage. The containers shall provide adequate protection for the equipment in a dry indoor environment until time for installation.
- d. *Closeout Submittals.* Developer/Contractor shall submit 3 set(s) of Operation and Maintenance manuals to the Wastewater Resources Department's Service Maintenance Supervisor. The manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, and the recommended lubricants.

## 4.2. Pumps.

- a. *General Standards.* Pumps must be manufactured in accordance with ISO 9000 quality assurance standards, be UL listed, and meet the standards of the Hydraulic Institute. Pumps not manufactured to these standards are not considered compatible with the pump's intended use and are therefore unacceptable.
- b. *Manufacturers.* Acceptable pump suppliers include Flygt, Fairbanks-Morse, Myers, and Peabody-Barnes.
- c. *Number.* At least two pumps must be provided at each pump station. Each pump must be able to independently pump peak flow.
- d. *Types.*
  1. Only continuous duty pumps designed and manufactured for use in conveying raw, unscreened wastewater are acceptable.
  2. Pumps must be submersible.
  3. Grinder pumps may be used for design flows up to, but not exceeding, 100 gallons per minute.
  4. Non-clog pumps must be used for design flows greater than 100 gallons per minute.
- e. *Efficiency.* Pumps must be designed to be at least 45 percent efficient at under normal operating conditions.
- f. *Impellers.*
  1. Impellers must be non-clogging in design and secured from rotation on the shaft through the use of a shaft key or locking collet.
  2. Pump impellers must be ASTM A48 Class 30B cast iron; otherwise the City must approve the use of ductile iron or an approved stainless steel for wastewater applications as required for specific applications.
- g. *Volutes.*
  1. Pump volutes must be, at a minimum, ASTM A48 Class 30B cast iron with a minimum Brinell hardness rating of 180. Lesser grades of cast iron or materials having a Brinell hardness rating less than 180 are not compatible with the typical grit concentration in wastewater.
  2. The volute must be further protected from wear through the use of a replaceable wear ring.
  3. Lower seals must be tungsten carbide. Pumps shall be equipped with a plug on the outside of the oil chamber, in order to inspect the lower seal condition.
- h. *Solids Handling.* Pumps must be capable of comminuting solids into a liquid slurry when discharging to force mains with 2-inch or smaller diameters; otherwise, non-clog pumps capable of passing a 3-inch diameter object must be used.

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- i. Mounting and Removal Equipment.
    - 1. All lift-out rail systems must be an approved stainless steel for wastewater applications.
    - 2. All lifting cables shall be adequately-sized an approved stainless steel for wastewater applications with an approved stainless steel for wastewater applications clips.
    - 3. Chains are not allowed.
    - 4. Cables must be supplied with 6 feet of slack.

**4.3. Motors.**

- a. *General Standards.* The motor and motor housing must be designed for use in domestic wastewater.
- b. Types.
  - 1. Motors shall be squirrel-cage induction motors with continuous duty NEMA Design B, at 40 degrees C ambient.
  - 2. Motors shall be designed for at least six starts per hour.
  - 3. High efficiency motors should be used in all cases.
  - 4. Oil-filled or air-filled motors shall be used.
  - 5. Motors must be non-overloading over the entire operating range.
- c. *Bearings.* Bearings must be lubricated per manufacturer's specifications and have a minimum 50,000-hour B-10 bearing life. Lower B-10 bearing lives are not acceptable for normal pump station life expectancies.
- d. Thermal Protection.
  - 1. Motors must have at least a 1.25 service factor and 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.
  - 2. Overheat detection and telemetry are required on all motors.
  - 3. Overheat detection must be connected to a separate detection indicator alarm light on the control panel.
  - 4. The detection of an excessive temperature should cause the motor to shutdown.
- e. Moisture Protection.
  - 1. Motors shall have moisture resistant Class "F" (155 degrees C) insulation.
  - 2. Motors must be protected from moisture intrusion through the use of a sealed cable entry system utilizing an approved stainless steel for wastewater applications washers and must be protected from moisture intrusion from the pump's hydraulic end.
  - 3. Moisture detection and telemetry are required on all pump motors. Moisture

detection must be connected to an indicator alarm light on the control panel.

4. The detection of moisture should cause the motor to shutdown.
- f. Shafts.
  1. The motor and pump shaft must be a 400 Series at minimum and must be composed of an approved stainless steel for wastewater applications. No other materials are acceptable for this application.
  2. Shafts must be completely isolated from the pump media by a mechanical seal. Mechanical seals of tungsten carbide must be provided.

#### 4.4. Power Supply.

- a. *Voltage Ratings.* Motor rated voltage shall be as follows unless indicated otherwise on the drawings.
  1. 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.
  2. All three-phase pumps 5 to 10 horsepower shall be rated for 277/480 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.
  3. 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.
  4. 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.
  5. A soft start shall be provided for all three-phase motors 5 HP and greater.
- b. Power Source Provisions.
  1. *Installation.* 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.
  2. *Surge Arrest.* At both single- and three-phase service poles, a surge arrester shall be furnished and installed within the service disconnect enclosure and connected to the incoming service conductors for surge protection.
  3. Area Light.
    - (a) A minimum 100-watt, HPS lamp, with multi-tap ballast, shall be

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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.

- (b) The area light branch power supply shall originate within the cabinet and shall be switch operated from a separate circuit in the cabinet.
- (c) Conduit and branch power circuit conductors shall be routed from the cabinet underground to a riser conduit along the exterior of the wood pole.

c. Auxiliary Power Connections.

- 1. 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 approved construction drawings.
- 2. Final acceptance of the standby power source connection receptacle will be made by the City of Concord Engineering Department during startup operations.
- 3. 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.
- 4. 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.
- 5. Lockout provisions shall be furnished on the switch handle.
- 6. The double throw safety switch shall be operable only after first opening the outer doors of the cabinet.
- 7. 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 Wastewater Resources Department's Service Maintenance Supervisor.

d. Instrumentation and Controls.

- 1. *General Specifications.* 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. The pump station supplier shall furnish the controls for operation of the pump station. Control operation shall correspond to the approved drawings and as specified herein. High-water detection and telemetry shall be provided at all pump stations.

e. *Cabinets.* Cabinets shall be custom-engineered enclosures suitable for mounting as indicated on the approved drawings and contain the system components indicated

on the approved drawings and specified herein. In all applications, unless specifically approved by the City of Concord Engineering Department, all controls, meters, and devices shall be placed within the interior of the cabinet.

1. Exterior.

- (a) *Dimensions.* Cabinets shall be 54" x 69" on at least 12" legs. The cabinets shall be mounted on an appropriately sized concrete pad.
- (b) *Material.* Cabinets shall be fabricated from 12-gauge steel and be NEMA 3R waterproof, dustproof, and weatherproof or NEMA 4X, as specified by the City of Concord Engineering Department.
- (c) *Front.* Cabinets shall be equipped with full-size, gasketed, double doors with a three-point latch and an approved stainless steel for wastewater applications hinges. The doors shall be capable of being locked in an open position.
- (d) *Back.* Cabinets shall include a non-corrosive aluminum backplate.
- (e) *Bottom.* 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.
- (f) *Color.* Cabinets shall be painted Pad Mount green.



Cabinet Exterior.

2. Interior.

- (a) *Components.* A second set of doors shall be located inside the cabinet. The interior cabinet door shall be equipped with heavy-duty oil-tight pilot lights, reset buttons, a button that serves as a common alarm acknowledgement, and selector switches. Monitoring and accessory equipment shall be located within the cabinet. Green "Pump Running" indicator lights and elapsed time meters for each pump shall be mounted

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on the face of the interior door. Non-reset time meters shall designate the six-digit pump run time in hours and tenths of hours.

(b) Detection and Alarm Equipment.

(1) *Types.* Individual red alarm lights mounted within the cabinet on the hinged interior deadfront panel door shall be provided for the following.

- (i) Pump No. 1 Overload
- (ii) Pump No. 2 Overload
- (iii) Pump No. 1 Moisture Detected
- (iv) Pump No. 2 Moisture Detected
- (v) Pump No. 1 Over Temperature
- (vi) Pump No. 2 Over Temperature
- (vii) Pump No. 1 Phase Protection Trip
- (viii) Pump No. 2 Phase Protection Trip
- (ix) Wetwell High-Water Level





(c) Figure 2: Cabinet Interior.

(d) Operation.

- (1) *Telemetry.* 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 notification.
- (2) *Beacon.* Alarms shall illuminate a flashing red vapor-tight alarm beacon. 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.
- (3) *Horn.* Alarms shall sound a horn. 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.
- (4) *Uninterruptible Power Supply.* 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, alarm horn, telemetry, and level controls when the power supply to the pump station is interrupted.
- (5) *Thermal Protection.* Condensation protection space heaters with thermostat control shall be provided for internal temperature control as recommended by the manufacturer.
- (6) *Surge Protection.* Surge protection equipment shall be provided for all instrumentation and controls and shall be located within the cabinet.
- (7) *Arrangement.* All operating controls and instruments shall be securely mounted in a logical arrangement and such that any standard options offered by submersible pump manufacturer may be

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added in the field.

- (8) *Labels.* All controls, pilot lights, and selector switches shall be clearly labeled to indicate function.

3. Wiring.

- (a) *General Standards.* All wiring shall meet National Electrical Code standards. Internal device wiring shall be furnished by the manufacturer of the device. All other wiring shall be grouped or cabled and firmly supported to the cabinet.
- (b) *Material.* 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.
- (c) *Size.* Power distribution wiring on the line side of panel fuses shall be at least 12 AWG. Secondary power distribution wiring and wiring for control circuits shall be at least 14 AWG. Indicating light circuits shall be at least 16 AWG.
- (d) *Color and Labels.* Wiring for alternating current (AC) power distribution, direct current (DC) power distribution, and control circuits shall have different colors and wire numbers and shall match the control schematic on the supplier's panel wiring diagrams.

4. Terminals.

- (a) *Number.* A terminal shall be provided for each conductor of external circuits. Not less than 25 percent spare terminals shall be provided.
- (b) *Placement.* 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.
- (c) *Components.* Terminal blocks shall be fabricated complete with marking strip, covers, and pressure connectors.
- (d) *Rating.* For external connections, terminal blocks shall be suitable for 12 AWG wire and shall be rated for 30 amperes at not less than 300 volts.
- (e) *Labels.* Terminals shall be labeled to agree with identification shown on the supplier's drawings.

5. Pump Controls.

- (a) *Instrumentation.*
  - (1) Each submersible pump system shall be furnished with a pump control panel, control devices, and level switches as indicated on the approved drawings and specified herein.
  - (2) The control panel shall be designed to operate from a 240-, or 277/480-volt, 60-Hz, single- or three-phase external source.
  - (3) Terminals shall be provided for terminating up to a #1/0 AWG size cable per phase.

- (4) Any additional circuits required for proper operation shall be provided.
- (b) Operation.
  - (1) *Pump Selection.* 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.
    - (i) *Automatic.* The pumps shall be controlled in a typical duplex lead-lag manner, including the following. In AUTO, pump controls shall also allow for an external RUN command, via telemetry system, to initiate pump operation.
      - i. a) Automatic alternation on successive starts to include the standby pump,
      - i. b) Automatic failover in the event of a pump failure to start the standby pump, and
      - i. c) Override to start two pumps if level continues to increase.
    - (ii) *Manual.* 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.
- (c) Detection and Alarm Equipment.
  - (1) Each pump shall be provided with a seal failure and high temperature detection and alarm systems in the cabinet for protection of each individual pump motor.
  - (2) A moisture-sensing device shall be provided in the stator housing for seal-failure protection and, if necessary, a monitoring module shall also be provided within the cabinet 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.
  - (3) Operating voltage power supply requirements necessary to interrogate the moisture-sensing device within each motor shall be provided within the control panel enclosure.
  - (4) A high water float for a ultrasonic transducer backup.
- f. Motor Controls.
  - 1. Instrumentation.
    - (a) *Size.* 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.
    - (b) *Electric Leads.* 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.

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2. Starters.

(a) General Standards.

- (1) *Contacts.* Each starter shall include auxiliary running status contacts wired to terminals for external connection by others for remote notification, plus one spare “NO” and one spare “NC” contact.
- (2) *Disconnect.* Each starter shall be provided with an interlocking mechanism that disconnects all external sources of power from the terminal blocks within the starter, such as external power across motor auxiliary status contacts, when the disconnect handle is moved to the “OFF” position.
- (3) *Thermal Overload Reset.* 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 mounted on the hinged interior panel front within the cabinet and accessible by opening the outer door.

(b) Three-Phase Starters/Variable Frequency Drives (VFD's) Components.

- (1) *Three Phase Starter. Components.* Three phase starters shall be “Soft Start” type optimized for centrifugal pump loads. Units shall be furnished with shunt-trip circuit breakers (combination type starter) with shorting contactor to bypass SCR's after start up to reduce heat dissipation inside enclosure. Starter shall be 480-volt, 3 Phase, 60 Hz, with electronic adjustable overload relay. 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. In addition provide with normally open dry contacts for telemetry annunciation of pump failure. The contact shall close on motor overload and open when manually reset. Starters shall be sized based on motor full load amps of furnished pumps. Specification is based on Square D, Altistart Type #ATS46, or approved equal. Where VFD drives are indicated (in lieu of starters) they shall be similarly equipped with auxiliary contacts motor short circuit & overload protection. VFD units shall meet City of Concord's standards: where no VFD standards exist, units shall be equal to “Altivar 31” units by Square D Inc. (See details and description on the plans for more information.)
  - (i) *Rating.* The complete three-phase shall have an interrupting rating of at least 14,000 amperes at 208 volt, and 25,000 amperes at 480 volts..
  - (ii) *Starter Size.* Starters shall be at least NEMA Size 1 or as indicated on the approved drawings.
  - (iii) *Soft Start.* A soft start shall be provided for all three-phase motors 5 HP and greater.
  - (iv) *Circuit Protection.* Circuit breakers shall be 600-volt magnetic motor circuit protectors. If an inverse time thermal 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.

(v) *Transformer Size.* Control power transformers shall be sized to handle all simultaneous loads.

(vi) *Overload Relay.* An overload relay shall be provided with one normally open dry contact. The contact shall close on motor overload and open when manually reset.

(c) Single-Phase Starters.

(1) *Components.* Single-phase starters shall consist of single-phase, 60 Hz contactors with thermal overloads and an integral or separately enclosed short-circuit protection device.

(2) *Rating.* 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.

(3) *Starter Size.* Starters shall be at least NEMA Size O or as indicated on the drawings.

(4) *Circuit Protection.* Integral short-circuit protection devices for single-phase starters shall be 120/240 volt, magnetic motor circuit protectors.

(d) Operation.

(1) *Motor Protection Relay.* 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.

(2) *Manufacturers.* The relay shall be “Motor Saver Model SP3” by SymCom, Inc., Time-Mark Phase Loss Relay, or equal.

(e) Detection and Alarm Equipment. A motor protection relay shutdown alarm shall be connected to a separate detection indicator light on the cabinet. A dry, resistive contact shall also be provided and wired by others for remote notification.

g. Wetwell Wastewater Level Controls.

1. *Instrumentation.*

(a) *Ultrasonic Level Transmitters.* This device must control the pump off, lead on, and lag on; and interface with telemetry, RTU 4-20MA, inputs to monitor wetwell levels. The ultrasonic level transmitter shall be a Milltronics HydroRanger 200 or equal and wired off a terminal strip through the control of a circuit breaker.

(b) *Ultrasonic Transducer.* This device must provide continuous level

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monitoring of liquids and slurries in narrow lift stations/wet wells. The ultrasonic transducer shall be non-contacting with a measuring range shall conform with the requirement of the pump station depth. Echo processing must ensure reliable data even in conditions with possible obstructions, turbulence and foam.

(c) *High-Water Level-Sensing Float.*

- (1) One high-water level-sensing float with cable and cable supports shall be provided for high-water level detection.
- (2) The high-water level float shall be a weighted pear-shaped enclosure, hermetically sealed, housing a double-pole mercury switch.
- (3) The switch shall be cushioned, mounted approximately at 65 degrees inclination from the enclosure main axis and connected to a special three-conductor cable.
- (4) The cable shall be insulated and heavily sheathed with PVC for resistance to immersion, corrosion, and abrasion.
- (5) 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. .
- (6) *Manufacturers.* Floats shall be Roto-Float type-S or equivalent.

2. Operation.

- (a) *Interrogation Voltage.* The contact interrogation voltage shall be no more than 24 volts across the level-sensing switches within the wetwell to meet intrinsically safe, explosion-proof requirements.
- (b) *Transformer.* The control power transformer with 24-volt secondary voltage shall be furnished and installed within the cabinet as necessary to interface with the level sensing switches.
- (c) *Manufacturer.* Controls shall be Diversified Electronics ISR Module Part # ISO-120-ACE, 120-volt supply; or equivalent.
- (d) *Detection and Alarm Equipment.* The following level detectors and alarms shall be provided based on elevations in the approved drawings.

- (1) All pumps off.
- (2) Lead pump on.
- (3) Lag pump on.
- (4) High-Water level exceeded, as detected by both the ultrasonic level transmitter and the float. High-water detection shall be connected to a separate detection indicator alarm light on the control panel.

h. *Telemetry Controls.* A remote telemetry unit (RTU), antenna and associated appurtenance shall be installed at every pump station.

1. *Manufacturer.* Telemetry units shall be Telemetric T646 Micro RTU, and the antenna shall be a high gain directional “Yagi” antenna or equal as approved by the City of Concord Engineering Department with all associated appurtenances required to complete the system.

2. *Location.* The RTU and associated hook-ups shall be mounted inside the

- cabinet. The high gain antenna shall be pole mounted on a mast with adequate grounding. The associated coaxial cable shall run in a separate sealed PVC coated rigid electrical conduit from cabinet to final mounting.
3. *Configuration.* The power supply for the telemetry unit shall be wired to the terminal strip. For details on indicator light and switches associated with these hook-ups, mounting location of antenna, and signal propagation contact the Wastewater Resources Department's Service Maintenance Supervisor.
    - (a) Hook-up No. 1 is to be connected to the high-water alarms.
    - (b) Hook-up No. 2 is to be connected to the moisture seal indicators.
    - (c) Hook-up No. 3 is to be connected to the pump thermal alarms.
  - i. *Flowmeters.* A magnetic wastewater flowmeter shall be installed at pump stations as directed by the City of Concord Engineering Department. Flowmeters shall be flanged for easy installation or removal.
    1. *Manufacturer.* Flowmeters shall be ABB Automation or an approved equal. Associated controls and transmitters used at the pump station shall be those specified by the flowmeter manufacturer.
    2. *Size.* Flowmeters shall be sized based on force main size.
    3. *Material.* Flowmeters shall be NEMA 7. Flanges shall be Class 150.
    4. *Micro Signal Converter.*
      - (a) *Housing.* The converter shall be enclosed in the pump control cabinet.
      - (b) *Range.* The range shall be determined based on the size of the flowmeter.
      - (c) *Display.* The converter shall have a direct reading totalizer flow rate display in gallons per minute using a standard unidirectional flow direction.
      - (d) *Power.* A 110.115/120-volt power supply shall be provided with 4-20 mA DC outputs.
  - j. *Convenience Receptacles.*
    1. A single 120-volt, 20-ampere, ground fault interrupting convenience receptacle shall be provided with the control panel enclosure.
    2. If necessary, a step-down transformer shall be provided to supply 120-volt power to the receptacle.
    3. If the receptacle cannot be located on the face of the interior panel door within the cabinet, then it shall be located on the exterior of the cabinet within its own lockable access receptacle box, which shall be waterproof, dustproof, and weatherproof.
    4. Placement must be approved by the City of Concord Engineering Department.
  - k. *Area Light Controls.*
    1. A snap action switch shall be furnished and installed on the face of the interior

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- panel door within the cabinet.
2. The switch shall be connected to a branch power circuit of minimum 15 amperes with either 120- or 240-volt single-phase electricity, supplied from the control power transformer within the cabinet.
1. Labels.
    1. Nameplates shall be provided on the face of the interior panel door within the cabinet or on the individual device as required.
    2. 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.
    3. Nameplates shall be secured firmly to the door.
- m. Installation. All associated cables and connectors supplied by manufacturer shall be installed per manufacturer's recommendations.
1. Control Protection.
    - (a) *Electric Current Protection.* The cabinet shall be grounded with a shielded ground in accordance with NEC 250.56.
    - (b) *Hazard Protection.* The electrical equipment enclosures shall be located outside the hazardous boundaries indicated. If located in a wet well or other location where explosive or flammable gases may concentrate, electrical and instrumentation/control systems and components shall meet the requirements for a Class I, Group D, Division 1 location. A minimum working clearance "from panel faces" shall be maintained per NEC 110.26.
    - (c) *Collision Protection.* For unfenced pump station lots located in parking lots or street rights-of-way, the cabinet shall be placed as far as possible from the travel lane as possible and protected from potential vehicle collisions, where noted and approved, by posts or bosses painted "reflective safety yellow."
    - (d) *Flood Protection.* The floor of the enclosure cabinet shall be located 2 feet above the 100-year flood elevation.
    - (e) *Protection from Unauthorized Use.* The cabinet shall be lockable with a single locking mechanism to prevent access and/or use by unauthorized personnel.
    - (f) *Corrosion Protection.* Seal fittings shall be provided to prevent wastewater gases from entering the enclosure cabinet.
  2. Control Conduits.
    - (a) *Number.* Three separate conduits shall extend from the cabinet.

- (b) *Size.* Conduits shall have a 2-inch diameter.
- (c) *Material.* Conduits shall be rigid plastic-coated steel. Outside of the cabinet, conduits shall be covered with an accessible metal enclosure.
- (d) *Contents.* Two separate conduits shall extend to the wetwell. Motor control cords shall be contained in the right-hand wetwell conduit (facing the control panel access door) and the float control cables shall be placed in the left-hand wetwell conduit. The third conduit shall extend to the area light and contain the necessary wiring.
- (e) *Junction Box.* A watertight junction box shall be provided on each conduit and mounted to the outside of the enclosure cabinet for access to cables and cords.
- (f) *Seals.* Seals shall have a plastic coating and be located at the cabinet below the junction box. Duct seals shall be provided for the wetwell conduits entering the wetwell and at the bottom of the cabinet.

3. Electrical Components.

- (a) *Installer.* All electrical work required for the installation of the pump station and associated connections to the power source shall be performed by a licensed electrical contractor. All electrical hook-ups associated with the pump and controls inside the wetwell shall be the responsibility of the pump supplier and the contractor's electrician.
- (b) *Protective Equipment.* All electrical connections inside the wetwell and in proximity to wastewater gases shall be explosion-proof. All connections, receptacles, etc., that have the potential to be negatively impacted by moisture, dust, and extreme temperatures shall be protected as necessary.
- (c) *Utility Connections.* Installation of all utilities at the site, including power and gas, shall be coordinated with the City of Concord Engineering Department.

**4.5. Trash Baskets.**

- a. *Location.* Pump station facilities shall be designed with trash collection basket(s) and associated lift-out component(s) in the wetwell or as indicated in the engineering drawings and approved by the Director of Engineer.
- b. No Bar screen allowed.
- c. *Function.* Baskets must catch non-comminutable items while passing wastewater.
- d. *Placement.* Baskets shall be placed so that a minimum of 12 inches of wastewater spillage will drop through the basket. Inlet pipes must stub 3 inches into the basket. Wetwells and storage basins shall accommodate the basket assembly yet still provide sufficient slope to achieve wastewater velocities of 2 feet per second (fps). When installed in manholes, an access hatch assembly shall be utilized instead of a standard manhole cover.

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- 4.6. Grinder (Comminutors):** The City of Concord reserves the right to specify grinder or an approved comminutor assembly in lieu of a trash basket, if the constraints of the proposed pump station design does not facilitate a trash basket assembly, the proposed pump station will be or may become a regional pump station and/or the wastewater volume or constituents of the effluent (commercial, industrial, etc wastewater) warrant a comminutor system.
- a. *Quality Assurance.* Qualified suppliers shall have a minimum 5 years experience at manufacturing, support systems, two-shafted grinding equipment and motor controls with a minimum of 2,000 installations with similar equipment.
  - b. *Manufacturers.* Grinder(s), and motor controller(s) shall be in compliance with these specifications and plans and shall be supplied by one of the following manufacturers, JWC Environmental<sup>®</sup>: Muffin Monster<sup>®</sup> or City approved equal. Manufacturers requesting to be selected as an approved equal shall submit certified documentation showing compliance with these specifications to the Wastewater Resources Department's Service Maintenance Supervisor for approval. The manufacturer must certify that the unit can be returned for maintenance to the factory or a local repair facility. The certification shall include a statement that there will be no charge for repair labor.
  - c. *Support System(s).*
    1. *General:* A grinder shall handle the required wastewater discharge and a support frame with adjustable mounting brackets shall be provided for specified channel or pipe opening within the proposed wetwell.
    2. *Components.* The support frame and additional supports shall be of welded square tube, angle, and plate construction. The construction material shall be a stainless steel approved for wastewater application.
    3. *Grinder(s).* Each grinder shall include cutters, spacers, shafts, bearings and seals, side rails, end housings, covers, reducer, and motor. The grinder shall be of two-shaft design and be capable of continuous operation, processing wet or dry. Bar screens or single-shaft devices utilizing a single rotating cutter bar with stationary cutters shall not be acceptable. Grinders designed with cutter and spacer cartridges rather than individual cutters and spacers, shall not be acceptable. Two-shaft design shall consist of two parallel shafts alternately stacked with individual intermeshing cutters and spacers positioned on the shaft to form a helical pattern. The two shafts shall counter-rotate with the driven shaft operating at approximately two-thirds (2/3) the speed of the drive shaft.
    4. *Motor.*
      - (a) The motor shall be sized in accordance with the manufactures recommendation for each specific model. The motor shall be submersible or semi-submersible, as applicable.
      - (b) The controller shall provide independent control of the grinder and shall be in accordance with the manufactures recommendation for each specific model.

- (c) *Motor Controller(s)*. The controller shall provide independent control of the grinder and shall be in accordance with the manufacturer's recommendation for each specific model. The controller shall be equipped with a GRINDER ON-OFF/RESET-AUTO three (3) position selector switch and with an auxiliary relay designated for telemetry monitoring of grinder failure and power failure. In the OFF/RESET mode the grinder shall not run. In the ON mode the grinder will run. In the AUTO mode the grinder shall start and stop as controlled by a remotely-located dry contact. The grinder shall only be reset by switching the GRINDER ON-OFF/RESET-AUTO switch to the OFF/RESET position.
- (d) *Safety Features*. When a grinder jam condition occurs in the grinder ON or AUTO mode the controller shall stop the grinder, then reverse the grinder rotation to clear the obstruction. If the jam is cleared, the controller shall return the grinder to normal operation. Up to two (2) additional reversing cycles (3 times total) may occur within 30 seconds before the controller de-energizes the grinder motor and activates the grinder fail indicator and relay.
  - (1) Auxiliary relays designated for telemetry monitoring of grinder failure and power failure shall be provided.
  - (2) If a power failure occurs while a grinder is running, operation will resume when power is restored.
  - (3) If a power failure occurs while the grinder is in a fail condition the fail indicator shall reactivate when power is restored.
  - (4) The controller shall provide overload protection for the motor through an overload relay mounted directly on the grinder starter.
  - (5) Short-circuit protection requires that a properly-sized circuit breaker or fuses be installed by others.
  - (6) Controller reset shall be from the local panel controls only.
- (e) *Components*. All controls and accessories shall be of the manufacturer's model and type specified and approved by the City of Concord Engineering Department and the Cabarrus County Building Inspection Department. Cabinet(s) shall be custom-engineered enclosures suitable for mounting and shall contain the system components indicated on the approved drawings and specified herein in "Instrumentation and Controls". In all applications, unless specifically approved by the City of Concord Engineering Department, all controls, and devices shall be placed within the interior of a separate cabinet and the electrical components integrated with the pump control cabinet.
  - (1) Control Devices.
    - (i) Pilot devices shall be mounted on the enclosure front panel door. A second set of doors shall be located inside the cabinet.
    - (ii) The controller shall have indicator lights for POWER ON, RUN, and FAIL.
    - (iii) The interior cabinet door shall be equipped with heavy-duty oil-

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tight pilot lights, reset buttons, a button that serves as a common alarm acknowledgement, and selector switches. Monitoring and accessory equipment shall be located within the cabinet. Green “Grinder Running” indicator lights and elapsed time meter for the grinder shall be mounted on the face of the interior door. Non-reset time meters shall designate the six-digit grinder run time in hours and tenths of hours. Lamps and the selector switches shall be heavy duty NEMA 4X type.

- (iv) Control transformer shall be protected by two primary fuses and one secondary fuse. The 120 volt secondary shall have one leg grounded.
- (v) Relay contacts shall be included for GRINDER RUN and FAIL signal outputs.
- (f) Motor Starter.
  - (1) Starter shall be a full-voltage reversing type with 120 volt operating coils.
  - (2) Forward and reverse contactors on the starters shall have both mechanical and electrical interlocks.
  - (3) Overload relays (OL) shall be adjustable so that the range selected includes the FLA (full load amperes) rating and service factor.

**4.7. Standby Generators or Standby Auxiliary Pump.**

- a. The Developer/Contractor shall provide an auxiliary standby generator, as approved by the City of Concord Engineering Department, together with all appurtenances, as part of the public acceptance of the pump station. The City of Concord reserves the right to specify a standby pump in lieu of an auxiliary standby generator, if the cost of the standby pump is approximately the same as the proposed generator, the proposed pump station will be or may become a regional pump station and/or the wastewater volume or constituents of the effluent (commercial, industrial, etc wastewater) warrant a standby pump system. The Developer/Contractor shall provide at least 12 hours of natural gas or propane required for the operation of the auxiliary standby generator and/or the standby auxiliary pump, together with all appurtenances, as part of the public acceptance of the pump station.
  - 1. If so required, this item shall have the capability for changing voltage.
  - 2. A selector switch on the control panel for allowing such changing of voltage must be supplied as part of the equipment.
  - 3. The auxiliary standby generator and the standby auxiliary pump shall be mounted on an appropriately sized concrete pad.
  - 4. The 12-hour fuel source shall be separated from the cabinet in accordance with National Electrical Code (NEC) standards.
  - 5. The fuel source shall be located within a lockable fenced area with a gate, in accordance with the access control section of this technical standard.
  - 6. All required onsite generators and/or standby pumps shall become the property

of City of Concord upon final acceptance of the pump station facility by the City of Concord.

- b. Receptacles for Portable Generators.
  - 1. *General Standards.* Receptacles and receptacle boxes shall be dust and weatherproof, waterproof, and, where specified by City of Concord Engineering Department, explosion-proof. For 480-volt, 200-amp services, receptacles shall be specified on a case-by-case basis by the City of Concord Engineering Department.
    - (a) Three-Phase, 277/480-Volt Connections.
      - (1) *Pump Motors less than 15 Horsepower.* A fusible disconnect of the required voltage and amperage with a Crouse Hinds No. AR642, 60-amp, 4-wire receptacle shall be provided as specified by the Wastewater Resources Department (based on station lot location).
      - (2) *Pump Motors 15 Horsepower or Greater.* 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.
    - (b) Single-Phase, 240-Volt Connections.
      - (1) *Pump Motors up to 3 Horsepower.* Thirty-amp fusible, 125-250 volt, L14-30 NEMA receptacles shall be provided.
      - (2) *Pump Motors with 5 Horsepower.* Fifty-amp fusible disconnect CS style Leviton “6374-CR” flanged inlet receptacles shall be provided.

#### 4.8. Wetwells and Storage Basins.

- a. *General Standard.* Wetwells and storage basins shall conform to WSACC’s manhole standards.
- b. Capacity.
  - 1. *Pump Stations serving a Single Development.* Wetwells and 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.
  - 2. *Pump Stations serving the Entire Drainage Basin.* For regional pump stations, the design shall take into consideration the tributary drainage basin area, potential growth (zoning) in the area, and expected service life of the pump station.
  - 3. *Criteria for Calculating Wastewater Volume.* Wetwells and storage basins shall be designed with an emergency storage capacity that can accommodate 2-hours of peak flow in the event of pump failure. Peak flow shall include the diurnal peak, as well as inflow and infiltration from a 5-year storm.
  - 4. *Criteria for Calculating Storage Volume.* The required storage volume shall be measured between the pump-off elevation and six inches below the elevation where wastewater could escape to daylight (i.e., six inches below the wetwell

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rim or six inches below the lowest upstream manhole, whichever is lower). Since this volume calculation includes almost the full depth of the wetwell, in reality wastewater will back up in the sanitary sewer system. However, the wastewater in the sanitary sewer system may not be included in the calculation for the 2-hour storage requirement.

5. *Deviations to Volume Calculations.* 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.
  6. *Phased Development.* Approval of staged storage 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 storage is under consideration, the design engineer shall furnish a development construction schedule that explains the construction sequence for the time when additional capacity is added. Staged volume projects shall not adversely effect the City of Concord's ability to operate the pump station.
- c. *Wetwell Size.* The minimum size allowed for any wetwell shall be 6 feet in diameter. Smaller diameter wetwells shall be considered on a case by case basis.
  - d. *Additional Storage Basins.* In cases where storage basins are needed in addition to the wetwell, the diameter shall be at least as large as the wetwell. Also, the storage basin shall be designed with a uniform cross section from top to bottom.
  - e. *Internal Components.* Wetwells must be furnished with mounting assemblies, pump removal accessories, internal piping and pump controls, accessories, and all else required for complete installation and operation per the manufacturer's requirements or these specifications, whichever is more stringent.
1. Pump Controls
    - (a) *High Water Float.* The high-water float shall be mounted on a stainless steel bracket approved for wastewater applications and accessible through an access hatch. The high-water float must not be obstructed or located near an area of turbulence.
    - (b) *Ultra Sonic Transducer.* The ultra sonic transducer shall be mounted on a stainless steel bracket approved for wastewater applications and accessible through an access hatch. The transducer must be mounted such that it is unobstructed and free for removal. The transducer beam angle must not be obstructed or located near an area of turbulence.
  2. Materials
    - (a) *Spark Protection.* All such metal items shall be configured, covered, protected, or made so as to present non-sparking surfaces. The supplier shall provide evidence of this protection to the City of Concord Engineering Department and receive approval of their product before installation.

- (b) *Corrosion Protection.* All exposed metal items, such as nuts, bolts, cables, supports, etc., must be made of an approved stainless steel for wastewater applications. Internal piping must be an approved stainless steel for wastewater applications or ductile iron Class 50. All ductile iron Class 50 components must be cleaned in accordance with the coating manufacturer's recommendations and painted with an epoxy coating approved for wastewater use.
    - (c) *Thickness.* The coating must have a dry film thickness of at least 10 millimeters and consist of a prime (first) coat and one or more finish coats.
  - 3. Metal Coating.
    - (a) *Surface Preparation.* All iron and steel parts that will be submerged or exposed to wastewater, or wastewater gases and are located within the wetwell, or valve vault, including the, internal piping, the pedestal mount, restrains, associated fittings, and restrains, must be cleaned in accordance with the coating manufacturer's recommendations and painted with an epoxy coating approved for wastewater use.
    - (b) *Thickness.* The coating must have a dry film thickness of at least 10 millimeters and consist of a prime (first) coat and one or more finish coats.
    - (c) *Supply.* At least 1 quart of the finish coat material must be furnished with each pump.
  - 4. *Steps.* Support steps shall not be used in wetwells or storage basins. (Move to the front)
- f. Auxiliary Pumping Connection.
  - 1. 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.
  - 2. The top of the suction pipe shall be connected to a 90-elbow, supported by a pipe stand, blind cap on a Bauer quick-connect adapter.
  - 3. A blind cap shall be provided to prevent vermin access through the suction pipe.
- g. Ventilation.
  - 1. Wetwells and storage basins shall be vented to the atmosphere at the washdown pad with a 4-inch screwed plug vent with non-corrosive screens to prevent vermin access.
  - 2. Wetwells with 8-foot or larger diameters (or equivalent areas for rectangular structures) shall contain a 6-inch ductile iron or larger diameter vent.
- h. Wetwell Coatings.
  - 1. Concrete surfaces inside wetwells and storage basins shall be protected with a

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coating especially formulated to resist corrosion and abrasive material from wastewater and associated gases (21 mils Sherwin-Williams Targuard Coal Tar Epoxy or approved equal).

2. All joints in wetwells and storage basins shall be grouted with a non-shrinking grout before any coating is applied.
  3. Coatings shall have a smooth surface.
  4. Coatings shall be removed from areas and equipment that do not require this type of protection.
- i. *Inlets.* Stations shall be designed to have only one wetwell inflow inlet.
  - j. *Bedding.* 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.
  - k. *Labels.* The phrase “Confined Space” shall be posted on a highly visible sign.
1. Wetwell, and Storage Basin Penetrations.
    1. *Method.* Pipe and conduit penetrations into wetwells and storage basins shall be core-drilled in the field to facilitate the proper orientation of entry and exit holes and eliminate the need for unnecessary fittings.
    2. *Seals.* All pipes and conduits penetrating the wall of the wetwell and storage basin shall meet WSACC’s manhole standards.

4.9. Valves and Valves Vault.

- a. General Standards. Specified valves must meet the manufacturer’s recommended use for that valve type and model unless directed otherwise by the City. Valve vaults shall conform to WSACCs’ manhole standards.
- b. *Valves.* One check valve and one plug valve shall be installed on the discharge pipe of each pump. The City may also require a surge relief valve. If required, the surge relief valve shall be supplied with the pump station and located as directed by the City of Concord Engineering Department. Acceptable surge relief valve manufacturers include APCO–series 6500 globe surge relief valve or equal. Please contact the manufacturer for the recommended surge relief value size based on the hydraulic conditions of the system.
  1. Valve Operations.
    - (a) *Check Valves.* Check valves shall be of the lever weight reset type.
    - (b) *Plug Valves.* Plug valves shall have a hand-wheel operator having an “open-left” stem operation.
  2. Equipment Configuration.
    - (a) Check valves and plug valves on pump discharge pipes must be installed on the pump station lot in a concrete valve vault separate from the wetwell and storage basins.

- (b) Pipes and valves shall be aligned horizontally with the check valve preceding the plug valve.
  - (c) An appropriately-sized cross shall be provided connecting the parallel pump discharge pipes with 90-degree bends, the auxiliary pumping port, and the force main discharge.
  - (d) An appropriately-sized auxiliary pumping port shall be provided on the opposite side of the cross from the force main discharge. This assembly shall consist of a 90-degree elbow turned upward toward the top of the valve vault with an appropriately-sized ¼ turn eccentric plug valve with hand wheel and a blind cap on a Bauer quick-connect adapter fitting.
  - (e) Within the valve vault on the discharge side of the force main a stainless steel tapping saddle, nibble, flange and pressure gauge with the specified seals shall be provided. A pressure gauge shall be a Ashcroft, or equal 4½-inch, liquid-filled, 0-160 psi, sealed unit with an Ashcroft® Diaphragm Seals & Instrument Isolators or equal.
- c. Valve Vaults.
- 1. *Size.* All valve vault shall be sized to provide at least 12 inches of clearance (top, bottom, sides) between the walls of the box and internal components.
  - 2. *Internal Components.* All piping through the walls of the valve vault shall be ferrous material.
  - 3. *Drainage.* The floor of the box shall be shaped or sloped to drain toward the wetwell. A ductile iron pipe shall be installed to drain any liquid contents of the valve vault to the wetwell. A Tideflex check valve or equal shall be installed on the discharge end of the drainage pipe to prevent the wetwell contents from entering the valve vault.
  - 4. *Ventilation.* Valve vaults shall have a 6-inch minimum diameter PVC pipe vent with non-corrosive screens to prevent vermin access.
  - 5. *Bedding.* All valve vaults shall be set on a minimum of 18 inches of stone. Over-excavation areas below 18 inches shall be filled with concrete.
  - 6. *Labels.* A sign must be posted on the valve vault stating “Confined Space.”
- d. Valve Vault Penetrations.
- 1. *Method.* Pipe and conduit penetrations into valve vaults shall be core-drilled in the field to facilitate the proper orientation of entry and exit holes and eliminate the need for unnecessary fittings.
  - 2. *Seals.* All pipes and conduits penetrating the wall of the valve vault shall meet WSACC’s manhole standards.

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**4.10. Access Hatches for Wetwells and Valve Vaults.**

- a. Size and Location.
  1. Access hatches on underground structures shall be sized and located so as to provide easy and direct access for maintenance crews and equipment. Access hatches on underground structures shall be flush mounted on the structures lid.
  2. Pump station components must not hinder or obstruct a person's ability to completely open access hatches and work in the area near the opening.
  3. All hatches shall be located to avoid traffic loading.
- b. Elevation.
  1. The top of all structures shall be level and shall be located at least 6 inches above finished grade.
  2. No voids shall be left under the slab containing the hatch and the surrounding area shall be graded to minimize inflow and potential erosion.
- c. Materials.
  1. Valve vault hatches shall be weatherproof, heavy-duty, double-hinged aluminum rated for either 300-pound per square foot live loadings or H20 wheel loads, if subject to maintenance vehicle traffic.
  2. All access hatches shall be mounted in such a way that the structure material (typically concrete) completely supports the bottom face of the frame. The structure material shall be designed to support the weight of the hatch.
  3. Frames and covers shall be provided with a continuous concrete anchor, as part of the one-piece extrusion. Any aluminum embedded in concrete shall be coated with bitumastic.
  4. Frames shall have self-draining channels with a 1-1/2 inch drain coupling located in the channel frame.
  5. All accessory components of access hatches (hinges, handles, locking arms, etc.) shall meet the manufacturer's recommendations and specifications for loadings and serviceability. Doors shall be equipped with compression spring operators enclosed in telescopic tubes and automatic hold-open arm with grip handle release.
  6. All nuts, bolts, washers, and miscellaneous hardware shall be an approved stainless steel for wastewater applications. In no case shall carbon steel components be allowed that will present a rusting or sparking condition.
- d. *Manufacturer.* Acceptable hatch manufacturers include Bilco or equivalent.
- e. Operation.
  1. Access hatches shall be hinged to the frame skirt and slab and contain a padlocked hasp.
  2. Hatches shall open to 90 degrees and lock automatically in that position with a

positive locking arm and a release handle.

3. Hatches shall close flush with the top of the frame, resting on a ½-inch minimum wide lip around the entire inside of the frame.
- f. Security.
1. Hatches shall be provided with tamperproof fasteners.
  2. All access hatches shall be lockable.

#### 4.11. Force Mains.

- a. *Material.* Wastewater force main piping shall be rated equal to water main piping standards or greater depending on pressure requirements. Wastewater force main shall comply with WSACC technical standards for pipe installation. The wastewater force main must have location tape and tracing wire.
1. Ratings shall be reviewed and approved by the City of Concord Engineering Department.
  2. Erosion caused by friction and chemistry shall be considered when selecting the pipe wall thickness.
- b. *Size.*
1. The pipe diameter of the force main shall be larger than the diameter of the maximum solid size that is passed by pumps present in the pump station.
  2. A minimum four-inch force main shall be used unless the force main is served by pumps capable of grinding, chopping, or cutting solids or a mechanical means of reducing the size of a three-inch solid and any trash or stringy material that can pass through a four-inch hose is installed in the pump station. Acceptable mechanical means of solids reduction shall be as specified by this specification and/or by the Director of Engineering.
- c. *Outlets.* Termination points for force mains shall be configured in such a manner as to prevent splashing in the receiving manhole.
- d. *Air-Relief Valves.*
1. *Function.* All air-relief valves shall be capable of venting air or breaking a vacuum. In no case shall the capacity be less than 5 pounds per square inch (psi).
  2. *Manufacturers.* Acceptable air-relief valve manufactures include A.R.I., or an approved equal.
  3. *Size.* 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.
  4. *Material.* The internals and trim of air-relief valves and associated fittings shall be an approved stainless steel for wastewater applications. A stainless steel

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tapping saddle, nibbles, and gate valve shall be provided.

5. *Location.* Valves shall be positioned at all high points with elevation differentials 10 feet or greater and spaced approximately 2,000 feet apart on long ascending or descending runs.
6. *Containment.* 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.
7. *Configuration.* Gate valve attachments shall be rotated to provide easy operation. The assembly shall be anchored to the manhole wall to prevent flexing and vibration during surge conditions.
8. *Backflushing Attachments.* Backflushing attachments are required on systems that are projected to remain in use more than 3 years.

**4.12. Hoists & Jib Cranes.** The City of Concord reserves the right to specify an approved hoist or jib crane for the removal of the pump station components, if the constraints of the proposed pump station design does not facilitate removal of the components by City of Concord's maintenance equipment.

- a. The jib crane boom and hoisting assembly must extend to the trash basket, pumps, valve vault and other associated appurtenances to facilitate removal and regular maintenance by the City of Concord's maintenance personnel. The final location of the jib crane boom and hoisting assembly City of Concord Engineering Department.
- b. Hoists shall be positioned so lifting is direct and free from obstructions.

**4.13. Pump Station Lot and Site Access.**

- a. *Property Ownership.* All pump station lots shall be deeded to the City of Concord or its successors, assigns, or designees.
- b. *Site Access.*
  1. *Flood Protection.* All portions of the pump station lot and access road shall be above the 100-year flood (FEMA and local) elevation. Provisions shall be made to protect side slopes from erosion and wave action during flood conditions.
  2. *Access Roads.*
    - (a) *Surface.* Access roads shall have a travel surface that is able to support 60,000 pounds using at least 4-inches of compacted ABC stone; however, if site conditions warrant, the City of Concord Engineering Department may require an all-weather travel surface. The travel surface shall be at least 15-feet wide.
    - (b) *Slope.* The longitudinal grade of the site access road shall not exceed an 8 percent slope. The transverse grade of the site access road shall not

exceed a one-fourth inch rise to one foot run.

- (c) *Vehicle Turnaround Area.* 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 required, the minimum inside turning radii for a 90-degree turn is 34-foot with a 62-foot arc length. The total turning radius must be sufficient to accommodate the largest vehicle expected to access the facility. All stations shall be accessible by the Wastewater Resources Department's maintenance vehicles and either the electric utility's bucket truck or line truck.
- 3. *Maintenance.* All structures, equipment, and components on the pump station lot shall be configured in manner to facilitate maintenance activities. Stormwater features, structures, and ditches shall not isolate any portion of the lot.
- 4. *Security.* A security gate shall be required at all site access road(s) that are equal or exceed 100 linear feet in length. The security gate shall be located perpendicular to the outside edge of the NCDOT public road rights-of-way, City of Concord public road rights-of-way, and all other access roads.
  - (a) Gate.
    - (1) *Materials.* The security gate and crossing bracing shall be fabricated from 2-inch diameter schedule 40 black pipe and at least 20-feet in horizontal length. The gate shall be supported by a cross brace. The cross brace must be long enough in length to support the swing weight of the gate with a total length that is at least half of the gate length.
    - (2) *Surface Preparation.* Metal parts must be cleaned in accordance with the coating manufacturer's recommendations and painted with "safety yellow" enamel.
    - (3) *Thickness.* The coating must have a dry film thickness of at least 10 millimeters and consist of a prime (first) coat and one or more finish coats.
    - (4) *Configuration.* The gate arm must be cross braced to support the horizontal length. Joints and fitting are to be welded. Gates shall be equipped with a latch and hasp assembly containing locking hardware for connection to the lock post that can be utilized by the City.
  - (b) Posts. Gate post assembly and Lock post assembly.
    - (1) *Materials.* Posts shall be 4-inch diameter schedule 40 black pipe and at least 6-feet in vertical length. Gate post shall be 180-degree swing hinged with anti-theft connections. Lock post shall be equipped with fittings to facilitate the gate latch and hasp assembly.
    - (2) *Surface Preparation.* Metal parts must be cleaned in accordance with the coating manufacturer's recommendations and painted with

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- “safety yellow” enamel.
- (3) **Thickness.** The coating must have a dry film thickness of at least 10 millimeters and consist of a prime (first) coat and one or more finish coats.
  - (4) **Post Footer(s).** Post footer dimensions shall be at least 2-foot diameter by 2-foot deep filled with concrete. Concrete shall conform with the WSACCs’ “Concrete” technical specification.
  - (5) **Configuration.** The posts shall be recessed into the concrete footer to a depth of at least 2-feet.
- (c) **Gate Hold-back.** All gates shall be equipped with gate hold-backs. A ground anchor cast in concrete shall be provided.
- c. *Access Control.* As directed by the City of Concord Engineering Department, a chain-link fence and gate and/or wooden privacy fence and gate shall be provided at the pump station lot. The Director of Engineering may elect not to require fencing if all pump station components are secured and lockable, and the pump station lot is in a visually sensitive area.
- 1. **Chain-Link Fencing.**
    - (a) *Height.* Chain-link fencing must be 8-feet high.
    - (b) *Material.* Fencing material shall be Class I coated galvanized steel.
      - (1) *Mesh.* Mesh shall be 9-gauge.
      - (2) *Wire.* Bottom tension wire shall be 7-gauge spring coil wire; otherwise, wire shall be 12-1/2 gauge with four-point, 14-gauge barbs.
      - (3) *Posts.* End, corner, and pull posts shall be 2-1/2 inch O.D. Top and line posts shall be 2-inch O.D. (4)
      - (4) **Post Footer(s).** Post footer dimensions shall be at least 2-foot diameter by 2-foot deep filled with concrete. Concrete shall conform with the WSACCs’ “Concrete” technical specification.
    - (c) *Configuration.* Ends must be twisted and barbed. Barbs must be spaced 5 inches on center. Fencing shall be topped with three rows of outward facing barbed wire. All post footings shall be sloped to drain.
    - (d) *Access Gates.*
      - (1) *Size.* Gates shall consist of a pair of 8-foot long, 7-foot high sections constructed of 2-inch O.D. pipe.
      - (2) *Material.* Gates shall be factory fabricated coated galvanized steel. Gate posts shall be 3-inch O.D. coated galvanized steel.
      - (3) *Configuration.* Gates shall slide open in a direction parallel to the fence inside of the enclosure 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 containing locking hardware that can be utilized by the City. Panels shall have

a horizontal brace at the center of the mesh height. Alternative gate configurations can be approved on a case-by-case base by City of Concord Director of Engineering.

- (e) *Location.* The location shall be coordinated and approved by the City of Concord Engineering Department.

2. Wooden Privacy Fencing.

- (a) *General Standard.* Wooden privacy fencing must be designed, fabricated, and installed by a supplier specializing in this type of fencing. Data and drawings of the proposed wooden privacy fencing shall be submitted to the City of Concord Engineering Department for review and approval.
- (b) *Height.* Wooden privacy fencing must be 8-feet high
  - (1) *For Screening.* If the fence is to be used only for screening, the height shall be determined by the City of Concord Engineering Department.
  - (2) *For Security.* If the fence is to be used for site security (in lieu of chain-link fencing), the height shall be determined by the supplier's recommendation.
- (c) *Material.* Lumber shall be pressure-treated structural lumber (treated with chromated copper arsenate), redwood, or cedar.
- (d) *Post Footer(s).* Post footer dimensions shall be at least 2-foot diameter by 2-foot deep filled with concrete. Concrete shall conform with the WSACCs' "Concrete" technical specification.
- (e) *Configuration.* If the fence is to be used only for screening, the fence shall be installed just outside of the chain-link fencing. 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.
- (f) *Access Gates.*
  - (1) *Size.* Gates shall consist of a pair of minimum 8-foot long sections designed to accommodate the unobstructed opening of interior chain-link gates, if provided.
  - (2) *Configuration.* Gates shall slide open in a direction parallel to the fence inside of the enclosure 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 containing locking hardware that can be utilized by the City. Alternative gate configurations can be approved on a case-by-case bases by City of Concord Director of Engineering.
- (g) *Location.* The location shall be coordinated and approved by the City of Concord Engineering Department.

4.0 Pump Station Specifications

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- d. *Site Stabilization.* At sites with severe perimeter slopes, riprap shall not be used for final stabilization unless authorized by the City of Concord Engineering Department. In lieu of rip-rap, ground cover plants and/or shrubs identified in NCDENR Erosion and Sediment Control Planning and Design Manual shall be planted on these slopes.
  - e. *Vegetation Control.* The entire pump station site shall be covered with a weed-resistant fabric that prohibits the growth of vegetation yet allows rainwater to pass through. This fabric shall be covered with 4 inches of compacted ABC stone. (If the site is fenced, the weed-resistant fabric and stone shall cover the entire area inside the fence and at least 1 foot outside the fence.
  - f. Erosion Control.
    - 1. *Preconstruction.* All erosion control devices required by the NCDENR Division of Land Resources shall be installed.
    - 2. *Construction.* Erosion control devices and measures shall be maintained throughout the entire construction process.
    - 3. *Post 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 properly dispose them off site.
  - g. Backfill Compaction.
    - 1. *General Standard.* Adequate compaction of backfill around the wetwell, storage basins, and valve vaults shall be achieved to prevent erosion around these structures once the pump station is in service.
    - 2. *Backfill Process.* Backfill material shall be deposited in layers not to exceed 8 inches in uncompacted thickness.
    - 3. *Compaction Density.* Backfill shall be compacted to at least 95 percent of maximum density at optimum moisture content as determined by ASTM D698. A roller may be used to compact backfill around pump station structures provided the desired compaction density is obtained and damage to the structure is prevented. Soil shall not be inundated with water to achieve the required compaction density.
  - h. Landscaping.
    - 1. Landscaping and/or visual screening may be required by the City of Concord.
    - 2. Acceptable plant materials are identified in the City's landscaping standards. 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.
    - 3. Landscaping material and installation costs shall be the responsibility of the Developer/Contractor.
  - i. *Yard Hydrant and Washdown Pad.* The Contractor shall supply a lockable yard

hydrant supplying potable water and a washdown pad for washing equipment on the pump station lot inside any required security fencing.

1. Hydrant.
  - (a) *Location.* The hydrant must be adjacent to a washdown pad that meets these specifications.
  - (b) *Water Supply.* The water service line shall have a ¾-inch or 1-inch diameter and be metered in accordance with City standards.
  - (c) *Backflow Prevention.* The service line shall have a backflow prevention device in accordance with City of Concord ordinances and specifications.
2. Washdown Pad.
  - (a) *Size.* The dimensions of the washdown pad shall be as indicated on the approved drawings but in no case shall be less than 3 by 3 feet square.
  - (b) *Material.* The washdown pad shall be 4-inch thick concrete with wire reinforcement.
  - (c) *Configuration.* A 4-inch curb/lip shall be poured as an integral part of the pad. A 4-inch PVC drain shall be installed in the center of the pad with a ductile iron pipe that discharges via gravity flow into the wetwell above the high-water elevation.
- j. *Signage.* The Contractor shall supply a metal reflective tape sign at the pump station lot. This sign must state, “City of Concord, Pump Station Number (as provided), Problems: Call 704-920-5555, (street address as provided).” The pump station identification number and street address will be provided by the City of Concord. The cost of the sign shall be borne by the developer.

**4.14. Additional Deliverables.** The following deliverables shall be supplied on or before final inspection.

- a. *Documentation.* Three complete sets of as-builts and record drawings, and other documentation as specified in City of Concord Code of Ordinance Chapter 62 for final approval, operation and maintenance manuals, software, training materials, copies of certified tests, inspection data, and termination schedules shall be supplied.
- b. *High-Water Level-Sensing Equipment.* One spare high-water level float (normally open type) with 30-ft of cable shall be supplied.
- c. *Pump Spare Parts.* An o-ring and gasket kit for pump motor and impeller shall be supplied. Two seal assemblies shall be supplied for the top and bottom of the impeller and at the winding of motor. One complete set of bearings for each pump shall be supplied.
- d. *Spare pump.* One spare pump, equal to the pump specified in the approved plans.
- e. *Soft Start or VFD.* One spare soft start or VFD, as specified in the approved plans.

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- f. *Uninterruptible Power Supply.* A spare Liebert UPStation GXT 2U, Model GXT2-700RT120, 700 VA, 490 watts capacity, 120VAC or equal uninterruptible power supply system shall be provided.
  - g. *Ultrasonic Level Controller and Transducer.* One spare ultrasonic level controller and transducer, equal to controls specified in the approved plans. .
  - h. *Ultrasonic Level Controller Software.* One complete copy of the Dolphin Plus software, complete with manuals, to configure, monitor, tune, and diagnose the HydroRanger 200 from a PC or directly in the field with a laptop.
  - i. *Grinders (Comminutors).* One spare set of cutters, spacers, shafts, bearings and seals, side rails, end housings, covers, reducer, and motor, as specified in the approved plans.

**4.15. Startup Operations.** 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. All pumps, motors, controls, alarms, grinders, standby pumps, and backup power equipment shall be operable for startup testing. The developer is responsible for establishing utility service at the pump station lot. The developer must transfer all utility service accounts through the Wastewater Resources Utility Service Coordinator.

- a. *Timing.* Upon the completion of the construction and 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. 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. After the Certificate of Final Completion is issued by the City, the developer shall transfer all pump station lot utility service accounts to the City of Concord.
- b. *Observation.* All testing shall be conducted 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.
- c. Supplier shall provide the services of a factory-trained representative to check the installation and to start-up each grinder and controller. The factory representative shall have complete knowledge of proper installation, operation, and maintenance of equipment supplied. The City of Concord Wastewater Resource Department’s Service Maintenance Supervisor or designee shall inspect the final installation and a start-up test of the equipment.