SPECIFICATIONS – VOLUME II

Gabordy Canal Stormwater Treatment Facility at 10th Street

Volusia County
FLORIDA

Electrical Engineering Specifications

Prepared For:

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SECTION 16050

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 Section Includes

Panels, conductors, raceways, conduit, boxes.

1.02 General Description of Work Included

A. Work included in this section consists of furnishing all labor, materials, equipment and transportation and performing all testing and demonstration operations of all system features required for electrical work in accordance with these specifications and drawings which includes, but is not limited to the following:

1. Complete electrical wiring of all electrical service and distribution systems, provide stand-by generator receptacle to power loads as shown on the drawings and herein specified.
2. Mounting and making all field connections to process instrument panels and other control panels.
3. Electrical permits, fees, tests, inspection and guarantees.
4. Connection of all electrical equipment, including complete ground system.
5. Submittal of shop drawings.
6. Coordination of work with the Owner.
7. Providing Record Drawings.

1.02 Proprietary Names

For convenience of description and as a standard for grade, type, quality, and performance characteristics, proprietary names are included with some descriptions. This does not imply preference to specific manufacturers (except where multiple choice is specified), but minimum requirements with approval to be made by the ENGINEER.

1.03 Quality Assurance

A. Standards: All materials shall be new and free of defects, and shall be U.L. listed, bear the U.L. label or be labeled or listed with an approved, nationally recognized Electrical Testing Agency.

B. Codes: Install in accordance with latest edition of the National Electric Code and the regulations of governing local, State, County and other applicable codes, including the Utilities Company. Pay for all required licenses, fees and inspections.

C. Contract Documents: The drawings are generally diagrammatic; therefore, the CONTRACTOR shall make use of all the data in all of the contract documents and shall verify all information at the site. During construction, the location of electrical

apparatus shall be coordinated with the OWNER. All questionable locations shall be approved by OWNER or his representative prior to installation.

D. Inspections: During the course of construction, the work will be observed by the ENGINEER. The CONTRACTOR shall call for inspections by the local building inspector during the normal phases of installation and, following each inspection phase, the ENGINEER shall be furnished with Certificates of Inspection from all authorities having jurisdiction. After the completion of the work, the CONTRACTOR shall deliver all certifications or letters of approval from such bodies to the ENGINEER. Following the successful completion of the final inspection, furnish the OWNER with a certificate of final approval.

E. Tests: The CONTRACTOR shall provide all necessary instruments and special apparatus to conduct any test that may be required to insure system performance and that control wiring and power cables are free of all improper grounds and short circuits. These tests shall be conducted in the presence of the OWNER'S representative prior to final acceptance.

F. After service, feeders, and mechanical equipment feeder wires or cables are in place, but before being connected to devices and equipment, the system shall be tested for shorts, opens, intentional and unintentional grounds by means of an approved type of constant "megger". All wires in conduit that are shorted or unintentionally grounded shall be replaced.

G. With the system energized, line-to-line voltage and line current measurements shall be made under full load conditions. Should measured values deviate ± 10 % from the nameplate rating, the condition shall be corrected. Notify the ENGINEER immediately should deviations occur.

H. The resistance between ground and absolute earth shall not exceed 5 ohms and shall be measured by the Electrical CONTRACTOR before equipment is placed in operation. Testing shall be performed on all ground rod installations. Testing shall be three (3) point method in accordance with IEEE recommended practice.

1.04 Submittals

A. Before submittal to the ENGINEER, all shop drawings shall be perused, corrected and verified by signature, or stamp and signature as approved by the applicable subcontractor to be in accordance with the requirements of the drawings and specification. Shop drawings that have not been signed or stamped and signed as approved, but have not been perused for compliance with the drawings and specifications and have not been coordinated with other equipment and other trades, will be returned to the CONTRACTOR without being reviewed by the ENGINEER. All component manufacturers' names shall be clearly visible on each submittal sheet. Dimensions, material lists, wiring diagrams, capacities, catalog numbers/cuts and other such pertinent data shall be submitted for approval of all NEMA 4X boxes and the following equipment: disconnect switch, including circuit breakers, safety switches and controls; and all wiring and control devices. Approval of material will be based on the manufacturer's published ratings or on

test results where specified. All data shall be submitted in a single package. No partial list will be reviewed.

B. If any required items are omitted from this submittal, the ENGINEER shall select each such item indicating manufacturer, model, etc., and such decision shall be final. The term "Per Specifications" will not be acceptable. Samples shall be required as requested by the ENGINEER to further substantiate any substitutions.

C. Any deviation from the specifications pertinent to shop drawings shall be listed separately and submitted with shop drawings. Failure to list all deviations in this manner shall be grounds for requiring removal of such items and installation of new items in exact accordance with specifications at no extra cost to the OWNER. No material shall be purchased or installed before written approval by the Owner of any submission.

D. In addition to the shop drawings, which must be submitted for approval before ordering equipment, the CONTRACTOR shall furnish four copies of complete installation drawings, instruction books, maintenance manuals, and parts lists for each major item of electrical equipment, and similar data on minor items of equipment if requested by the ENGINEER. This information must be submitted before the installation of the equipment.

1.05 Permits, Fees, Inspection Certificates and Tests

A. All required permits, fees and inspection certificates shall be obtained, paid for, and be made available by the CONTRACTOR during the progress of the work.

B. Perform or secure such tests as may be required, supplying all labor and instruments needed, or paying such costs as may be involved.

C. All tests required to establish the adequacy and quality of all systems shall be made in the presence of and to the satisfaction of the ENGINEER.

D. All concealed work must remain uncovered until approved. All tests shall be made in strict accordance to code requirements. Defects disclosed by tests shall be made good and the defective materials replaced without additional cost to the OWNER. Tests shall be repeated after repairs or replacements have been made.

1.06 Record Drawings

A. During the progress of the work, the job superintendent shall daily record on his complete field set of electrical drawings the exact location as installed of all underground and otherwise concealed conduits which were not installed exactly as shown on the contract drawings.

B. This work must be kept up-to-date and verified by the ENGINEER'S field representative before the payment is made. The complete marked set shall be delivered to the OWNER before the final acceptance of the work.

1.07 Guarantee

A. All equipment materials and workmanship shall be guaranteed to conform with the specifications and accepted alternates. Parts, defective or not in accordance with the specifications or accepted alternates, shall be replaced in the system and tested free of cost to the OWNER.

B. In the event that a repetition of any one material defect occurs, indicating the probability of repeated failures which can be traced to faulty manufacture, manufacturer's design of material or item, or CONTRACTOR'S method of installation, the CONTRACTOR shall not continue to replace with the same material, part or method, but shall take steps to remedy the fault through replacement of all such defective material or revise completely the method of installation.

C. Manufacturer's guarantees, which extend beyond the guarantee period specified, shall be transferred to the OWNER before request for final payment.

D. All equipment, accessories and connections shall be guaranteed to operate without undue heating, noise or voltage drop; and the CONTRACTOR shall correct or adjust any items, should such conditions be found to exist after system has been put into operation. Whether or not a condition or noise is objectionable shall be decided by the ENGINEER.

E. Certification must be provided stating that all materials and equipment used on the project are new.

1.08 Supervision And Workmanship

A. All work shall be performed under the immediate direction of fully qualified foremen. Insofar as possible and unless approved by the ENGINEER, there shall be no change in supervision during the course of construction.

B. It is the intent and of the essence of the specifications that all personnel shall cooperate with all other personnel at all times to insure the furnishing of highest quality workmanship.

PART 2 - PRODUCTS

2.01 General

All electrical materials and equipment shall be new, of recent manufacture, shall bear the manufacturer's name, date of manufacture, trade mark and be approved by the Underwriters' Laboratories, Inc., except as otherwise specified herein. Material or equipment damaged in the course of installation or test shall be replaced or repaired in a manner meeting with the approval of the ENGINEER. All equipment shall be complete and in operating condition unless otherwise specified herein. Fusible equipment shall be equipped with fuses, and six (6) spare fuses of each type shall be supplied. Equipment and materials shall be delivered to the site and stored in original containers, suitably

sheltered from the elements, but readily accessible for inspection. Spare parts shall be properly packaged and labeled for easy identification without opening the package.

2.02 Raceways and Fittings

A. All conduit used in the construction of the electric system shall be SCH 40 PVC below grade rigid aluminum conduit above grade. The conduit shall be properly clamped and protected from physical damage.

B. All above grade electrical conduit shall be Rigid Aluminum, below grade electrical conduit shall be Schedule 40 PVC.

2.03 Conductors

A. All power conductors shall be copper Type THWN PVC insulation, nylon jacket, 600 volts insulation, or approved equal. No. 10 and smaller may be single strand. No. 8 through No. 2 shall be 19 strand and No. 1 through 4/0 shall be 37 strand. 250 MCM through 500 MCM shall be 37 strand.

B. Connectors and lugs shall be Burndy series YA, YS YSV, applied with Burndy recommended tools. Taps in gutters shall be Burndy KSU, tin plated. All connectors shall be insulated with PVC tape and made watertight. Scotchlock insulated spring type connectors shall be used for fixture connections.

C. Pull compound, if used, shall conform to the recommendations of the wire manufacturer.

2.04 Nameplates

The following items shall be equipped with nameplates: All safety switches, motors and control panels. Special electrical systems shall be identified at junction and pull boxes, and equipment and cable racks. Nameplates shall adequately describe the function of the particular equipment involved. Nameplates for panel shall include the panel designation, voltage and phase of the supply. For example, "Pump Control Panel, 480V, 3-phase, 3-wire". The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters and for that machine branch circuit breakers. Nameplates shall be laminated phenolic plastic, black front and back with white core, with lettering etched through the outer covering. White engraved letters on black background. Attach with plated self-tapping screws or brass bolts.

2.05 Boxes

A. All outlet and switch boxes and fittings used throughout the job shall be cast aluminum. Boxes shall be minimum size as required by the National Electric Code and large enough to permit a satisfactory installation of the required conductors. Extra large boxes shall be used in accordance with the NEC where necessary to prevent undue crowding of wires. Cast type gang boxes shall be used for gang switches and to provide additional conductor space.

B. All NEMA 4X boxes shall be water tight and shall be a minimum 16 gage Type 316 stainless steel, as manufactured by Hoffman or approved equal. The door shall be hinged on one side with a continuous stainless steel hinge and stainless steel draw latches provided on three sides of the door (a minimum of two latches per side). The door shall include a seamless foam-in-place gasket. The door shall also include a hasp and staple for padlocking. Upon request by the Owner, the Contractor shall prove the proposed box is water tight prior to installation. Boxes that are found to be non water tight will be rejected and shall be replaced at no additional cost to the Owner.

2.06 Ground Rods

Ground rods shall be a copper clad steel rod 5/8 inch diameter by 20 feet long, approved for that use.

2.07 Lightning Arrestors

Secondary lightning protection shall be provided on each phase on the line side of main service as shown on the Drawings.

2.08 Electric Service Support Channels

All electric service support channels shall be manufactured by a reputable firm having experience in rating and construction of such equipment. All support channels, hereinafter called strut, shall be cold worked roll formed A.I.S.I. Type 316 stainless steel or extruded 6063-T6 Aluminum. The minimum allowable stainless steel strut shall be 1-5/8" x 1-5/8", 12 gauge thickness. The stainless strut shall have no holes drilled larger than 5/8" and no closer than 1-1/2" in spacing. No holes shall be drilled or enlarged in pre-punched strut. All attachments to the stainless struts shall be made with the appropriate clamping devices, made of Type 316 stainless steel. The minimum allowable aluminum strut shall be 1-5/8: x 2-3/8". Attachments to aluminum strut shall be made with appropriate clamping devices made of 5052-H32 alloy. All loading of strut materials shall have a 15 percent load safety factor.

2.09 Gas Tight Seals

Crouse-Hinds Type EYSR, cast aluminum.

PART 3 - EXECUTION

3.01 General

A. All work shall be executed in a neat and workmanlike manner by experienced and capable electricians so as to present a neat installation upon completion. Electrical work shall be coordinated so as not to interfere with other construction operations. All work shall be laid out and installed in advance of pouring concrete floors or walls.

B. The CONTRACTOR shall perform or be responsible for all necessary cutting,

sleeving, excavating and backfilling and compacting for the installation of the equipment and the patching thereafter. Metal conduits installed underground or in concrete slabs shall be coated with two coats of asphalt paints.

C. The CONTRACTOR shall furnish and install all inserts, and hangers required to support conduit, cables, pull boxes, etc. The CONTRACTOR shall furnish and install all sleeves or openings through floors or walls required for passage of all conduits or ducts installed. Sleeves shall be of 18 gauge galvanized sheet steel rigidly supported and suitably packed to prevent ingress of wet concrete. If sleeves, hangers, inserts, etc., are improperly installed, all necessary cutting and patching to rectify such error shall be performed at no additional cost to the Owner.

D. The CONTRACTOR shall permanently and effectively ground service neutral and all raceways, devices, and utilization equipment in accordance with requirements of National Electrical code, and as shown or required. All grounding electrodes shall have rigid clamp jaws.

E. The CONTRACTOR shall install control devices furnished by equipment manufacturers with their equipment and complete the wiring in accordance with manufacturer's recommendations and approved wiring diagrams.

3.02 Feeders and Branch Circuitry

Sizing of main feeders and branch feeders is fully delineated on the drawings. The CONTRACTOR shall provide all feeders in accordance with the indications of the drawings and shall connect them for correct phase sequence and the proper operation of the equipment they serve.

3.03 Conductors

Conductors pulled in raceways shall be greased to reduce strains on the conductor and on the insulation. Conductors that are nicked or scarred during installation shall be removed. The raceways will be cleaned and freed from any burrs or abrasions and new conductors installed. Conductors shall be laced and trained in all panelboards, control panels and terminal cabinets. Color coding of conductors is mandatory. The phase conductors of all feeder circuits and the control conductors of all control circuits shall be grouped as such, laced and identified where installed in the pull boxes.

3.04 Grounding

A. In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated or bare copper system grounding conductor in accordance with specific rules of Article 250 of the NEC. Bonding conductor through the raceway system shall be continuous from main panel grounding bar to branch circuit equipment and devices.

B. Grounding conductors shall be so installed as to permit shortest and most direct path from equipment to ground, be installed in metal conduit with both conductor and conduit bonded at each end, have connections accessible for inspection and

made with approved solderless connectors brazed (or bolted) to the equipment or structure to be grounded, in NO case be a current carrying conductor, have green jacket unless it is bare copper, be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods.

C. All contact surfaces shall be thoroughly cleaned before connections are made to insure good metal to metal contact.

D. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets and shall be manufactured by Anderson, Buchanan, Thomas and Betts Co., or Burndy.

E. All exterior grade mounted equipment shall have their enclosures grounded directly to a separate driven ground at the equipment.

F. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors run with feeders shall be bare only.

G. Ground wire shall not run across the top of any concrete pads or walkways.

3.05 Raceways

A. General: Conduits shall be installed to insure against the collection of trapped condensation, and all runs shall be arranged so as to be devoid of all traps wherever possible. Precautions shall be taken to prevent the lodging of dirt, plaster or trash in conduit, tubing, fittings and boxes during the course of construction. A run that has been or becomes clogged shall be entirely cleared or replaced. All metallic conduit installed in concrete or below grade shall be painted with two coats of black asphalt paint. Where conduits leave or enter a slab, a flush coupling shall be installed.

B. Size: Minimum size for all conduit is 3/4 inch.

C. Rigid Aluminum Conduit: Rigid conduit shall be securely fastened to all enclosures, care being taken to see that the full number of threads project into the hub. All conduits in contact with concrete shall be coated.

D. Flexible Conduit: All equipment and motors, where indicated, shall be connected with vapor tight flexible metallic conduit of the size required for the conductors to the equipment. Bonding shall be in accordance with local codes.

3.06 Devices

Devices shall be set plumb with the footing or floor and at locations indicated. Where devices must be moved because of conflict, approval of the ENGINEER shall be obtained

prior to relocation.

3.07 Electrical Work Required for the Installation of Equipment

The CONTRACTOR shall provide all conduit, conductors, boxes, safety switches, and all necessary hardware required for the installation of equipment.

END OF SECTION

SECTION 16900

CONTROL PANEL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish, install and test one (1) UL certified control panel and SCADA system as hereinafter specified and as shown on the electrical drawings.

2. The control panels to be furnished under this section are as follows:

a. Storm Water Pump Station: 277/480 volts, 3 phase, 4 wire

1.02 QUALITY ASSURANCE

A. Standards:

1. National Electric Code (NEC).

2. Underwriters Laboratories UL 508A (UL-508).

B. Equipment Manufacturers:

1. Sanders Company SciText Plus, 321-229-7643

1.03 SUBMITTALS

A. Each control panel shall be individually submitted as hereafter required.

B. Submit detailed drawings concerning each control panel and all components including:

1. Cabinet assembly and layout drawings to scale.

2. Fabrication specifications with materials of construction of all components.

3. Point-to-point wiring diagrams depicting wiring within the panel and connection to external devices. Freehand drawings are unacceptable.

4. Catalog cut-sheet on all panel components with manufacturer's complete model number.

C. The data sheet and drawings shall be provided with an index and proper identification and cross-referencing. Each control panel shall be submitted in its entirety.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. After completion of shop assembly, factory test, and approval, all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust and moisture. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at job site.

B. Special instructions for proper field handling, storage and installation required by MANUFACTURER for proper protection, shall be securely attached to each piece of equipment prior to packaging and shipment.

C. Each component shall be tagged to identify its location, tag number, and function in the system. Identification shall be prominently displayed on the outside of the package.

D. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the ENGINEER. This shall be at the cost and expense of the CONTRACTOR, or the apparatus shall be replaced by the CONTRACTOR at his own expense.

1.05 WARRANTY AND GUARANTEES

A. The equipment manufacturer shall warrant the units being supplied to the Owner against defects in workmanship and materials for a period of one (1) year from the date of equipment start-up and acceptance. In the event that the equipment fails to perform as specified, the equipment manufacturer shall promptly repair or replace the defective equipment without any cost to the Owner.

PART 2 - PRODUCTS

2.01 AUTOMATION

A. Control Panels

1. General: Control panels shall be supplied for each station; containing all the electrical and mechanical equipment necessary to provide for the operation of designated number of electric submersible pumps. The panel as an assembly shall be UL rated at a minimum of SCCR of 22 KAIC. The panel shall be wall-mounted type and provide, low level cut off, high-level alarm and intermediate operating levels. The Owner utilizes a combination lift station pump control panel and SCADA RTU to monitor lift station. All combination panels shall contain a SCADA PLC and display. The Panel shall be complete, and Factory tested with floats, and programming/startup.

2. Operation Requirements:

   a. The control panel shall consist of a main and emergency circuit breaker and a motor circuit protector and magnetic starter for each pump motor, and 15-ampere, 120-volt circuit breakers as required. A high level alarm and pump shutoff shall be accomplished by a float type liquid level control system with all control components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control system shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle.

   b. Liquid level switch: Furnish and install seven (7) float switches which shall be tilt switches: SPDT, 4.5 amps, 120 VAC, encapsulated in a weighted float covered with chemical resistant polypropylene. Float shall be suspended on a cable that shall be connected directly to the control panel. Sufficient length of cable shall be provided to allow field adjustment of actuation level.

   c. Construction and Materials: The control panel shall be NEMA 3R 304 stainless steel dead front construction with welded double locking hasps and dead front aluminum inner door, and oriented as shown on the Drawings. The control panel shall include thirty percent (30%) extra mounting space for additional equipment. The enclosure shall allow a minimum 8 inches (8") of clear space above the main circuit breakers and 10 inches (10") below the motor starters for making wire terminations. The control panel enclosure shall have a minimum 6 inches (6") of clear space along each side with bracing to allow strapping of the incoming power feeder from the electric service. The control panel enclosure shall be Underwriters Laboratories (US) 50 Type 3R listed.

d. Panel Exterior:

(1) Panel shall have stainless steel heavy-duty pad locking door handle and three point latch. Mounted on the exterior enclosure shall be an alarm light and a high water level audible alarm with silencer pushbutton.

(2) All exterior mounted accessories shall be constructed of corrosion proof materials such as stainless steel or aluminum.

(3) Control wiring from the wet well shall enter the panel in a manner to prevent the possible entry of gases from the wet well.

e. Panel Inner Door:

(1) The inner aluminum door mounted on a continuous hinge, two pivot handles shall be furnished for protection against exposed wiring and shall have cutouts for access to all of the circuit breakers. The inner door shall include a restraining mechanism to fix the inner door in the open position. Mounted on the inner door will be pump run lights, high level alarm, run and level indication lights, hand-off automatic switches, elapsed time meters for each pump, a 20 ampere ground fault duplex receptacle, motor overload resets and alarm reset.

(2) A 10" x 12" pocket for log sheet storage. The nameplate shall contain the voltage, phase, rated horsepower, speed, date of manufacture, pump and panel manufacturer's name, address, and telephone number, pump data, including impeller data, operating point and head, KW input, amps at the operating point and at least two (2) other points on the pump curve.

(3) All enclosures shall be 304 stainless steel enclosures complete with the required removable white enameled inner panel and drip edge. Enclosures shall include a single, gasketed front door, full height hinges, locking hasp and 3-point door clamping hardware. All enclosures shall be wall mounted, properly sized for the application and UL listed. All major components and sub-assembles shall be identified as to function with laminated, engraved, bakelite nameplates, or similar approved means. All enclosures shall

include the correctly sized corrosion inhibitor device required to protect the interior panel components

f. Control Circuits: All wet well (level sensor) circuits shall operate at 24 volts AC and be made intrinsically safe. The control circuit breaker shall operate on 115 volts.

g. Panel Components: The following power, control and alarm components shall be:

(1) Main, Emergency and Branch Circuit Breakers: All circuit breakers shall be heavy-duty industrial service molded case breakers with amperage rating as required. All circuit breakers shall have an appropriate locking device to meet OSHA lockout and tag-out rules. Both main and emergency breakers shall be equal in size. Circuit breakers shall be thermo-magnetic as manufactured by Square D.

(2) An emergency power receptacle shall be installed on the side of the control panel and connected to the line side of the generator breaker. The receptacle shall be the JRS series as manufactured by Russellstoll. The panel manufacturer shall coordinate with the Owner to ensure the receptacle will properly mate with the Owner's generator plug.

(3) An eight-pin, plug-in solid-state alternator shall be provided to change the pump starting sequence on each pumping cycle. The alternation operation shall be wired to permit the manual selection of the lead, lag-pumping order. The plug base shall be keyed to allow for proper pin alignment.

(4) The control relays shall operate from a 24-volt circuit. The relays shall be enclosed, eight-pin and/or eleven-pin plug-in type. The control relays shall contain test button and neon or LED energized indicator. The plug base shall be keyed to allow for proper pin alignment. Control relay sockets shall be octal-style with clamp on screw terminals. These sockets shall be mounted on DIN railing and 600 VAC rating. All relay sockets shall be keyed to allow for proper pin alignment. The control panel shall include an adjustable time delay relay to prevent both pumps from starting simultaneously. Relays shall be AA Electric Company, Series AAE, or equal.

(5) Duplex Service Receptacle: A duplex service receptacle supplying 20 amps at 115 volts shall be provided on the panel door. The duplex receptacle shall be provided with ground fault protection.

(6) Lightning Arrestor and Surge Capacitor: A lightning arrestor and surge capacitor shall be installed and wired to protect motors and control equipment from lightning induced line surges and transient voltage surges.

(7) Elapsed Time Meters: Elapsed time meters shall be 115-volt non-reset types and shall indicate pump running time in hours and tenths of hours to 99999.9 hours.

(8) Motor Starters:

(a) Across the Line: An open frame, across-the-line, NEMA rated, magnetic motor-starter, as manufactured by Square-D, shall be furnished for each pump motor. All motor starters shall be equipped to provide under-voltage release and individual overload protection on all three phases. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position. Overload reset push-buttons shall be located on the exterior of the inner compartment door.

(b) Each pump motor shall be protected by a 3-pole motor circuit protector. The motor circuit protector shall be operated by a toggle-type handle and contain a quick-make, quick-break, over center switching mechanism mechanically trip-free from the handle so contacts cannot be held closed against a short circuit and abnormal currents causing the motor circuit protector to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal "ON" and "OFF" positions. All latch surfaces shall be ground and polished. All poles shall be constructed to open, close, and trip simultaneously. The motor circuit protector shall be completely enclosed in a high-strength glass polyester molded case. Ampere ratings shall be clear and visible.

Contacts shall be non-welding silver alloy. A manual push to trip button shall be provided for manual exercising of the trip mechanism. Each pole of these motor circuit protectors shall provide instantaneous short circuit protection by means of an adjustable magnetic-only element.

(9) Phase Monitor: A 3-phase monitor shall be installed and wired to disconnect control power from the motor starters in the event of loss of power, phase reversal, loss of any phase or phase balance, or low voltage. The phase monitor shall automatically reset upon removal of any and all of the preceding conditions.

(10) Indicator Lights: Indicator lamps shall be mounted in NEMA 4X, as manufactured by Square D, or equal. Lamp modules shall use LED lamps and be equipped to operate at 120-volt input. Lamps shall be easily replaceable from the front of the control compartment door without removing lamp module from its mounted position.

(a) Pump Run Lights: A 120-volt pump run light shall be connected in parallel with each motor starter and indicate when a particular pump is running.

(11) Control System: The control system shall consist of 24-volt transformer; plug-in relays; solid state automatic alternator with test switch; plug-in three phase monitor (as required); and terminal strip for the installation of level regulators. All control wiring shall be color coded (minimum 18 colors) size 18, rated for 600 volts, 80 C stranded tinned copper, PVC insulated, and shall be installed in wiring duct with cover.

(a) Programmable Logic Controller

1) The PLC will be provided with configurable I/O to allow monitoring and control of the pump station. Interface to the PLC will be by 2 line display and keypad. Sample screens will be provided for approval. Text messaging will be the primary means of communication

2) The PLC shall contain ten (10) 24Vac input signals received from devices such as pushbuttons, selector switches, pressure switches, temperature switches, or limit switches and converts them into voltage logic levels that can be processed by the controller. Six (6), relay outputs switched, 120Vac output signals that can drive loads up to 1 amp such as relays, starters, and solenoid valves. Two (2) analog inputs shall accept 4-20mA DC signals. Input shall be set for Unipolar with Offset and Extended Resolution mode to detect loss of signal or low input indication. Resolution shall be 11 bit plus sign with a 10 ms conversion time.

3) Operation of the PLC processor shall be continuously monitored, and in the event the controller should stop functioning, or the branch circuit breaker is opened, an alarm from the Scitext will be generated. If the level rises to the backup floats the pumps shall run as required

(b) PLC Ladder Logic Software

1) The System Integrator shall configure PLC to perform and warrant proper system operation as described in this document.

2) Control (Command) points shall be programmed such that control can be performed from HAND field devices (such as a selector switch) or from REMOTE by operator interface or MMI SCADA system, as described in contract. In some applications this will require that OR logic is in the program. The control description shall include how the MMI software should handle the commands.

3) Modification to the existing Sanders Company SciText Plus SCADA system Master RTU (PLC) and additions to include all Remote Telemetry Unit (RTU) panel information as transmitted via Text messaging.

4) The integrated cellular text modem system supplied shall comply with all applicable FCC requirements

(12) A seal leak relay shall be furnished for each pump to sense a seal leakage condition. The control manufacture shall coordinate the relay furnished with the pump manufacture to insure compatibility. A door mounted pilot light and seal leakage sensor shall be provided to indicate a pump seal failure alarm condition of each sewage pump

(13) LEVEL CONTROL: control shall be based upon float activation as indicated on drawings.

(14) The independent alarm/control panel equipment shall be designed to UL508 Industrial Control Panel standards and shall incorporate 120 VAC input power transient protection, a fused primary and a DC power supply with limited 12 VDC to power the level sensing float circuits and dedicated redundant (backup) level control circuit.

(15) The front face of the RTU control panel shall be accessible through an operator's swing out door and shall incorporate the previously specified red indicator lights and push buttons.

(16) The following outlines the level function indicator lights and push buttons required for the redundant (backup) Lift Station wet well level controls:
a. High Level Float and Test
b. Low Level Float and Test

(17) An Operator energized panel mounted Test pushbutton shall be included with each of

the float indicator lights for the purpose of testing the indicator lights and redundant (back up) control circuits.

(18) An alternator relay shall be included for the purpose of alternating Lift Station Pumps 1 and 2 in conjunction with the redundant (backup) float switch operation.

(19) The redundant (backup) level control shall operate in conjunction with the required direct-acting float switches. The backup float switch system shall be mounted in the Lift Station wet well at the elevations required to ensure lift station pump control when the primary level controls fail for any reason (i.e. primary level transmitter fails, primary level controller fails, primary level relay fails, etc.) The Float system shall be 24Vac.

(20) The float switch shall be mounted in the Lift Station wet well pit in accordance with the manufacturer's instructions or as shown on the plans.

(21) The High Level float shall energize a high level relay and indicator light providing the Operator a level alarm status. This High Level status shall also energize the panel mounted Local Alarm System horn, strobe alarm light and shall record this alarm condition at the Microprocessor Controller/Telemetry Unit (MCT). The Operator must acknowledge this alarm condition to silence the horn.

(22) The Pump OFF float shall energize the pump off relay stopping all Lead and Lag pumps in operation.

(23) Audible Alarm: The audible alarm shall consist of a weatherproof high intensity electronic horn mounted on the side of the enclosure. The audible alarm shall be equipped with a control panel mounted pushbutton silencer. The alarm circuit will automatically reset when the high liquid level condition is corrected and reset button pressed.

(24) Alarm Light: The alarm light shall consist of a weatherproof light with lexan globe.

(28) Alarm Control: An audible alarm shall sound and an alarm light shall flash. When alarm condition clears, light shall remain on until reset button is pressed.

(29) Alarms:

(a) High level alarm: Provide dry alarm contact to activate alarm for remote indication.

(30) Interface:

(a) The control panel shall be constructed to interface with the telemetry system. As a minimum provide the following signals:

1) Pump Run Status (Each pump)
2) Pump In Auto (Each pump)
3) Pump in Hand (Each pump)
4) Pump Fail (Each pump)
5) Power Fail
6) High Levels
7) Low Levels

3. Identification Markers

a. Provide identification nameplates for the following equipment:

1. Breakers, circuit, enclosed.
2. Contactors, magnetic, enclosed.
3. Panelboards, distribution.
4. Panels, control.
5. Receptacles
6. Relays, enclosed.
7. Starters, magnetic motor, enclosed.
8. Starters, manual motor, enclosed.
9. Stations, control.
10. Switches, toggle, ac, except standard lighting control type.
11. Switches, toggle, motor starting.

b. Identification Markers

1. All circuit breakers, control switches, indicator lights, relays, and other control devices shall be identified with permanently affixed legend plates and lamicoid-type engraved nameplates where applicable. A black and red on white label stating "DANGER<HIGH VOLTAGE<240 or 480 (use applicable) VOLTS" shall be affixed to the face of the inner door unit.

2. Install nameplates using stainless steel drive pins or machine screws. Dymo type labels and labels fastened with adhesive only will not be accepted.

3. Install conductor identification markers on conductors at terminations and in junction and pull boxes through which the conductors pass. Color code power conductors by insulation or tape and identifies by markers in junction and pull boxes to indicate the conductor's panel and circuit number. Identify control conductors by markers at all locations.

4. Mark junction and pull boxes with a suitable permanent marking to indicate the type(s) of circuits enclosed by the boxes.

5. Identification markers that are not preprinted, such as panelboard indexes, terminal block marking strips, and special cable markers, shall be typewritten or otherwise mechanically printed, not hand lettered.

B. Level Sensor Control System

1. Float Switches: The Contractor shall furnish and install float switches for the pump station as follows:

a. Float switches shall consist of a hermetically sealed switch in a stainless-steel body. Floats shall be supplied with two conductor fine-stranded No. 14 AWG cable with heavy-duty neoprene jacket.

b. The float switches shall be Consolidated Electric Model 9G or equal.

2. Submersible Level Transducer:

a. The liquid level at the Lift Station shall be sensed by maintenance free Loop Powered Submersible Level

Transducer system that uses reliable hydrostatic head pressure sensing principle to provide an accurate and reliable proportional 4-20 mA signal representing level/pressure.

b. The submersible level transducer system shall be an Birdcage by Blue Ribbon Inc.

C. Spare Parts

1. The manufacturer shall furnish the following parts for each panel supplied:

a. Phase Monitor
b. Alternator
c. Fuses of each size and type used
d. Bulbs of each size and type used

2. Spare parts shall be properly packaged and labeled for easy identification without opening the package and delivered at pump station start-up.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The control panel shall be mounted on a pipe rack as detailed on the drawings.

B. The control panel fabricator shall visit the site before submitting the shop drawing to determine the exact requirements for the control systems.

3.02 INSPECTION AND TESTING

A. The control panel manufacturer shall provide one (1) day start-up and testing services for each installed and completed installation. The services shall include all required adjustments of field and panel devices pertinent to the supplied control panel.

END OF SECTION