SECTION 11175  PUMP STATION INTAKE DEBRIS REMOVAL SYSTEM

PART 1 - GENERAL

1.01 SCOPE:

A. Summary of Work: The CONTRACTOR shall furnish all labor, equipment and materials to provide and install a trash collection system for the intake of Pump Station G-251. Pump Station G-251 discharges runoff from the constructed wetland, Stormwater Treatment Area 1W (STA -1W), to the Water Conservation Area, WCA-1. The pump station consists of (3) reinforced concrete intake bays with a total of (6) drainage pumps, two pumps per bay. The work consists of removal and disposal of the existing trash rake and rack, modification of the intake entrance to flatten the rack inclination to 60 degrees, and the installation of a new scraper style rake, stainless steel rack, and belt conveyor for collection and removal of trash and vegetation debris from the intake channel flows. The system shall consist of three major components: (1) stainless steel trash racks, (2) scraper style trash rakes and (3) belt conveyor to transport the trash to a disposal pit. The racks and rakes shall be designed as a single assembly furnished by the rake manufacturer. The trash rake shall be a front cleaning, front return, scraper style rake. A total of (6) rack/rake assemblies shall be provided, (2) per intake bay. The units shall be easily removed and installed for maintenance and there shall be no submerged components of the rake that require maintenance. The collection system shall include all auxiliary equipment and accessories needed for a complete and functional system.

B. Related Work Specified Elsewhere:
   1. SECTION 09900 Protective Coatings
   2. SECTION 16150 Motors

1.02 REFERENCES:

A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this section and those of the listed document, the requirements of this section shall prevail.
   1. American Welding Society (AWS)
   3. National Electrical Manufacturer's Association (NEMA)
   4. Steel Structures Painting Council (SSPC)
   5. American Institute of Steel Construction (AISC)
   6. American National Standards Institute (ANSI)
   7. Conveyor Equipment Manufacturers Association (CEMA)
   8. National Fire Protection Association (NFPA)
   9. Anti-Friction Bearing Manufacturers Association (AFBMA)
   10. Florida Building Code (FBC)

1.03 SUBMITTALS: Submit as specified in SECTION 01300, and as indicated below:

A. PART 1 - GENERAL Submittals: The CONTRACTOR shall submit to the DISTRICT for approval prior to placing order for any proposed equipment the required information as indicated in the following specification paragraphs:
   1. Manufacturer's Qualifications and Experience, see Paragraph 1.04
2. Product Qualifications, see Paragraph 1.05
3. Manufacturer’s Certification of Compliance with Specifications and any variances from the specifications, see Paragraph 1.06
4. Installation and Erection Manual, see Paragraph 1.07
5. Operation and Maintenance Manual, see Paragraph 1.08
6. Warranty, see Paragraph 1.09

B. PART 2 - PRODUCTS Technical Data: The CONTRACTOR shall submit the following technical data for review and approval by the DISTRICT for the rake, rack and conveyor assemblies and associated appurtenances and systems prior to fabrication of any equipment. The data shall consist of:
1. Manufacturer's standard catalog information and data including manufacturer's capabilities for assembly to be supplied
2. Details of the manufacturer's required embeds and anchorage for the connection of the rack and rake to the station's service bridge and the seating of the rack on the intake sill.
3. Detailed fabrication drawings for the rake, rack and conveyor including assembly and installation notes, part numbers and key notes, and material specifications
4. Rake performance data including trash loading assumptions and raking speed
5. Rake wind load design certification, see Paragraph 2.02 D
6. Conveyor performance data including load assumptions, belt speed, and other conveyance requirements
7. Layout drawings, plans, elevations, and sections, to scale and with dimensions (US) for all equipment to be furnished
8. Bill of materials for all assemblies including the part numbers, key notes, and material and component specifications
9. Structural design calculations for the trash rack, see Paragraph 2.01
10. Electrical, control and instrumentation schematics and diagrams for the rake and conveyor including associated component specifications or performance data

C. PART 3 - EXECUTION Operating Test Report, see Paragraph 3.06

1.04 MANUFACTURER’S QUALIFICATIONS: The manufacturer of the raking equipment shall have the following minimum qualifications to be considered an acceptable manufacturer to provide, install, and service the equipment specified in this Contract:

A. Experience: The raking equipment manufacturer shall have experience within the last five (5) years (from the date of the submittal) in the design and manufacture of trash collection systems as specified herein. The manufacture shall have completed a minimum of (10) similar installations over the period all of which are currently in service as constructed. The manufacturer shall provide a minimum of five (5) references of projects that the manufacturer has provided trash collection systems of equal or larger size. These project references shall include the name and telephone number of the owner’s representative who has direct knowledge of the performance of the manufacturer. The reference must indicate an acceptable performance by the manufacturer to be considered by this Contract.

B. Technical Support: The manufacturer shall have an engineering service department to support the project design, perform the required tests, and provide field supervision of the installation.

C. Service: The manufacturer shall have a service department capable of providing immediate response (24 hour notice), to service calls. The manufacturer’s service department shall include skilled technicians and mechanics that can diagnose and repair the equipment supplied by this Contract.
1.05 **PRODUCT QUALIFICATION:** The rakes and conveyance equipment shall be from the product line that have been used in similar applications and backed with after-sales service from direct factory engineering representatives. Spare parts shall be readily available and be "off-the-shelf" from the manufacturer. To facilitate this components for the equipment provided shall not be custom fabricated specifically for this project and shall be standard components used as part of the specific equipment product line.

1.06 **MANUFACTURER’S CERTIFICATION:** The CONTRACTOR shall submit a letter to the DISTRICT from the raking equipment manufacturer and signed by an officer of the company, certifying that the manufacturer has read and studied the Contract Documents and agrees to conform and comply with all the requirements of this specification. All exceptions to the requirements of this specification including those addressed by compliance submittals shall be clearly stated in this certification letter.

1.07 **INSTALLATION AND ERECTION MANUAL:** The CONTRACTOR shall submit no later than at the time of delivery, the installation and erection manual describing procedures to be followed in erecting, assembling, installing, and testing the rake and conveyor equipment. The manual shall include such things as alignment procedures, bolt torque values, permissible clearances; permissible shaft misalignment; bearing clearances, etc.

1.08 **OPERATION AND MAINTENANCE MANUAL:** The CONTRACTOR shall submit the raking and conveyor equipment's operation and maintenance manual containing complete information on operation, lubrication, adjustment, routine and special maintenance, disassembly, repair, re-assembly, and trouble diagnosis of the rake and conveyor equipment and its auxiliary units. Include cross-sectional drawings showing the equipment with the complete list of parts.

1.09 **WARRANTY**

A. The raking equipment manufacturer shall warrant the EQUIPMENT, MATERIALS, and PRODUCTS of this specification against defective materials and workmanship with the manufacturer's standard warranty, but for no less than FIVE (5) years from the date of Substantial Completion, and as described in Article 13 of Section 00700 - General Terms and Conditions of this Contract. If the manufacturer standard warranty is less than the stipulated period, the manufacturer shall provide a special manufacturer's extended warranty for the stipulated period.

B. The CONTRACTOR shall warranty the WORK against defects for ONE (1) year from the date of Substantial Completion and as described in Article 13 of Section 00700 - General Terms and Conditions of this Contract.

1.10 **PRODUCT SUBSTITUTIONS:** The CONTRACTOR is specifically advised that all products provided shall be in strict conformance with the specification and that no exceptions to any of the stated requirements will be permitted. In general, no product substitutions will be approved unless the CONTRACTOR can substantiate complete conformance of the proposed product substitution with all requirements of this specification. All product substitution requests shall be completed in accordance with SECTION 01630.

**PART 2 - PRODUCTS**

2.01 **TRASH RACK:** The rack and raking equipment shall be designed and fabricated as a single assembly by the rake manufacturer. The rake manufacturer shall design, furnish, and install stainless steel trash racks complete with all structural support and anchorage. Because of the width of the intakes, (2) racks shall be provided for each of the (3) intake bays or a total of (6) racks.

A. General Design Requirements: The rack shall protect the pumping equipment by preventing the inflow of debris, trash, etc. from entering the intake. The rack shall span the full distance from the intake sill to the service bridge as well from abutment to pier or pier to pier providing total closure for the intake opening. The rack shall at a minimum satisfy the following requirements:
1. General Requirements:
   a. Bar Spacing: The clear spacing between vertical bars of the trash rack shall be 3.5 inches.
   b. Rack Inclination: 60 degrees from horizontal
   c. Rack Height: The rack shall extend above the elevation of the service bridge a distance considered necessary by the manufacturer to ensure the debris falls freely onto the conveyor. The rack shall be designed to facilitate the movement of the debris by the raking equipment to the conveyor by means of metal guides, sloping end bar sections, etc.
   d. The racks shall be identical and interchangeable between intake bays.

2. Removal and Reinstallation: The rack shall be capable of being removed for access to the pump. Anchorage of the rack shall be at the service bridge with the toe of the rack resting on the sill plate as indicated on the Contract Drawings. The rack shall be designed for two lift points. The rack anchorage shall be readily accessible with adequate tolerance to facilitate easy reinstallation.

B. Fabrication: All welding shall be in accordance with ANSI/AWS D1.1.

C. Structural Design: The rack shall be rigid frame of all welded construction and consist of vertical parallel flat bars with regularly spaced horizontal cross braces for stability. The toe of the rack shall have a flat plate for added stiffness. The structural design shall be in accordance with the AISC Manual of Steel Construction.

1. Design Loads: The design shall address all live and dead loads with a minimum 25% increase in live loads to address impact loads caused by the operation of the rake. The rack shall be designed for a maximum loading corresponding to a (5) ft. of differential head above the elevation of the pump’s low water shut off for the full width of the rack. Lifting lugs shall be designed to withstand a load of no less than (3) times the weight of the rack.

2. Rack Deflection: The maximum allowable deflection of the rack shall be L/360.

3. Intermediate Support: A maximum of one (1) intermediate supports shall be provided if required. All materials of the support shall be corrosive resistant. The support member, if not an integral part of the rack, shall be easily removed and re-installed for pump maintenance.

4. Minimum Bar and Component Size: All structural members shall have a minimum thickness of 0.5 in. The vertical collection bars shall have a minimum depth of 4.0 in.

5. Allowable Stresses: Allowable stress for the rack’s structural elements shall be as stated in AISC Specification for Design, Fabrication, and Erection of Structural Steel Buildings but not higher than the following percentages of the minimum yield strength of the materials used:

   - Tension (on net section at holes) ........................................................................40%
   - Bending (tension and compression on extreme fibers of members).............55%
   - Shear (on gross section of member) .................................................................35%
   - Bearing on contact area of machine surfaces .............................................70%

   Stress concentration factors shall be used where applicable.

D. Flow Induced Vibration: The rack shall be designed to prevent resonant vibrations induced by flow through the rack. The laterally unsupported lengths of the vertical bars and other members shall limit the natural frequency of the rack when submerged and subject to flow to not less than 2.5 times the vortex shedding frequency. Fixed supports shall be assumed for the calculation of the natural frequency of the rack. The average net flow velocity at the rack shall be increased 50% to account for flow concentration. The Strouhal’s number shall be NS = 0.14 + 0.01(d/t); d = rack bar depth, t = rack bar thickness.
E. As-Built Conditions: The CONTRACTOR shall verify all as-built conditions of the intake structure to ensure the manufacturer has accounted for any deviations from the contract drawings. The manufacturer shall provide conservative allowances and clearances in the design of the rack dimensions to address possible deviations in as-built conditions.

F. Materials of Construction: The materials specified are considered the minimum acceptable for the purposes of durability, strength and resistance to erosion and corrosion. The CONTRACTOR may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. Such alternatives are considered substitutes and therefore shall be submitted in accordance with SECTION 01630. The DISTRICT reserves the right to deny any or all product substitution requests. The CONTRACTOR will not be due additional compensation to offset any costs to provide the specified material in the event the product substitution is not approved. All material shall conform to the latest ASTM specification or other listed commercial specifications covering the class or kind of material to be used.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MATERIAL</th>
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<tr>
<td>Bars, plates or other structural shapes</td>
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</tr>
<tr>
<td>Nuts, Bolts, Anchors, Fasteners</td>
<td>Stainless steel - ASTM F593 type 316 (bolts)</td>
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<tr>
<td></td>
<td>Stainless steel - ASTM F594 type 316 (nuts)</td>
</tr>
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</table>

G. Submittals: Submit to the DISTRICT for review and approval:

1. Detailed fabrication and layout drawings including materials of construction
2. Structural design calculations including trash loading assumptions, rake requirements, and hydraulic loading assumptions

2.02 TRASH RAKE: The rake manufacturer shall design, furnish and install front cleaning; front return scraper style trash rakes complete with all structural support, motors, and monitoring and control components. The rake shall be a standard model suited for removal of heavy trash, debris, and vegetation loads from the outflow runoff from a large scale constructed wetland. The total design flow rate for the (6) drainage pumps of the station is 450 cfs. The rake and the trash rack shall be designed as a single assembly but the rake shall be capable of being removed for maintenance without removal of the rack. Because of the width of the (3) intake bays, (2) rakes shall be provided for each bay for a total of (6) rakes. The rake shall be designed to clean the full width and depth of the trash rack pulling the accumulated material from the bottom of the rack to above the service bridge elevation and depositing the trash load to a belt conveyor located on the bridge. The raking equipment shall be capable of collecting and conveying floating and submerged debris in a cycle time that results in a head loss across the rack less than the maximum allowed.

A. Acceptable Manufacturers: All raking system components shall be furnished by a single manufacturer that meets the requirements of this specification. Any manufacturer proposed by the CONTRACTOR other than those specifically named herein shall demonstrate, to the satisfaction of the DISTRICT, that the quality of the equipment is a least equal to the equipment fabricated by these manufacturer(s) specifically named herein and fully complies with the requirements of this specification.

1. Duperon Corporation
2. D & J Machinery, Inc.
3. Approved Equal

B. General Design Requirements: The rake shall be designed to prevent the build up of trash, debris, etc. on the trash rack which may cause partial blockage of flow through the rack and excessive head loss. The raking equipment shall satisfy the following requirements:

1. Rack Design: The rake manufacturer shall be responsible for the design, fabrication and installation of the trash racks. The rack and rake shall be considered a single assembly to ensure the two component designs are compatible and the most efficient unit design can be obtained.
2. Head Loss: The rake manufacturer shall, based on experience and conservative judgment, provide a scraper bar cycle time that prevents the build-up of trash on the rack that will cause a head loss in excess of (1) foot. The design of the scraper bar speed and bar spacing shall assume the extreme loading event.

3. Trash Loading: Under normal operation the trash will consist of submerged and floating vegetation consisting of aquatic and wetland vegetation. This vegetation may vary from tall grasses, reeds and other aquatic plants such as hydrilla to floating leafy plants such as water hyacinth. The rate of loading will vary seasonally as well as with discharge conditions. During a flood event there is the possibility of larger debris being part of the trash load. This debris could be upland vegetation including small trees and brush as well as man-made items such as lumber. It is recommended the rake manufacturer visit the project site and make an evaluation of the service condition requirements to determine the adequacy of the raking equipment proposed to be supplied. The vegetative loading is considered **HEAVY to SEVERE** when compared to conditions at other DISTRICT pump stations.

4. Service Life: The raking equipment shall be designed to provide a minimum (25) years service life under the loading, operation and environmental conditions described herein.

5. Service: The raking equipment shall be designed for standby service which is defined as a normally idle piece of equipment that is capable of immediate automatic or manual start-up and continuous operation. All rakes shall operate when any of the station's pumps are operating. Pump operation will vary from 700 to 1500 hours per year.

6. Minimum Bridge Clearances: The trash rake equipment shall be mounted on the service bridge. The equipment shall be positioned on the intake side of the bridge and shall limited to the area shown on the Contract Drawings. The CONTRACTOR and rake manufacturer shall review the available space provided on the bridge for the rake and conveyor and shall adjust the equipment design to maintain the minimum traffic lane clearance across the bridge as shown on the Contract Drawings.

7. Removal and Reinstallation: The rake and trash rack shall be capable of being removed for access to the pump. The rake may be removed separately from the rack for maintenance. The rake shall be require minimal dismantling necessary to facilitate this maintenance requirement and shall be designed for easy reinstallation.

8. Maintenance: Submerged components shall not require service, lubrication, etc. i.e. bearings. The layout of the trash conveyance equipment shall allow for easy access to the major operating parts of the mechanism for maintenance, cleaning and repair.

C. Control and Operation:

1. Operational Control: The operation of the rake and conveyance equipment shall be determined by the position of an “Auto-Off-Manual” selector switch located on the Control Panel. “Auto” mode shall interlock the rakes and conveyor equipment with the operation of the pump station pump and require no operator interface for proper operation of the system. “Manual” mode shall allow operation of the system or any of the system components by an operator. See Electrical Drawings for additional requirements.

2. Auto Mode: The “Auto Mode” will start ALL raking equipment including the (6) rakes and conveyor with the operation of any of the station's (6) drainage pumps. The raking equipment will remain on as long as there is a pump operating. Upon shut-down of the pumps, the raking equipment will remain on for a period on (3) three minutes to clear the racks of trash. The conveyor will remain on an additional (3) minutes after shut-down of the rakes to move the collected trash to the trash pit.

3. Electrical Controls: The electrical control panel for the raking equipment shall be mounted inside of the pump station building, or as otherwise indicated on the Contract Drawings, with local controls, disconnects, etc. as required located adjacent to rake equipment on the service bridge. The control panel enclosure shall be rated NEMA type 12. Local disconnects,
enclosures for local controls, etc. shall be rated NEMA type 4X. All components of the control system, control schematics, and other electrical components shall be submitted to the DISTRICT for approval.

4. Load Limiting Device: The rakes shall be provided with a load limiting device that shall shut down the rake and signal an alarm condition back to the control panel, if the pull force on the rake exceeds the setting of the load limiting device.

D. Structural Design: The rake shall be designed to address all live and dead loads due to the raking operation. In addition, the rake and associated equipment shall be designed to withstand without structural damage sustained wind speeds up to 140 mph. The raking equipment shall also be designed to operate without loss of effectiveness up to sustained wind speeds of 70 mph. The rake manufacturer shall provide a written certification the raking equipment proposed for use is capable of satisfying the wind load requirements specified above. The following criteria shall apply to the structural design:

1. All structural design of the equipment shall be in accordance with AISC Manual of Steel Construction.
2. Maximum allowable deflections shall be L/360.
3. Wind Loads: Design wind loads for the equipment shall be in accordance with the Florida Building Code and the DISTRICT's stricter requirements; Wind Speed = 140 mph; Importance Factor I = 1.3; Exposure Factor C.
4. Handling Capacity: The minimum handling capacity per rake shall not be less than 1000 lbs.
5. Welding shall be in accordance with ANSI/AWS D1.1 - Structural Welding Code.

E. Mechanical Design: The mechanical design of the rakes shall conform to the following requirements:

1. The rake shall be a chain driven, front cleaning, front return scraper style rake. The rake shall be capable of cleaning vegetation and other debris across the full width and depth of the trash rack. Each rake shall deposit the trash collected onto a common horizontal belt conveyor located on the station's service bridge. The rake and rack shall be robustly designed to address the dynamic loads during operation as well as the installation and removal and shall be designed for continuous duty. All bolted connections shall have a minimum of (2) bolts per connection. Each rake shall be able to operate independently with its own drive unit and controls. The layout of the rake mechanism shall permit easy access to all the major operating parts for maintenance, cleaning, and repair. All lubrication fittings which are not easily accessible shall be modified and equipped with 316 stainless steel tubing to extend the grease fittings to the nearest accessible location for the ease of maintenance. All stainless steel tubing and grease fittings shall be rigidly secured using 316 stainless steel fasteners and clips as required.
2. The trash rack and rake shall have a 60 degree inclination from horizontal to improve the scraper bars ability to hold the collected debris as it emerges from the water and is pulled up and deposited on the belt conveyor.
3. The scraper UHMW blades shall span the full width of the trash rack with a tooth pattern to penetrate between the rack vertical bars for removal of debris. The bars shall be bolted to a stainless steel member to provide the necessary structural support and easily replaced when necessary. The standard blade (or bar) spacing has been approximately 60 inches at other DISTRICT pump stations. However, the DISTRICT recommends the manufacturer evaluate the need to increase the cycle time of the rake and space the blades at not greater than 48 inches.
4. A stripper assembly shall be provided as recommended by the manufacturer to assist in the removal of debris from the scrapers.
5. Each rake shall be equipped with a speed reducer to provide the required output speed. The drive unit shall have a coated CL40 cast iron drive and end castings. The drive shaft shall be type 316 stainless steel.
6. Bearings shall be greaseable, ball bearing type, non-self-aligning, sealed and lubricated, with a radial load rating as required for the intended service. Underwater bearings of any kind are not acceptable.

7. The rake shall be fabricated from the following materials:

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<td>Chain Pins</td>
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<td>Stripper Assembly</td>
<td>Stainless steel - ASTM A276 type 304</td>
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<td>Other Miscellaneous Components</td>
<td>Corrosive Resistant Metals or Plastic</td>
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<td>Nuts, Bolts, Anchors, Fasteners</td>
<td>Stainless steel - ASTM F593 type 316 (bolts)</td>
</tr>
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<td></td>
<td>Stainless steel - ASTM F594 type 316 (nuts)</td>
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</table>

F. Electrical Design: See DIVISION 16 - Electrical of the Contract Specifications and the Contract Drawings for the details of the service and control required for the raking units.

1. Drive Motor: Each rake shall be driven by an electrically operated gear motor sized by the rake manufacturer for the design loads. The motor shall be a 1/8 to 1/2 Hp single phase, 60 cycle, 120 VAC Sumitomo integral gear motor (or approved equal) capable of operating the scrapers and chain at approximately (28) inches per minute. The motor shall be totally enclosed, fan cooled, type, suitable for outdoor service and shall be driven by a variable frequency drive.

2. Motor Starters: A reversing starter properly sized shall be provided for each drive motor. The starter shall be mounted within the main control panel. Sufficient starter contacts shall be provided to open all motor leads when the motor is de-energized. The starter shall be interlocked electrically and mechanically to prevent energizing forward and reverse contactors simultaneously.

3. Electrical Controls: The electrical control panel for the raking equipment shall be mounted inside of the pump station building, or as otherwise indicated on the Contract Drawings, with local controls, disconnects, push button station, etc. as required located adjacent to rake equipment on the service bridge. The control panel enclosure shall be rated NEMA type 12. Local disconnects, enclosures for local controls, etc. shall be rated NEMA type 4X. All components of the control system, control schematics, and other electrical components shall be submitted to the DISTRICT for approval.

G. Safety: The equipment shall comply with the applicable provisions of the Federal Occupational Safety and Health Standards.

2.03 TRASH CONVEYOR: The trash collected shall be transported to the disposal pit by a belt conveyor located on the service bridge running parallel to the rakes. The conveyor is to be furnished by the rake manufacturer and shall be designed to operate in unison with the rakes to provide automated or manual removal of the debris as it is deposited. The conveyor shall be a flat roller bed conveyor with integrated side rails designed to handle wet debris that can be expected from the raking operation. The conveyor shall dump the material in a collection pit at the end of the service bridge. The pit will be constructed below grade; there will be no need for an inclined conveyor to ensure a free fall of trash. The rake manufacturer shall be responsible for the design and operation of the conveyor to ensure it is fully compatible with the raking system.

A. General Design Criteria: The conveyor shall satisfy the following general design criteria:

1. The unit shall be designed to withstand the free fall of a 1000 lb object from a height of 5 feet.
2. The conveyor side rails or guides shall have a minimum 24 inch height and shall be pitched to receive the debris and convey it to the moving belt without becoming jammed, wedged or bound in the assembly. The conveyor controls shall be interlocked with the rake operation, starting automatically with the operation of the rakes. The unit's safety and shutdown safeguards shall also be interlocked with the rake controls. The unit shall also be capable of manual operation. When in the manual mode all of the safety features shall remain enabled. With shutdown of the raking system the conveyor will continue to operate for 3 minutes to clear all trash to the disposal pit.

3. The conveyor shall be anchored to the service bridge. The anchorage shall address the dynamic loads of the unit but also consider the wind loads. Design wind loads for the equipment shall be in accordance with the Florida Building Code and the DISTRICT's stricter requirements; Wind Speed = 140 mph; Importance Factor I = 1.3; Exposure Factor C.

B. Safety Devices: The conveyor shall be equipped to comply with the applicable provisions of the Federal Occupational and Health Administration (OSHA) standards. The following safety devices shall be provided:

1. Safety guards shall be provided for all exposed pulleys, chains, etc. as require by OSHA and shall be supported and properly secured to the conveyor frame. Guards and connecting components, fasteners, etc. shall be stainless steel. The guards shall also be painted a safety orange.

2. Emergency trip cord running on the side of the conveyor accessible from the service bridge. The trip cable shall be a minimum 3/16 inch stainless steel cable with orange nylon sheathing. The cabling shall be supported by stainless steel eyebolts at 10 foot intervals.

3. Two safety stop switches located at each end of the conveyor. The switches shall be housed in NEMA 4x stainless steel enclosures mounted on the conveyor frame.

4. A zero speed switch connected directly to the tail pulley. The switch shall be housed in a NEMA 4X stainless steel enclosure mounted on the conveyor frame.

C. Framing Members and Supports: The conveyor framing members and supports shall satisfy the following design considerations:

1. All framing members and supports shall be fabricated from ASTM-A36 steel plate and structural steel shapes. The main structural frame shall be structural grade channel sections. All structural members shall have a minimum thickness greater than 0.25 inches. Side closeouts shall have a minimum thickness greater than 0.125 inches. The frame shall include adequate supports for the head and tail section machinery as well as supports required for the idlers. The frame shall be provided with support legs spaced at intervals determined by the manufacturer. The support legs shall be equipped with base plates to facilitate anchoring the conveyor to the service bridge. All anchorage shall be stainless steel with a minimum of two anchors per leg.

2. All steel shall be hot-dipped galvanized in accordance with ASTM A123 and/or ASTM A153 following fabrication. All structural components shall be hot dipped zinc galvanized in accordance with ASTM A123 following fabrication. All holes required for assembly and/or connection of conveyor components shall be pre-drilled or punched prior to galvanizing. Fielding drilling and/or punching of any galvanized component will not be permitted.

D. Belt: The conveyor belt shall satisfy the following design considerations:

1. The belt shall be a 30 to 36 inches wide shall be constructed of uniform ply and covering. The belt shall have a minimum of (2) plies and shall be of sufficient weight that the belt tension does not exceed 75% of the manufacturer's recommended allowable tension.

2. The belt shall withstand the maximum operating and starting tensions when fully loaded and shall properly bend over the idlers and drive pulleys without overstressing the belt covering, carcass or splice.
3. The covers shall be oil resistant with a 1/4 minimum cover on the carrying side and a minimum 1/8 cover on the bottom side.

4. The belt profile on the carrying side shall be provided with cleats or a chevron patterned cover. The layout and size of the cleats or patterns shall prevent material roll back or material stacking.

5. Belt splices shall be a mechanical stainless steel splice with a 100% efficiency base on the belt's allowable tension recommendations.

6. The belt shall be manufactured by Goodyear, Georgia Duck or an approved equal.

E. Idlers: The conveyor idlers shall meet or exceed the following criteria:

1. Idlers shall be CEMA Class C non-metallic rollers with a rigid shaft, single roller type.
2. Idler bearings shall be a tapered roller type with a minimum B-10 life of 60,000 hrs.
3. Bearing seals shall be double seals with a contact seal to exclude outside contaminants and a triple labyrinth seat to retain the lubricant.
4. The idlers shall be self-lubricating and require no grease fittings.
5. Rollers shall be provided with a minimum 1/8 inch urethane cover.
6. Carrying idlers shall have a minimum 2 foot spacing for belt loading areas and 3 foot minimum spacing for other areas.
7. Return idlers shall have minimum 5 foot spacing.
8. Idlers shall be provided at any point necessary to reduce or minimize belt stress.
9. The belt sag across all idlers shall not exceed 2% of the idler spacing under full load.
10. All idler frames, brackets or other hardware shall be stainless steel.

F. Pulleys: Conveyor pulleys shall meet or exceed the following requirements:

1. Pulleys shall be welded steel drum type with grooved lagging. The lagging shall be a minimum 1/2 thick with a 1/4 inch deep herringbone grooves and shall be a minimum 60 durometer hardness, vulcanized rubber.
2. Pulley shaft shall be ANSI C1045 steel. Pulleys shall be keyed to the shaft. The shafts shall be supported by roller bearing pillow blocks secured to the conveyor structural frame. The bearing shall be self-aligning rollers with a minimum B-10 life of 60,000 hours. Bearing adjustment screws shall be provided on each end of the bearing for alignment.
3. Pulley bearing shall be lubricated by a single grease fitting located on the service bridge side of the conveyor. All grease fittings shall be zerk type.
4. The tail pulley shall be a screw type capable of tensioning and loosening the belt by turning capture nuts located on either side of the supporting frame. The take up assembly shall capable of adjustment while the belt is fully loaded. The take up assembly shall be stainless steel.

G. Drive Motor: The belt conveyor shall be driven by an electrically operated gear motor sized for the intended loads. The motor shall satisfy the following requirements:

1. The motor size shall be 3 Hp, single phase, 60 cycles, 120 VAC. The CONTRACTOR shall make all modifications to the electrical system required due to a variation of this motor Hp. The CONTRACTOR shall submit the proposed changes to the DISTRICT for approval.
2. The motor shall be Sumitomo integral gear motor or approved equal.
3. The motor shall be capable of operating the conveyor at a minimum speed of 60 ft per minute and/or a maximum speed of 90 fpm.
4. The motor shall be totally enclosed, fan cooled, and suitable for outdoor service.
5. The motor shall be a constant speed drive.

H. Mechanical/Structural Components: The materials of the conveyor shall be corrosive resistant, durable, and suitable for the intended service. The following materials shall be considered the minimum acceptable for the major components of the conveyor unit:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Framing and supports</td>
<td>Structural steel - ASTM A36/A66M</td>
</tr>
<tr>
<td>Rollers, other bed items</td>
<td>Stainless steel - ASTM A276 type 316L</td>
</tr>
<tr>
<td>Drive components</td>
<td>Stainless steel - ASTM A276 type 316L</td>
</tr>
<tr>
<td>Speed reducer</td>
<td>Fully enclosed, weatherproof</td>
</tr>
<tr>
<td>Chain drives, pulleys</td>
<td>Fully enclosed, weatherproof</td>
</tr>
<tr>
<td>Belt</td>
<td>Nitrile impregnated belt</td>
</tr>
<tr>
<td>Bolts, Anchors, Fasteners</td>
<td>Stainless steel - ASTM F593 type 316</td>
</tr>
<tr>
<td>Nuts</td>
<td>Stainless steel - ASTM F594 type 316</td>
</tr>
</tbody>
</table>

2.04 SPARE PARTS: All spare parts shall be duplicates of the original parts furnished and shall be interchangeable. Spare parts shall be packed in crates. The CONTRACTOR shall furnish one set of replacement parts for those wear components of the rake and conveyor equipment. Wear parts are defined as those mechanical components that are subject to replacement due to wear for a cycle time less than the (25) year service life, excluding motors, drive units and/or consumables such as the UHMW scraper blades.

2.05 SPECIAL TOOLS: The CONTRACTOR shall furnish one set of “special tools” required for complete assembly, disassembly, or maintenance of the rake and conveyance equipment. Special tools refer to oversized or specially dimensioned tools, special attachments or fixtures, or any similar items.

2.06 PROTECTIVE COATINGS: The units shall have the following paint system applications. See SECTION 09900 - Protective Coatings for additional details.

A. Shop Painting: All non-corrosive resistant metals including all ancillary items such as guards shall have a shop applied protective coating as indicated below. The CONTRACTOR shall submit the manufacturer’s product data for the proposed for the paint system. Metal surfaces of stainless steel, bronze, fiberglass, or neoprene shall not be coated.
   1. Surface Preparation: SSPC-SP2 or SSPC-SP3 hand or power tool cleaned
   3. Intermediate Coat: High solids polyamine or polyamide epoxy with 67% solids by volume. Apply at 5 to 8 mils dry film thickness.
   4. Top Coat: High solids aliphatic polyurethane gloss enamel with minimum 52% solids by volume. Apply at 2 mils dry film thickness.

B. Field Painting: CONTRACTOR shall touch-up coatings damaged during shipment or installation.

PART 3 - EXECUTION

3.01 FACTORY TESTS: The equipment manufacturer shall conduct all necessary factory performance tests to ensure the mechanical and electrical operation of the equipment to be supplied is in accordance with the specifications and free of defects prior to shipment. All such tests shall be documented by the manufacturer and supplied to the DISTRICT if requested.
3.02 FACTORY INSPECTIONS: The DISTRICT may make periodic visits to the manufacturer’s plant to inspect the fabrication and assembly of the equipment. The manufacturer shall have available for review detailed fabrication and assembly drawings. Drawing details shall include all dimensions, tolerances, shaft clearances, and bearings. The manufacturer shall also have available at the time of the inspections purchase orders, mill orders, or shop orders including certified material test reports that indicate components and/or materials to be used in the equipment’s manufacture. The DISTRICT shall review these records, drawing details and the unit for compliance with the specifications as well as standard industry practice. The DISTRICT shall provide a written report to the CONTRACTOR of the inspection that will include those items observed to be in non-compliance with the specifications. It will be the CONTRACTOR’s responsibility to ensure all items are corrected by the manufacturer. Re-inspection of the items in non-compliance may be requested by the DISTRICT.

3.03 FACTORY ASSEMBLY: All equipment shall be completely shop assembled and aligned prior to shipping. Tolerances shall not exceed those specified or shown in the manufacturer’s drawings. Rotating elements shall be checked for binding. The DISTRICT shall witness the shop assembly unless otherwise stated. After completion of the specified factory tests, equipment shall be prepared for shipment with the minimum amount of disassembly. Any components removed for shipping shall be match-marked prior to removal and shipment.

3.04 STORAGE: All equipment placed in storage shall be stored indoors, protected from the weather, humidity and temperature variations, dirt, dust and other contaminants. The CONTRACTOR is responsible to locate and procure all off-site storage that may be required throughout the life of the Contract. All on-site and off-site storage provisions are subject to approval.

3.05 INSTALLATION: Installation, start-up and testing of all equipment and associated construction shall conform to manufacturer's recommendations and the installation and erection manual. The manufacturer's field representative shall meet with CONTRACTOR to provide all necessary guidelines and specifications for installation and testing of equipment supplied. This field representative shall also inspect all equipment after installation and prior to start-up. The equipment manufacturer, upon completion of the installation, shall certify in writing to the DISTRICT, the equipment has been installed in accordance with the manufacturer’s installation and erection manuals.

A. Equipment Leveling: The rake and conveyor equipment shall be installed and leveled by millwrights experienced in setting and leveling heavy equipment. The CONTRACTOR shall level the base plates against the anchor bolt nuts using steel leveling blocks and shims at every bolt location to a maximum tolerance of 0.005 in./ft. unless otherwise recommended by the manufacturer. Leveling equipment shall be precision surveying equipment. Grout below base plates with non-shrinkable grout shall be in accordance with SECTION 03600 Grout. The grout shall be placed in manner to avoid air entrapment and shall be one continuous operation. After the grout has attained the required compressive strength, the leveling blocks and shims shall be removed and torque anchor bolts to the required clamping force required by the equipment manufacturer. Torque bolts in increments of not more than 25 percent of the final value in an alternating pattern to avoid stress concentration on the grout surface. Void spaces created by the removal of the leveling blocks and shims shall be filled with grout after the anchor bolts have been tighten to their final value.

B. Equipment Alignment: All equipment shall be aligned in accordance with the manufacturer’s installation and erection manual.

3.06 FIELD OPERATING TEST:

A. General: The objective of the field operating test is to ensure the equipment operates in accordance with the specifications. The drainage pumps do not need to be operated and this test is not to determine the effectiveness of the collection system's ability to collect and remove the trash. The intent is to test the mechanical operation as well as the controls, safety features, etc. of the equipment to ensure the system functions as specified. All field operating and equipment tests shall be performed by the CONTRACTOR and in the presence of the DISTRICT. The manufacturer's field representative shall
be present during all operating tests. The CONTRACTOR’s monitoring and control subcontractor and/or electrical subcontractor shall also be present during all operating tests. The CONTRACTOR shall be responsible for the coordination of the various trades and responsible parties for the successful performance of all field tests. Should the tests reveal a design deficiency or a manufacturing error, the problem shall be promptly corrected by and at the expense of the CONTRACTOR.

B. Operating Tests: The CONTRACTOR shall conduct operational tests as necessary to determine that the performance of equipment and controls is as specified. Tests shall consist of placing all equipment in operation.

1. Make all necessary equipment adjustments and corrective work indicated by tests.
2. Submit a written test report of all tests performed and their results to the DISTRICT.

3.07 POST CONSTRUCTION INSPECTION AND OPERATION:

A. Post Construction Check: The CONTRACTOR shall re-check equipment operation after the equipment has been placed in service with the drainage pumps running and trash collection is underway. The purpose of this test is to evaluate the performance of the trash collection system's ability to collect trash and make any possible adjustments or corrective work to the equipment as indicated. This check test shall be conducted as soon as possible after the DISTRICT's acceptance or date beneficial use of the equipment given the environmental conditions warrant trash collection. The DISTRICT will be responsible for the scheduling of the test for coordination with their operational schedule of pump station. If problems with the system can not be addressed by the CONTRACTOR, the CONTRACTOR shall obtain the services of the manufacturer's field representative and the test repeated as necessary to correct the problems of make the necessary adjustments. The cost for the work by the CONTRACTOR or the manufacturer's field representative as part of the task shall part of the original base bid for the construction of the Contract.

B. Warranty Period: The DISTRICT shall perform all required inspection checks in accordance with the manufacturer’s operation and maintenance manual throughout the warranty period. If a problem is found and it is determined to be defective design, workmanship, materials, or other causes that are the result of the equipment manufacture or installation and not from the normal operation of the unit in accordance with the operation and maintenance instructions, the CONTRACTOR, in accordance with the warranty agreement of this Contract, shall take the necessary action to correct the problem at the CONTRACTOR’s expense.

END OF SECTION