Fairfield County Utilities Department

Wastewater Pump Station Specifications and Requirements

July 2002

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INTRODUCTION

This document has been developed to provide guidance to land developers, their consulting engineers, and contractors as to the requirements of the Fairfield County Utilities Department (County) for design and technical specifications of wastewater pumping stations. These requirements are intended to supplement the requirements set forth by the Ohio Environmental Protection Agency (Ohio EPA) and in the following Fairfield County Utilities Department documents:

1) Water, Drainage and Sewer Regulations

2) Construction and Material Specifications and Standard Drawings

There are several general requirements for all new and replacement wastewater pump stations to be built in Fairfield County. These include the following:

- All new and replacement wastewater pump stations shall be fitted with submersible pumps.

- Typically, new pumping stations will be duplex stations, where each of two pumps will be capable of meeting the station's design capacity. In some cases, larger capacity pumping stations may be required, which shall be constructed with three or more pumps.

- Where possible, the requirements presented in this document have been developed to address both temporary and permanent installations; however, the County reserves the right to modify the requirements for individual projects as deemed necessary for the protection of public health and/or the environment.

- In general, ALL pump stations shall be considered to be permanent unless a project exists on the Fairfield County Utilities Department's 5-Year Capital Improvements Plan that would eliminate the pump station or the Developer has specific plans for eliminating the pump station within approximately 5 years. However, each pump station will be reviewed at the inception of design by the Fairfield County Utilities Department to determine whether the pump station will be considered permanent or temporary for design purposes. If a pump station is to be temporary (as determined by the County), certain requirements may be modified or omitted at the discretion of the Director of the Fairfield County Utilities Department. In general, these modifications and omissions will be as defined in Appendix A.

- The Fairfield County Utilities Department will also evaluate options for preventing each pump station through the extension of gravity sewers to the site. The Developer and/or their engineers may be required to evaluate these options to determine feasibility and estimated costs for the gravity sewer extensions as well as the estimated cost of the proposed pump station and force main. These costs will be compared to assist in determining if a pump station will be allowed or a gravity sewer extension will be required.

Wherever the requirements specify "Contractor," they are intended to refer to land developers and their agents, who are typically contractors and their consulting engineers. Nothing in these requirements is intended to assign responsibility contradictory to legitimate contractual arrangements between those parties.

Where these specifications are included with Plans and Contract Documents for a project publicly bid by the Fairfield County Utilities Department, the Plans and Specifications shall govern in the event of conflicts between them and this document.

1.0 SCOPE

A. The specifications herein given are general and subject to any special provisions or requirements set forth in the sections of this document.

1.1 Scope of Work

A. The Contractor shall, unless otherwise notified, furnish all labor, materials, equipment, tools, and incidentals necessary to install, test, complete, and make ready for operation a submersible wastewater pump station. This includes the furnishing and installation of all necessary and desirable accessory equipment and auxiliaries, whether specifically mentioned in these specifications or not, as required for an installation incorporating the highest standards for the types of service which this pump station is to perform.

B. These specifications are intended to give a general description of that which is required and do not purport to describe all details of the equipment to be furnished. Such details are considered to be either standard among all manufacturers or variable in accordance with specific equipment formulations, but resulting, in either case, in equipment equal in performance, long-term reliability, and life-cycle cost-effectiveness.

C. The Contractor shall be responsible for all excavation and removal of obstructions and restoration of all properties involved directly with the construction and/or installation of the pump station.

D. All pump stations shall include the monitoring and control equipment, as specified in Chapter 7.0.

1.2 Capacity

A The facility shall be sized to handle all flows from the total upstream watershed, except for the pumps, which shall be sized to handle the peak flow of the upstream watershed or twice the design peak flow of the proposed development, whichever is less. However, the facility shall be designed to permit future installation of pumps sized to handle the peak flow of the upstream watershed.

B. The capacity of a pump station handling flow from existing gravity sewers shall be adequate to manage existing flows, including infiltration/inflow, as well as additional flows anticipated to be required for the proposed development.

1.3 Design

A Design of pump stations shall be completed by a Professional Engineer registered in the State of Ohio. All plans, specifications and submittals shall be stamped and signed by the Professional Engineer.

B. Design of pump stations shall be coordinated at all stages with Fairfield County Utilities Department. Plans and specifications shall be submitted for review and approval along with water and sewer construction plans. The Ohio EPA Pump Station Data Sheet must be submitted with the plans and specifications for review. Plan review fees shall be paid according to standard departmental policies.

C. Design efficiency of the pumps shall be submitted for review and approval by the County. Pumps which are not properly selected for efficient operation may be rejected.

1.4 Responsibilities of Contractor

A. The Contractor shall be responsible for all materials stored on the job site. The Contractor shall bear the responsibility of any damages incurred either to private or public property.

1.5 Inspection

A. Materials provided and work performed shall be subject to inspections by County representatives and/or by appointed agents of the County. Acceptance of the pump station shall be contingent on the condition that all materials, equipment, and workmanship provided pass set inspections, satisfactory completion of all work, and proper operation of the completed pump station.

1.6 Warranty

A. A minimum of a full twelve (12) month warranty shall be provided for the pump station. This warranty shall begin on the date the pump station is accepted by the County for operation. The warranty shall cover all of the following:

1) All equipment, parts, and labor.

2) Site materials, roadways, and fences.

3) Ground subsidence and settlement of valve chamber and wet well.

B. The pumps shall have at least an eighteen (18)-month full (all parts and labor) manufacturer's warranty and 5-year prorated manufacturer's warranty, which shall both begin no earlier than the date of shipment to the Contractor. In the event that the pump station is not accepted within six months of shipment of the pumps, the full warranty shall be extended to twelve months from the date the pump station is accepted by the County for operation.

1.7 Tools and Spare Parts

A. All special tools and recommended spare parts required for normal operation and maintenance shall be supplied for each piece of equipment furnished.

B. The following spare parts shall be furnished as a minimum:

1) One set of 1 upper and 1 lower mechanical seals and a seal tool

2) One set of gaskets, O-rings, grommets, and other sealing devices

3) One rotating wear ring (if so equipped) or a spare impeller, and one stationary wear ring (if so equipped) or a spare volute

4) One complete set of spare fuses for all electrical devices.

5) Ten spare bulbs for each lamp type.

6) One control relay of each type used.

7) Sufficient quantity of oil to change the seal compartment lubricating oil in all pumps provided.

C. All tools and spare parts shall be properly packed and protected for long storage and placed in containers clearly identified in indelible markings as to contents.

1.8 Submittals

A. The Contractor shall submit to the County for approval five sets of the following prior to ordering equipment and materials or initiating construction. One set of submittals will be returned to the Contractor with comments and/or approvals.

1) Certified shop and erection drawings and data regarding pumps, motors, characteristics, and performance. The data shall include guaranteed performance curves, based on actual shop tests of duplicate pumping units, which show that the units meet the specified requirements for head, capacity, efficiency, and input power. Curves shall be submitted in quadruplicate on 8-1/2-inch by 11-inch sheets. For pumping units of the same size and type, only curves for a single unit need be provided.

2) Literature and drawings describing the equipment and showing all important details of construction and dimensions

3) Complete data on motors, including schematic electrical wiring diagrams and other data as required

4) Complete schematic electrical wiring diagrams for the pump station, control panel, and SCADA.

5) Conduit routing and wire-pulling schedules.

6) Complete grounding scheme.

B. Submittals shall be provided for each of the items listed in Appendix B of this document.

1.9 Operation and Maintenance Manuals

A. Four complete sets of installation, operation, and maintenance instructions shall be provided for all equipment and electrical components. The manuals shall be prepared specifically for the installation to which they pertain and shall include all available installation manuals, operation manuals, maintenance manuals, catalog cuts, drawings, wiring diagrams, equipment and parts lists, list of spare parts provided, warranties, product descriptions, etc. All four sets of manuals for major equipment shall be original manufacturer's manuals–(copies will not be acceptable). Only one set of original manufacturer's literature is required for miscellaneous components; copies of this literature will be acceptable for the other three O&M manuals.

All manuals shall be furnished to the County no later than the date of acceptance.

B. The manual for each piece of equipment shall be a separate document with the following specific requirements:

1) Contents:

- Table of contents and index
- Brief description of each system and its components
- Starting and stopping procedures
- Special operating instructions
- Routine maintenance procedures
- Manufacturer's printed operating and maintenance instructions, parts list, illustrations, and diagrams
- Instrumentation data sheets with calibration data and specifications.
- One copy of each wiring diagram
- Conduit routing and wire-pulling schedules.
- One copy of each approved shop drawing and each Contractor's coordination and layout drawing
- List of spare parts, manufacturer's price, and recommended quantity
- Name, address, and telephone numbers of local service representatives

2) Material:

- Loose leaf, on 24-pound three-hole punched paper
- Holes reinforced with plastic, cloth, or metal
- Page size, 8-1/2 inches by 11 inches
- Diagrams, illustrations, and attached foldouts as required, of original quality, reproduced by dry-copy method
- Covers of oil-, moisture-, and wear-resistant material, 9-1/2-inches by 12-inches in size

1.10 Record Drawings

A. The Record Drawings shall consist of the Contract Drawings revised per as-built conditions and the approved Shop Drawings. As-built revisions to the Contract Drawings shall be professionally drafted. The Record Drawings shall be submitted to the County in reproducible form (i.e., 3-mil Mylar) and on disk (or CD Rom) in AutoCADD format upon completion of the construction.

B. Contract Drawings shall be legibly marked to record actual construction, including:

1) All deviations in location or elevation of any underground installation from that shown on the Contract Drawings

2) Any significant changes in above-ground installations from the approved Shop Drawings or Contract Drawings

3) Indication of Fairfield County's approval of any such deviations or changes from the Contract Drawings or approved Shop Drawings

C. Specifications and addenda shall be legibly marked to record:

1) Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed

2) Changes made by change order or field order

3) Other matters not originally specified

D. Shop Drawings shall be legibly annotated to record changes made after review.

E. Reproducible Record Drawings shall be submitted within seven calendar days after the date of acceptance.

1.11 Additional Items

A. Each installation shall be individually assessed as to the need for equipment, structures, procedures and other items not named or described in these specifications. Installation of these items may be required at the discretion of the Director of the Utilities Department or his appointed agent.

B. Any variations from the specifications provided in this document must be approved through the Director of the Utilities Department or the appointed agent of the County.

C. These specifications are subject to change or revision without notification.

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2.0 SUBMERSIBLE PUMPS

A. The pumps used in all submersible wastewater pump stations shall meet the following specifications.

2.1 Pumps, Motors, and Installation

A. Pumps shall be Fairbanks Morse or ITT Flygt CP, shall be capable of passing solids at least three inches in diameter, shall have a maximum ambient operating temperature of at least 115E F, and shall be capable of withstanding corrosive materials normally found in domestic and industrial waste.

B. Pump motors shall be 460/480 volt AC, 3-phase, 60 Hz or 230/240 volt AC, 3-phase, 60 Hz, depending upon site constraints, power availability, and pump size and application requirements. The need for dual-voltage motors which are field changeable shall be considered on an individual basis dependent on pump size, location, and other factors.

C. A nameplate of 316 stainless steel shall be attached to each pump, giving the name of the manufacturer, rated capacity, head, speed, model number, serial number, and all other pertinent data.

D. All anchor bolts shall be of 316 stainless steel.

E. Each pump shall be provided with a sufficiently long power cable to suit its installation without splicing. The power cable shall be type SPC cable, chloroprene rubber-jacketed, suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and shall also meet with P-MSHA approval. Each power cable shall be installed in a separate conduit to the control panel.

F. A 316 stainless steel lifting chain shall be provided for each pump, of sufficient length to reach from the pump attachment to a stainless steel chain holder, furnished by the equipment manufacturer and installed near the upper guide rail support for that pump. The chain shall be of sufficient strength to allow the raising and lowering of the pump with a safety factor of at least 2, but in no case less than 1/4-inch chain links. An ITT Flygt Corp. “Grip-eye” or equal sized for the pump lifting chains shall be provided for each pumping station.

G. The pump shall be supplied with a mating cast-iron discharge connection elbow. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection or service. There shall be no need for personnel to enter the wet well to install, remove, or maintain the pumps.

H. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. The entire weight of the pump unit shall be guided by no less than two guide bars and shall be pressed tightly against the discharge connection elbow with metal-to-metal contact. Sealing of the devices by any other means shall not be acceptable. No portion of the pump shall bear directly on the floor of the wet well, and the minimum clearance specified by the manufacturer shall be maintained with at least 4" in all cases. The pump, with its appurtenances and cable, shall be capable of continuous submergence under water to a depth of 65 feet without loss of watertight integrity.

I. Major pump components shall be of gray cast iron, with smooth surfaces devoid of blow holes and other irregularities. All exposed nuts and bolts shall be of AISI-type 304 stainless steel or brass construction. All surfaces which will come into contact with sewage, other than stainless steel or brass, shall be protected by an approved sewage-resistant coating. The impeller shall be factory-coated with acrylic dispersion zinc phosphate primer. The pump exterior shall be protected by a factory-applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish.

J. All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. This shall result in controlled compression of the O-rings without the requirement of a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease, or other devices shall be used.

K. The design of the cable-entry water seal shall insure a watertight and submersible seal. A single cable entry to the pump housing shall contain all leads. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by stainless steel washers, all having a close-tolerance fit against the outside diameter of the cable and compressed by the entry body containing a stainless steel strain-relief function, separate from the function of sealing the cable. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall protect the interior of the motor from foreign material which might gain access through the top of the pump. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable. The pump supplier shall provide a watertight connector, equal to a Crouse Hinds Type CGB with a neoprene gland to terminate the cable in the pump disconnect.

L. The pump motor shall be designed and manufactured by the same manufacturer as the pump. The pump motor shall be of a squirrel-cage, induction, shell-type design, housed in an air-filled, watertight chamber. The stator winding and stator leads shall be insulated with moisture-resistant Class F insulation which shall resist a temperature of 155E C. The stator shall be dipped and baked three times in Class F varnish and shall be fitted into the stator housing by heat-shrinking. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing shall not be acceptable. The motor shall be designed for continuous duty, capable of sustaining a minimum of ten starts per hour with the liquid surface located at the top of the pump's volute but below the motor casing, with a temperature rise not exceeding 40E C above ambient temperature.

M. The junction chamber, containing the terminal board, shall be sealed from the motor by an elastomer compression seal (O-ring). Connection between the cable conductors and stator leads shall be made with threaded, compressed-type binding posts permanently affixed to a terminal board.

N. Each motor 20 horsepower or larger shall be provided with an adequately designed cooling system, consisting of a water jacket encircling the stator housing. The water jacket shall be provided with a separate circulation of the pumped liquid. Cooling media channels and ports shall be non-clogging by virtue of their dimensions. Systems that utilize a closed loop cooling system such as ethylene or propylene glycol or oil shall not be acceptable.

O. Thermal sensors shall be used to monitor stator temperatures on all pumps. The stator shall be equipped with three (3) normally open thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase).

P. Each pump shaft shall be of either stainless steel or carbon steel C1034 and shall be completely isolated from the pumped liquid.

Q. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The upper of the tandem set of seals shall operate in an oil chamber located just below the stator housing. This set shall contain one stationary tungsten carbide ring and one positively driven rotating silicon carbide ring and shall function as an independent secondary barrier between the pumped liquid and the stator housing. The lower of the tandem set of seals shall function as the primary barrier between the pumped liquid and the stator housing. This set shall consist of a tungsten carbide stationary ring and a positively driven rotating silicon carbide ring. Each interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable The following seal types shall not be considered acceptable nor equal to the dual independent seals specified:

- Shaft seals without positively driven rotating members
- Conventional double mechanical seals containing either a common or double spring acting between the upper and lower units (this conventional system requires a pressure differential to offset external pressure and effect sealing).

R. The only functions of the oil chamber shall be as a secondary barrier between the pumped liquid and as a seal lubricant. It shall be designed to compensate for oil expansion that can occur due to temperature variations. Drain and inspection plugs, with positive sealing, shall be easily accessible from the outside.

S. The pump shaft shall rotate on two permanently lubricated bearings. The upper bearing, providing for radial thrust, shall be a single-row roller bearing. The lower bearing shall be a two-row angular-contact bearing to compensate for axial thrust and radial thrust.

T. The impeller shall be of a gray cast-iron, dynamically balanced, double-shrouded, non-clogging design having a long throughlet without acute turns. The impeller shall be capable of handling grit, solids, fibrous materials, heavy sludge, and other matter found in normal sewage applications. The pump manufacturer shall furnish data on mass moment of inertia for the proposed impeller. The fit between the impeller and the shaft shall be a sliding fit with one key, and the fastening of the impeller to the shaft shall be made by a locking assembly which is sealed from the liquid by a protective rubber cap and a bolt threaded to the shaft terminal.

U. The volute shall be of a single-piece, non-concentric design and shall have smooth fluid passages large enough at all points to pass any solids which can pass through the impeller. The volute bottom shall be of a suction-bell design. A replaceable wear-ring system shall be installed to provide efficient sealing between the volute inlet and the impeller skirt. The wear rings shall consist of a stationary brass wear ring in the volute. Pumps 14 horsepower or larger shall also have a rotating stainless steel wear ring on the impeller skirt.

V. Cable support shall be provided for the pump power cable and shall consist of a stainless steel braided wire sleeve with attachment tails for connection to supports furnished by the equipment manufacturer and installed in locations indicated in the manufacturer's drawings and approved by the County.

W. A mix-flush system may be required for each pump, if designed with long pump cycles initially. If required, the mix-flush system should be equal to an ITT FLYGT 4901 flush valve. The valve shall use the ejector principle, in which water exiting the valve shall violently agitate the liquid in the sump, thereby re-suspending any accumulation of sludge. The flushing period of the valve shall be adjustable. The direction of discharge from the mix-flush system shall be adjustable in 360-degrees to any part of the wet well.

X. Pump removal equipment shall meet the following specifications:

1) Pump stations supplied with pumps weighing 800 pounds or less shall be supplied with sockets at each pump and a single portable stainless steel winch-type hoist system capable of pulling either pump completely out of the wet well. The winch and hoist shall be rated for at least twice the maximum weight of the pump (minimum 1,000 pounds). The hoist shall be fitted with a static loop and screw pin anchor shackle to support the weight of the pump while regripping the chain with the winch hook. Hoist shall be Halliday Products Series DB (D2B36B for 1,000 pounds) or equal.

2) Pump stations equipped with pumps weighing in excess of 800 pounds shall have a derrick-type lifting system. This system shall be designed so as to allow lifting, moving, and loading of pumps onto the bed of a standard one-ton truck. The lifting system and the structural design of the derrick shall be rated at a minimum of twice the weight of the heaviest pump installed in the station. The lifting system shall be supplied with a means of operating electrically--for both lifting and rotating. A galvanized steel shield shall be attached to the jib to shield the trolley when not in use.

3) The above listed requirement for pump removal equipment may be waived by the County if an asphalt drive is provided to and around the pump station for access by the County's crane truck.

2.2 Mounting Hardware

A. All slide rails shall be made of 316 stainless steel and shall be of tubular design. Upper guide bar brackets, middle support brackets, chain holders and float hangers shall also be made of 316 stainless steel. All other hardware (bolts, nuts, etc.) shall similarly be made of 316 stainless steel.

2.3 Additional Equipment

A. All pumps shall be equipped with seal leak detectors, so as to give adequate warning if the lower seal unit should fail.

2.4 Shop Testing of Pumps

A. All pumps of 20 horsepower capacity or greater shall undergo certified testing at the factory for capacity, power requirements, and efficiency at specified extremes for rated head, shutoff head, and operating head, and at as many other points as necessary for accurate plotting of performance curves, with the completely assembled pump and motor that will be furnished.

B. All tests and test reports shall be made in conformity with the requirements and recommendations of the Hydraulic Institute Standards.

C. Copies of the test logs, a description of the test piping, equipment, and set-up, and a discussion of the test procedure shall accompany certified test performance curves and shall be submitted to the County. The curves shall include head, bhp, overall (wire-to-water) efficiency, rpm, and test NPSHRe plotted against capacity. The curves shall be easily read and plotted to scales consistent with performance requirements.

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3.0 STRUCTURES, BACKFILL AND EMBANKMENT

Structures shall be constructed as required, in accordance with the following specifications:

3.1 Wet Well and Valve Pit Design and Construction

A. Wet wells and valve pits shall be constructed using either precast concrete sections or poured-in-place concrete. If precast construction is used, each section shall be set and sealed with the proper gasket and joint sealing compound approved by the County. If the pump station will be constructed of poured-in-place concrete, the concrete shall be reinforced with steel bar reinforcement in accordance with acceptable engineering design practice and shall be certified by a Professional Engineer registered in the State of Ohio.

B. Either type of construction shall have a foundation designed so as to adequately support the station. At least one subsurface test boring shall be made at the pump station site to at least five feet below the proposed bottom of the wet well. A complete soil analysis including ground water level shall be submitted with the plans. Soil analysis shall include at least Standard Penetration Tests (ASTM D 1586); classification of soils' textures and consistencies; tests for natural moisture content; engineering classification of predominant soil horizons (including sieve and hydrometer analysis (ASTM D 422), Atterberg limits (ASTM D 4318), and specific gravity (ASTM D 854)); and determination of Rock Quality Designation values, if applicable. This analysis shall be used by the design engineer to verify that adequate ground support exists for the station as well as to design the structure to prevent flotation. This design shall be certified by a Professional Engineer registered in the State of Ohio.

C. Plans shall indicate the elevation of the 100-year flood plain at the pump station site. The tops of the wet well and valve pit, as well as the generator and control panel pads, shall be at least one foot above the 100-year flood plain.

D. Design shall be such that a 30-minute cycle time for each pump (i.e. 15-minute overall cycle time for duplex stations; 10-minute overall cycle time for triplex stations) shall be obtained at average design flow. The wet well shall also incorporate a design sufficient to provide at least one hour of storage at twice ultimate average flow from the high water alarm to the invert of the influent sewer. In no case shall this distance be less than five feet.

E. No more than one influent sewer shall enter the wet well, and it shall be located opposite the pumps.

F. Wet wells shall have a minimum inside diameter of six feet. Valve pits shall have a minimum inside dimension in all directions of six feet. Valve pits shall have an inside depth of no more than 8 feet.

G. A grout fillet shall be properly designed and constructed around the full circumference of the wet well's bottom to direct grit and other solids to the pumps. The slope of this fillet shall be at least 1:1. The inner diameter of this "grout circle" shall be as recommended by the pump manufacturer for the specified pump and approved by the County, but in general should be as small as possible without creating a vortex condition around the pumps. The inner "grout circle" shall be centered around the pumps. Either of the following mixes will be acceptable for this fillet, but the final mix design and slump shall be determined by the Contractor and approved by the County.

1) Sand-cement grout consisting of one part Portland cement, two parts fine aggregate and a maximum of 4.5 gallons of water per sack (cubic foot) of cement. Portland cement shall be Type III conforming to ASTM C 150. Fine aggregate shall be natural siliceous sand, consisting of hard, clean, sharp, dense, durable and uncoated particles, free from organic material and injurious amounts of deleterious substances. 100% of fine aggregate shall pass a Size No. 4 sieve.

2) 4,000 psi concrete mix, with 5-7 percent air content and 3/4"-1" slump. Mix shall include 510 lbs. Type I cement conforming to ASTM C 150; 90 lbs. Class F fly ash conforming to ASTM C 618; 1,315 lbs. sand conforming to ASTM C 33, ODOT 703.02; 1,651 lbs. AASHTO M-43 Size No. 8 aggregate; 200 lbs. water; and 2-4 oz./100 lbs. Type A or D water reducer conforming to ASTM C 494.

H. Each valve pit shall be fitted with a drainage system such that any liquid entering the valve pit will be drained back to the wet well. Drainage of the valve pit shall be ensured by a 1-degree slope to the floor of the valve chamber draining to the invert of a drain line fitted with a check valve to prevent sewage from entering the valve chamber. The drain line shall be minimum 2" diameter constructed of schedule 80 PVC, and the check valve shall be constructed of PVC. The check valve should be attached to the drain pipe with a NPT threaded joint to permit changing the valve. The pipe shall extend at least 12" into the wet well but shall not interfere with pump removal. The check valve shall be normally closed.

I. Each valve pit shall also be furnished with a valved connection to the force main beyond the pump isolation valves for emergency pumping. This connection shall be sized to equal the discharge piping from the pumps, unless otherwise directed by the County, and shall have a minimum diameter of six (6) inches. This connection shall be equipped with a 6" male camlock fitting for ease of hose connection. Camlock fitting and accessories shall include one discharge connection, one rubber sealing ring, and one end cap.

J. All pipe and conduit penetrations through the wet well and valve pit structures shall be sealed with Dura-seal rubber compression gaskets, rubber Link Seal sleeves with stainless steel components, or approved equal products. Once it is shown that all penetrations are watertight and do not leak, all voids should be filled with non-shrink grout on both sides of the wall.

K. The wet well shall be provided with at least one “gooseneck” inverted vent pipe or “Green” cap style vent pipe. The piping shall be made of epoxy-coated ductile iron, aluminum, or other corrosion-resistant material and shall be at least as large as the largest pump discharge piping (minimum 4"). Black iron pipe will not be allowed. Also, PVC or other plastic pipe will not be allowed. The exterior end of the pipe shall be covered with a stainless steel screen.

L. Adequate water-proofing of the wet well and valve pit shall be included in the design and performed by the Contractor. A leakage test shall be performed on the entire wet well and valve pit prior to backfilling (see Section 3.2). The Contractor/Developer shall be responsible for properly repairing any leaks or correcting any other problems discovered during this test.

M. All valve pits shall be fitted with either an aluminum ladder or polypropylene manhole steps for access, and an aluminum hand hold embedded on top of the valve pit at the ladder of manhole steps. An aluminum Bilco Ladder-Up safety post or equal shall be provided.

N. Wet wells and valve vaults shall be supplied with embedded sockets at each access lid/hatch to support a portable stainless steel winch-type hoist.

3.2 Leakage Testing of Wet Well and Valve Pit

Wet well and valve pits shall be tested for leakage prior to backfilling as follows: structures shall be filled with water and allowed to remain for 24 hours. Any visible leaks shall be repaired immediately (prior to backfilling). If the water level in the structures drops substantially (generally, more than 6"-12") during the leakage test, the Contractor may be required to investigate for additional leaks and another test may be required.

3.3 Shear/Sluice Gate Manhole

A. A separate manhole with a slab top shall be installed on the influent sewer within 15 feet of the wet well either within the fence or near one of the fence gates. Ductile iron pipe shall be installed between this manhole and the wet well. A shear gate valve or sluice gate shall be installed on the outlet side of this manhole. Polypropylene manhole steps shall be installed in the manhole.

B. A 30" x 30" (minimum) aluminum hatch shall be provided in the top slab of this manhole above the manhole steps and should open away from the manhole steps.

C. A pole with a lifting handle shall be included on the shear gate valve or sluice gate, and shall extend to about 6" below the top of the manhole when the valve is fully open. A stainless steel eye bolt (2" eye) shall be installed about 4" from the top of the manhole to allow the handle to be chained and padlocked open. This pole and eye bolt shall be under the hatch near the manhole steps. The pole and handle shall be installed so that the handle is accessible without entering the manhole and the hatch can be closed with the valve fully open or closed.

3.4 Backfill and Embankment

A. The Contractor shall provide all labor, materials, tools, equipment, and incidentals required to place the compacted backfill or embankment where shown on the plans or where directed by the County and as specified herein.

B. Compacted backfill and embankment shall consist of suitable excavated material approved by the County or Granular Backfill meeting O.D.O.T. Specification 307, Type 1-A. This material may be obtained from suitable excavated material elsewhere on the project, if available. Use of frozen material, wood, rocks, or rubbish for backfill or embankment will not be permitted. If suitable material cannot be obtained from the excavated material, the Contractor shall furnish the material.

C. No fill shall be placed covering other work until such work has been inspected and approved by the County. Where fill is required on both sides of a foundation or wall, the fill shall be placed simultaneously on each side. Fill against building walls shall not be placed until the first floor slab has been poured and set, unless otherwise approved by the Engineer. Fill against other work shall be in a manner and at such time as not to endanger the stability of or damage the work. No fill shall be placed against water bearing walls until they have been inspected, tested, and approved by the Engineer. No fill shall be placed over snow or frozen material.

D. All fill shall be compacted as specified herein, unless otherwise shown.

1) Backfill. Backfill shall be placed in 6" loose layers and each layer compacted to not less than 95% of maximum dry density; the moisture content shall be not less than 1 percentage point below or greater than 3 percentage points above optimum as determined by ASTM D698. Compaction shall be accomplished with a vibratory double-drum steel wheel roller no less that 2.0 Tons and no greater than 3.0 Tons or by other means approved in writing by the Engineer.

Flushing with water before compacting is also encouraged if satisfactory drainage is provided for the free water. The method of compaction within road right-of-ways shall be approved by the Fairfield County Engineer's Office or the Ohio Department of Transportation, as appropriate.

2) Embankments. Embankment areas shall be constructed in accordance with this specification. Embankment fill shall be placed in 6" loose layers and each layer compacted to not less than the percent of maximum dry density specified herein; the moisture content shall be not less than 1 percentage point below optimum and not greater than 3 percentage points above optimum. For material which displays pronounced elasticity or deformation under action of compaction equipment, the moisture content shall be reduced and proper stability obtained. Moisture density shall be as determined by ASTM D698.

Maximum Dry Density (lbs/cu ft)	Compaction Percent Maximum Dry Density
90-104.9	102
105-119.9	100
120 and more	98

3) Subgrade. All pavement subgrades for new pavement shall be compacted to a depth of 12". Subgrade soils with a maximum dry density of less than 100 pounds per cubic foot are considered unsuitable for use where subgrade compaction for a depth of 12" is required, and when encountered in the upper 12" of the subgrade shall be replaced with suitable soil or granular material. Soil subgrade with maximum dry density of 100 to 105 pounds per cubic foot shall be compacted to not less than 102% of maximum dry density. All other soil subgrade shall be compacted to not less than 100% of maximum dry density; the moisture content shall be not less than 1 percentage point below or greater than 3 percentage points above optimum as determined by ASTM D698.

E. The Contractor shall obtain up to three (3) soil samples where directed by the County and transport the samples to an approved testing agency for Standard Proctor dry density testing (ASTM D-698). In addition, the Contractor shall cause a trained and experienced soil technician from an approved testing agency to be onsite during all backfill and embankment placement and to conduct at least two field density tests for every vertical foot of backfill or embankment placed. The County shall review and approve the field density test reports at least every ten (10) vertical feet of embankment, and placement of embankment may not continue without this approval.

3.5 Wet Well, Valve Pit and Shear Gate Manhole Lids and Accessories

A. Wet well, valve pit and shear gate manhole lids shall be composed of minimum 0.25-inch-thick aluminum rated at 150 pounds per square foot minimum (H-20 load rating in traffic bearing situations or if top of structures are not elevated at least 6" above grade). Lids shall be affixed with stainless steel hinges and hardware. A retractable handle constructed of stainless steel or aluminum shall be furnished with each lid--such that when the lid is closed, there shall be no protrusions above the lid level.

B. The channel frame shall be 1/4 inch minimum aluminum with anchor flange around the perimeter with a drain into the wet well.

C. Factory finish shall be mill-finish with bituminous coating applied to the exterior of the frame.

D. Each lid shall be furnished with a stainless steel or aluminum padlock tab for securing the lid, a stainless steel or aluminum snap lock with gasketed, threaded cover plug and removable key wrench, and a stainless steel or aluminum hold-open arm with release handle for securing the lid in a 90^{E} open position. Also, compression-spring operators enclosed in telescopic tubes shall be provided for smooth, easy and controlled door operation throughout the entire arc of opening and closing.

E. Pump access lids shall be sized according to the pump manufacturer's recommendation. Access hatch(es) on the valve pit shall be large enough to permit easy installation and removal of the check valves and gate valves, as well as permit access to the Bauer connection. Every structure shall have double access lids with a minimum size of 48" x 60" (except that the hatch on the shear gate manhole may be 30" x 30") that will permit entry of maintenance personnel wearing self-contained breathing apparatus.

F. Access lids over the pumps in the wet well shall lift away from the pump guide rails (i.e. toward the influent sewer).

G. Access to the control panels shall meet National Electric Code (NEC) conditions with the lids in the 90E open position.

H. Aluminum access lids shall be as manufactured by Bilco or approved equal.

I. The Contractor shall post the following signs on <u>every</u> aluminum hatch door frame: 5" x 7" "**DANGER**: CONFINED SPACE: ENTER BY: PERMIT ONLY" and 5" x 7" "FALL PROTECTION REQUIRED". Signs shall be according to State and Federal OSHA requirements. Signs shall be heavy gauge 0.063" aluminum with rounded corners and 1/4" I.D. corner eyelets for mounting. Paint or ink shall be weather-resistant, and the face of the sign shall be covered with a clear mylar topcoat. Signs shall be attached with stainless steel self-tapping screws or other appropriate aluminum or stainless steel fasteners. Signs shall be mounted such that they do not present a tripping hazard.

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4.0 PIPES, ISOLATION VALVES, CHECK VALVES, AND SURGE RELIEF VALVES

All pipes and related equipment shall conform to the following specifications:

4.1 Pipes

A. The force main and other piping at the pump station shall be a minimum of four inches (4") in diameter. Pipes shall be of Class 53 ductile iron meeting ANSI/AWWA C151/A21.51. All pipes shall be cement-lined, meeting ANSI/AWWA C104/A21.4 standards with asphaltic seal coating on the interior. Force main piping may be PVC DR-14 with approval of the County.

B. All mating ends in the pump station and valve pit shall be Class 125 flanged meeting ANSI/AWWA C110/A21.10 and C115/A21.15, with a gasket no larger than 0.125 inch between flanges. Flange adapters such as Union Flange will not be allowed. All flanges shall be ductile iron (gray iron not acceptable). All flange bolts shall be 316 stainless steel. Exterior of pipes in the wet well and valve pit shall be coated with epoxy-based paint, in accordance with AWWA standards. Only one joint or fitting will be permitted on each pipe between the wet well and the valve pit. This shall be a restrained flexible joint such as a mechanical-joint solid sleeve with MegaLugs. No flanged joints will be permitted outside the wet well and valve pit.

C. Each pump discharge line shall have a pressure gauge with a lever-operated ball valve installed in the valve pit between the check valve and the gate valve. The gauges shall be stainless steel glycerin-filled diaphragm gauges suitable for raw sewage service. Gauges shall have at least a 2 ½ inch face with a polycarbonate window and a full scale pressure of twice the shut-off head of the pump. Connections shall be NPT brass or stainless steel with a stainless steel diaphragm seal between the valve and the gauge. Ball valves shall be lever operated stainless steel with vinyl grip handles and NPT connections. Valves shall be rated for at least 350 psi working pressure. Piping shall be stainless steel or brass with a minimum pressure rating of 200 psi. Hydrostatic tests shall be performed with ball valves turned off. A single pressure gauge on the common force main (instead of one for each pump) may be approved in some cases; the gauge must be installed between the individual pump isolation valves and the valve on the common force main.

D. Force main piping shall have standard push-on bell and spigot joints meeting ANSI/AWWA C111/A21.11 and shall be installed in accordance with ANSI/AWWA C600. Exterior of ductile iron piping shall be coated with standard asphaltic coating. Ring gaskets shall be of approved composition suitable for the required service. Fittings shall be ductile iron conforming to ANSI/AWWA C153/A21.53 or C110/A21.10. Piping at all bends and at both ends of the force main shall be restrained for sufficient lengths to withstand the higher of: a) the test pressure, or b) the operating pressure plus a reasonable surge allowance. Substitution of concrete thrust-blocks in accordance with AWWA and County standards in lieu of restrained joint pipe will be considered on a case-by-case basis.

E. Force mains shall have a minimum cover of 5.0 feet and a maximum cover of 12.0 feet. High points in the force main should be minimized by the use of deeper cuts through small hills along the alignment. Automatic combination air release valves shall be located at each high point on the force

main. The force main shall discharge at an elevation not more than 2 feet above the invert of the receiving sewer, to a separate terminal manhole having no upstream gravity sewer connections. A smooth uniform invert shall be poured in the manhole from the force main discharge to the gravity sewer.

4.2 Isolation Valves

A. Each pump discharge line shall be furnished with an individual isolation valve. Isolation valves shall also be furnished for the Bauer connection and on the common force main beyond the flow meter (before exiting the valve pit, if no flow meter is provided). An isolation valve shall also be installed on the force main side of the surge relief valve, if applicable.

B. Isolation valves shall be of the resilient-seat gate type and shall be as manufactured by Mueller, American Flow Control, Kennedy Valve, or M & H Valve.

C. Gate valves shall conform to the requirements of AWWA C-509 as applicable.

D. Valves shall be furnished with Class 125 flanged ends.

E. All-metal valves shall be manufactured of ASTM A-126 cast iron, Class B, with bronze mounting hardware.

F. Valves shall be of the non-rising stem type, using a double O-ring stem seal, except that packing shall be used when gear operations are required.

G. Valves shall be rated for the following working pressures:

Valve Size	Pressure (psig)	Class
3-in. to 12-in.	200	125
14-in. to 20-in.	150	125

Piping and valves larger than 20-inch diameter shall be individually designed.

H. All valve bodies shall be hydrostatically tested to at least twice the rated working water pressure. In addition, valves shall be seat-tested, bi-directional at the rated working pressure, with seat leakage not to exceed one fluid ounce per inch of valve diameter per hour. A certificate of testing shall be provided.

I. Flanged valves shall have face-to-face dimensions in accordance with ANSI B16.1 and flanges in accordance with ANSI B16.10.

J. All bonnet and packing gland bolts shall be steel, electro-plated with either zinc or cadmium; packing gland bolts shall have bronze nuts.

K. Valves shall be furnished with handwheels as well as geared operators where required to produce the specified torque with a maximum pull of 80 pounds on the handwheel.

L. All valves shall be marked in accordance with AWWA standards, including the name of the manufacturer, valve size, working pressure, and year of manufacture.

M. Valves shall open counter-clockwise and close clockwise. Permanent labels shall be provided for each valve, showing both the "Open" position and indicating arrows.

N. Resilient-seated valves shall be coated, interior, exterior, and valve bonnet, with fusion-bonded epoxy, in accordance with AWWA C-550.

O. Each valve gate shall be encapsulated with synthetic rubber which has been bonded and vulcanized in accordance with ASTM B-429, Method B.

P. Recesses in the valve body shall not be permitted.

4.3 Check Valves

A. Check valves for ductile iron pipelines shall be swing-type and shall meet the material requirements of AWWA specification C508 swing-check valves for ordinary waterworks service. The valves shall be of cast-iron body, bronze-mounted, single-disc 175 psi working water pressure, cushioned closing type, and hydrostatically tested at 300 psi. Valve ends shall be 125-pound ANSI B16.1 flanges. Interior and exterior of valve body shall be coated with fusion-bonded epoxy in accordance with AWWA C-550.

B When there is no flow through the line, the disc shall hang lightly against its seat in a vertical position. When open, the disc shall swing clear of the waterway.

C. Check valves shall have bronze seat and body rings, extended bronze hinge pins, and bronze nuts on the bolts of bolted covers.

D. Valves shall be fitted with an extended hinge arm with outside lever and weights. Valves shall be so constructed that disc and body seat may be easily removed and replaced without removing the valve from the line. Check valves shall thus be installed with enough clearance between the valves and the walls of the valve pit to permit removal of the shaft for maintenance purposes.

E. Pump stations designed with a total dynamic head above 80 feet or a force main velocity above 4 feet per second shall be provided with hydraulic cushion check valves. If required, check valves shall be equipped with a hydraulic cushion to dampen the last ten percent of the valve closing action. The hydraulic-cushion chamber shall be arranged so that the valve closing speed is adjustable to meet the service requirements.

F. All check valve shafts shall be designed to accept an hydraulic cushion in case future modification is desired.

4.4 Surge Relief Valves

A. Pump stations designed for a total dynamic head greater than 80 feet and/or force main velocity greater than 4 feet per second shall be evaluated to determine the need for a surge relief valve. The surge relief valve shall be designed to prevent damage to any piping, valves, or other equipment in the event of a power failure during operation of all pumps in the station.

B. Any surge relief valve shall be installed in the valve pit with discharge into the wet well.

C. The surge relief valve shall meet the same material and pressure-rating requirements as the check valves.

D. Surge relief valve design and construction shall be approved by the County. Surge relief valves shall have a hydraulic cylinder and externally-adjustable spring. Surge relief valves shall be APCO Angle-Style Surge Relief Valve (Drawing No. S-3000) or approved equal.

E. The requirement for surge relief valves can be waived by the County if cushioned check valves and soft starters are specified.

5.0 ELECTRICAL

A. All electrical components shall meet NEMA standards, and shall comply with NEC and UL as applicable to construction and installation of wiring and components. The electrical system inside the wet well shall comply with the National Electric Code for Hazardous Locations, Class I, Division 1, Group D.

B. An enclosure shall be provided to house all electrical equipment outlined in the following specifications. The enclosure shall be located on a separate reinforced concrete pad adjacent to the wet well as close to the wet well as safely and practically possible. The pad shall be of sufficient size to support the enclosure and provide access in accordance with NEC requirements.

C. The enclosure and the electrical equipment which shall be supplied with each wastewater pump station are described in this section.

D. The utility company electric meter, utility company CT enclosure, service entrance-rated main breaker or fusible disconnect, and automatic transfer switch enclosure shall be mounted on a structure of 3" stainless steel strut (square tubing and U-channel) to one side of the main motor control panel enclosure on the same concrete pad. The control transformer shall be mounted either on the stainless steel strut or on the side or back of the main control panel enclosure. Where the utility company mounting requirements differ from the requirements herein, the utility company requirements shall govern for those items under their jurisdiction only.

5.1 Enclosures

A. The enclosure shall contain both the motor control panel and the Supervisory Control and Data Acquisition (SCADA) remote terminal unit (RTU). The enclosure shall have room for the RTU even if the initial installation of SCADA is waived by the County. The RTU shall be isolated from the motor control panel. Hardwire controls must be kept away from the RTU (or the space reserved for a future a RTU) to prevent electrical noise interference. A separate enclosure for the SCADA remote terminal unit is permissible with approval of the County.

B. Enclosures supplied with each station shall be free-standing, double-door Hoffman # A-74H7224SSLP or equal (or appropriately sized equivalent) and shall be rated NEMA Type 4X. The enclosure shall be large enough to provide an unused space equal to at least 30% of the space required. This space shall be reserved for installation of future equipment by the County, and no wiring or controls shall intrude into this reserved space. The construction shall be equal to or of better quality than 12-gauge 304 stainless steel, in accordance with ASTM A-167, and shall be supplied with a drip shield, a continuous hinge on the panel, and smooth seamless sides. All bolts, screws, pins, and other fasteners used in the enclosure shall be stainless steel.

C. The enclosure shall include add-on kits equal to the Hoffman kits listed by catalog number below:

1) A-DSTOPK Door Stop Kit.

2) A-LF16M18 Light with remote switch (provide 2 lights if panel size or configuration dictates).

3) Design-air Electric Heater, 115 volt, with built-in thermostat, Model D-AH2001A, or other Hoffman model sized properly to ensure proper air transfer and heating of entire enclosure (provide 20E F temperature rise above ambient). Two heaters will be necessary where the enclosure is divided into separate compartments.

D. Each enclosure shall have a door-in-door arrangement with interior swing-out panels on each side. The alternating on-off switch, circuit breakers, control switches, pilot lights, etc., shall be accessible to the operator from the inner panel without opening the inner doors. The outer panel shall be void of control devices.

E. The outer panel doors of the enclosure shall be secured as follows: Both the right-hand and left-hand doors shall be secured with pad-lockable Hoffman latch, Cat. # A-L1CR.

F. The subpanel in the back of the main enclosure shall be steel painted with white ceramic paint (Hoffman A-72P72 or equal). All other components of the enclosure shall be stainless steel.

G. Each wastewater pump station enclosure shall be provided with one duplex service outlet of 120-volt AC 20-amp rating. This outlet shall be supplied from the control transformer and shall have GFCI circuit protection. The outlet shall be located in the motor control panel behind the inner door.

H. All enclosures, panels, etc. (including the motor control panel) shall be UL-listed and shall be fabricated by a UL-approved shop in accordance with NFPA 79 Electrical Standards for Industrial Machinery.

I. An outline drawing of the control panel shall be provided, showing panel elevation, dimensions, and weight. Interconnecting wiring diagrams shall be provided, which show all electrical connections between field-installed equipment and the control panel. Schematic control wiring diagrams shall be provided, showing all control components, switches, pilot lights, relays, etc. The wiring diagrams shall indicate wire and terminal numbers. Each component shall be uniquely labeled. A copy of all as-built electrical/control/instrumentation drawings shall be laminated (or otherwise sealed in plastic) and permanently located in the main control panel enclosure.

J. The Contractor shall provide for the County to inspect the motor control panel during fabrication at the following points: 1) Once all components are arranged in their proper positions in the panel (preferably, physically positioned in the panel, but not bolted in place) before any wiring is completed. 2) When the panel is substantially complete, but before it has been shipped from the site of assembly. These inspections shall be by one of the following methods at the discretion of the County: either employees of the County will travel (at the County's expense) to the site of assembly or the Contractor shall provide to the County sufficient digital photographs in a format acceptable to the County clearly showing all portions and details of the control panel to the County's satisfaction. Work on the control panel shall not progress beyond these points without the approval of the County. Any changes required by the County as a result of these inspections shall be performed prior to any further work on the panel.

K. A minimum 24"x24"x8" stainless steel NEMA 4X junction box shall be mounted over the wet well on two 6"x6"x24" vented stainless steel feed-through wireways (Hoffman F-66W24SS or equal) over two 5" holes through the wet well top slab. The door of this junction box shall open in a direction away from any access hatches in the wet well, and the door shall be padlockable. All wires entering

the wet well (pump power and control wires, float wires, etc.) shall be connected to terminal strips inside this junction box with corresponding wires extending to the main control panel. Terminals shall be labeled as "Pump 1," "Pump 2," etc. Cord grip connectors or other appropriate components shall be used at the bottom of this junction box for all wires entering the wet well to seal the opening and provide strain relief for the wires. Stainless steel braided wire sleeves with attachment tails shall also be provided for large pump cords.

5.2 Circuit Breakers

A. All circuit breakers shall be of the thermal magnetic type, with molded case breakers. Breakers shall be UL-listed and CSA-certified, and shall meet Federal Specification W-C-375B/GEN.

B. Three-pole breakers shall be manufactured by Square D or approved equal, and shall have a short-circuit rating equal to 125% of the available fault current. Regardless of the available fault rating, circuit breakers shall not be less than Style FA for applications under 100 amps, or Style KA for applications between 100 and 250 amps.

C. Single-pole breakers shall be Square D QOB series (bolt on) or approved equal, and shall be used for control circuitry and peripheral devices.

D. A main circuit breaker shall be provided inside the main enclosure for the control panel (on the load side of the automatic transfer switch), with separate circuit breakers for each motor and transformer primary, as well as single-pole circuit breakers for control circuitry, RTU, lighting, outlets, flow meter & chart recorder, generator block heater, generator battery charger, etc. Another service entrance-rated circuit breaker or fusible disconnect shall be provided in a NEMA 4X stainless steel enclosure outside the main enclosure on the line side of the automatic transfer switch, lightning arrester, etc.

E. Circuit breakers shall be accessible to the operator through the inner panel door without having to come in contact with open wiring. The main and motor branch circuit breakers shall be lockable.

F. A minimum of two spare 120-volt AC, 20-amp circuit breakers shall be provided and mounted on the panel.

5.3 Starters

A. Motor starters shall be soft start, electronic overload starters with adjustable trip phase loss, ground fault, and phase reversal protection. Magnetic Full Voltage non-reversing motor starters with electronic overload, user selectable trip class, phase loss sensing, jam protection, ground fault sensing, and automatic reset may be permitted for pump motors less than 40 horsepower if required by the local power company or otherwise allowed by the County. Motor starters shall be equipped with three poles and shall be provided with auxiliary contacts for use in the control circuit and for status inputs to the SCADA system. All soft start starters shall also be provided with a soft stop feature. Starters shall be Allen Bradley Bulletin 509 type with SMP-2 adjustable overload relay, Square D Class 8536 full voltage NEMA starters with optional solid state motor logic overload relay (Class 9065 if ordered separately), or Furnas ESP 100 series, Class 14 with Class 20 trip overload, with solid state adjustable thermal overloads. No other starters will be considered equal or allowed.

B. Starters shall conform to all NEMA ratings. The minimum size starter shall be NEMA 1.

C. Starters shall have at least one set of auxillary dry N.O. contacts rated at 10 amps for SCADA use.

D. Provisions for sequential pump starting shall be made in the controls to prevent more than one pump from starting simultaneously.

5.4 Step Down Transformers

A. Step down transformers shall be dry type, stainless steel enclosed (NEMA 3R), mounted external to the main control panel. Primary voltage shall be 480 volt AC (or 240 volt AC if same as main power supply) and secondary voltage shall be 120 volt AC.

B. The transformer should be sized for the proposed power requirements of the pumping station plus an additional 25% capacity for future loads, with a minimum output current rating of 30 amps. The transformer shall be protected by circuit breakers on the primary and secondary sides.

5.5 Control Relays

A. All control relays shall be of the illuminated 8- or 11-pin octal plug-in type, Allen Bradley, Square D or approval equal. Relays may be either direct panel-mounted or DIN rail-mounted. Control relays shall be of at least DPDT configuration.

B. Intrinsically safe relays (Warrick Series 27A1D0 Intrinsic Barrier or approved equal) shall be provided for operation with the wet well float switches. Wiring associated with the intrinsically safe relays shall be segregated from other power and control wiring.

5.6 Duplex Alternator

A. The alternating relay shall be rated for 120 - 600 Volts and shall be Furnas, Cat. No. 47AB10A*, Class 47, Square D Class 8501 or approved equal.

B. An alternating on-off switch shall be provided in the panel. For duplex stations this shall consist of a selector switch with the following options: PUMP 1 -- ALTERNATE -- PUMP 2.

C. The above describes a duplex alternator. Pump stations with three or more pumps shall have an alternator capable of equalizing operating hours among the pumps.

5.7 Level Controllers and Float Switches

A. A level controller by Consolidated Electric or Drexelbrook shall be provided with a 4" PVC sleeve pipe, equal to the depth of the wet well, and mounted to the pump station wet well with stainless steel straps and brackets.

B. Float switches shall be supplied, in addition to the level controller, with both a normally open and a normally closed contact closure. All floats shall be internally weighted or have external cable weights. Float switches shall be non-mercury type.

C. There shall be a minimum of two float switches supplied with each station. They shall be used as follows: (1) low level (pumps off), and (2) high level alarm.

D. Both float switches shall be wired into the SCADA system and to a local alarm (see Section 5.17, Local Alarm).

E. All floats shall be provided with enough extra cable to permit installation at least ten feet lower than the elevation shown on the plans or at the level of the top of the pump volute, whichever is higher. Excess cable shall be neatly looped at the float hanger. Cable support shall be provided for each float cable and shall consist of a stainless steel braided wire sleeve with attachment tails for connection to the float hanger(s). Float hanger(s) shall be stainless steel and be located at the edge of the pump hatch opening, unless otherwise shown on the plans or directed by the Engineer.

5.8 Switches and Pilot Lamps

A. All lamps shall be of the transformer type.

B. Switches and pilot lamps shall be oil-tight and shall meet NEMA standards for A600 heavy-duty contacts. Each pump shall have a separate selector switch with the following settings: HAND -- OFF -- AUTO. Each pump shall also have a green pilot lamp connected to auxiliary contacts on the starter to indicate when the pump is running. These switches and lights should be located inside the control panel in non-secured locations and on the control panel door in secure (fenced) locations.

C. All HOA switches and pilot lamps shall be Allen-Bradley 800 series or approved equal. Switches and pilot lamps shall be oil-tight and shall meet NEMA standards for A600 heavy-duty contacts. All pilot lamps shall have the push-to-test feature.

5.9 Over-Current Relays

A. Adjustable over-current relays shall be provided and shall be wired so that every motor lead passes through a separate current loop (i.e. one current loop for each phase of each pump).

B. Output contacts for a remote alarm shall be provided.

C. The over-current relays shall be SSAC Model No. ECS41BC or equivalent for pumps with full-load current up to 20 amps or SSAC Model No. ECSH4HBD for pumps with current rating between 20 and 50 amps.

D. When rated motor current exceeds 50 amps, current transformers shall be provided to satisfy the current requirements (i.e. current shall be reduced to below 50 amps for monitoring purposes). This shall be accomplished by running the motor leads through appropriately sized current transformer "donuts" and running the leads from the current transformers through the current loops of appropriately sized over-current relays.

5.10 Voltage Monitors

A. A voltage monitor shall be supplied to monitor the incoming voltage. This unit shall be manufactured by SSAC, Model No. WVM911AL (480 volt), WVM611AL (240 volt) or equal. The monitor shall be rated at either 480 volt AC or 240 volt AC, according to the incoming voltage source. The restart delay shall be adjustable from 0.25 to 64 seconds. Voltage monitor shall monitor all incoming phases. Protection of the voltage monitor, on the incoming voltage, shall be through 2-amp fast-blow fuses (Bussman KTK-R2 or equal).

B. When an under-voltage condition occurs, an alarm shall be sent via the SCADA system after an adjustable time delay.

5.11 Wire and Cable

A. All wiring and cable installation shall conform to NEC regulations and shall comply with local codes. All conductors shall be copper. Wiring shall not be operated above 75E C.

B. For electrical equipment feeders (motor control centers, motor branch circuits, etc.), located below grade or for exterior control and motor circuits, wiring shall be type THHN through #2 AWG and type RHH for larger than #2 AWG.

C. For branch circuits for lighting and receptacles, wiring shall be type THHN in conduit. For branch circuits for interior control, wiring shall be type MTW.

D. Power wiring shall be 12 AWG minimum, and control wiring shall be 14 AWG minimum.

E. For instrumentation (i.e. 4-20 mA signals), cables shall be 16 AWG copper, NEC-type TC rated at 600 volts (Belden No. 1118A or equal) individually shielded twisted pair cable. All digital signal wires may be of the type of wire specified above.

F. All SCADA and signal wires shall be in conduit separate from any AC power lines. All motor circuits must be in separate conduits apart from any lighting, receptacle, or control wiring.

G. All conductors shall be sized such that voltage drop does not exceed three percent for branch circuits or five percent for feeder branch circuit combinations.

H. The use of pulling compound shall be required in all installations of wire pulled in conduit as needed. All conduits shall be sized in accordance with NEC regulations and/or local codes.

I. All terminal blocks shall be Allen Bradley terminals Model # 1492-CA1 for wire sizes #22 - #8 with mounting channel Model # 1492-N1, end barriers Model # 1492-N16, and end anchors Model # 1492-N23, or approved equal. At least 10% spare terminals shall be provided on all terminal strips. Bare wire ends shall be connected into the recessed terminals. No fork-tongue compression terminals shall be used unless approved by the County for specific applications. A UL-listed anti-oxidation compound shall be used on any wires connected with wire nuts.

J. All wiring and components shall be tag-numbered and clearly marked at each termination in accordance with the drawings and as directed by the Engineer. Wire tags shall be heat shrink type wire markers with permanent legible machine printed markings and numbers. Adhesive or taped-on tags are not acceptable.

5.12 Raceways and Conduit

A. All conduits shall be of one of the following types:

1) Rigid aluminum, which shall comply with NEC and local codes. Rigid aluminum conduit shall be used for all above-grade installations and shall not be used for buried conduits.

2) PVC plastic, which shall be Schedule 80. All PVC conduit shall comply with NEC and local codes and have glued joints. PVC conduit shall not be used for interior conduits or above-grade exterior conduits, but shall be used for <u>all</u> buried conduits.

3) Liquid-tight, which shall be flexible steel conduit with a high tensile strength galvanized steel core and continuous copper ground built into the core. This conduit shall have a smooth non-wrinkling PVC jacket that will not pull away from fittings. This conduit shall be type LA Liquatite as manufactured by Electri-flex, or equal. Liquid-tight conduit shall be used for any final runs into instrumentation equipment, and shall not exceed 18 inches in length.

B. Conduits between the wet well and control panel shall have a minimum size of 2", shall be sealed gas-tight, and shall be as follows, unless otherwise approved by Fairfield County Utilities:

1 conduit for each pump
1 conduit for future mixer or influent grinder (spare)
1 conduit for high-high level float (SCADA)
1 conduit for remaining floats or level transducer.

C. All conduits shall be tagged and identified with brass tags held on by copper wire at both ends.

D. Conduit routing and wire-pulling schedules shall be submitted with shop drawings.

E. Conduits for three phase wires between the main transformer and the transfer switch, as well as between the generator and the transfer switch, shall be encased in a minimum of three inches of concrete on all sides. Other conduits shall be encased in concrete when shown on the plans. Other buried conduits may be encased at the discretion of the Contractor. Concrete encasement shall be colored as required by electrical codes.

F. Plastic conduit spacers shall be used for all buried conduits, whether encased in concrete or not.

5.13 Grounding

A. All submitted site plans shall show a grounding scheme. Grounding shall comply to NEC requirements.

5.14 Security System Devices

A. Security system devices shall be furnished and installed as described below.

B. For pumping stations with a building, a limit switch shall be mounted on each exterior door such that the switch opens when the door is opened. All such switches shall be connected in series to the Site Entry input point on the SCADA RTU.

C. All outdoor control enclosures shall have a limit switch mounted at each exterior door such that the switch opens when the door is opened. All such switches shall be connected in series to the Site Entry input point on the SCADA RTU.

D. A limit switch shall also be mounted at the control panel subpanel door that covers the SCADA RTU, radio, modules, etc. such that the switch closes when this subpanel door is opened. This limit switch shall be connected to the Tamper Switch input point on the SCADA RTU.

E. Limit switches shall be Allen Bradley model BUL802M-AY5 (or approved equal) with lever arm. Conduit shall be continuous to the limit switch or the Contractor shall install heavy duty, moisture proof cable type ST00W-A 16 AWG 4C by AIW Corp. or equal from the limit switch to the conduit grip end.

F. An Allen Bradley model 800T-H2A switch (or equal) with adjustable time delay shall be used for the operator ("Entry/Depart" switch).

5.15 Nameplates

A. Engraved nameplates shall be provided for every circuit breaker, control switch, pilot light, etc. Nameplates shall be white-faced tags with engraved black letters. Letters shall be at least 3/16-inch in height.

B. Nameplates shall be attached to the panel by means of stainless steel machine screws.

5.16 Line-Surge Protection

A. A lightning arrester and line-surge capacitor shall be provided on the incoming power lines. The lightning arrester shall be of the 650-volt, 3-phase, "Transquell" type, as manufactured by General Electric Co., Cat. No. 9L15ECC001, Square D Model SDSA3650, or equal. Line-surge capacitors shall be 650-volt, 3-phase, non-toxic liquid-insulated, as manufactured by General Electric Co., Cat. No. 9L18BBB301, or equal. The lightning arrester and line-surge capacitor shall be mounted outside the control panel. Wiring to the lightning arrester and line-surge capacitor shall be twisted together and kept as short as possible. The length of wiring shall not exceed 3 feet.

5.17 Local Alarm

A. An audible and a visual alarm shall be mounted on the enclosure. Mounting the alarm on the top or front of the panel shall not be acceptable. Specific site conditions shall dictate the orientation of the alarm and panel.

B. The alarm light shall be visible from 360E.

C. The local alarm shall be connected to the high level float, as described in Section 5.7, Level Controllers and Float Switches.

5.18 Elapsed-Time Meters

A. An elapsed-time meter connected to auxiliary contacts on the pump starter shall be furnished for each pump.

B. A separate elapsed-time meter shall also be furnished to indicate when two pumps run simultaneously.

C. Elapsed-time meters shall have an increment of 1/100 hour.

D. Elapsed-time meters shall be non-resettable.

5.19 Site Lighting

A 250 watt high pressure sodium flood light shall be mounted on the SCADA antenna pole at least 15 feet above the ground, but below the antenna. Conduit shall be extended continuously up the pole to the light. A three-position switch (on-photo cell-off) shall be mounted on the interior door of the main control panel to control this light. A photoelectric cell shall also be installed and switched to the control panel. The light shall be a bracket type fixture equal to GE #PBP-25S1H-V5A with a 250 watt HPS coated lamp. The fixture shall be 120 volt with power supply via the local 120 volt circuit.

5.20 Installation

All electrical devices, conduit, wiring, and grounding must be installed and connected by a licensed electrical contractor. All electrical work shall comply with all local, state, and federal electrical codes.

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6.0 STANDBY POWER

A. Standby power shall be provided for each pump station through either a weatherproof receptacle capable of connecting to a portable generator with a manual transfer switch or a permanent on-site generator with an automatic transfer switch.

B. A permanent on-site standby power system shall be required at all permanent wastewater pump stations and any other station where required by the Ohio EPA or the County (see Appendix A).

C. Each generator shall be sized to supply emergency backup power capable of starting and operating a sufficient number of pumps to pump the maximum design flow for the station, as well as operating all other electrical components. The generator set shall be manufactured by Kohler, or Caterpillar, for 480 Volts (or dual 480/240 Volts, if 240 Volt is main power supply), 3 phase, 4 wire, 60 Hz operation, complete with all standard equipment and all accessories described herein.

D. Provisions for sequential pump starting shall be made to minimize generator size and prevent overloading.

E. The backup power supply unit shall be a modular, self-contained package, conforming to NEC and local electric codes, as well as to any and all EPA and OSHA regulations.

F. The power plant driving the generator, whether permanent or portable, shall be diesel.

G. Each location with a permanent generator shall be equipped with a fuel tank capable of supplying fuel sufficient for a minimum of twenty four hours of generator operation at full load. The fuel tank shall be self-contained and double-walled with mechanical fuel gauge, low level fuel switch, and leak detection.

H. Each permanent generator shall be mounted on a raised reinforced concrete pad in a weatherproof enclosure with louvers and shall have removable panels or housing to allow access to the engine, generator, or controls. Enclosure shall be completely rodent-proofed. Permanent generators shall be located so as to be accessible by a truck for maintenance purposes.

I. Other required equipment shall include a radiator coolant system, electric block heater, flexible fuel lines, line circuit breaker (100 amp minimum), safeguard breakers, oil drain extension, voltage regulator, overvoltage shutdown protection, 12- or 24- volt battery pack and automatic float battery charger, vibration isolators, alarm horn with silencing switch, critical or residential-grade (as appropriate) exhaust muffler, tail pipe and rain cap. A sound-attenuating treatment shall be provided to reduce sound levels to no more than 85 dbA at 50 feet from the enclosure if any residence is located within 100 feet of the enclosure or if there is a potential for any residence to be located within this distance in the future.

J. Auxiliary contacts shall be furnished and installed to interface with the SCADA system for monitoring purposes. This shall include an engine run relay and a common failure relay (the common failure relay should be wired to a terminal strip near the SCADA system, but not connected to SCADA at installation).

K. The generator set controller shall be a Dec III Controller or equivalent and shall include the following features: oil pressure gauge, engine water temperature gauge, DC battery voltmeter, low water temperature fault alarm, auxiliary prealarm senders (incl. low water temperature, approaching low oil pressure, and approaching high water temperature), and battery charger fault and low voltage alarm.

L. The Automatic Transfer Switch (ATS) shall be the electrically-operated type that is mechanically held in both operating positions with time delay neutral position. ATS shall be suitable for use in standby systems described in NFPA 70. ATS shall be rated for continuous duty at the continuous current rating specified. All rating data shall be shown on shop drawings, and shall equal or exceed those specified. Switches shall be adequately rated for the application indicated and shall have the following characteristics and features.

1) Voltage: 480 Volts AC (or 240 Volts AC if same as main power supply)

2) Number of Phases: Three (3)

3) Number of Wires: Four (4)

4) Number of Switched Poles: Three (3)

5) Frequency: 60 Hz

6) Type of Load: Total system load

7) Continuous Phase or Main Current Rating: Equal to or exceeding the rating shown, but in no case less than 125 percent of the full load rating of the emergency power source or 100 amperes.

8) ATS Withstand Rating (Fault Current Availability Rating): Rated to withstand an available fault or short-circuit current of at least 22K amperes, RMS symmetrical, at a power factor between 0.0 and approximately 0.20, for a duration of 0.5, 3, 10 cycles at a maximum voltage of 600 Volts AC.

9) Overload Rating: 100 amperes, RMS symmetrical

10) Nonwelding of Contacts: Rated for nonwelding of contacts when used with the appropriate feeder overcurrent devices and with the available fault current specified.

11) Main and Neutral Contacts: Contacts shall have a silver composition and shall be protected by approved arcing contacts. Neutral contacts shall have not less than 1.5 times the continuous current rating of the main or phase contacts.

12) Features: ATS shall include adjustable time delays between switch positions and an in-phase monitor (unless a programmed transition switch is provided). ATS shall have a manual override and a disconnect plug, if applicable. ATS shall include main shaft auxiliary contacts for Normal and Emergency positions that shall be connected to SCADA. Automatic and Inhibit Transfer switch shall be provided. Include pilot lights to indicate normal or emergency switch position as well as normal and emergency source availability. ATS shall include test switch and auto-exercise capabilities with load/no-load selector switch.

13) Enclosure: Stainless steel NEMA 4X with enclosure heater and drip shield. All switches, lights and other controls for the transfer switch shall be mounted internal to the enclosure–either on an inner door or an inner "standout." No controls shall be mounted through the outside of the enclosure.

M. If no permanent generator is provided, an auxiliary receptacle and manual transfer switch shall be provided suitable for connecting to the County's portable generator. The transfer switch shall be 3-pole, 240 VAC, double-throw (center position off) stainless steel, externally-mounted. The transfer switch shall be Square D Class 3140 or equal. The receptacle shall be Crouse Hinds AREA 204227-S22.

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7.0 SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

A. All pump stations shall be supplied with Supervisory Control and Data Acquisition (SCADA) equipment. The SCADA equipment shall include all materials and software; and all necessary installation, programming, and testing procedures shall be performed by the Contractor or by the County at the Contractor's expense (as determined by the County). SCADA equipment shall conform to the specifications set forth in the following sections.

7.1 SCADA Equipment

A. The SCADA equipment shall be supplied by Westerman Companies. Configuration of the SCADA RTU equipment shall consist of: one (1) CT-4000 Front End Processor, one (1) CA-1511 RS-232 Modem Card, one (1) I/O-4240 Analog Input Card, one (1) I/O-4481 Digital Input Card, two (2) I/O-4480 Status Inpurt/Output Card, sixteen (16) Crydom Relays, one (1) Metricom Spread Spectrum Radio, model 20043, one (1) fabricated back panel, one (1) Maxrad Omni Antenna, one (1) Polyphaser, one (1) Power Sonic 10 AH Battery, one (1) Wattlow enclosure strip heater, one (1) #150-15 Power Supply for the RTU, one (1) NEMA 4X enclosure, which provides for deletion of the enclosure normally supplied by Motorola with this equipment. The RTU shall be equipped with all input/output (I/O) modules needed to monitor and/or control all functions outlined in Sections 7.4 and 7.5 below. The radio shall be programmed as necessary to integrate with the County's existing systems.

B. The RTU shall be housed in the main control enclosure (see Section 5.1), or in a separate NEMA 4X enclosure immediately adjacent to the main control enclosure.

C. The SCADA equipment can be obtained from Westerman Companies, 245 North Broad Street, Bremen, Ohio 43107, (740) 569-4143.

7.2 Electrical

A. All wiring, conduits, and grounding shall adhere to the provisions and specifications in Section 5.11, Wire and Cable; Section 5.12, Raceways and Conduit; and Section 5.13, Grounding.

B. Lightning protection must be provided on all DC signal loops connected to the RTU or instrumentation from a location outside of the main control enclosure. Surge arresters shall be CITEL or equivalent

7.3 Antenna

A. A computer path study and an actual path study at the site shall be performed by Westerman Companies, 245 North Broad Street, Bremen, OH. 43107, (740) 569-4143 (or other licensed company approved by the County) to determine antenna type and placement. A formal report

with all documentation and data obtained from the study shall be provided to the County. The path study shall also include an evaluation of whether there are any voice transmissions that will interfere with the SCADA system, and whether the SCADA system will interfere with any other voice transmissions, including emergency personnel or departments.

B. The antenna shall be a MFB Series with a based matched half wave antenna encapsulated in a heavy duty fiberglass radome with a thick wall aluminum mounting base for reliable long term use and a fiberglass end cap. Rated wind loading shall be for 125 mph. Antenna shall be a Maxrad Model MFB-9157 (omni-directional) or equal, as recommended by the path study and approved by the County. Location and height of the antenna shall be such that 99% communications rate with the Fairfield County Operations Center shall be guaranteed year round with a 15-year design goal.

C. Mounting shall be as determined by the path study. Wood utility poles used for antenna mounting shall be Class #5 up to 30' long and Class #4 for 30' to 70' long. Installation of poles must be plumb and straight. All mounting brackets shall be aluminum, stainless steel, or galvanized steel. Shop drawings for all antenna and antenna cable assembly hardware shall be submitted and approved.

D. Connection from the antenna to the RTU shall be through the use of Andrews coaxial cable type LDF4-50A. Cable connectors shall be Andrews coaxial connectors type L44AW.

E. Installation of the cable shall conform to all manufacturer's specifications.

F. The coaxial cable shall be properly grounded by the use of an Andrews 204989-1 grounding kit (or appropriate size). Surge suppression which is rated for exterior weather conditions shall be provided at the RTU end of the coaxial cable. A Polyphaser bulkhead type lightning surge protector shall be provided for the antenna installation and shall be mounted on the outside wall of the main enclosure. This lightning surge protection shall include coaxial impulse suppressors combined with AC line protectors.

G. All heliax connections, grounding, and lightning protection shall conform to Westerman installation prints. See below for Metricoms recommended lengths for heliax

Andrew Cable	RF Attention @ 100 feet	Maximum Suggested Length	Minimum Bend Radius	Cable Outside Diameter
LDF4-50A	2.2	136'	5"	.63"
LDF4-50A	1.2	243'	10"	1.09"

7.4 I/O Requirements

A. All input/output points on a standard two-pump wastewater pump station are presented in the list below. All inputs and outputs at the pumping station shall conform to this listing. Pump stations having more than two pumps will have a slightly different input/output arrangement as directed by the County.

I/O-4481 Digital Input Card
(16 Dry Contact Inputs)*

No.	Name	Description	Status[1]	
1	Site entry	Limit switches on exterior doors	0 = alarm	1 = secure
2	Operator switch	Switch on subpanel door	0 = depart	1 = entry
3	Tamper switch	Limit switch on SCADA subpanel door	0 = secure	1 = alarm
4	Spare			
5	P1 status	Auxiliary contact from motor starter	0 = off	1 = on
6	P1 hand	Auxiliary contact on HOA switch	0 = off	1 = hand
7	P1 auto	Auxiliary contact on HOA switch	0 = off	1 = auto
8	P1 fail	Contacts from SSAC overcurrent relays	0 = normal	1= fail
9	P2 status	Auxiliary contact from motor starter	0 = off	1 = on
10	P2 hand	Auxiliary contact on HOA switch	0 = off	1 = hand
11	P2 auto	Auxiliary contact on HOA switch	0 = off	1 = auto
12	P2 fail	Contacts from SSAC overcurrent relays	0 = normal	1 = fail
13	Site Power	3-phase voltage monitor	0 = normal	1 = alarm
14	Generator Status[2]	Auxiliary contact from generator	0 = off	1 = on
15	High wet well	High level alarm float	0 = normal	1 = alarm
16	ATS Status[2]	Auxiliary contacts from transfer switch	0 = CG&E	1 = generator

Notes:
- All inputs will be provided by the control panel manufacturer and must be dry contacts.
- Auxiliary contacts on the HOA switches will be provided by the control panel manufacturer for the hand/auto signals.

I/O-4480 Modular Digital Input/Output Card
(8 digital inputs/outputs)

1	P1 start/stop	0 = stop	1 = start
2	P2 start/stop	0 = stop	1 = start
3	Communication fail[3]	0 = OK	1 = Comm Fail
4	High wet well[3]	0 = OK	1 = High wet well
5	Spare		
6	Spare		
7	P1 fails[3]	0 = OK	1 = Pump 1 Fail
8	P2 fails[3]	0 = OK	1 = Pump 2 Fail
9	Pumps on float	0 = OFF	1 = Enabled

10	Pumps on float	0 = OFF	1 = Enabled
11-16	Spare		

I/O-4240 Analog Input Card
(4 analog inputs, 1 accumulator/status input)

1	Station flow	4-20 mA dc input from flow meter	Range 0 - xxx gpm
2	Wetwell level	(if wetwell sensor is provided)	
3	Pump 1 speed	(if this is a VFD station)	
4	Pump 2 speed	(if this is a VFD station)	

1. High Speed Accumulator (flow totalization, if flow meter is provided)

Notes: [1]Digital input: 0 = open contact, 1 = closed contact
[2]If applicable to site configuration [3]For local pilot lamp only

B. I/O requirements to be provided by the control panel manufacturer.

1) Digital input signals will be dry contact.

2) Analog input signals will be 4-20mA.

3) Digital output signals can be 12 Volts DC or 120 Volts AC, specified by the control panel manufacturer.

4) Float signals will be provided by the control panel manufacturer.

5) Auxiliary contacts on the HOA switches will be provided by the control panel manufacturer for the hand/auto signals.

6) If the station is a VFD station, the control panel manufacturer will provide a 4-20mA signal representing the speed of the pumps (pump #1 speed, pump #2 speed, etc).

7) If a flow meter is specified, the control panel manufacturer will provide a 4-20mA signal for flow and a pulse output representing totalized flow.

8) Control panel manufacturer is to provide for all analog inputs to the SCADA supplier.

7.5 I/O Equipment

A. All input devices shall be identical to existing equipment previously installed on existing SCADA systems within the Fairfield County water and wastewater systems.

B. Voltage and current sensors shall be as specified in Section 5.9, Over-Current Relays, and 5.10, Voltage Monitors. If used, relays shall comply with Section 5.5, Control Relays; otherwise, auxiliary contacts shall be compatible with their host equipment (motor starters).

C. Intelligent Remote Terminal Units (RTUs) shall meet the following specifications.

1) Westerman CT - 4000 Microprocessor

   a. Environmental
   Ambient temp. (operational) -20 to 80 dg. C
   Ambient Humidity 0-95% R.H. (Non-condensing)

   b. Power Requirements
   Voltage: 10 to 15 VDC
   Power: 0.6 Watts

   c. Field Wiring Requirements
   Type: Screw type clamping, unpluggable
   Wire range: #30 to #12 A WG

   d. Memory Capacity
   ROM: 128K bytes EPROM.
   RAM: 128K bytes static RAM.
   EEPROM: 128K bytes flash-memory.

   e. Serial Ports
   EIA: One port selectable, RS-232 or RS-485.
   I/O for small area network: 100K bytes with two connectors.
   Additional: Plug-in card receptacle for choice of communications interface.

   f. Watchdog Timer
   Time interval: Resets processor if not addressed in 1.6 seconds.

2) Remote terminal units (RTUs) at the remote sites shall be specified for operation over a temperature range of -20 to +80 dg. C. This operating range shall be achievable while operating in a non-ventilated enclosure and without the use of mechanical cooling devices or heaters.

3) RTUs shall be easily removed for repair or replacement. Terminal shall be of the plug in type, with detachment and reattachment possible without the use of tools. Insulation displacement type connections (including ribbon cable) shall be prohibited.

4) The system to be installed shall have capabilities for automatic control, which can be expanded to a fully distributed control system. Remote Terminal Units (RTUs) shall have future capabilities for control at each individual site.

D. Input/Output boards shall meet the following specificifications.

1) Westerman I/0-4240 Analog Input Board

   a. Environmental
   Ambient temp. (operational) -20 to 80 dg C
   Ambient Humidity 0-95% R.H. (Non-condensing)

   b. Power Requirements
   Voltage: 6 to 15 VDC
   Power: 0.25 watts at 12V

c. Field Wiring Requirements
Type: Screw type clamping, unpluggable
Wire range: #30 to #12 A WG

d. Accumulators/Status Input
Type: Opto-isolated
Voltage to turn on: Six volts max
Current to turn on: one mA max. (at six volt)
Surge protection: 600 volt, 1.2/50 uS (ANSI/IEEE C62.1)

e. Communication Port
Type: 100 kbits/s Small Area Network (SAN)
Connector: Modular RJ11 Type, two (2) supplied

f. Voltage Booster
Purpose: Power Current loops from 12 V power supply input
Voltage output, low range selected: 18V +IV-OV
Voltage output, high range selected: 24V+IV-OV
Maximum current: 80 mA

g. Analog Inputs
Number External: Four (4)

1. Voltage Range 0 to 25 VDC
2. Current Range 0 to 20 mA
3. Resolution: 12 bits (0-65535 counts)
4. Accuracy (% of full scale, voltage input): 001%
5. Accuracy (supplied 125-0HM processor resistor): 005%
6. Power line rejection: 30 dB at 50 Hz
7. Surge Protection: 6000V, 12/50 uS (ANSI/IEEE C621)

Number Internal: Two (2)

1. Use Power supply (battery input, voltage booster output)
2. Resolution: 12 bits
3. Accuracy: 1%

2) Westerman I/0-4480 Input/Output Board

a. Environmental
Ambient temperature (operational) -20 to 80 dg C
Ambient Humidity 0-95% R.H. (Non-condensing)

b. Power Requirements
Voltage: 6 to 15 VDC
Power: 0.25 watts at 12 volts

c. Field Wiring Requirements
Type: Screw type clamping, unpluggable
Wiring range: #30 to #12 A WG

d. Watchdog Timer
Function: Turns off outputs if communication is lost

e. Communication Port
Type: 100 kbits/s Small Area Network (SAN)
Connector: Modular RJ11 Type, two (2) supplied

f. Inputs/Outputs
Number: Eight (8)
Configuration: Any mixture of Inputs/Outputs
Module: Standard IAC/IDC, OAC/ODC, or high density or conformal coated
Other Options: Dry contact relays available

3) Westerman I/O-4481 Status Input Board

a. Environmental
Ambient tempertaure (operational) -20 to 80 dg C
Ambient Humidity 0-95% R.H. (Non-condensing)

b. Power Supply Requirements
Voltage: 7 to 15 VDC
Power: 0.25 watts at 12 volts

c. Field Wiring Requirements
Type: Screw type clamping, unpluggable
Wiring range: #30 to #12 A WG

d. Communication Port
Type: 100 kbits/s Small Area Network (SAN)
Connector: Modular RJ11 Type, two (2) supplied

e. Status Inputs
Number: Sixteen (16)
For dry contacts switched to ground with LED indicators Status Input Power
1. Voltage: 10 to 30 VDC, Fused Isolated from Main Power
2. Current: 3-10 mA per Input

E. Communications Modem shall meet the following specifications.

1) Westerman CA-1511 Modem

a. Environmental
Ambient tempertaure (operational) -20 to 80 dg C
Ambient Humidity 0-95% R.H. (Non-condensing)

b. Power Supply Requirements
Voltage: 5 V dc
Tolerance: 10%
Power (maximum): 100m W

c. Field Wiring Requirements
Type: Screw type clamping
Wiring range: #30 to #14 AWG

d. Serial Interface
Number: One (1)
Type: EIA RS-232C

e. Baud Rate
Jumper Selectable: 150 to 9600 Baud

F. Radios shall meet the following specifications.

1) Spread Spectrum Radio

a. General

Frequency range	902-928 MHz
Channels	162
Channel spacing	160 kHz
Data throughput rate	19.2 kbps
Spreading technique	Frequency hopping
Hopping technique	Pseudo-random, asynchronous

b. Receiver

Type	Double conversion superheterodyne
Dynamic range	-100 to 0 dBm
Packet error rate @ - 100 dBm	1x10(-1)
Frequency stability	+/- 5 ppm

c. Transmitter

RF Output min (antenna conn.)	+28.5 dBm
RF Ouput max (antenna conn.)	+30.0 dBm (max. IW transit)
Out of band spurious radiation	FCC 15.205
Deviation	+/- 37.5 kHz
Modulation bandwidth	160 kHz
Modulation type	GFSK
Output impedance	50 Ohms
Frequency stability	+/- 5ppm

d. Processing

CPU	SHI-RISC
Clock speed	16 MHz
DRAM Memory	2 Mbytes
Flash ROM memory	512 Kbytes

e. Environmental

Operating temperature range	-40 to +60 dg. C
Storage temperature range	-40 to +85 dg. C
Operating vibration	FCC Part 68D, paragraph 302
Operating shock	Mil. Std. 802 modified
Humidity	Mil. Std. 202F modified

f. EMI & Power/Control Susceptibility

Electromagnetic radiation	FCC Class B, CFR 47 Part 15
Electromagnetic susceptibility	ANSI C37.90.2 modified
Surge withstand capabilitiy	ANSI C37.90.1
Electrostatic discharge	IEC 801.2

g. Data Port

Serial interface	RS 232, AT command interface
Data rate	1200 bps to 19.2 kbps asynchronous
Parity	Odd, even, or none
Data bits	7 or 8
Stop bits	1 or 2
Transmission protocol	Half Duplex

h. Power

Voltage	12.0 VDC (10.7 -24.0 VDC range)
Rx Input current @ 12 VDC	300 mA
Tx Input current @ 12 VDC	800 mA
Fuse	Internal thern 1 al (resettable)
Reverse polarity protection	Yes

i. Agency Approvals - FCC Certified Part 15.247

j. Mechanical

Power connection	2-pin, Amp Mate-N-Lock (or equal)
Data port connection	DB-9, female, DCE
Antenna connection	N-Type, female
Status indicator	LED
Case	Sheet metal
Weight	2 lbs. (approx.)
Size	6" wide x 8" dp. x 2" high (approx.)

k. Manufacturer

1. Metricom Spread Spectrum Data Radio Wangate Integrated Utilinet Series II, Model 20043. Manufactured by Schlumberger.

7.6 Programming and Testing

A. Programming of the local RTU, the County's central SCADA system, and other related equipment, as well as all testing procedures (OATs & FATs) shall be performed by the Contractor or by the County at the Contractor's expense (as determined by the County on a case-by-case basis). In the event that the County performs the programming, the Contractor shall ship the CPU module and any associated equipment necessary to the County's subcontractor (Westerman, Bremen, Ohio) for programming. Regardless of who performs the programming and testing, the Contractor shall resolve any equipment or wiring deficiencies discovered during the testing.

8.0 FLOW METERING

A. All permanent pump stations, as well as other pump stations specifically identified by the County, shall be provided with a flow metering device for monitoring the discharge from each station. Station discharge piping shall be configured with a straight run of pipe with no valves, tees or reducers upstream of the flow meter equal in length to at least ten pipe diameters and downstream of the flow meter equal in length to at least six pipe diameters--or as otherwise recommended by the flow meter manufacturer, to provide an acceptable flow pattern through the flowmeter.

B. All flow meters shall be calibrated at the factory prior to shipment to the site. The contractor shall be responsible for the complete installation.

C. All new pump station flow meters shall be magnetic flow meters and shall include the transmitter, the remote-mounted flow tube, and the vendor-supplied shielded cable between the two elements.

8.1 Magnetic Flow Meter Flow Element

A. The flow element of the magnetic flow meter shall conform to the following specifications.

B. Pulsed DC electromagnetic induction-type, providing a signal which is linear in relation to the liquid flow rate. **NOTE: AC-type meters may be required if conductivity is below 5 microsiemens/ centimeter**.

C. Functional/performance specifications shall be as follows:

1) Power requirements shall be matched to the flow transmitter/ converter.

2) Accuracy shall be ±1 percent of rate (including the transmitter/converter).

3) The flow meter shall be suitable for operations in process liquid temperatures up to 70E C and an ambient temperature of 65E F.

4) RFI protection shall be provided.

5) The flow meter shall be capable of operations under pressures of 240 psi, if 150-pound flanges are used, and 700 psi, if 300-pound flanges are used.

6) The flow meter shall be capable of running under no-flow conditions without damage to any component.

D. Physical specifications shall be as follows:

1) The metering tube of the flow meter shall be carbon steel, unless otherwise indicated.

2) Flow meter flanges shall be ANSI 150-pound carbon steel, unless otherwise indicated.

3) The liner shall be polyurethane, teflon or fusion-bonded epoxy, unless otherwise approved by Fairfield County Utilities.

4) Electrodes shall be 316 stainless steel, bullet-nosed or elliptical self-cleaning type, unless otherwise indicated.

5) Flow meters shall be housed in below-grade vaults and shall be designed to withstand accidental submergence in 30 feet of water for 24 hours. Where hazardous areas are indicated on the Contract Drawings, flow meters shall be rated for conditions in those areas.

6) All external surfaces of the flow meters shall be painted with a chemical- and corrosion-resistant epoxy finish.

E. Accessories/options required:

1) All flow meters shall be factory-calibrated. A copy of the calibration report shall be included in the operations and maintenance manual.

2) Flow meters shall be grounded according to manufacturer's recommendation. All accessories, such as a ground ring, ground wires, gaskets, etc., shall be provided as required or as otherwise specified. All materials shall be suitable for the liquid being measured.

F. Flow meters shall be a Foxboro 8000 Series, Fischer and Porter, or Rosemount magnetic flow meter.

8.2 Magnetic Flow Meter Transmitter/Converter

A. The flow transmitter/converter shall be supplied by the manufacturer of the flow element.

B. Functional/performance specifications shall be as follows:

1) Power requirements shall be 120 volt AC, ±10 percent.

2) Accuracy shall be as defined for the flow element.

3) The operating temperature range shall be -25E C to 65E C

4) The output shall be isolated 4-20 ma. DC into 0 to 1000 ohms

C. The flow meter transmitter/converter shall be mounted in the main control panel.

D. Accessories/options required:

1) A signal cable shall be provided between the flow element and the signal converter.

2) A local indicator shall be provided with an engineering scale to indicate actual flow rate and total flow.

3) A second flow rate indicator and non-resettable totalizer shall be provided on the enclosure RTU subpanel if the transmitter is not located in the enclosure. This unit shall be a Newport P6000 ratemeter/totalizer.

8.3 Chart Recorder

A. A circular paper chart recorder shall be provided for each pump station that has a flow meter. Recorder shall have a rotation time (recording time per chart) of at least 7 days.

B. Chart recorder shall be Eurotherm Chessel Model 392, Foxboro 740, or Fisher Porter.

C. Chart recorder shall have 2-channels and pens and shall include a totalizer display for both channels.

D. A one year supply of pens and single-sided charts weekly shall be provided.

8.4 Flow Meter Manhole

A The magnetic flow meter shall be installed in a five foot (5') diameter manhole with slab top and a 30"x30" (minimum) aluminum access hatch meeting the requirements of Section 3.5.

B. The flow meter manhole shall be supplied with an embedded socket at the access hatch to support a Halliday Products Model D2B36B portable stainless steel winch-type hoist.

C. The flow meter manhole shall be watertight (except for the aluminum access hatch) and shall not be fitted with any drainage system.

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9.0 PERIMETER FENCE

A. The pump station area shall be enclosed with industrial-grade chain link fence. This fence shall be 9-gauge chain link, with 3-inch end posts and 2-inch line posts. A 1-5/8" top rail shall be placed on the fence. The end posts, line posts, and top rail shall be structural galvanized steel with a rating of SS40. The fence shall be six feet high and shall be topped with three strands of barbed wire facing outward. The fence fabric shall be kept approximately 3-4 inches off the ground to allow trimming but prevent access under the fence. If required by the County or local zoning codes, a decorative vinyl fence may be required in lieu of chainlink fence.

B. Access through the perimeter fence shall be by means of a lockable sliding gate with a working length of 16 feet. In the event that the site layout makes a sliding gate impractical, dual-leaf swinging gates (8' each) may be acceptable. Either gate shall be constructed with SS40 structural galvanized steel for the outside frame (2.5" for sliding gate or 2" for dual-leaf swinging gates) and SS40 structural galvanized steel 1-5/8" filler supports. The frame shall be covered in 9-gauge chain link. The gate shall be capable of being padlocked to prevent unauthorized access to the station.

C. A personnel access swing gate (minimum 3 feet wide) shall also be installed in the fence in addition to the sliding gate. This gate shall be located on the perimeter fence as appropriate for convenient access to the station. This personnel access gate shall be capable of being padlocked to prevent unauthorized access to the station. The gate shall be constructed of SS40 structural galvanized steel tubing and 9-gauge chain link. The frame shall be 2" tubing with 1-5/8" filler support.

D. The perimeter fence shall be constructed no closer than fifteen feet from the wet well, valve pit, or any building, or four feet from the generator pad, control panel pad, or SCADA pole. Gate placement shall be such that there is adequate truck access to the wet well, valve chamber, and generator, or, if a portable generator is used, to a plug and transfer switch. There shall be sufficient room within the fence to permit later installation of a generator (if one is not initially installed) while still meeting the above requirements.

E. The Contractor shall post the following sign on the sliding gate: 14" x 20" "DANGER: HIGH VOLTAGE" (EMED Co., Inc. Sign No. PD102859 or equal). The sign shall be according to State and Federal OSHA requirements. The sign shall be heavy gauge 0.063" aluminum with rounded corners and 1/4" I.D. corner eyelets for mounting. The sign shall be attached with aluminum or stainless steel fasteners. Paint or ink shall be weather-resistant, and the face of the sign shall be covered with a clear mylar topcoat.

9.1 Chain Link Fence Specifications

A. The Contractor shall provide all labor, materials, tools, and equipment required to furnish and install in good workmanlike manner the chain link fence and gates complete as shown on the plans and as specified herein.

B. GENERAL

1) Layout. Unless directed otherwise by the County, the fence shall be erected in close conformance with lines, grades, and locations shown.

2) Hot Dip Zinc Coating (Galvanizing) After fabrication, all steel fence parts shall be coated with a minimum of 1.2 ounces of zinc per square foot of surface area. The coating shall be applied by the hot dip process. Provide manufacturer's certification as to process and thickness of coating.

3) Shapes All post, rails, and gate frames noted herein are **nominal** size, Schedule 40 steel pipe; however, "H" shapes may be substituted with the approval of the County.

C. APPROVAL DRAWING Shop drawings for all work in this section shall be presented to the Engineer for approval and shall indicate size, gauge, weight and finish of all materials, method of anchorage, gate details, hardware, and a plan layout. Fabrication and erection shall be in accordance with the approved shop drawings.

D. MATERIAL

1) Fabric Fence fabric shall be 2 inch mesh of a 9 gauge medium carbon steel wire. Fabric shall be woven as one piece to the heights shown on the plans. Fabrics 6 feet high and over shall have the selvage edges twisted and barbed. Fabrics 5 feet and under shall be over knuckled at the top and twisted and barbed at the bottom.

2) Top Rail Top rail shall be 1-5/8 inch at 2.49 pounds per foot of length.

3) Bottom Rail or Tension Wire

a. Bottom Rail Bottom rail shall be 1-¼ inch at 2.27 pounds per foot.

b. Tension Wire Tension wire shall be 0.177 inch diameter, high carbon steel coil spring wire.

4) Line post Line post shall be 2 inch diameter at 3.65 pounds per foot.

5) Terminal and Straining Posts Terminal and straining posts shall be 3 inch diameter at 7.58 pounds per foot.

6) Gate Posts Gate posts shall be sized to meet the following:

a. 2-½ inch at 5.79 pounds per foot for gate leaves up to 6 feet wide

b. 3-½ inch at 9.11 pounds per foot for gate leaves from 6 to 13 feet wide

c. 6 inch at 18.97 pounds per foot for gate leaves from 13 to 18 feet wide

d. 8 inch at 24.70 pounds per foot for gate leaves over 18 feet wide

7) Post Brace Post brace shall be 1-5/8 inch diameter at 2.49 pounds per foot.

8) Truss Rod Truss rods shall be ½ inch diameter steel rod complete with turnbuckle.

9) Gates The gates shall be of the same height and fabric as the fence to which the gate is installed. Gate frame shall be fabricated from 2 inch diameter galvanized steel pipe at 3.65 pounds per foot (for gate leaves up to 11 feet wide) or 2-½ inch diameter pipe at 5.79 pounds per foot (for gate leaves from 11 to 18 feet wide). Gates shall be adequately braced for the size or sizes shown with all corners electrically welded. Sliding gates shall slide fully open one way with stops at both ends to prevent derailment. Swinging gates shall be capable of opening 180 degrees in at least one direction.

10) Barbed Wire Fence posts shall be fitted with adjustable barbed wire arms for carrying three strands of barbed wire at a 45 degree angle. Barbed wire shall be four point pattern consisting of two strands of 12.5 gauge steel wire with heavy steel barbs spaced not greater than 5 inches on center.

11) Hardware Fence shall come complete with all necessary hardware; such as, tension bars, tension bands, brace bands, end clamps, gate post caps, nuts, and bolts. Gate hardware shall consist of bottom corner pivot hinge, upper hinge, latch fork with lock keeper and guide, fork catch, stop and hold open, and plunger bar and "mushroom" catch (for double leaf units).

12) Concrete Concrete for setting posts in the ground shall be at least Class B.

E. INSTALLATION

1) Clearing and Grading The Contractor shall perform such clearing, grubbing and grading as may be necessary to construct the fence to the required alignment and shall provide a reasonably smooth ground profile at the fence line.

2) Posts

a. Ground Installation Post placed in the ground shall be set vertically in concrete not less than 32 inches below finished grade. Concrete encasement shall be a minimum of 36 inches below finished grade with 6 inches around the post and a 1 inch crown.

b. Concrete Installation Posts placed in concrete slabs, walls, or floors shall be set vertically in preformed holes, not less than 8 inches deep with the inside diameter 1 inch greater than the outside diameter of the post. Fill the annular space with non-shrink grout.

c. Spacing Lines posts shall be spaced at not more than 10 foot centers, except when fence is utilized as railing, then post spacing shall meet all local, state, and OSHA codes.

3) Fabric The fabric shall not be erected until after 5 days from the time of setting posts in concrete. The fabric shall be fastened to the line posts with clips or bands spaced at approximately 14 inches apart, and to the top and bottom rails with bands or tie wires at approximately 24 inch intervals. The fabric shall be fastened to terminal posts using a tension bar with tension bands spaced 12 inches apart. Fabric shall be rigid and taut.

4) Horizontal Deflection Special treatment will not be required at deflection points where the fence changes alignment by 5 degrees or less. At points of deflection where the fence changes alignment by more than 5 degrees, a post brace and truss rod shall be provided in each fence panel adjacent to the post located at the angle point.

5) Post Braces A post brace and truss rod shall support each gate, straining, and terminal post. The brace shall extend from the line post back to the gate, straining, or terminal post.

6) Bottom Rail or Tension Wire When a bottom rail is not shown or noted on the plans, the bottom of the fabric shall be reinforced by a galvanized spring steel wire stretched through the fabric and tied to the posts with the fabric.

7) Barbed Wire Three strands of barbed wire shall be pulled and anchored to the arms. Alternate location of barbs in each strand so that barbs will be spaced not greater than 2½ inches on center in alternate layers.

10.0 FINAL GRADING AND FINISH WORK

A. Initial backfill for the pump station structure shall be non-compacting, washed pea gravel or washed limestone, extending to five feet above the bottom of the wet well. From that point to a point eight to ten inches below final grade, backfill shall consist of compacted fill dirt excavated from the station site, unless otherwise directed by Fairfield County Utilities. No rock or unstable backfill will be accepted. The Contractor shall ensure that compaction is sufficient to prevent any subsidence. All ground shall be stable, and Contractor is responsible for repairing all subsidence and associated damage for 18 month from acceptance of the pump station by the County.

B. Any access driveway longer than 120 feet should be constructed with a turnaround at the pump station allowing a minimum 50 foot turning radius for a truck 8 ft. - 6 in. wide with an overall length of 30 feet.

C. Access driveways and turnarounds shall be asphalt on a granular base. Aggregate base for asphalt drives shall consist of one 6-inch course of Item 304 of the State of Ohio Department of Transportation (ODOT) Construction Materials and Specifications. The surface shall consist of one 1½-inch (minimum) course of asphalt concrete meeting the requirements of ODOT Item 404 and one 1½-inch (minimum) course of asphalt concrete meeting the requirements of ODOT item 402.

D. A concrete parking area may be required. This area shall be located inside the perimeter fence if site considerations allow; otherwise, it shall be located outside the perimeter fence as near as possible to the sliding gate. This area shall be a minimum of 8" of 4,500 psi concrete with steel mesh reinforcing. A reinforced concrete slab (minimum 4" thick) shall be poured under the control panel. This slab shall have at least four times the horizontal surface area of the control panel to help prevent settlement. A minimum 4"-thick gravel base of ODOT Item 304 shall be provided under all concrete.

E. Six inches (6") of AASHTO M 43 Size No. 57 crushed stone shall be provided around the wet well, valve chamber, generator pad, etc., over all non-paved areas within the perimeter fence. A solid layer of black visquine plastic (minimum 6 mil thickness) shall be placed under the crushed stone to prevent vegetative growth. The County may require asphalt paving around the wet well, valve chamber, generator pad, etc. within the perimeter fence, in accordance with Part C above.

F. Pavement subgrades shall be compacted in accordance with Section 3.4, Part D of these specifications.

G. Finish grading shall provide positive drainage away from the wet well and valve pit top slabs and control panel. The tops of all structures should be either designed for H-20 loading or raised 6- to 12-inches above surrounding grade to prevent vehicles from driving onto them.

H. All unpaved areas around the pump station shall be finish-graded and planted with grass seed, to meet ODOT Item 659 requirements. Bushes and trees shall be planted in accordance with the surrounding landscaping and anticipated land use. In general, the site shall be left in an aesthetically pleasing manner.

I. If public water supply is available to the site (generally within 500 feet of the site), all pump stations shall be supplied with a 1" frostless hose bib/yard hydrant–Murdock M-75 Compression Hydrant or equal for 4 feet bury. Water service piping shall be Phillips Driscopipe Polyethylene SDR-9 and shall be sized for a maximum pressure drop of twenty-five pounds per square inch from the water main to the pump station with the hydrant full-open, with a minimum working pressure of 35 psi at the hydrant at all times. Backflow prevention shall be as mandated by OEPA and shall be located in an accessible vault inside the fence.

APPENDIX A: TEMPORARY PUMP STATIONS

In general, ALL pump stations shall be considered to be permanent unless a project exists on the Fairfield County Utilities Department's 5-year Capital Improvements Plan that would eliminate the pump station or the Developer has specific plans for eliminating the pump station within approximately 5 years. However, each pump station will be reviewed at the inception of design by the Fairfield County Utilities Department to determine whether the pump station will be considered "permanent" or "temporary" for design purposes.

The criteria to be considered by the County will include: 1) capacity of the pump station, 2) complexity of operation, 3) overflow impact upon customers, 4) overflow impact upon the environment, 5) location and ease of entry/exit for emergency equipment such as sludge trucks, etc., 6) proximity to the nearest gravity sewer and likelihood of a future sewer extension to eliminate the pump station, 7) proximity to existing and proposed residential development, and 8) other factors unique to a given pump station site.

If a pump station is to be "temporary" (as determined by the County), certain requirements may be modified or omitted at the discretion of the Director of the Fairfield County Utilities Department. An outline of what these modifications and omissions will generally be is provided below.

A. The County will not require the pump station to be sized for the total upstream watershed. Instead, the pump station shall be sized for all existing and planned development (including all preliminary plans) within the watershed, regardless of whether or not all such development is associated directly with the pump station. This means that the pump station shall have the capacity to both eliminate any existing upstream pump stations and serve development in the watershed being planned by others. Also, the requirement of one hour emergency storage at twice ultimate average flow will remain.

B. A permanent on-site generator and automatic transfer switch will not be required. Instead, a manual transfer switch and auxiliary receptacle shall be provided as described in Section 6.0, Paragraph M. There shall be sufficient room within the perimeter fence to park a portable generator or install an on-site generator at a later time (see Section 9.0, Paragraph D). Also, if the generator required to operate the pump station would be too large to pull on a trailer behind a pickup truck, a permanent on-site generator will be required.

C. The SCADA system described in Section 7.0 Supervisory Control and Data Acquisition (SCADA) is required. The installation shall be such that the SCADA System can be relocated to a permanent pump station in the future. Inputs to the SCADA shall be as follows:

    1) Pump fail for all pumps

    2) High water level

    3) Unauthorized access

    4) Power failure

    5) Generator run (if provided)

The Contractor will still be required to install: 1) an antenna pole at least 35 feet tall within the perimeter fence and 2) the necessary conduit(s) for the SCADA system, in such a manner that the County can relocate the SCADA system at a later time. Also, the stainless steel enclosure for the controls shall be designed to permit future relocation of the SCADA Remote Terminal Unit and associated components.

D. No magnetic flow meter and no flow metering vault will be required. The pump hour meters will be used to estimate flow rates.

The County will assess each "temporary" pump station individually, based on the criteria listed above, to determine the acceptability of each modification and omission. Therefore, it is possible that a "temporary" pump station may be required to meet some or all of the "permanent" standards.

All other requirements listed within the Wastewater Pump Station Specifications and Requirements shall apply universally to all pump stations, regardless of their status as "permanent" or "temporary."

APPENDIX B: REQUIRED SUBMITTALS

The Contractor shall submit at least five (5) copies of submittals for each of the following items. The County will keep three (3) copies of the submittal and all other copies will be returned to the Contractor with comments and/or approvals.

Wet well structure
Valve vault structure
Flow meter manhole
Shear gate manhole
Other manholes & covers (if applicable)
Aluminum hatches
Ladder(s) & safety post
Hoist (if applicable) and hoist sockets
Vent pipe & screen for wet well
Waterproofing (if applicable)
Gaskets/seals for pipe & conduit penetrations through concrete structures

PVC drain pipe & check valve
Gravity sewer pipe (if applicable)
Ductile iron pipe, fittings, flange adapter, mega-lugs, etc.
Polyethylene encasement (if applicable)
Pipe mounting brackets (for mounting to wet well walls)
Gate valves (or plug valves, if applicable)
Check valves
Shear/Sluice gate & handle
Surge relief valve (if applicable)
Air release valve(s), if applicable
Pipe supports (in valve vault)
Camlock fitting(s)
Pressure gauge, snubber, valves, piping, etc.
Misc. fasteners, anchors, & hardware
Epoxy paint for ductile iron piping

Pumps (incl. discharge bases, other misc. components, & spare parts)
Level Controllers/Tranducers
Float switches
Cable support bracket
Stainless steel cable grips
Guide rails
Upper & intermediate guide rail brackets
Chains and Grip-eye for lifting pumps
Influent grinder–incl. frame, hydraulic drive unit, grinder unit, etc. (if applicable)
Flow meter (primary & secondary devices, cables, grounding kit, etc.)
Chart recorder

Water service materials (piping, fittings, valves, meter pit, etc., as applicable)
Backflow preventer
Enclosure for backflow preventer
Frost-proof yard hydrant

Generator and automatic/manual transfer switch (incl. housing, battery charger, controller, etc.)
Enclosure for automatic/manual transfer switch

SCADA: Westerman RTU equipment
Metricom spread spectrum radio
Radio Path study
Antenna
Enclosure
Lightning surge protector, grounding kit, connectors, etc.
Battery
Coaxial Cable
Panel Heater
Power Supply
SCADA wiring diagram and I/O list

Electrical, Instrumentation & Control:

Interconnecting diagrams/wiring and control schematics for lift station and control panel
Panel layout (dimensioned) for all planes
Site electrical plan
Conduit routing/layout and wire-pulling schedules
Grounding scheme
Bill of materials

Conduit, wiring & connectors
Enclosure(s) & junction boxes, incl. all accessories
Panel supports (i.e. stainless steel strut, anchors, etc.)

Equipment: High pressure sodium yard light
Main disconnect, including S.S. enclosure (outside panel)
Control transformer, including S.S. enclosure (outside panel)
Power blocks & terminal blocks
Ground lugs
Lightning arrestor and surge capacitor
Main circuit breaker (inside panel)
Pump circuit breakers
Voltage monitor, including disconnect and fuses
Motor starters w/ electronic overloads
Over-current relays (& current transformers, if applicable)
Primary circuit breaker for control xfmr. (& secondary CB, if applicable)
Auxiliary circuit breakers
Handle assembly for main CB (& pump CB's, if applicable)
All fuses and fuse holders
Panel light(s)
Panel heater(s)

Duplex GFCI receptacle & cover plate
Alternator
Alternator selector switch
Time delay relays (if applicable)
HOA selector switches
Indicator lights (pump run, pump fail, SCADA output, hi-hi level, etc.)
Elapsed-time meters
Relays
Intrinsically-safe relays
24V transformer for MiniCAS (if applicable)
MiniCAS relay or equivalent relays
Reset push button for MiniCAS (if applicable)
Selector switches for panel light(s) & yard light
Selector switch & push button for high-high level alarm
Silence relay
Alarm light (& flasher, if applicable)
Alarm horn/siren/bell
Limit switches for security and tamper alarms
Operator selector switch
Engraved labels/tags
Other push-buttons & switches, as applicable
Other fuses, as applicable

Concrete slabs (incl. reinforcing) for generator, control panel, transformer, etc.
Chain link fence & gates
Signage
Ready mixed concrete
Asphalt material certifications
Granular materials & other fill
Seed mixes and landscaping materials
Testing reports (backfill compaction, leakage tests, etc.)

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