SECTION 16050

ELECTRICAL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required for a complete electrical system at the North Bay Wastewater Pump Station Improvements located in Miami-Dade County, Florida, as hereinafter specified and shown on the Drawings.

B. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Drawings shall include all items listed hereinafter and/or shown on the Drawings. Certain equipment which will require wiring thereto and/or complete installation is indicated. All materials necessary for the complete installation shall be furnished and installed by the CONTRACTOR to provide complete power, lighting, instrumentation, wiring and control systems as indicated on the Drawings and/or as specified herein.

C. The CONTRACTOR shall furnish and install the necessary cables, protective devices, conductors, supports, raceways, exterior electrical system, etc., to serve lighting loads and miscellaneous electrical loads as indicated on the Drawings and/or as specified. The CONTRACTOR shall install any control panel or instrumentation/control device provided under this or any other sections on the specifications.

D. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; sub-standard work will be rejected.

E. For process instrumentation, furnish and install all conduit, wire and interconnections between primary elements, local indicators and receivers.

F. Each bidder or his authorized representatives shall, before preparing his proposal, visit all areas of the existing sites and structures in which work under this Section

is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that he or his representative has visited the existing site and noted the locations and conditions under which the work will be performed and that he takes full responsibility for a complete knowledge of all factors governing his work.

G. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.

1.02 SERVICE AND METERING

A. Permanent electrical power will be provided by Florida Power & Light at the voltages indicated on the drawings.

B. The CONTRACTOR shall furnish and install the secondary conduit and wire from the service transformer to the FPL meter at each station. The CONTRACTOR shall confirm the distance from the FPL service transformer to the FPL meter.

C. The CONTRACTOR is responsible for the service installation and coordination associated with providing electrical service to each pump station site. The CONTRACTOR shall be responsible for all FPL charges. The FPL Contact is Isabella Arcos (786) 719-0535. Isabella.arcos@fpl.com. Provide a total FPL electrical service allowance of $30,000 for all FPL services as noted below for each station:

- $10,000 for Hispanola
- $10.000 for the Main Pump Station
- $10,000 for South Treasure

1.03 CODES, INSPECTION AND FEES

A. All material and installation shall be in accordance with the latest edition of the National Electrical Code and all applicable national, local and state codes, laws and ordinances.

B. Pay all fees required for permits and inspections.

1.04 TESTS

A. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct OWNER's personnel in the proper operation of the systems.

B. The following minimum tests and checks shall be made prior to the energizing of electrical equipment. Test shall be by the CONTRACTOR and a certified test report shall be submitted providing all test results and stating that the equipment meets and operates in accordance with the Manufacturer's and job specifications, and that equipment and installation conforms to all applicable Standards and Specifications:

1. Testing of protective relays for calibration and proper operation.

2. Test all service and motor conductor 600 volt wire insulation with a megohm meter after installation. Make tests at not less than 1000 volts. Submit a written test report of the results to the engineer.

3. Mechanical inspection of all circuit breakers to assure proper operation.

C. The Engineer shall be notified forty-eight (48) hours before tests are made to enable the Owner to have designated personnel present.

1.05 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating slabs, floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured. Include all conduits shown as future.

1.06 CUTTING AND PATCHING

A. All cutting and patching shall be done in a thoroughly workmanlike manner. Restore all areas where work is performed to like new condition.

1.07 INTERPRETATION OF DRAWINGS

A. The Drawings are not intended to show exact locations of conduit runs.

B. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.

C. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

D. Where circuits are shown as "home-runs," all necessary fittings and boxes shall be provided for a complete raceway installation.

E. The CONTRACTOR shall harmonize the work of the different trades so that interferences between conduits, piping, equipment, civil, and mechanical work will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc., required to accomplish this shall be furnished and installed by the CONTRACTOR without additional expense to the Owner. In case interference develops, the Owner's authorized representative is to decide which equipment, piping, etc., must be relocated, regardless of which was installed first.

F. Verify with the Engineer the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

G. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

H. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

I. Circuit layouts shown are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.

J. The ratings of motors and other electrically operated devices together with the size shown for their branch circuit conductors and conduits are approximate only

and are indicative of the probable power requirements insofar as they can be determined in advance of the purchase of equipment.

K. All connections to equipment shall be made as shown, specified and directed and in accordance with the approved shop drawings, regardless of the number of conductors shown on the Electrical Drawings.

1.08 SIZE OF EQUIPMENT

A. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

1.09 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of project Contract Drawings. When the project is complete, furnish a complete set of reproducible "As-built" drawings and electronic AutoCAD 2015 files for the Project Record Documents.

1.10 COMPONENT INTERCONNECTIONS

A. Component equipment furnished under this Specification will not be furnished as integrated systems.

B. Analyze all systems components and their shop drawings; identify all terminals and prepare drawings or wiring tables necessary for component interconnection.

C. Terminate all power cables per approved shop drawings. SYSTEM SUPPLIER to terminate all control cables per approved shop drawings.

1.11 SHOP DRAWINGS

A. As specified under other Sections, shop drawings shall be submitted for approval for all materials, equipment, apparatus, and other items as required by the Engineer.

B. Shop drawings, including manufacturer's name and product designation and catalog cutsheets, shall be submitted for the following equipment:

1. Macerator Control Panel
2. Pump Station Control Panel (PSCP)
3. Fused Disconnect
4. Meter Can
5. Electrical Equipment racks with Structural Engineering Certification
6. Surge protection devices
7. Boxes and Fittings
8. Wire & cable
9. Conduit
10. Conduit layout drawings
11. Ground Test Reports
12. Pumps, Pump motors and cables

C. Prior to submittal by the CONTRACTOR, all shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This statement shall also list all discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned.

D. The Engineer's check shall be only for conformance with the design concept of the project and compliance with the Specifications and Drawings. The responsibility of, or the necessity of, furnishing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings is included under the work of this Section.

E. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section.

F. No material shall be ordered or shop work started until the Engineer's approval of shop drawings has been given.

1.10 Conduit Layout Drawings

A. In addition to the manufacturer's equipment shop drawings, the Contractor shall submit for the approval, electrical installation working drawings for the overall site containing the following:

1. Concealed and buried conduit layouts shown on floor plans drawn at not less than 1/4-inch = 1-foot-0-inch scale. The layouts shall include locations of process equipment, control panels, transformers, panelboards and equipment, motors, switches, motor starters, large junction or pull boxes, instruments, and any other electrical devices connected to concealed or buried conduits.

2. Plans shall be drawn on high quality reproducible, bond paper, size 34-inch x 22-inch, and shall be presented in a neat, professional manner.

3. Concrete floors and/or walls containing concealed conduits shall not be poured until conduit layouts are approved.

4. Site plan conduit layout drawings shall be at 1" = 10'-0".

Note: ACAD drawing files are available from the Engineer.

1.11 Demolition

A. Remove all electrical work associated with equipment shown to be removed (TBR) except those portions indicated to remain or be reused. Remove all unused exposed conduit and wiring back to point of concealment. Remove unused wiring in concealed conduits back to source (or nearest point of usage). Electrical work to be removed corresponds to the associated mechanical equipment to be removed.

B. Where electrical systems pass through the demolition areas to serve other portions of the premises, they shall remain or shall be suitably relocated and the system restored to normal operation. Coordinate outages in systems with the Owner. Where duration of proposed outage cannot be allowed by the Owner, provide temporary connections as required to maintain service.

C. All removals and relocations of existing installations cannot be completely detailed on the Drawings. Survey the site before submitting bid proposal.

D. Continuous service is required on all circuits and outlets affected by these changes, except where the Owner will permit outage for a specific time. Obtain Owner's written consent before removing any circuit from continuous service.

E. Where required to disconnect and/or remove any part of an existing circuit, reconnect that circuit to reestablish service in the remaining portion.

F. Remove exposed conduits, wireways, outlet boxes, pull boxes and hangers made obsolete by the alternations, unless specifically designated to remain. Exposed conduits shall be removed back to point of concealment, where they shall be cut and threaded for a cap. A threaded cap shall then be installed. Conduits may be removed back to first coupling if within 3-inches of point of concealment. Cut back in traffic areas to the floor level and patch.

G. Repair all walls to “Like new” condition and paint to match existing wall color.

1.12 Disposition of Removed Materials and Equipment

A. In general, it is intended that all materials and equipment indicated to be removed and returned to the OWNER by the CONTRACTOR shall, upon removal, remain the OWNER’s property, unless otherwise directed by the OWNER.

B. In general, it is intended that all materials and equipment indicated to be removed and disposed of by the CONTRACTOR shall, upon removal, become the CONTRACTOR's property and shall be disposed of off the site by the CONTRACTOR, unless otherwise directed by the OWNER.

C. Reuse of wire will not be permitted. An exception is the reuse or relocation when wire is part of an existing lighting branch circuit and reuse or relocation is specifically designated and can be accomplished without removing and re-pulling the wire.

D. All reusable and salvageable disconnect switches, starters, control devices, control panels and instruments, receptacles, etc. shall be sorted and returned to the OWNER.

E. All electrical equipment to be salvaged shall be removed and shall be moved by the CONTRACTOR to a location on the site for storage as directed by the OWNER.

1.13 Warranty

A. Provide a warranty for all the electrical equipment in accordance with the requirements of other sections. Under no circumstances shall the warranty be for less than one year starting from substantial completion.

PART 2 PRODUCTS

2.01 GENERAL

A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or Manufacturer's specifications shall be submitted for approval as required by the Engineer.

B. Materials and equipment used shall be Underwriters Laboratories, Inc. listed and conform with applicable standards of NEMA and ANSI.

C. Electrical equipment shall, at all times during construction, be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired by the CONTRACTOR at his expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, at the cost and expense of the CONTRACTOR, or shall be replaced by the CONTRACTOR at his own expense.

D. All electrical panels, enclosures, raceways, conduits, wireways, boxes, cabinets, etc., shall be fabricated of metal. Nonmetallic substitutes are not acceptable. This does not apply to buried work.

2.02 RACEWAYS AND FITTINGS

A. All above ground power and control conduits shall be aluminum, unless otherwise noted below or on the electrical drawings.

B. All conduits between the wetwell and macerator starter panel and all conduits between the wetwell and PSCP shall be PVC coated GRS conduit.

1. All tools, (benders, threading machines, etc.) used with PVC coated conduit shall be designed and approved by the conduit manufacturer for use with

PVC coated conduit.

2. Tools shall not damage the PVC coating of the conduit. No patching of damaged PVC coated conduit will be permitted.

3. Any damaged conduit shall be removed and replaced without exception. Strap wrenches shall be used for tightening PVC coated conduits. Pipe wrenches, channel locks, chain wrenches, pliers, etc. shall not be used.

C. All other below grade conduits shall be schedule 80 PVC.

D. Conduit fitting material and coating shall match corresponding conduit specification.

E. Where metallic conduit is cut, the inside edge shall be reamed smooth to prevent injury to conductors.

2.03 CONDUCTORS

A. Wire for lighting and receptacle circuits above grade shall be type THWN-2.

B. Wire for all power motor circuits and below grade lighting and receptacle circuits shall be type XHHW-2, stranded.

C. Single conductor wire for control, indication and metering shall be type MTW No. 14 AWG, 19 stranded.

D. Multi-conductor control cable shall be No. 14 AWG, 19 strand.

E. Wire for process instrumentation or shielded control cable shall be No. 16 AWG, shielded and stranded.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION

A. Where conduits enter or leave all outlet boxes, cabinets safety switches, tap boxes, motor controllers, etc., other than those having threaded hubs, a standard lock nut shall be used on the outside of the box. Busings 1-inch and larger shall

be of an approved insulated type. Unless otherwise indicated, conduit 2-inches and larger shall be supported at intervals not exceeding six (6) feet and for smaller sizes at intervals not exceeding four (4) feet.

B. During construction, all installed raceways shall be temporarily plugged or otherwise protected from the entrance of moisture, dirt, trash, plaster, moisture, etc., through neglect of the CONTRACTOR to so protect them, shall be replaced by the CONTRACTOR without additional expense to the Owner. No kinked, clogged or deformed raceways will be permitted on the job. Raceways shall be cut to proper length so that ends will fit accurately in the outlets.

C. Size of raceway shall not be less than NEC requirements, but in no case shall be less than indicated on the Drawings. Combining of circuits, other than detailed, will not be permitted. The CONTRACTOR shall install larger size raceways than detailed where there is excessive length of unbroken run or excessive number of bends.

D. Bends in metallic raceways shall be made while "cold" and in no case shall the raceways be heated. Raceways shall not be bent through more than 90 degrees. The radius of bends shall not be less than six (6) times the internal diameter of the raceway. Not more than four (4) (equivalent 90 degree) bends will be permitted between outlets, the bends at the outlets being counted.

E. Raceways shall be properly aligned, grouped and supported. Exposed raceways shall be installed at the right angles to or parallel to the principal structural members. Concealed raceways, unless otherwise indicated, may take the most direct route between outlets. Raceways shall be firmly held in place. Raceways shall run to avoid trapping wherever possible. Where areas are indicated for future openings, foundations, etc., all raceways shall be run around such areas. The CONTRACTOR shall provide necessary inserts in poured concrete areas and shall furnish and install all necessary sleeves through walls, floors and roofs for passage of raceways. Sleeves through roofs and/or exterior walls shall be properly sealed by the CONTRACTOR against entrance of moisture, etc., into the building. Where necessary repairs to the building structure using material in no way inferior to that originally installed and using labor skilled in the trades involved.

F. Contractor shall provide 4” high concrete housekeeping pads around all conduits installed outdoors above grade.

3.02 BOXES

A. All boxes shall be 304 stainless steel. Install all outlet boxes, tap, junction or pull boxes, device boxes, etc., necessary for the complete installation as indicated on the Drawing and/or specified herein. All boxes shall be rigidly mounted and shall be equipped with suitable screw fastened covers. Where necessary for boxes to be supported away from the ceiling, structural steel members shall be provided for supports. All raceways entering boxes shall be mechanically and electrically secure. Open knockouts or holes in boxes shall be plugged with suitable blanking devices. Boxes shall be cleared of all plaster, dirt, trash, etc., before the installation of any wiring devices and/or before the installation of cover plates.

3.03 CONDUCTORS

A. Splices, taps and attachments of fittings and lugs shall be electrically and mechanically secure. Splices shall be compression type with heat shrink weatherproof boot. There shall be plenty of slack cable in boxes, outlets and cabinets to insure that there is no binding at the bushings. All lugs shall be of the correct sizes for the conductor in order to fit the conductor into a lug.

3.04 GROUNDING

A. The entire electrical system shall be completely and effectively grounded as required by the NEC and as specified hereinafter.

B. The CONTRACTOR shall test the ground resistance of the system by 3 point method fall of potential.

C. All metallic raceways shall be mechanically and electrically secure at all joints and at all boxes, cabinets, fittings and equipment. Metallic raceways entering the control panels or other electrical boxes shall be grounded to the appropriate ground bus. All metallic raceways shall be electrically continuous throughout the entire conduit system. Bond wires shall be used in exterior concrete pull boxes.

D. The ground plane shall consist of a minimum of three (3) - 5/8" x 20' copper ground rods spaced at a minimum distance of 10 feet apart. Rods and system ground shall be connected with a #2 bare copper ground to the service entrance

ground. The ground resistance shall be tested and additional rods or plates added to achieve a dry season resistance not exceeding 5 ohms.

3.05 CONDUCTOR COLOR CODING

A. All conductors shall be color coded as specified hereinafter. Color coding shall be by means of colored insulation material, colored braid or jacket over the insulation, or by means of suitable colored permanent, non-aging insulation tape equal to Scotch #471 or "Texcel 98" applied to conductors at each outlet, cabinet or junction point.

B. The following system of color coding shall be strictly adhered to:

1. Ground leads, green.

2. Grounded neutral leads, white.

3. Ungrounded phase wires of a wye connected 277/480-volt, 3-phase, 4-wire system shall be brown, purple, yellow and gray for the grounded conductor.

4. All control leads, other than line connected "hot" leads, shall be yellow, orange and brown and/or I.P.C.E.A. standard control cable coding provided method of identification is different from method used on power conductors.

C. The color coding assigned to each phase wire shall be consistently followed throughout the Work.

3.06 PAINTING

A. Painting shall be as specified in Division 9 and as shown on the Drawings except that all exposed raceways, fitting, boxes, supports, panelboards, etc., shall be prepared for painting by removing therefrom all oil, grease, dirt, etc. The CONTRACTOR shall employ the necessary precautionary methods to prevent painting over of obscuring any nameplate, designation, etc., on all electrical apparatus and devices.

B. The painting of motor controllers, pushbuttons, transformers, and similar electrical apparatus shall be limited to touching-up any surface scratched or

marred during shipment or erection. The materials used shall match exactly the surfaces being touched up.

3.07 SUPPORTS

A. The CONTRACTOR shall furnish and install all necessary supports for properly mounting all electrical equipment and raceways. Such supports shall be fabricated and installed in a neat manner, and care shall be taken so that no portion of the service rack structure is overloaded. Should the service rack structure sustain damage through carelessness or through failure of the CONTRACTOR to properly support and install the electrical equipment, the CONTRACTOR shall bear all costs involved in replacing such installation.

B. All steel shapes exposed to the weather shall be galvanized after all cutting, drilling, or welding is done. All shop connections shall be welded or riveted and all field connections shall be bolted on all outdoor structures. Where the field cutting or drilling of galvanized steel is necessary, the CONTRACTOR shall apply one (1) coat of priming paint and one (1) finish coat of aluminum and oil paint.

3.08 TESTS AND CHECKS

A. The following minimum tests and checks shall be made after the assembly of the motor control centers, but prior to the termination of any field wiring.

1. Megger terminals and buses after disconnecting devices sensitive to megger voltage.

2. A 1,000V DC megger shall be used for these tests.

3. The first test shall be made with main circuit breaker closed and all remaining breakers open. A second test shall be made with all circuit breakers closed.

4. The test results shall be recorded and forwarded to the Engineer for his review. Minimum megger readings shall be 100 megohms in both tests.

B. The following shall be done before energizing any control panel.

1. Remove all current transformer shunts after completing the secondary circuit.

2. Install overload relay heaters based on actual motor nameplate current. If capacitors are installed between starter and motor, use overload relay heaters based on measured motor current.

3. Check all mechanical interlocks for proper operation and vacuum clean all interior equipment.

END OF SECTION