

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A167-99(2004), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 Canadian Standards Association (CSA)
 - .1 CSA B651-2018, Accessible Design for the Built Environment.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for accessories for incorporation into maintenance manual.

1.4 EXTRA MATERIALS

- .1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories
- .2 Deliver special tools to Owner.

Part 2 Products

2.1 COMPONENTS

- .1 Mirrors: 6 mm tempered glazing with stainless steel channel frame:
 - .1 Sizes: 460 x 762 mm.
 - .2 Quantity: Refer to Drawings.
 - .3 Acceptable Products: American Specialties 0600 Series, Bobrick B-165 Series, Bradley 781 Series.
- .2 Paper Towel Dispenser: Touch-free dispensing for roll towels, stainless steel cabinet, surface mounted.
 - .1 Quantity: Refer to Drawings.
 - .2 Acceptable Products: American Specialties 8524, Bobrick B-2860, Frost 109- 60S.
- .3 Toilet Tissue Dispenser: surface mounted, double-roll, stainless steel.

- .1 Quantity: Refer to Drawings.
- .2 Acceptable Products: American Specialties 20030, Bobrick B-2888, Bradley 5402.
- .4 Soap Dispenser:
 - .1 Quantity: Refer to Drawings.
 - .2 Acceptable Products: American Specialties 0347, Bobrick B-2111, Bradley 6562.
- .5 Robe Hook:
 - .1 Quantity: Refer to Drawings.
 - .2 Acceptable Products: American Specialties 8425, Bobrick B-233, Bradley 917.
- .6 Grab Bars: 32 mm diameter x 1.2 mm wall tubing of stainless steel, length and shape as indicated, 76 mm diameter wall flanges, concealed screw attachment. Peen bar at area of hand grips. Provide anchoring and mounting accessories.
 - .1 Quantity: Refer to Drawings.
 - .2 Acceptable Products: American Specialties 3400 Series, Bobrick B-5806 Series, Bradley 832 Series.
- .7 Hand Dryer: Refer to Electrical.

Part 3 Execution

3.1 INSTALLATION

- .1 Install and secure accessories rigidly in place as follows:
 - .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
 - .2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.
 - .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
- .2 Use tamper proof screws/bolts for fasteners.
- .3 Fill units with necessary supplies shortly before final acceptance of building.

3.2 SCHEDULE

- .1 Locate accessories where indicated. Exact locations determined by Departmental Representative.
- .2 Refer to Drawings for quantities unless otherwise indicated.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 30 00 Cast-in-Place Concrete.
- .2 Division 26 Electrical.
- .3 Section 22 05 20 - Meters and Gauges for Wastewater System.

1.2 INSTALLATION DESCRIPTION

- .1 Furnish all labour, materials, equipment and appurtenances required to provide an open channel, gravity flow, ultraviolet (UV) disinfection system complete and operational with all control equipment and accessories as specified. This system shall be capable of disinfecting effluent to meet water quality standards specified
- .2 The UV Disinfection System is to be installed at an aerated lagoon WWTP, to be placed in a single concrete channel inside a building. The WWTP will be an aerated lagoon consisting of aerated treatment cells designed to treat the wastewater to 25 mg/L TSS and 25 mg/L BOD₅, followed by a partially aerated polishing cell before the UV disinfection system. This is to be considered in the UV system design.
- .3 As a result of the polishing cell, the wastewater coming into the UV disinfection facility may be at 25 mg/L BOD₅ with occasional jumps to 40 mg/L TSS.

1.3 REFERENCES

- .1 Reference Standards:
 - .1 US EPA Design Manual - Municipal Wastewater Disinfection (EPA/625/1-86/021).
 - .2 Standard Methods for the Examination of Water and Wastewater, latest edition.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for UV System and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Complete assembly and installation drawings, together with detailed specifications and data covering material used and accessories forming a part of the equipment furnished, shall be submitted in accordance with the submittal section. The data and specifications for each until shall include, but not be limited to, the following:

- .1 Complete description in sufficient detail to permit an item by item comparison with the specification;
- .2 Dimensions and installation requirements;
- .3 Descriptive information including catalog cuts and manufacturer's specifications for all components;
- .4 Electrical schematic and layouts;
- .5 Hydraulic calculations demonstrating compliance with the specified hydraulic characteristics;
- .6 Experience documentation;
- .7 Bioassay validation report for proposed system to verify that the proposed system and number of lamps delivers specified UV dose.

1.5 START-UP ASSISTANCE AND TRAINING

- .1 In addition to the Installation Manual, furnish the necessary skilled technical personnel to check the installation, carry out an evaluation of, and start-up the equipment supplied under this contract. This personnel shall be available on site for not less than two (2) full days of eight (8) hours each. Also during this time on site, the Supplier's personnel shall instruct the Owner or his representative fully on the operation, adjustment, and maintenance of all equipment furnished. All training sessions shall be recorded on video, and copies of training videos shall be provided with the O&M Manuals.
- .2 These two (2) days of on-site assistance and training will not be paid separately, but are considered incidental to the work and is to include all transportation, accommodation, personnel, and related costs. If additional on-site time is required from the personnel, it must be requested by the Owner in writing and will be paid at the all inclusive per diem rate to be provided by the Contractor prior to Substantial Completion. This does not include any time or costs to carry out repairs under the warranty, which is incidental to the contract.
- .3 The Supplier shall not charge for office technical support provided during the warranty period.

1.6 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit to the Departmental Representative prior to Substantial Completion a formal quote for additional on-site technical services / operator training beyond the scope of work as described in these Specifications. This fee shall be an all-inclusive per diem rate, including the services of a qualified technical representative, include all travel, accommodation, general expenses, and salary costs associated with such on-site services based on an eight (8) hour working day.
- .3 Operating and Maintenance Manuals:
 - .1 Supply written operating and maintenance instructions, sufficiently comprehensive to enable the operator to operate and maintain the equipment supplied.
 - .2 All information in the O & M Manuals shall be clear and legible. Any data sheets with information on multiple model or optional equipment shall be clearly marked to indicate the information which applies to the equipment supplied.

- .3 Arrange in a hard cover, durable, three-ring binder.
- .4 Number pages consecutively.
- .5 Arrange manual in three sections: General; Equipment; and Operating and Maintenance Procedures. Each section is to include at least the following information:
- .6 General
 - .1 Summary of Information Page: project name, equipment description, order number, serial numbers, manufacturer's nearest service representative, date prepared (and revised if necessary);
 - .2 Index for the O & M Manual;
 - .3 Warranty Information;
 - .4 Listing and explanation of abbreviations used.
- .7 Equipment
 - .1 Provide details for all components provided including shop drawings; certified performance curves or data; parts diagram and parts list; materials of construction; product specifications; physical characteristics, serial numbers; performance specifications, drawings with dimensions, etc.
- .8 Operating and Maintenance Procedures
 - .1 Provide normal start-up and shut-down procedures; maintenance checklist with maintenance operation and frequency; lubricant points diagrams; cleaning procedures, bulb replacement procedure, recommended spare parts list for minor field repairs; alignment instructions; troubleshooting tips; preventative maintenance inspection and monitoring charts.
 - .2 Any other instructions or information the Owner should have for the safe and reliable operation of the equipment.

1.7 GUARANTEE

- .1 The equipment furnished under this section shall be free of defects in material and workmanship, including damages that may be incurred during shipping for a period of 12 months from date of start-up or 18 months after shipment, whichever comes first.
- .2 The UV lamps are to be warranted for a minimum of 12,000 hours. Pro-rated lamp warranties will not be accepted.
- .3 Wires that are exposed to the effluent shall be warranted for 15 years.
- .4 All travel expenses, accommodation, etc. for a service visit required under the warranty period will be included in the warranty.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 UV Disinfection System

- .1 Approved System: UV3000™ - PTP, as manufactured by Trojan Technologies Inc., London, Ontario, Canada (or approved equivalent) as supplied by:
 - .1 Atlantic Purifications (Attention: Hettie Sacre)
10 Ferguson Street, P.O. Box 877
Dartmouth, NS, B2Y 3Z5
(902) 469-2806
 - .2 Requests for approved equivalents must be submitted a minimum of ten (10) working days prior to Tender closing, as the supplier will be required to complete and submit a technical questionnaire providing relevant data for the evaluation of the proposed system no less than five (5) working days before receipt of Tenders, in accordance with Section 00 21 13 Instructions to Bidders.
- .2 Design Criteria:
 - .1 Provide equipment which will disinfect an effluent (from the partially aerated polishing cell) with the following characteristics:
 - .1 Peak Flow Rate: 25 L/s
 - .2 Average Design Flow Rate: 585 m³/day
 - .3 Design Total Suspended Solids: 25 mg/l, 30 day average, with occasional spikes to 40 mg/L
 - .4 Annual Effluent Temperature: 0 °C - 29°C
 - .5 Ultraviolet Transmittance @ 253.7 nm: 40% minimum
 - .6 Max Mean Particle Size: 30 microns
 - .7 Disinfection Limit: 200 Fecal Coliform per 100 ml, based on a 30 day geometric mean of consecutive daily grab samples
 - .8 Effluent standards shall be achieved regardless of influent count to UV system.
 - .2 The UV equipment will be installed in an open concrete channel having dimensions as shown on the drawings.
- .3 Performance Requirements:
 - .1 The UV system shall be designed to deliver a minimum UV dose of 30,000 µWs/cm² or 30 mJ/cm², at peak flow with a UV Transmission of 40% and at end of lamp life (accounting for quartz sleeve absorption, sleeve fouling, lamp aging, etc.), as calculated by the Point Source Summation Method and verified through independent third party bioassay in

- accordance with US EPA Design Manual – Municipal Wastewater Disinfection (EPA/625/1-86/021). The manufacturer’s bioassay report must clearly demonstrate that the proposed UV system design and number of lamps will deliver the specified dose.
- .2 The UV system shall produce an effluent conforming to the following discharge limit: 200 fecal coliform /100 ml, based on a 30 day Geometric Mean. Grab samples will be taken in accordance with the Microbiology Sampling Techniques found in Standard Methods for the Examination of Water and Wastewater, latest edition.
 - .3 Provide a UV disinfection system complete with UV Modules, Monitoring System, Power Distribution Center(s), Support Rack(s) and Level Controller.
 - .4 The system shall be able to continue providing disinfection while replacing UV lamps, quartz sleeves and ballasts, and while cleaning the sleeves.
 - .5 The system will be housed inside a building, but shall be designed for complete outdoor installation without shelter or supplemental cooling or heating required.
- .4 Metal components in contact with effluent: Type 304 or Type 316 stainless steel.
 - .5 Wires exposed to effluent: Teflon™ coated to prevent degradation under constant exposure to UV light.
 - .6 Wiring exposed to UV light: Teflon™ coated.
 - .7 Materials exposed to UV light: Type 316 stainless steel, anodised aluminium, Type 214 quartz, or Teflon™.
 - .8 Lamp Array Configuration:
 - .1 Uniform array with all lamps parallel to each other and to the flow. The lamps shall be evenly spaced in horizontal and vertical rows with centerline spacing equal in both directions.
 - .2 The single array pattern shall be continuous and symmetrical throughout the reactor.
 - .3 The system shall be designed for complete immersion of the UV lamps including both electrodes and the full length of the lamp tube in the effluent. Both lamp electrodes shall operate at the same temperature and be cooled by the effluent.
 - .9 UV Module:
 - .1 Each UV lamp module shall consist of the required lamps and their corresponding electronic ballast.
 - .2 Each lamp shall be enclosed in its individual quartz sleeve, one end of which shall be closed and the other end sealed by a lamp end seal and holder.
 - .3 All wires connecting the lamps to the ballasts shall be enclosed inside the stainless steel frame of the UV Module and not exposed to the effluent. Systems where lamp wiring is submerged in the effluent and exposed to UV light will not be allowed.
 - .4 Each UV module shall be provided with a standard 120 Volt plug and weatherproof cable for connection to a receptacle. The cable shall be no longer than 10 feet (3.0 m). Lamp status will be displayed on top of each UV module using watertight LED indicator lights.

-
- .5 Modules materials of construction shall be stainless steel type 316, anodized aluminum, quartz 214, and Teflon™, with UL rating of Type 6P.
- .10 UV Lamps:
- .1 Low pressure mercury slim line lamps of the hot cathode instant start design. The coiled filamentary cathodes to be heated by the arc current.
- .2 The filament shall be of the clamped design, significantly rugged to withstand shock and vibration.
- .3 Electrical connections at one end.
- .4 Each connection shall have only two pins.
- .5 90% of UV output shall be within the wavelengths of 233.7 to 273.7 nm.
- .6 Rated to produce zero levels of ozone.
- .7 Lamp bases: metal and ceramic construction resistant to UV and ozone.
- .8 The lamp shall incorporate a dielectric barrier or pin isolator. The pin isolator shall consist of a non-conductive divider placed between the lamp pins to prevent direct arcing across the pins in moist conditions.
- .11 Lamp End Seal and Lamp Holder:
- .1 The open end of the lamp sleeve shall be sealed by means of a Type 316 stainless steel sleeve nut which threads onto a sleeve cup and compresses the sleeve O-ring.
- .2 The sleeve nut shall have a knurled surface to allow a hand grip for tightening. The sleeve nut shall not require any special tools for removal.
- .3 The lamp shall be held in place by means of a moulded lamp holder that will incorporate two seals. The lamp holder shall seal against the inside of the quartz sleeve to act as a second seal in series with the external O-ring seal.
- .4 The second seal on the lamp holder shall isolate and seal the lamp from the module frame and all other lamps in the module.
- .5 In the event of a quartz sleeve fracture the two seals of the lamp holder shall prevent moisture from entering the lamp module frame and the electrical connections to the other lamps in the module.
- .6 The lamp holder shall also incorporate a UV resistant plastic stop that will prevent the lamp sleeve from touching the steel sleeve cup.
- .12 UV Lamp Sleeves:
- .1 Type 214 clear fused quartz circular tubing as manufactured by General Electric or equivalent.
- .2 Lamp sleeves shall be domed at one end.
- .3 Quartz to be rated for UV transmission of 89% and not subject to solarization.
- .4 Nominal wall thickness: 1.5 to 2.0 mm to maximize UV transmission.
- .13 UV Lamp Module Support Rack:
- .1 UV system shall be provided with UV module support racks for each bank.

- .2 The module support rack shall be Type 304 stainless steel and be suspended above the effluent in the channel by means of slotted angles allowing adjustment to the precise height of the channel and requiring no fastening of the individual UV lamp modules.
 - .3 The module support rack shall be designed so that no ultraviolet light will radiate above the channel when the UV lamp modules are energized and fully immersed in the effluent.
- .14 Effluent Level Controller (Weir):
- .1 Located at discharge end of the UV channel and sized to fit the channel location shown on the drawings.
 - .2 Weir shall be designed to maintain a minimum channel level as required to keep lamps submerged at all times.
 - .3 Constructed of Type 304 stainless steel.
 - .4 Weir shall be welded water tight and include a drain.
 - .5 To be supplied by manufacturer.
- .15 Electrical:
- .1 The UV disinfection system shall be divided into six (6) UV modules per bank.
 - .2 Interconnecting Cables to be standard 120 Volt, weatherproof, 10 feet (3.0 m) long and shall be suitable for outdoor installation.
 - .3 Power Distribution Receptacles:
 - .1 120 Volt receptacles rated for continuous outdoor use shall be provided. Receptacles shall be of the duplex type complete with ground fault interrupter circuitry.
 - .2 Receptacles to be provided by the UV Manufacturer.
 - .4 Power Consumption:
 - .1 Maximum power draw to UV System shall be 4,200 watts (2,100 watts per bank).
 - .2 All electrical supplies shall be 120 Volt, 60 Hz.
 - .3 A separate 120 volt, 5 amp supply to be provided for the Monitoring System.
- .16 Power Distribution Receptacle (PDR):
- .1 Duplex ground fault interrupter receptacle(s) shall be provided by the UV Manufacturer.
 - .2 Receptacles shall be mounted in an individual, impact resistant thermoplastic junction box complete with a Type 3R rain shield for outdoor installation.
 - .3 Contractor to supply appropriate 120 Volt, single phase, 60 Hz circuit to power the PDRs which have a total current draw of approximately 19.2 amps per bank (38.4 amps total). Contractor to be responsible for distributing the power from the main 120 Volt feed to the individual PDRs. Responsibility to be all encompassing and in accordance with the local electrical codes.
- .17 Monitoring System:
- .1 Two (2) submersible UV sensors (1 per bank) shall continuously monitor the UV intensity produced in the bank of UV lamp modules. The sensor shall measure the germicidal portion of the light emitted by the UV lamps.

- .2 UV intensity shall be indicated on a 3 character display in mW/cm^2 .
- .3 Elapsed time in hours (lamp age) shall be indicated on a 5 character display.
- .4 Both displays shall utilize LEDs and shall be visible through the panel door.
- .5 Two (2) dry contacts shall be provided (1 per bank) for remote indication of Low UV intensity alarm.
- .6 Monitoring System shall be enclosed in a fiberglass Type 4X wall mounted panel and is to be located less than twelve (12) feet (3.66 m) from the LED end of the UV Module.
- .18 Maintenance Rack:
 - .1 One (1) Type 304 stainless steel maintenance rack shall be supplied. The rack shall be designed to hold UV modules during service or maintenance.
- .19 Portable UVT Field Meter
 - .1 Provide a portable UVT field meter to allow measurement of UV Transmittance.
 - .2 The device shall have a range of 0 – 100% Transmittance with 0 – 2 Absorbance and an accuracy of $\pm 0.5\%$ UVT. The device shall include a back-lit LCD display.
 - .3 Acceptable product: Real UVT Field Meter as manufactured by Real Tech Ltd. and supplied by Atlantic Purification, or approved equivalent.
 - .4 It is to be noted that the portable UVT field meter shall be supplied by the same supplier as for the UV system.
- .20 Spare Parts:
 - .1 Eight (8) UV lamps
 - .2 Eight (8) Quartz sleeves
 - .3 Eight (8) Lamp holder seals
 - .4 One (1) Electronic Ballast;
 - .5 Two (2) Operators Kits including face shield, gloves and cleaning solution.

Part 3 Execution

3.1 Installation

- .1 Installation of UV system shall be included in this contract and shall be done in accordance with the manufacturer's instructions.
- .2 Clear water for testing of the equipment is the responsibility of the Contractor and will not be provided by the Owner.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 10 81 01 Supply and Installation of WWTP Aeration System.
- .2 Section 22 20 13 Pressure Piping.

1.2 GENERAL

- .1 These specifications are for the design, fabrication, delivery, installation and start-up of positive displacement air blowers complete with electric motors including:
 - .1 Two (2) units each comprised of a blower and motor skid mounted as a unit as described herein;
 - .2 Flexible connector and clamp for inlet and outlet connections on each unit supplied;
 - .3 Each unit shall be complete with check valves, isolation valves, and piping;
 - .4 Each unit shall be complete with a high efficiency motor, suitable for use with variable frequency drive controllers (inverter duty);
 - .5 Each unit shall be housed in an acoustic enclosure to limit sound intensity;
 - .6 Each unit shall be complete with an acoustical air intake louvre and transition duct as shown on the drawings.
 - .7 Lubricants required for start-up and operation, spare parts, shop drawings, installation manuals;
 - .8 Operating and Maintenance Manuals;
 - .9 Installation inspection, start-up, testing and personnel training assistance by the manufacturer's representative.
 - .1 The Contractor's electrical and mechanical representatives will be required to be present and assist in the start-up of the equipment by the blower manufacturer. This will be for a period of two (2) days.
 - .2 The final Blower start-up will only be possible after the liquid levels in the Lagoon Cells are at design elevation.
 - .3 As noted in the general construction sequence shown on the drawings, it is anticipated that the aeration system in Lagoon #2 will be used to provide treatment during construction. Any blower start-up for treatment during construction is in addition to the two (2) days of start-up assistance required by Article 1.2.9.1 above, and shall be incidental to the Work.
- .2 The Contractor shall be responsible for maintaining the units to the manufacturer's requirements until the work is accepted by the Departmental Representative.
- .3 The foregoing will not be construed as limiting, restricting, or modifying any general or specific requirements as set forth in any part of the Contract Documents.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for review prior to fabrication and in accordance with construction sequence outlined in Section 01 32 16.19 - Construction Schedule.
 - .1 Submit for review detailed shop drawings of all equipment and all material required to complete the project.
 - .2 No material or equipment may be delivered to the job site or installed until the Supplier has in his possession the reviewed shop drawings for the particular material or equipment.
 - .3 If the Supplier must revise and resubmit shop drawings, promptly re-submit the same number of sets.
 - .4 Shop drawings shall refer not only to drawings, but also any brochures, reports, charts, forms, etc., required for complete review of the equipment of material.
 - .5 Blower shop drawings shall include all components and information necessary for the evaluation of the blower units including but not necessarily limited to: blower dimensions, weight, skid mounting details, performance curves for varying blower speed and discharge pressures, power curves for blower operation, details on inlet and outlet connections, blower noise rating information (with and without acoustic enclosure), etc.
 - .6 Blower motor shop drawings shall include: motor electrical characteristics, power rating, service factor, coupling details with the blower, motor dimensions, weight, location of electrical connections, skid mounting details, etc.
 - .7 Shop drawings shall also be provided for the blower accessories that are to be provided with each unit. This will include detailed information on the blower acoustical enclosure, flexible inlet and outlet discharge connections, acoustical intake louvre and transition duct, check valves, isolation valves, piping, gauges, pressure switches, inlet filter/silencer, discharge silencer, and any other accessories specified herein.
 - .8 Submit for review detailed, dimensioned drawings or cuts, showing construction, size, arrangement, operating clearances, mounting or anchoring details, performance characteristics and capacity.
 - .9 Submit for review complete assembly and installation drawings, detailed specifications and data covering material used and accessories forming a part of the equipment furnished.
 - .10 Each piece of material or equipment proposed shall be a standard catalogue product of an established manufacturer and of quality, finish, and durability equal to that specified.
 - .11 Shop Drawings to Include:
 - .1 Package
 - .1 Letter from factory confirming blower package is fully shop assembled and will meet the performance requirements specified herein;
 - .2 Package drawing, showing dimensions and connection sizes and locations;
 - .3 Package weight.
 - .2 Blowers
 - .1 Name of manufacturer;
 - .2 Type and model;

- .3 Rotative speed;
- .4 Critical speed of the rotor;
- .5 Type of bearings, lubrication, and AFBMA L10 Bearing life rating;
- .6 Connection sizes;
- .7 Maximum air temperature at discharge flange;
- .8 Net weight or blower;
- .9 Net weight of heaviest single component requiring removal for maintenance;
- .10 Overall dimensions;
- .11 Complete performance curves showing discharge pressure versus capacity, operating speed, and bhp at minimum and maximum ambient air temperatures and at standard condition. Curves shall indicate performance at various speeds and discharge pressures and shall include the specified minimum airflow and specified maximum airflow at the specified discharge pressure;
- .12 Shop painting data;
- .13 Vibration isolator base pads;
- .14 Estimated maximum noise level measured 1.0 m from the outside of the blower enclosure;
- .15 Blower/motor skid: bolt-hole locations, overall dimensions, x-y-z coordinates for blower inlet and outlet;
- .16 Heat generation (BTU/hr.) at design operation;
- .17 Parts list and parts diagram.
- .3 Motors
 - .1 Name of manufacturer;
 - .2 Type and model;
 - .3 Bearing type and lubrication;
 - .4 Horsepower rating and service factor;
 - .5 Terminal box location;
 - .6 Temperature rise and insulation rating;
 - .7 Full load rotative speed;
 - .8 Net weight;
 - .9 Efficiency at full load, $\frac{3}{4}$ load $\frac{1}{2}$ load, and rated blower;
 - .10 Full load current;
 - .11 Locked rotor current;
 - .12 Overall dimensions;
 - .13 Parts list and parts diagram.
- .4 Accessories
 - .1 Name of manufacturer;

- .2 Equipment data.
- .5 Certified Shop Tests Reports
 - .1 Performance curves;
 - .2 Data;
 - .3 Calculations.
- .3 Provide installation manuals in accordance with construction sequence outlined in Section 01 32 16.19 - Construction Schedule.
 - .1 This Manual is to include:
 - .1 Dimensions and weights of equipment to be installed. Specific information on off-loading equipment required when the equipment is delivered to the site;
 - .2 A checklist of each individual component supplied and identification of the crate/package each is in;
 - .3 Drawings showing equipment configuration, dimensions, location of lifting points, etc;
 - .4 Recommended clearance requirements;
 - .5 Anchor bolt patterns, gasket/pad information, anchor bolt torquing requirements, alignment information;
 - .6 Drawings showing connection/termination point, sizes, etc. for piping, electrical, etc;
 - .7 Electrical characteristics and connection points;
 - .8 Installation sequence and checklist;
 - .9 Specific information on proper maintenance of the equipment between the time it is installed and the time it is brought into normal service;
 - .10 Other information as required to ensure the equipment is safely and properly installed;

1.4 START-UP ASSISTANCE AND TRAINING

- .1 In addition to the Installation Manuals, the supplier shall furnish the necessary skilled technical personnel to check the installation, carry out an evaluation of, and start-up the equipment supplied under this contract.
 - .1 This personnel shall be available on site for not less than two (2) full days of eight (8) hours each for aeration system start-up, including Blowers. Co-ordinate timing with Departmental Representative.
 - .2 The Contractor's electrical and mechanical representatives will also be required to be present and assist in the start-up of the equipment by the blower manufacturer.
- .2 Also during this time on site, the Supplier's personnel shall instruct the Owner or his representative fully on the operation, adjustment, and maintenance of all equipment furnished. All training sessions shall be recorded on video, and copies of training videos shall be provided with the O&M Manuals.

- .3 Provide fourteen (14) calendar days notice of the time when this service will be provided. It will be scheduled when the installation is completed and the remainder of the Wastewater Treatment Plant is constructed and the cells have been filled to sufficient levels for this work to be done.
- .4 These two (2) days of on-site assistance and training will not be paid separately, but is considered incidental to the work and is to include all transportation, accommodation, personnel, and related costs including office support.
- .5 NOTE: It is intended that the two days of on-site presence for the purpose of start-up and commissioning, and for training of the Owner's personnel, is common to the aeration system and the blower system (as described in Section 10 81 01 Supply and Installation of WWTP Aeration System). In addition, a final inspection of the blowers and aeration system will also be required eleven (11) months after commissioning (as described in Section 10 81 01 Supply and Installation of WWTP Aeration System).
- .6 If additional on-site time is required from the personnel, it must be requested by the Owner in writing and will be paid at the all inclusive per diem rate to be provided by the Contractor prior to Substantial Completion. This does not include any time or costs to carry out repairs under the warranty, which is incidental to the contract.
- .7 The Supplier shall not charge for office technical support provided during the warranty period.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit for review draft copies of the Operating and Maintenance Manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .2 All final copies of these manuals shall be delivered within two (2) calendar weeks of the return of the reviewed draft.
 - .1 Provide bound and indexed final hard copy and digital copies of an Operating and Maintenance Manual for the blower assemblies supplied under this contract.
 - .2 Submit three (3) hard-copy draft copies of the O & M Manuals to the Departmental Representative for review in accordance with Section 01 78 00 - Closeout Submittals.
 - .3 One (1) copy will be returned to the Supplier with any comments or changes required. Three (3) final copies are then to be submitted to the Departmental Representative.
 - .4 Supply written operating and maintenance instructions from the Supplier, which shall be sufficiently comprehensive to enable the operator to operate and maintain the equipment supplied.
 - .5 All information in the O & M Manuals shall be clear and legible. Any data sheets with information on multiple models or optional equipment shall be clearly marked to indicate the information which applies to the equipment supplied.
 - .6 Assemble all data in a vinyl hard covered, plastic jacketed, 3 hole 'D' ring binder for 215 x 280 mm size paper with spine and face pockets. Binder to be of thickness to adequately contain all necessary information. Number pages consecutively.
 - .7 Prepare the instructions as a systems manual applicable solely to the equipment supplied by the manufacturer to these specifications, including those devices and equipment supplied by him. Also refer to Section 10 81 01 – Supply and Installation of WWTP Aeration System, Article 1.6 – Operation and Maintenance Manuals. The Operation and Maintenance Manual

for the Aeration System is to be integrated with the Operation and Maintenance Manual for the Blowers as a single document. The instructions shall include, but not be limited to, the following:

- .1 Descriptions of, and operating instruction for, each major component of the facility as supplied, including detailed parts lists.
- .2 Instructions for operation of the equipment in all intended modes of operation.
- .3 Instructions for all adjustments which must be performed at initial startup of the facility, adjustments which must be performed after the replacement of level control system components, and adjustments which must be performed in the course of preventive maintenance as specified by the Manufacturer.
- .4 Service instructions for major components not manufactured by the Manufacturers but which are supplied by them in accordance with these Specifications. The incorporation of literature produced by the actual components Manufacturer shall be acceptable.
- .5 Copies of the reviewed shop drawings for the equipment.
- .6 A list of major equipment components with complete model and serial number information, and a list of local and head office Manufacturer's representatives including telephone and fax numbers.
- .7 Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these Specifications. Instruction manuals applicable to many different configurations, and which require the operator to selectively read portions of the instructions, shall not be acceptable.
- .8 Arrange each manual in three sections: General; Equipment; and Operating and Maintenance Procedures.
 - .1 General:
 - .1 Summary of Information Page: project name, equipment description, order number, serial numbers for all components, Manufacturer, Manufacturer's nearest service representative, date prepared (and revised if necessary).
 - .2 Table of Contents.
 - .3 Warranty Information.
 - .4 Listing and Explanation of Abbreviations Used.
 - .2 Equipment:
 - .1 Blowers: shop drawings; certified performance curves identified by serial numbers; parts diagram and parts list; direction of rotation; materials of construction; product specifications, physical characteristics;
 - .2 Electric motors: shop drawings; standard performance data; serial numbers; parts diagram and parts list; physical characteristics;
 - .3 Expansion joints: shop drawings; performance specifications; dimensions;
 - .4 Check valves: shop drawings; performance specifications; dimensions;
 - .5 Filter/silencers: shop drawings; performance specifications; dimensions;
 - .6 Discharge Silencers: shop drawings; performance specifications; dimensions;

- .7 Acoustic Inlet Hood: shop drawings; performance specifications; dimensions.
- .3 Operating and Maintenance Procedures:
 - .1 Blower and motor units: normal start-up and shut-down procedures; maintenance checklist with maintenance operation and frequency; lubricant list; lubrication points diagrams; recommended spare parts list for minor field repairs; alignment instructions; troubleshooting tips; preventative maintenance inspection and monitoring charts.
 - .2 Filter/silencer units: cartridge element source (manufacturer, model) information; pressure loss and/or time interval for element change.
 - .3 Any other instructions or information the Owner should have for the safe and reliable operation of the equipment.

1.6 WARRANTY AND GUARANTEE REQUIREMENTS

- .1 Full warranty against defects in performance, workmanship and materials on the blowers including all accessories shall be maintained for twenty-four (24) months following the date of substantial completion. Warranty documentation to be provided at commissioning.
- .2 Defects which occur or are discovered during this period shall be repaired or replaced by the Manufacturer to the Departmental Representative's satisfaction, at no cost to the Owner. Work under the guarantee/warranty shall include not only replacement of defective parts or materials but also all work incidental thereto. Work required under the Guarantee/Warranty shall be carried out promptly after notification of an issue by the Owner or the Departmental Representative.
- .3 The Guarantee/Warranty Certificate shall be submitted to the Departmental Representative not less than two (2) calendar weeks prior to the date of submission of the draft O & M Manual.
- .4 This Certificate shall clearly identify the following:
 - .1 The Project and Owner being covered by the Guarantee/Warranty.
 - .2 The blower unit manufacturer providing the Guarantee/Warranty, including legal name, address telephone number, and name of authorized representative.
 - .3 The details of coverage of the Guarantee/Warranty stated in accordance with this Section.
- .5 The Certificate shall be signed (and witnessed if required) by a representative of the blower unit manufacturer authorized to sign such documents on behalf of the manufacturer, and the manufacturer's corporate seal shall be affixed to this document.
- .6 The original of this Guarantee/Warranty Certificate shall be delivered to the Owner. A copy shall be delivered to the Departmental Representative, and copies shall be included with the O & M Manuals as stated above.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 The equipment and accessories to be supplied under this contract are to be shipped by the supplier to the Springhill Institution Wastewater Treatment Plant located in Springhill, Nova Scotia.
- .2 Arrangements for delivery and coordination of the equipment are to be made by the successful contractor.

- .3 All equipment and materials are to be properly packaged, protected and secured to ensure there is no damage or loss.
- .4 Notify the Departmental Representative in writing no less than seven (7) working days in advance of shipment of the method, dimensions and weights of each part of each shipment and its anticipated date of arrival at the site.
- .5 Promptly repair and /or replace any damaged items to the satisfaction of the Departmental Representative and at no additional cost, even if any damages or deficiencies are not identified until after delivery.
- .6 For protection until incorporated into the work, equipment and material may not be unpacked and carefully examined until time of installation.
- .7 Final acceptance of material will be dependent upon shop test and inspections, field test and inspections, the performance of the materials under operating conditions, and the fulfilment of all guarantees.
- .8 It should be noted that equipment necessary for off-loading at the site will not be provided by the owner.
- .9 All equipment (for a complete installation, as described in these Specifications), material, information, etc. required to be provided by the supplier shall be delivered complete to the site. Exact date of delivery will be determined after award of contract and in coordination with the successful Contractor.
- .10 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .11 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .12 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 AIR BLOWERS

- .1 Skid-mounted blower package: blower, motor, combined inlet filter/ silencer, relief valve, pressure gauge, check valves, isolation valves, spare parts, base gasket/pad, discharge silencer with integral steel base, belts, sheaves, belt guard, safety valve, flexible connections (inlet and outlet), instrumentation, acoustical enclosure and vibration isolators. Provide pressure switch, temperature gauge, temperature switch, and all accessories and appurtenances indicated on the drawings, specified, or otherwise required for a complete, properly operating system.
- .2 General:

- .1 Equipment to be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and manufacturer's recommendations.
- .2 Coordinate the blowers with the equipment specified in other sections. The blower unit shall be a current standard product of the blower manufacturer and shall be a packaged type unit, engineered and fully shop assembled by the blower manufacturer. The blower manufacturer shall furnish all accessory items.
- .3 Approved blower packages:
 - .1 Com-paK Plus Package as manufactured by Kaeser Omega Blowers; Model DB.
 - .2 Delta GEN-5 GM Blower as manufactured by Aerzen;
 - .3 ZL range Positive Displacement Air Blowers as manufactured by Atlas Copco;
 - .4 Approved equivalent.
- .3 General Equipment Requirements:
 - .1 Power supply to the equipment:
 - .1 Blowers: 575 volts, 60 Hz, 3 Phase.
 - .2 Enclosure fan motors: 120 volt 60 Hz 1 phase or 575 volt 60 Hz 3 phase as required by blower manufacturer.
 - .2 Blower motor: inverter duty suitable for VFD control, designed to operate normally between 50-100% of maximum motor speed.
 - .3 Nameplates: provide nameplate for each blower shall indicating the equipment number.
 - .1 Location of nameplates and method of attachment to be acceptable to the Departmental Representative;
 - .4 Spare parts: each blower shall be provided with a set of spare parts consisting of the following items:
 - .1 Intake air filter elements: 3 sets
 - .2 V-belts: 1 matched set
 - .3 Replacement Oil and/ or Grease: 1 Year Supply
 - .4 One (1) set of any special tools required to operate and/or maintain the equipment supplied.
 - .5 Spare parts to be suitably packaged with labels indicating the contents of each package. Spare parts to be delivered to the Owner as directed.
- .4 Service Conditions:
 - .1 The blowers will be used to supply air to the WWTP aerated lagoon. This facility will be operating continuously, 24 hours/day, 7 days per week, 365 days per year. The equipment will be housed inside a building.
- .5 Performance and Design Requirements:
 - .1 The following design requirements are to be considered as a minimum. The blower supplier has the responsibility to meet the following requirements.

- .2 It is the responsibility of the aeration system Supplier as part of the aeration system design to identify and select an acceptable blower-motor unit that efficiently provides the volume of air at the required pressure as determined by the Design Brief for this specific project, including all requirements as specified herein. It will be the responsibility of the aeration system supplier to ensure that the blowers can meet or exceed the requirements of the aeration system. This will identify the following performance requirements:
 - .1 Output volume, L/s or scfm at design discharge pressure
 - .2 Motor rated power, HP/kW
 - .3 Pressure differential, kPa/psi
 - .4 Intermittent diffusers purging pressure, kPa/psi
 - .5 Blower unit power consumption in kWh at design operating conditions
- .3 In the event that the selected aeration system requires additional output volume, output pressure capability, aeration purging pressure or any other requirements that would result in higher motor horsepower requirements, the Contractor will be responsible for any resulting cost as determined by the Departmental Representative, including any mechanical and electrical modifications required as determined by the Departmental Representative.
- .4 Each blower shall be designed for the following conditions and requirements:
 - .1 Atmospheric pressure: 101 kPa (14.71 psia);
 - .2 Design inlet temperature: 24°C Summer and 0°C in Winter;
 - .3 Design relative humidity: 70%;
 - .4 Gas composition: Air;
 - .5 Gas specific gravity at inlet: 1.0;
 - .6 Maximum blower speed: As recommended by Manufacturer for proper operation;
 - .7 Elevation of installation: + 146.30 m geodetic at finished floor in building;
 - .8 Blower flexibility: able to provide from 50% to 100% of rated capacity without developing transition or heat problems. This will be done by variable frequency drive units. Motors to be capable of continuous operation with variable frequency drive at 50% output capacity without overheating to be inverter duty suitable for VFD;
 - .9 Maximum steady state operation noise level to meet OSHA standards, and not exceed 75 dB at 1.0 m in any direction (measured with blower and motor operating) with acoustic enclosure at 100% output and not exceed 95 dB at 1.0 m in any direction without acoustic enclosure measured inside the actual building (wood frame with drywall finish);
 - .10 Minimum mechanical efficiency of 75% at 100% output.
- .5 The Blowers shall produce the diffusers purging pressure without entering into the safety factor range.
- .6 Verify the performance of each unit prior to shipment from the factory by testing at various air flow rates from 50% to 110% of rated air flow to develop performance curves which shall be certified and provided to the Owner. The performance curves shall include a power (horsepower or kW) versus air flow rate curve. Each curve shall be developed from not less than five (5) points. These performance/test curves shall be clearly labelled to show the

serial number of the unit tested and certified copies provided to the Departmental Representative as soon as available but not less than three 3 weeks prior to delivery of the blowers to the site. Copies shall also be included in the O & M Manuals.

- .6 Positive Displacement Blower
 - .1 Casing: designed to withstand at least twice the specified discharge pressure and shall be reinforced with integrally cast ribs.
 - .1 Provide each casing with tapped and plugged openings for casing and bearing drains and fittings for proper bearing and gear lubrication maintenance.
 - .2 Arrange casing for top inlet and bottom discharge.
 - .3 Incorporate a built-in pulsation dampener to reduce air pulsations in the discharge piping by a minimum of 90% and reduce the overall noise level of the package.
 - .2 Rotors and Shaft: drop forged in one single piece to ASTM 1043 or equivalent.
 - .1 Rotors: made from high strength ductile iron.
 - .2 Impellers: of the straight, three lobe involute type (unless a rotary lobe blower is selected).
 - .3 Timing Gears: carburized and ground steel helical gears located at the drive end to eliminate torsional stress through the shaft. To be enclosed in oil tight housings, splash lubricated.
 - .4 Bearings:
 - .1 Each rotor and shaft assembly shall be supported by ball type anti-friction bearings rated for a minimum AFBMA life of 80,000 hours.
 - .2 Provide an additional roller bearing at the drive end designed to handle the V-belt drive stress.
 - .3 Incorporate a minimum of five (5) individual bearing assemblies in each blower.
 - .5 Lubrication:
 - .1 Each blower shall be provided with non-wearing, non-contacting piston ring seals designed to prevent lubricant from entering the air stream.
 - .2 Lubrication shall be accomplished via splash type lubrication on both ends of the blower.
 - .3 Provide oil slingers and gear dipping as well as suitable oil level sight glasses.
 - .4 No grease lubrication is allowed.
 - .5 Synthetic oil shall be used to improve bearing life.
- .7 Inlet Filter Silencer
 - .1 Provide an absorptive type inlet filter-silencer in each blower package to reduce noise at frequencies above 500 Hz with an integral resonator.
 - .2 The inlet filter shall be situated inside the inlet silencer, and shall be designed to protect the blower from harmful dirty and foreign matter.
 - .3 The filter element shall be of the dry, washable, synthetic media type, finished carbon steel, all weather housing, ANSI standard 125 lb. bottom flange, 6.35 mm (¼-inch) FNPT tap to allow installation of gauge to monitor pressure drop, and silencing tubes designed to effectively reduce blower noise.

- .4 Noise attenuation: not less than 12 dB from 500-8,000 Hz or as required to meet Article 2.1.5 - Performance and Design Requirements.
 - .5 Clean filter pressure drop: not to exceed 1.0 kPa (0.15 psi) at 100% rated flow.
 - .6 Size filter/silencer units properly to suit the design conditions.
 - .7 Effective inlet velocity at the filter housing inlet: maximum 3.05 m/s (600 ft/min).
 - .8 Filter inlets to be on the underside of the housing. Housings shall open to permit the convenient replacement/cleaning of filter elements.
 - .9 Inlet housings shall be complete with bird screen.
- .8 Discharge Silencer
- .1 Each blower package shall be provided with a reactive residential type discharge silencer composed of different expansion chambers. The silencer shall be fitted with an integral resonator “sleeve” for maximum noise reduction, as required to meet Article 2.1.5, Performance and Design Requirements. That is, noise within 1.0 m of the outlet of the discharge silencer shall not exceed 75 dBa.
 - .2 The discharge silencer shall be combined in a single assembly with the steel base-plate, which is designed to support the blower and all its appurtenances.
 - .3 Minimum steel thickness of welded carbon steel base: ¼-inch.
 - .4 The steel base/ discharge silencer shall be designed to maintain alignment of the blower and the drive components during operation. No other type of arrangement shall be allowed so as to prevent distortion or misalignment of the whole package.
- .9 V-Belt Drive
- .1 Each blower package shall be provided with V-belts and pulleys designed for the blower conditions. Provide a fully automatic belt tensioning system as part of the package. Slide rails shall not be acceptable.
 - .2 Service factor for the belt drive: minimum of 1.5 times over the BHP under maximum load conditions.
 - .3 The belt drive shall be covered by a belt guard in compliance with OSHA regulations.
- .10 Electric Motor
- .1 Motors: horizontal, open drip-proof, cast iron frame, induction type, with normal starting torque and low starting current characteristics, suitable for 3 phase, 60 Hertz, 575 volts, electric current. Motors shall not be overloaded at design operating conditions or at any pressure in blower operating range as specified. The motors shall be designed for use with Variable Frequency Drives, to be inverted duty type motors rated for minimum 1,600 Volts.
 - .2 The motor shall be capable of continuously operating at reduced speed of up to 50% of maximum speed without overheating.
 - .3 The motor shall be complete with a perforated belt guard primed with a minimum of 1.5 mils of zinc-based synthetic primer. A finish acrylic enamel coating (minimum 3.0 mils) shall be applied in accordance with Article 2.1.12 - Painting, Colour Definitions of ANSI 253.1; 1967, Safety Colour Code for Marking Physical Hazards.

- .4 Each motor shall be of cast iron frame construction and shall be of current NEMA design. Rolled steel or aluminum frame motors shall not be acceptable.
- .5 Motors shall be tested to ASA C50 and conform thereto for insulation resistance and dielectric strength.
- .6 The capacity shall be sufficient to operate associate driven devices under all conditions of operation and load and without overload, and at least horsepower indicated or specified. Each motor shall be selected for quiet operation. Motor specifications shall include:
 - .1 Motors shall be CSA approved, ULC listed, SCI type;
 - .2 Motor voltage: 575 V/60 Cycle/3 Phase;
 - .3 Enclosure: open drip proof;
 - .4 Service factor: 1.15;
 - .5 Maximum motor speed at 100% output: 1,800 RPM;
 - .6 Insulation Class F, suitable for continuous duty at 40°C ambient temperature;
 - .7 Motor Rating - as required to properly suit the blower;
 - .8 High efficiency (93% minimum);
 - .9 Manufactured to EEMAC Design B Standards;
 - .10 Frame 405 TS (direct connected to blower);
 - .11 Motors to be equipped with embedded thermistors (one per phase).
- .11 Vibration Isolator Pads
 - .1 Vibration isolator base pads shall be provided for each blower as recommended by the manufacturer.
- .12 Painting
 - .1 All ferrous metals shall be shop painted. Prior to shop priming, all surfaces shall be sandblasted per SSPC-SP6.
 - .2 The prime coat shall be one coat of universal primer to achieve a minimum dry film thickness of 2-2.5 mils. The application shall be uniform, free of runs, sags and pinholes and in strict compliance with the paint manufacturer's printed instructions. The finish paint of primed surface shall be the factory standard industrial enamel. The minimum dry film thickness for the finish paint shall be 2.0 mils.
 - .3 Blowers and motors shall be standard factory finish colours. The frame shall be painted to match the blower. The supplier shall be responsible for touch-up of any paint damaged during shipment of the equipment.
- .13 Discharge Pressure Relief Valve: spring-loaded type with housing in bronze, suitable for temperature up to 150°C.
 - .1 Provide each blower with a pressure relief valve, sized to provide adequate protection for the blower and the motor in case of operation against a closed discharge valve.
 - .2 Valve shall have flanged connection.
 - .3 The relief valve shall be set at the factory at not less than 7 kPa 1 psig above and not more than 35 kPa 5 psig above the maximum design operating discharge pressure.

-
- .14 Discharge Check Valve: Techocheck full flanged or wafer type, 125 lb. class, style 5004 CIL, or approved equivalent.
- .1 Provide a discharge check valve for each blower.
 - .2 Valve seat materials: designed for temperature up to 1750°C (350°F) and pressure up to 415 kPa (60 psig).
 - .3 Valve body: cast iron with aluminum internals, 316 S.S. springs, teflon sealing member materials.
- .15 Pressure and Vacuum Gauges
- .1 Provide each blower with a vacuum restriction gauge on the inlet side and a pressure gauge on the discharge side.
 - .2 Install all gauges with a valve cock between the blower and the gauge to facilitate removal/replacement of the gauge.
 - .3 For the sound enclosure design, supply the vacuum restriction gauge with 62.5 mm (2 ½ inch) dial installed on the sound enclosure wall and visible without opening the sound enclosure.
 - .4 Supply the pressure gauge with 62.5 mm (2 ½ inch) dial, 0-20 psig dial filled with low viscosity glycerin, with a body in stainless steel.
 - .5 For the sound enclosure design, the pressure gauge shall be installed on the outside of the sound enclosure wall.
- .16 Discharge Temperature Gauge
- .1 Provide each blower with a discharge temperature gauge. For the sound enclosure design, supply the temperature gauge with bulb and capillary tube with a 4-inch dial installed on the sound enclosure wall.
 - .2 Scale range: 0 to 200°C.
 - .3 Capillary length: sufficient for convenient mounting.
 - .4 Supply a stainless steel well to secure the bulb.
- .17 Discharge Temperature Switch: Allen Bradley Model 837-A6A complete with Thermowell 837-N1 manual reset, or approved equivalent
- .1 Provide each blower with a discharge temperature switch to automatically shut the blower down in the event of high temperature. Switch to be remote bulb type with single pole, single throw, 10 ampere switches suitable for 120 volts ac.
 - .2 Housing: NEMA Type 1 housing for indoor installation.
 - .3 Capillary length: sufficient for convenient mounting.
 - .4 Supply a stainless steel well to secure the bulb.
- .18 Discharge Pressure Switch
- .1 Install a pressure switch in the discharge piping of each blower.
 - .2 Adjustable range: 0 to 15 psig (0 to 100 kPa), and shall be set lower than the relief valve setting.

- .3 Each pressure switch shall be field adjustable and shall have a trip point repeatability of better than 1 percent of actual pressure.
 - .4 The contact shall close to shut down the blower, and the rating shall be 10 amperes at 120 volts ac. Each switch shall have a weatherproof NEMA 4 housing.
- .19 Acoustical Enclosure
- .1 The blower manufacturer shall provide an engineered acoustical enclosure to minimize the overall noise level. The enclosure shall be made of zinc plated steel sheets with high-density polyurethane noise dampening material. Two removable access doors shall be included, one on each side. The base plate of the noise enclosure shall be made of epoxy-coated steel, and be designed to facilitate lifting with a forklift. The entire blower unit shall be installed on a skid, as part of the acoustic enclosure.
 - .2 An internal high efficiency ventilation system shall be provided. The high efficiency exhaust fan shall be designed to maintain the temperature inside the enclosure at not more than 12°F above the ambient temperature.
 - .3 The acoustical enclosure shall be sandblasted per SSPC-SP6. The prime coat shall be one coat of universal epoxy primer to achieve a minimum dry film thickness of 2-2.5 mils. The application shall be uniform, free of runs, sags and pinholes and in strict compliance with the paint manufacturer's printed instructions.
 - .4 It should be noted that a ventilation fan attached to the blower shaft is acceptable. If a fan operated by 120 V power supply is used, the blower manufacturer shall include a controller to operate the fan when the blower is running and shut down when the blower is stopped. The blower manufacturer shall also include a junction box for electrical connection.
- .20 Acoustical Intake Hood and Transition Duct
- .1 The blower manufacturer shall provide an engineered acoustical intake hood to minimize the overall noise level at the inlet. These hoods shall be supplied loose.
 - .2 The hoods shall be galvanized steel sheet metal connected to the Blower Schedule 10 pipe using a flexible EPDM connector from the welded galvanized steel transition duct as shown on the Drawings.
 - .3 The enclosure shall include an aluminum louvre sized for the application. The louvre shall include a drainable blade and bird screen mesh.
 - .4 The acoustical hood shall include acoustic foam and baffles to reduce noise.
 - .5 Paint hood as specified under Article 2.1.12.
 - .6 Hoods shall be manufactured and supplied to be installed on the wall of a building, with mounting flanges and gaskets.
 - .7 The opening (intake) of the hood shall point downward.
 - .8 Refer to the Drawings for additional details.
 - .9 Both units (acoustical intake hood and transition duct) are required for each blower unit.

Part 3 Execution

3.1 INSTALLATION

- .1 Install according to manufacturer's recommendations.
- .2 The installation shall be inspected for approval by the manufacturer's representative prior to start-up.
- .3 Supplier to provide installation and start-up assistance as noted in this Section and in Sections 01 91 13 – General Commissioning (Cx) Requirements and 01 91 41 – Commissioning: Training.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 10 81 00 Supply & Installation of Blowers.
- .2 Section 10 90 00 Air Piping Systems.
- .3 Section 22 20 13 - Pressure Piping.

1.2 QUALIFICATIONS AND EXPERIENCE

- .1 The Supplier and Installer shall have experience in the design, manufacturing, supplying, installation and commissioning of fine bubble diffuser aeration systems and flow diversion baffles of the type specified.
- .2 Aeration equipment shall be of proven design and shall be referenced by at least five Canadian (5) installations in wastewater treatment lagoons of similar scope (cold climate with more than four (4) months of ice cover conditions), having been in operation for not less than two (2) years. All such systems shall currently be in operation. References of these installations shall be provided with any request for approval of alternate systems.
- .3 System installer shall be familiar with and shall have installed a minimum of three (3) of the specified systems within the past ten (10) years. Installation shall be conducted in accordance with the directions of the supplier/manufacturer. A summary-report of the installation procedures and recommended adjustments shall be submitted as part of the O&M Manuals submission.
- .4 Aeration diffusers shall have a documented history of efficient operation, freedom from clogging, excessive backpressures, or structural failure when applied to service conditions similar to those indicated for this project.
- .5 Diffuser membranes shall have a design life span of not less than 10 years before replacement is required. The Departmental Representative reserves the right to reject any product, which in the opinion of the Departmental Representative, does not meet the full qualification as set forth.

1.3 COMMISSIONING AND START-UP ASSISTANCE - AERATION SYSTEM

- .1 The Supplier / Manufacturer shall furnish the necessary skilled technical personnel to start-up and commissioning the aeration system supplied under this contract, including on-site training of the Owner's operators.
- .2 The personnel shall be available on site for not less than two (2) full days of eight (8) hours each for aeration system start-up, including Blowers. The timing of this is to be coordinated with the Departmental Representative. Also during this time on site, the Supplier's personnel shall instruct the Owner or his representative fully in the operation, adjustment, and maintenance of all equipment furnished. All training sessions shall be recorded on video, and copies of training videos shall be provided with the O&M Manuals.
- .3 Provide a minimum of fourteen (14) calendar day notice of the time when this service is to be provided. It will be scheduled when the installation is completed and the remainder of the

Wastewater Treatment Plant is constructed and ready for start-up and the cells have been filled sufficiently for this work to be done.

- .4 The two (2) days of on-site assistance and training will not be paid separately, but is considered incidental to the work and is to include all transportation, accommodation, personnel, and related costs including office support services.
- .5 In addition to commissioning and start-up assistance, the Tendered Price shall include two (2) full days of on-site assistance for a complete system verification, re-calibration and adjustment of all components, floating laterals and submerged diffusers, blowers, and general overview of the system maintenance. This work shall be performed eleven (11) months after the date of Substantial Completion and before the end of the first year of the guarantee/warranty period. The inspection is to be done by the Aeration System Manufacturer's skilled technical representative and personnel.
- .6 If additional on-site time is required of these personnel, it must be requested by the Owner in writing and will be paid at an all inclusive per diem rate to be provided by the Contractor prior to Substantial Completion. This does not include any time or costs to carry out repairs under the guarantee/warranty, which is incidental to the contract.
- .7 The Supplier shall not charge for office technical support provided during the warranty period.
- .8 As noted in the general construction sequence shown on the drawings, it is anticipated that temporary high-flow diffusers will be installed on the new floating laterals in Lagoon #2 and used to provide treatment during construction. Any aeration start-up for providing treatment during construction is in addition to the two (2) days of start-up assistance required by Article 1.3.2 above, and shall be incidental to the Work.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for aeration system and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit complete system shop drawings and design information to Departmental Representative for review prior to fabrication/installation. Submittals required under this Section include:
 - .1 Aeration System Design Brief, including layout drawings
 - .2 Aeration Floating Diffuser Lateral Shop Drawings
 - .3 "Free end" Self-Adjusting Tension Assembly and Anchor Post Shop Drawings
 - .4 Aeration System Operating and Maintenance Manuals
 - .5 Aeration System Guarantee/Warranty Certificate
- .4 The specific minimum requirements for each of these submittals are as follow:
 - .1 Aeration System Design Brief
 - .1 The Design Brief shall be organized in a logical manner with an index identifying each section, plans, attachments, etc. The Brief shall clearly identify the project and Owner for which the design applies.

- .2 All design factors and assumptions used in the system design shall be clearly identified.
- .3 The design is to be carried out for summer and winter conditions at the facility.
- .4 Air (oxygen) requirements for each cell shall be identified for summer and winter conditions, to be shown separately for BOD₅ reduction, and possible future denitrification. Air requirements shall also show calculations of field transfer rates (FTR) and scfm or L/s requirements for each cell.
- .5 Design treatment efficiency shall be shown for summer and winter conditions and shall show retention time, influent and effluent BOD₅, percentage BOD₅ removal, influent and effluent TSS, and NH₃ removal for each Cell.
- .6 Diffuser design shall be shown, including depth of each cell, depth of installation of each diffuser, number of diffusers in total per cell, diffuser model number(s), number of diffusers on each lateral in each cell, diffuser lateral spacing, delivery air pressure at the diffusers in each cell and any other relevant information.
- .7 The design of the air distribution headers shall be based on the design factors as stated in this Specification. The design of the air distribution headers shall consider all losses from the discharge side of the blowers from piping, fittings, valves, flow meters, etc., both inside the blower building and along the pipe route to each cell in determining the pipe sizes required. (Refer to the drawings for information on the proposed piping configuration inside the new Blower Building.)
- .8 The buried air distribution header system shall be HDPE DR17 pipe sized as per the Drawings, complete with appropriate fittings. Successful Contractor /Aeration Supplier/Manufacturer to confirm that indicated air header pipe size is acceptable.
- .9 The design of the aeration system shall also identify the manufacturer, model number, performance information, electric power characteristics, etc., of the blowers that will be supplied as part of the scope of the aeration system under this Contract. This Design Brief shall include a section which clearly shows that the blower selection made is appropriate to the requirements of the aeration system performance and oxygen transfer requirements, system pressure losses, etc. The blowers selected shall be as provided under Section 10 81 00 of these Specifications.
- .10 A schedule shall be included to show the time realistically required for the preparation and submission of shop drawings, and for delivery of the various components to the job site. The objective will be to meet the overall schedule/milestones as identified in Section 01 32 16.19 Construction Progress Schedule.
- .11 The Design Brief shall provide a detailed “operating concept” for the operation of the aeration system at this WWTP facility. This shall include such details as how the aeration system (blowers, diffusers, etc) is to be operated with varying organic and hydraulic loads delivered to the WWTP, and for seasonal variations that affect influent and WWTP operating temperatures.
- .12 Plans are to be included that clearly illustrate the layout and dimensional information of the aeration system, including the air distribution headers and

- fittings, air diffuser laterals, separation distances, details of the anchoring system required, and any other information required to provide a complete Design Brief.
- .13 Appendices are to be included for any relevant supporting information, such as Clean Water Oxygen Transfer Tests (ASCE certified), design worksheets, material specifications, material quantity summaries, etc. The certified oxygen transfer test curve shall show unit performance over an air flow rate range of at least 4.5 L/s (10 scfm) to 11.25 L/s (25 scfm).
 - .14 The Design Brief, calculations and any drawings shall be signed and stamped by a Professional Engineer experienced in this type of work and currently licensed or registered to practice in the Province of Nova Scotia. (stamp will be required to cover the total submission, including calculations, design process guaranty, confirmation of influent and effluent parameters, aeration parameters, physical dimensions of each cells all in accordance with these Specifications, as show on the drawings and incidentals).
- .2 Aeration Floating Lateral Diffuser Shop Drawings
- .1 These shop drawings are to provide precise details on the aeration floating lateral diffuser units.
 - .2 Aeration floating lateral diffuser shop drawings shall include all components including but not necessarily limited to float tube, diffuser, air feeder tubing, anchor cable and method of connection to the anchors, connection to the air header butterfly valve, aerator ballast, length of lateral between anchors, number of diffusers per lateral, etc.
 - .3 As part of the shop drawing submission for the floating lateral fine bubble aeration system, certified test information from an independent testing facility shall be submitted that confirms diffuser oxygen transfer efficiency:
 - .1 Diffusers shall have a minimum SOTE of 17.3% at a diffuser submergence depth of 2.8 m, and at a design diffuser flux rate of 2.00 SCFM/sq.ft of active surface area. Diffusers shall also deliver a minimum SOTE of 14.25% at a diffuser submergence depth of 2.8 m, and at a maximum diffuser flux rate of 3.2 SCFM/sq.ft of active surface area.
 - .2 Submit results of ASCE Standard Oxygen Transfer Efficiency (SOTE) tests conducted by an independent laboratory over the design flux rate range of 2.0 SCFM/sq.ft to 3.2 SCFM/sq.ft.
- .3 Free-end Self Adjusting Tension Assembly and Anchor Post Shop Drawings
- .1 These shop drawings are to provide precise details on the self-adjusting tension assembly and anchor post units.
 - .2 Self-adjusting tension assembly and anchor post shop drawings shall include all components including but not necessarily limited to anchor post diameter and length including bury, concrete base requirements, concrete counterweight, winch details including pulleys and ratchet mechanism, lateral cable connection details, etc. The number of anchor post units being supplied is to be stated.
 - .3 These shop drawings shall provide the installation contractor with all information required for the proper installation of the anchor posts, including the scope of the unit being supplied by the aeration system supplier.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit system operation and maintenance requirements to Departmental Representative prior to system start-up. Include with Operation/Maintenance manuals.
- .3 Submit written copies of the system performance warranty/guarantee to Consultant prior to system start-up. Include with Operation/Maintenance manuals for the Blowers.
- .4 Submit three (3) draft copies of the Operating and Maintenance Manuals to the Departmental Representative no later than five (5) weeks prior to delivery of the aeration system.
- .5 One (1) reviewed copy will be returned through the General Contractor, and three (3) final copies shall be prepared incorporating all of the Departmental Representative's comments.
- .6 Guarantee/Warranty Certificate for the aeration system: submit to Departmental Representative not less than two (2) calendar weeks prior to the date of submission of the draft O & M Manual.
- .7 Operation and Maintenance Manual – Aeration System (Also refer to Section 10 81 00 - Operation and Maintenance Manual for the Blowers, which is to be integrated with the Operation and Maintenance Manual for the Aeration System, as a single document):
 - .1 Arrange in a hard cover, durable, three-ring binder with pages consecutively numbered.
 - .2 The Supplier shall be responsible for supplying written operating and maintenance instructions, which shall be sufficiently comprehensive to enable the operator to operate and maintain the equipment supplied. This shall include the system operating philosophy.
 - .3 The instructions shall be prepared as a systems manual applicable solely to the equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him. The instructions shall include, but not be limited to, the following:
 - .1 Descriptions of, and operating instruction for, each major component of the facility as supplied, including detailed parts lists.
 - .2 Instructions for operation of the equipment in all intended modes of operation.
 - .3 Instructions for all adjustments which must be performed at initial start-up of the facility, adjustments which must be performed after the replacement of level control system components, and adjustments which must be performed in the course of preventive maintenance as specified by the Manufacturer.
 - .4 Service instructions for major components not manufactured by the Manufacturers but which are supplied by them in accordance with these Specifications. The incorporation of literature produced by the actual components Manufacturer shall be acceptable.
 - .5 Copies of the reviewed shop drawings for the equipment.
 - .6 A list of major equipment components with complete model and serial number information, and a list of local and head office Manufacturer's representatives including telephone and fax numbers.
 - .7 Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these Specifications. Instruction manuals applicable to many

different configurations, and which require the operator to selectively read portions of the instructions, shall not be acceptable.

- .4 Each manual is to be arranged in three sections: General; Equipment; and Operating and Maintenance Procedures. Each section is to include at least the following information:
 - .1 General
 - .1 Summary of Information Page: project name, equipment description, order number, model and serial numbers, Manufacturer and Manufacturer's nearest service representative including telephone and fax numbers, date prepared (and revised if necessary)
 - .2 Overall description of the system
 - .3 Index for the O & M Manual
 - .4 Warranty Information
 - .5 Listing of Explanation of Abbreviations Used
 - .2 Equipment
 - .1 The complete drawings; performance specifications; dimensions shall be submitted for all equipment related to the aeration system, including but not limited to:
 - .1 Diffuser units;
 - .2 Manifold diffuser fitting;
 - .3 Diffuser mounting;
 - .4 Aeration membrane;
 - .5 Feeder tubing;
 - .6 Other components supplied with aeration system.
 - .3 Operating and Maintenance Procedures
 - .1 Normal start-up and shut-down procedures; maintenance checklist with maintenance operation and frequency; recommended spare parts list for minor field repairs; alignment instructions; troubleshooting tips; preventative maintenance inspection and monitoring charts.
 - .2 Any other instructions or information the Owner should have for the safe and reliable operation of the aeration system.
- .5 All information in the O & M Manuals shall be clear and legible. Any data sheets with information on multiple models or optional equipment shall be clearly marked to indicate the information which applies to the equipment supplied.

1.6 WARRANTY AND GUARANTEE REQUIREMENTS

- .1 Guarantee/Warrantee Certificate shall clearly identify the following:
 - .1 The Project and Owner being covered by the Guarantee/Warranty;
 - .2 The aeration system manufacturer providing the Guarantee/Warranty, including legal name, address telephone number, and name of authorized representative;

- .3 The details of coverage of the Guarantee/Warranty stated in accordance with this Specification.
- .2 The Certificate shall be signed (and witnessed if required) by a representative of the aeration system manufacturer authorized to sign such documents on behalf of the manufacturer, and the manufacturer's corporate seal shall be affixed to this document.
- .3 The original of this Guarantee/Warranty Certificate shall be delivered to the Owner. A copy shall be delivered to the Departmental Representative, and copies shall be included with the O & M Manuals as stated above.
- .4 Header piping and fittings (in water and out of water components):
 - .1 Header piping and fittings shall be warranted to be free from defects in material and workmanship for a period of 60 months from the date of commissioning (shipping dates will not be used for warranty calculations).
 - .2 The Supplier/Manufacturers/Contractor shall repair or replace defective parts without charge to the Owner.
 - .3 The aeration Supplier/Manufacturers/Contractor will be responsible for removal (disposal) and reinstallation of any defective parts during the warranty period, and all work and expenses incidental thereto.
- .5 Aeration Diffuser Warranty
 - .1 Aeration diffusers shall be warranted 100% for the first 12 months and be warranted on a 100% down to 52% pro-rated basis (that is, warranty coverage reduces by one percent (1.00%) per month) for the following 48 months. This warranty shall cover not only replacement of defective parts and/or correction of defective work, but also all work and expenses incidental thereto.
 - .2 Product shall be free from defects in material and workmanship from the date of commissioning.
 - .3 The cost for removal (disposal) and installation of any diffusers during this warranty period shall be fully born by the Aeration Supplier.
- .6 System Performance Guarantee:
 - .1 Provide a written performance guarantee indicating that minimum average monthly dissolved oxygen levels in the aerated lagoons shall be within original design levels for a period of 60 months from the date of commissioning.
 - .2 In the event that the minimum monthly average dissolved oxygen levels are not within design levels for a consecutive period of 90 days or 3 months, the Supplier shall, at his own cost, adjust or modify the aeration equipment to bring the system within the design performance parameters.
 - .3 In the event that the average monthly BOD₅ reduction achieved through the cells where this aeration system has been installed does not meet the performance objectives required by these Specifications, the Supplier shall, at his own cost, adjust or modify the aeration equipment to bring the system within the design performance parameters. This action shall apply provided that the moving three-month averages of the influent BOD₅ value and the

flow rate through the system do not exceed the influent design BOD₅ value and the hydraulic design value as stated in these Specifications by more than ten (10) percent.

- .4 The evaluation of the system's performance shall be based on dissolved oxygen DO values and wastewater samples taken for analysis for BOD₅ concentrations by the Owner's operating and maintenance staff.
- .5 The performance guarantee is contingent upon the Owner adhering to the Supplier/Manufacturers operation and maintenance schedule.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 The equipment and accessories to be supplied under this contract are to be shipped by the supplier to the Springhill Institution Wastewater Treatment Plant located in Springhill, Nova Scotia.
- .2 Arrangements for delivery and coordination of the material and equipment are to be made by the successful contractor, who shall be responsible for providing the equipment and personnel to off-load this equipment and store it until required in the work.
- .3 All equipment and materials are to be properly packaged, protected and secured to ensure there is no damage or loss.
- .4 Label each crate or package to identify its contents and any special handling instructions. The supplier is responsible for the protection of all items until delivered to the site and shall promptly repair and /or replace any damaged items to the satisfaction of the Departmental Representative and at no additional cost, even if any damages or deficiencies are not identified until after delivery.
- .5 Final acceptance of material and equipment will be dependent upon shop tests and inspections, field tests and inspections, the performance of the components under operating conditions, and the fulfilment of all guarantees/warranties.
- .6 It should be noted that equipment necessary for off-loading at the site will not be provided by the owner.
- .7 All equipment (for a complete installation, as described in these Specifications), material, information, etc. required to be provided by the supplier shall be delivered complete to the site.
- .8 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .9 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .10 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 ACCEPTABLE AERATION SYSTEM MANUFACTURER

- .1 The aeration system shall be a “fine bubble type” consisting of floating lateral air distribution system and aeration diffusers. The system, as shown on the drawings and as described in these Specifications is based on the OptAER system as manufactured by Nexom Inc., available from:

Atlantic Purification Systems Ltd. (Attention: Ian Johnston or Hettie Sacre)
10 Ferguson Road
Dartmouth, NS B3A 4M1
(902) 469-2806 ext.102
- .2 All components specified herein shall be supplied by one supplier and shall be of the manufacturer’s latest design.
- .3 Indicating the systems named above as being “acceptable” means that they are “generally acceptable”; final acceptance of any system will be subject to submission of complete system information to confirm the details of the system being offered for this project in accordance with the requirements of these Specifications. This shall include the Design Brief, Shop Drawings, Manuals, and any other information required by these Specifications.
- .4 As described in these specifications and on the drawings, the aeration system was based on a typical floating lateral system. Any other components required for a complete installation of one of the approved systems shall be included in this item, and no extra payment will be made to the Contractor for omissions in the tendered price for floating laterals or any item required for a complete installation of the aeration system, as required by the Manufacturer and/or as shown on the drawings and in these specifications.

2.2 AERATION COMPONENTS REQUIREMENTS

- .1 The installation of the supplied aeration system may be different from what is shown on the drawings. If there are variations in the installation requirements for the system accepted for installation from those shown on the Drawings, the Contractor/Supplier will be responsible for the complete design, supply and installation of the systems, all in accordance with the manufacturer’s recommendations, these Specifications and drawings and as directed by the Departmental Representative.
- .2 The Owner will not be responsible for any additional parts and components required by different systems not shown on the drawings or described in these Specifications that are essential to each system. No extra payment will be made to the Contractor for additional components required for a complete installation of each system.
- .3 The components and accessories shown on the drawings are to be supplied with each system and to be included in the Tendered Price, and this, even if they are not required by the Manufacturer. This shall include, but not limited to S.S. cable tie bracket, flange connection for cable, counter weight and adjusting tension assembly.
- .4 The components and accessories shown on the drawings are schematic details for the purpose of illustration only, and are not intended to show the total scope of supply.

- .5 The Manufacturer must provide a detailed report of the installation to Departmental Representative no later than two (2) weeks after the start-up of the system. No extra payment will be made to the Contractor for the inspection and report done by the manufacturer and it shall be considered incidental to the installation of the aeration system.
- .6 All components for the aeration system shall be robust and be of materials and finishes suited for the conditions of installation and operation so as to provide a long service life and minimize maintenance requirements. Various components will be subject to UV exposure, immersion in wastewater, exposure to freeze-thaw conditions including ice, exposure to wind forces, burial in soil, and/or other conditions expected to be encountered at wastewater treatment lagoon systems.
- .7 It shall be noted that the bottom of the existing wastewater treatment plant is made of a bentonite liner with variable bottom elevation and sludge is present. The contractor will be responsible to provide an aeration diffuser system with variable depth. The final depth of the floating diffusers will be confirmed during the installation of the aeration system.

2.3 AERATION SYSTEM DESIGN CRITERIA

- .1 The aeration system design is the sole responsibility of the Supplier/Manufacturer and shall be submitted with the stamp of a Professional Engineer registered to practice in the Province of Nova Scotia (stamp will be required to cover the total submission, including calculations, design process guaranty, confirmation of influent and effluent parameters, aeration parameters, physical dimensions of each cells all in accordance with these Specifications, as shown on the drawings and incidentals, all in accordance with these Specifications, and as shown on the drawings). Additional specific requirements for the Design Brief are presented in Article 1.5.4 of these Specifications.
- .2 It is entirely the responsibility of the successful Supplier/Manufacturer to verify all design parameters. No allowance will be made for design errors or omissions that occur due to insufficient site investigation.
- .3 System design must be suitable for the site conditions, and meet all applicable standards and guidelines of WSER and the CCME regulations.
- .4 The supplied aeration system shall be capable of treating untreated wastewater with the following parameters and treatment shall be effective 12 months per year (effective year-round):
 - .1 Influent Parameters:
 - .1 Average Design Flow: 585 cu.m./day
 - .2 Total BOD₅: 180 mg/L (105 Kg/day)
 - .3 TSS: 180 mg/L (105 kg/day)
 - .2 Effluent Parameters:
 - .1 Total BOD₅: 25 mg/L (15 Kg/day)
 - .2 TSS*: 25 mg/L (15 kg/day)
 - .3 * TSS 25 mg/L, year-round with the following exception: The system will be considered in compliance if excess of TSS occurs during the months of July, August, September or October, in accordance with the Wastewater Systems Effluent Regulations.

- .4 Average results of three (3) consecutive months will be considered when determining effluent limit compliance for both BOD₅ and TSS based on effluent grab samples (except for effects of algae growth between July and October, inclusive).
- .5 Aeration Design Parameters:
 - .1 Alpha = 0.60
 - .2 Beta = 0.95
 - .3 Theta = 1.024
 - .4 Maximum Water Temperature = 16°C
 - .5 Minimum Water Temperature = 0.5°C
- .6 Aeration design factors (Alpha, Beta, and Theta): in accordance with these Specifications and shall be confirmed by the Aeration Manufacturer as part of the Design Brief submission.
- .7 The numbers of floating laterals and diffusers shown on the drawings shall be considered a minimum.
- .8 The minimum air flow in the lagoon shall be 360scfm. If the aeration system supplier's design brief indicates that less air may be required, the minimum specified air flow must still be met. Any air provided in excess of the quantity required by the aeration supplier's design brief will be considered as additional treatment.
- .9 The Aerated Cells, as shown on the drawings shall be considered as "partially mixed" treatment cells. The Polishing Cell shall be considered as the settling zone where minimum aeration is present. However, aeration in this cell is required, as shown on the drawings. Treatment for BOD₅ removal to be obtained prior to the Polishing Cell.
- .10 The design of the aeration system is to be based on the wastewater flowing through Lagoons #1 (Cells #1A, 1B, 1C) and #2 (Cells #2A, 2B) in series. Dimensions of each cell are to be in accordance with the drawings and confirmed as part of the Design Brief Submission.
- .11 Aeration System Oxygen Requirements
 - .1 Aeration system shall provide sufficient oxygen to accommodate loads from:
 - .1 BOD₅ and CBOD₅ removal
 - .2 Nitrification
 - .3 Internal sludge digestion
 - .2 The average dissolved oxygen content shall be not less than 2.0 mg/l in any part of the aerated lagoons.
 - .3 Submit complete design calculations and results of oxygen transfer efficiency tests conducted by an independent laboratory.
 - .4 The design of the aeration system shall allow for the following minimum reductions in actual liquid volume of each Cell from the theoretical total liquid volume:

CELL	BOTTOM SLUDGE ALLOWANCE, mm	WINTER ICE ALLOWANCE, mm (Aerated Cells Only)
Lagoon #1 (Partial Mix)	280	150
Lagoon #2 (Partial Mix/Polishing)	200	150

- .5 Water Volumes:
- .1 Aerated Lagoon 1 (Total):
 - .1 Total water volume: 17,600 cu.m.
 - .2 Total volume allowance for ice and sludge: 2,500 cu.m.
 - .3 Total volume available for treatment: 15,100 cu.m.
 - .2 Aerated Lagoon 2 (Aerated cell only):
 - .1 Total water volume: 3,020 cu.m.
 - .2 Total volume allowance for ice and sludge: 420 cu.m.
 - .3 Total volume available for treatment: 2,600 cu.m.
 - .3 Aerated Polishing Cell:
 - .1 Total water volume: 1,740 cu.m.
 - .2 Total volume allowance for sludge only (design based on summer conditions): 80 cu.m.
 - .3 Total volume available for treatment: 1,660 cu.m.

2.4 AERATION SYSTEM DESCRIPTION

- .1 Aeration system: fine bubble using low intensity type, to be compatible in every way with the “aerated-facultative” process for the partial mix aerated lagoon.
- .2 The aeration system design for the “partial mix” cells is to create mixing for uniform oxygen dispersion so as to maintain an aerobic biomass treatment system for the progressive reduction of the organic (BOD₅) strength of the wastewater through the system, and allow solids settling to reduce suspended solids concentrations.
- .3 Aeration system shall be fully compatible with possible future lagoon-based Nitrification and Phosphorus removal upgrades. Components specified herein shall be supplied by one supplier and shall be of the manufacturer’s latest design.
- .4 Aeration system shall transfer a minimum of two (2) kilograms of dissolved oxygen per one (1) kilogram of BOD₅ applied at normal operating conditions.
- .5 The system shall have the capability to transfer 2.5 kilograms of oxygen per one (1) kilogram of BOD₅ applied to help satisfy intermittent loads.
- .6 The average dissolved oxygen content shall be not less than 2.0 mg/L in any part of the aerated lagoon and in areas where aeration is provided.

- .7 The aeration system concept including the orientation of the laterals in each of the Cells is to be as indicated generally on the Drawings. The aeration system air supply design is to be based on a single air supply header from the blower header to Lagoons 1 and 2. The Drawings are intended to show the concept only, and not to indicate the number of laterals required in each Cell. The number of laterals and diffusers required in each Cell will be as determined by the manufacturer's Design Brief; however, the number of floating laterals and diffusers shown on the drawings shall be considered a minimum.
- .8 The aeration system shall be able to accommodate lagoon bottom elevation variations without loss in aeration efficiency.

2.5 GENERAL AIR HEADER/LATERAL/FEEDER ARRANGEMENTS

- .1 The air supply system shall generally consist of the blowers which shall provide the required air (oxygen) to the shallow buried main air supply distribution header with floating distribution laterals, as shown generally on the Drawings and as described in these Specifications. The buried air supply header between the blowers and the floating diffuser laterals will be supplied and installed under Section 10 90 00 – Air Piping Systems, terminating at a butterfly valve connection for each lateral diffuser.
- .2 Although the buried air supply header system between the blowers and the laterals is indicated on the Drawings, the requirements shall be confirmed as part of the overall aeration system design carried out by the Aeration System supplier/manufacturer. The design of this air distribution header must be done so as to achieve a cost-effective balance between pressure losses in the system and the cost of the piping; pipe sizes which the Departmental Representative considers excessively large or small will not be acceptable. The design of the air supply header system shall incorporate the following design criteria and operating limits:
 - .1 Design maximum allowable pressure loss through the piping system from the blower to the connection to the lateral piping shall not exceed 0.5 psi (3.45 kPa) at normal operation condition (maximum air flow from 1 blower running) and shall not exceed 1.0 psi (6.89 kPa) for the maximum flow of the system (2 blowers running), excluding static water pressure requirements for the floating laterals and submerged diffusers. The buried air supply header sizing as shown on the Drawings must be verified under this design process, and to confirm the conditions of this Article can be respected. If changes to the proposed sizing of the buried air supply header are recommended for proper operation of the system, it must be clearly identified in the submission of this Design Brief.
 - .2 Lateral piping shall be connected to the main air supply header with a flanged connection at the butterfly valve as shown on the Drawings.
 - .3 Lateral pipes shall be securely fastened to anchor posts at each end of the lateral to secure them in the proper position.
 - .4 Each lateral pipe shall have a shutoff butterfly valve at the main header connection.
 - .5 Lateral pipes shall be anchored to shore.
 - .6 Diffuser connection ports shall be thermally fused onto the lateral piping.
 - .7 A feeder hose of a length appropriate to the maximum water depth shall be connected to the connection port of each diffuser line with stainless steel clamps. The aeration diffuser shall be connected to the opposite end of the feeder hose.

- .3 The main header and lateral system shall ensure that the lagoons do not have to be drained for system installation or maintenance. Each diffuser assembly shall have the capability to be individually adjusted for submergence depth.
- .4 Submerged aeration headers will not be accepted. PVC headers will also not be accepted. The buried air distribution header shall be designed for HDPE of the appropriate class.
- .5 The aeration system shall be installed without de-watering the lagoons. Refer to drawings for configuration of aeration system.

2.6 SYSTEM OPERATION REQUIREMENTS

- .1 Aeration diffuser replacement shall require no more than a crew of two workers.
- .2 Each aeration diffuser shall be individually accessible from the water surface by boat.

2.7 PRODUCTS

- .1 Floating Lateral Pipe:
 - .1 Air floating laterals sizes and types shown on the drawings shall be considered as a minimum. All floating laterals sizes and types shall be confirmed by the Design Brief.
 - .2 HDPE pipe diameters as shown on the drawing are based on IPS size.
 - .3 Air floating lateral pipes (including transition from butterfly valve to floating lines, flexible hose not approved): high density polyethylene (HDPE) DR 17 pressure pipe to ASTM F714 and D3350.
- .2 Fittings for HDPE Pipes:
 - .1 Fittings for HDPE pipes: water/air-tight, butt-fused welded to the pipe and made of the same material and by the same Manufacturer of the pipe system as described above.
 - .2 Polyethylene stub end manufactured to match the pipe, with ductile S.S. slip-on flange. Provide saddles, tees, reducers, and other fittings required for the installation shown.
 - .3 HDPE fitting diameters as shown on the drawings are based on IPS size.
 - .4 Installation of fittings (fusion to pipe) to be made by the pipe Manufacturer.
 - .5 Supports: Provide pipe supports and hangers to suit piping system design.
- .3 Diffusers:
 - .1 Spare diffuser assembly: Provide five (5) complete diffuser assemblies of each type from the floating lateral line to the diffuser. Spare diffusers are not intended to be used during the start up or during the warranty period where additional units must be supplied, if so required, as per Article 1.7 - Warranty and Guarantee Requirements.
 - .2 Diffusers shall have a documented history of efficient operation, and freedom from clogging, excessive back pressures, or structural failure when applied to service conditions similar to those indicated for this project. Diffuser membranes shall have a design life span of not less than 12 years before replacement is required.
 - .3 Diffusers and feeder tubing must be capable of being operated at double airflow (short duration only, for cleaning purposes) without reducing diffuser life or increasing backpressure beyond the capability of supplied blowers.

- .4 Feeder Tubing:
 - .1 Feeder Tubing: Flexible PVC material reinforced with spiral polyester yarn; UV and weather resistant.
 - .2 Nominal inside diameter: to be confirmed by supplier/manufacturer.
 - .3 Nominal outside diameter: to be confirmed by supplier/manufacturer.
 - .4 Service temperature range -26°C to 65°C.
 - .5 The polyethylene shall conform to the requirements of ASTM D 1248. This specification requires 2% carbon black for ultra-violet stabilization.
 - .6 Feeder tubing used as the connection between the aeration tubing and the header pipe shall be SDR11 LDPE (black) Ultra Violet resistant tubing with continuous ballast.
- .5 Lateral Anchoring
 - .1 Each end of the floating laterals shall be held in place with a stainless steel cable attached to anchor posts.
 - .2 A Self-Adjusting Tension assembly shall be located at the free end of the lateral and shall have the follow characteristics:
 - .1 Adjustment range: ± 0.50 m.
 - .2 Tension assembly to provide a minimum constant tension force on lateral of 125 kg. Aeration system supplier to confirm required tension force as part of the aeration system design brief.
 - .3 Equipped with winch for initial adjustments.
 - .4 Constructed of materials that will ensure reliable operation and ease of use under the conditions that will be experienced.
 - .3 Anchor Posts:
 - .1 Anchor posts and concrete piers are to be sized as shown on the drawings as a minimum, and appropriate to the length of each lateral and anticipated wind and other forces acting on the laterals. The aeration supplier will be responsible to confirm the required size; the size shown on the drawings shall be considered as a minimum.
- .6 Miscellaneous Components:
 - .1 Provide all other miscellaneous process equipment accessories including ratchet winch, stainless steel cable, concrete diffuser ballasts, rope, clamps, pulleys, etc. as required for a complete system.

2.8 TEMPORARY HIGH FLOW DIFFUSERS

- .1 As noted in the general construction sequence shown on the drawings, temporary high-flow diffusers are to be installed on the new floating laterals in Lagoon #2 and used to provide treatment during construction. The contractor shall provide suitable diffusers, which will be removed and replaced with the new permanent aeration system once both cells are ready for the permanent aeration system installation.

Part 3 Execution

3.1 EXAMINATION

- .1 The aeration system shall be carefully installed to the elevations, lines and grades as shown on accepted Design Brief Drawings and shall be in accordance with these Specifications or as otherwise indicated by the Departmental Representative.
- .2 Provide the services of a trained factory service technician to check the aeration system installation and leveling of the aeration system to ensure a constant air transfer per diffuser, incidental to the work.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Supplying of all materials, labour, supervision, equipment, etc., necessary for the installation of a screening system as shown on the drawings and as described in these specifications. The screening system consists of mechanically cleaned perforated plate screen, including a screw washer compactor system and waste disposal containers.
 - .2 This shall include the supply of all materials, labour, supervision, equipment, etc., necessary for fabrication, manufacture and assembly of the screening system components, spare parts, and related documents and services, including packaging and transportation to the site, site visits; and, any other related work all as described in these Specifications.
 - .3 All equipment mentioned in this section, except from Waste Disposal Containers, must come from the same Supplier.
- .2 Related Sections:
 - .1 Division 03 – Concrete
 - .2 Division 20 – Mechanical
 - .3 Division 22 – Plumbing and Piping
 - .4 Division 26 – Electrical

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
- .2 American National Standards Institute (ANSI)/ American Water Works Association (AWWA)
- .3 Canadian Electrical Code
- .4 American Society for Testing Materials, Standards and Recommended Practices, (ASTM)
- .5 American Gear Manufacturers Association (AGMA)
- .6 Occupational Safety and Health Administration (OSHA)
- .7 Underwriters Laboratories (UL)
- .8 National Electrical Manufacturers Association (NEMA)

1.3 SCHEDULING

- .1 Schedule work to minimize interruptions to existing services.
- .2 Maintain existing sewage flows during construction

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

- .1 Submit for review detailed, dimensioned drawings and/or catalogue cuts, showing construction, size, arrangement, performance characteristics and capacity.
- .3 Shop Drawings:
 - .1 Submit drawings for all items of this section.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for mechanically cleaned perforated plate fine screen, screw washer compactor, waste disposal bins and accessories for incorporation into manual.
- .3 Includes information as follows:
 - .1 Record drawings of equipment as installed.
 - .2 Detailed operation and maintenance instructions for all intended modes of operations.
 - .3 Parts list comprising complete schedule clearly identified to facilitate re-ordering.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 The unit offered must meet the following requirements:
 - .1 The equipment shall be manufactured in Canada.
 - .2 The equipment supplier shall provide, on request, proof of experience in manufacturing this type of equipment, in the form of a reference list.
 - .3 The manufacturer shall be certified ISO 9001-2008.
 - .4 The unit shall be factory assembled and tested prior to its delivery to ensure it will perform as required.
 - .5 The supplier shall provide a certificate stating that the unit has been tested and its performance meets the Specification requirements for this project.
 - .6 The equipment must fit acceptably within the channel and structure with dimensions as specified herein and shown on the Drawings. If any discrepancies with dimensions shown drawings and shop drawings, Contractor shall notify the Engineer before proceeding with installation of equipment.
 - .7 Equipment of other dimensions shall be unacceptable if their use requires architectural, structural, mechanical or electrical design changes.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 The Contractor must ensure with the manufacturers that the openings provided in the building are sufficient for the entry of major equipment. The Contractor will be responsible for coordinating the installation of large equipment before closing the walls and the roof of the building without prejudice to the rest of the work.
- .3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates padding packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .5 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

1.8 WARRANTY

- .1 The mechanically cleaned perforated plate screen and the screw washer-compactor, including control system, shall be supplied as one complete working package by the same manufacturer.
- .2 The Supplier shall guarantee the performance, workmanship, materials, and construction of all equipment supplied under this contract for twelve (12) months from the date of Substantial Completion of the Headworks facility in which this unit will be installed, as determined by the Engineer.
- .3 Any repairs or replacement required under this warranty shall be carried out promptly and efficiently, and will include not only the defective work/materials, but also any other work, travel expenses, materials and/or labour incidental to its correction. Work required under the Warranty shall be done at no cost to the Owner. Any repairs or replacement of components made during the warranty period shall be covered by the balance of any warranty remaining.

Part 2 Products

2.1 Mechanically Cleaned Perforated Plate Fine Screen

- .1 System Description:
 - .1 The Supplier shall supply one (1) mechanically cleaned perforated fine screen system designed and built to positively remove debris from the incoming sewage by means of travelling filter elements.
 - .2 The fine screen specified herein shall achieve at least 79% removal efficiency of all solids larger than the perforation diameter, when on static mode.
 - .3 The Screen unit shall consist essentially of a structural frame with housing and a screenings removal mechanism which shall operate on the endless chain/belt principle. It shall consist of screening/filtering elements, connecting chains and chain wheels, a main shaft with drive system, a rotating self-adjusting cleaning brush, a wash water system and a discharge chute. The unit shall be fully enclosed but have access panels with service access. The screen shall be of a pivoting design that permits the unit to be raised for inspection and/or servicing.
 - .4 Designs employing rake, multiple rakes, bars or cams, shall not be acceptable.
 - .5 Designs employing the use of shear pins, filter shafts and rollers and designs using more than two (2) shafts or two (2) drives for screen rotation shall not be allowed. Designs employing the use of a wear shoe or boot as an alignment method for the perforated panels, shall not be allowed, as undue wear due to drag in an abrasive environment is unacceptable on the screen body and chain. Each unit shall be factory assembled and tested prior to its delivery and ready for installation. It shall not require field assembly of any components such as reducer or motor, except where partial disassembly is required by transportation

regulations or for protection of components. The Screening unit shall have integral lifting lugs to facilitate its loading, unloading and placement in a balanced and safe manner.

.2	Design Parameters:	
	Maximum Instantaneous Peak Flow:	25 L/s
	Screening Capture Performance:	79%
	Channel width:	600 mm
	Channel depth:	1500 mm
	Channel invert bottom recess:	150 mm
	Perforated element openings:	6 mm dia.
	Installation angle from horizontal:	60 degrees
	Differential Level Measuring Instrument:	Ultrasonic
	Downstream Water Level:	80.1 mm
	Head loss across the screen (Clean screen):	66.4 mm
	Head loss across the screen (50% obstructed):	102.6 mm
	Discharge height from operating floor:	829.6 mm
	Classification:	Class I, Division I, Group D (Explosion Proof)

The manufacturer shall, upon request, provide a performance curve showing head loss across the screen at different flow velocities through the perforated elements. This curve shall demonstrate that the screen will meet the specified operating requirements. The curve shall be based on third party testing performed in a hydraulic laboratory established in North America, using perforated elements of the type described in this specification.

.3	Specifications:	
	Quantity:	One (1)
.1	Structural frame	
	Frame thickness:	5 mm (min.)
	Front cover thickness:	2 mm (min.)
	Back housing thickness:	1.6 mm (min.)
	Discharge chute:	2 mm (min.)
	Type of pivot:	Lift type
.2	Screenings removal mechanism	
	Quantity of elements:	As recommended by manufacturer
	Element thickness:	3 mm (min.)
	Maximum Static Differential:	1.0 m
	Travelling speed:	3 m/min (or as recommended by manufacturer)
.3	Chain driving system	
	Chain type:	ISO M80
	Breaking load:	80 kN

.4	Wash water system	
	Wash water quality	Potable Water
	Washing flow	1.0 L/s at 414 kPa (15 gpm at 60 PSI)
	Connection / valves size	25 mm dia. (1.0 in)
	Solenoid valve enclosure	NEMA-7
.5	Drive unit	
	Main Power Supply	575 V, 3 Ph, 60 Hz
	Element drive motor power	0.5 HP (0.37 kW), Single speed Premium efficiency
	Cleaning brush drive motor power	1.0 HP (0.74 kW), Single speed Premium efficiency
	Enclosure	TEFC, Explosion-proof Class B design, Class F insulation
	Motor Service Factor	1.15 minimum
	Reducer Service Factor	1.4 minimum
.6	Materials of construction	
	Structural frame	316 stainless steel
	Housing sheets	316 stainless steel
	Discharge chute	316 stainless steel
	Side sealing flaps	Rubber
	Elements	316 stainless steel
	Chain links and bushings	316 stainless steel
	Chain pins	316 stainless steel
	Element fastening to chain	“NYLSTOP” Nylon fitted jam nut
	Sprockets	316 stainless steel
	Element slides	HDPE
	Bottom revolving element guides	316 stainless steel
	Revolving guides lube line	316 stainless steel
	Inner frame side seal	Polyethylene
	Element side seal (Wings)	316 stainless steel
	Polypropylene brushes covered with a rubber flap	
	Element drive shaft	316 stainless steel
	Cleaning brush drive shaft	316 stainless steel
	Lower stub shafts	316 stainless steel
	Spray wash manifold	316 stainless steel
	Spray nozzles	Brass
	Solenoid valve body	Brass
	Manual ball valve body	Brass
	Fasteners & Hardware	316 stainless steel

Anchors

316 stainless steel

.4 Structural Frame

- .1 The structural frame shall be designed to be of the monobloc type and be set at an angle from the horizontal as stated previously.
- .2 The structural frame shall be fabricated with two lateral plates connected by means of cross braces, forming a frame width of 520 mm. A bolted plate shall seal the top of the frame.
- .3 The structural frame shall be supplied with central ports to access the sparge system and to allow inspection of screen elements.
- .4 The screen frame shall be recessed in the channel bottom and be firmly anchored to the channel at all channel operating floor levels.
- .5 Steel sheeting shall be used to cover the front sections of the frame located above the channel top. The removable front panels shall be bolted to the screen frame.
- .6 Steel sheeting shall be used to cover the back sections of the frame located above the channel top. The housing shall be welded to the screen frame. The upper edge of the back section shall be fitted with a bolted rubber strip precisely fit to close the gap between the back section and the panels travelling downwards. The rubber strip shall be at an angle allowing screenings to freely fall towards the slope of the discharge chute.
- .7 Screenings shall be discharged down a steeply sloped enclosed discharge chute, on the downstream side, above the top-operating floor. The discharge chute housing shall also be supplied with a rotating brush access hatch.
- .8 Routine service, repair or replacement of damaged parts shall be possible with the screen in the channel. All designs shall ensure that day-to-day maintenance, replacement of chains and/or elements shall be done from the operating floor level.

.5 Frame Pivot

- .1 The structural frame shall include a pivot system to allow rotation of the unit out of the channel for inspection and servicing. The pivot system shall be designed to withstand the total unit weight without distortion at any position.
- .2 Pivot shall be lift type and shall allow raising the screen out of the channel without needing to remove component(s) below the discharge chute.
- .3 Pivot system shall be capable of pivoting the unit when submerged under site hydraulic conditions and shall be designed to handle all vertical and horizontal loads.

.6 Screenings Removal Mechanism

- .1 The unit shall be fitted with perforated panels carried by two endless chains and traveling upward on the upstream side of the screen frame.
- .2 The traveling elements shall be capable of stopping virtually all solids larger than the previously stated perforations size diameter, in both directions. Designs employing slotted openings instead of circular perforations shall not be allowed.
- .3 Elements shall be specially formed to create ledges to lift larger solids. The design of the elements shall limit the possibility of lifting solids that are larger than the screen internal passage way. Designs employing the use of curved elements, lifters or tines to take out solids shall not be allowed. Designs which require screenings handling in order to be lifted up shall not be allowed.
- .4 Element travelling speed shall be adapted to the application requirements.

- .5 Elements shall be easily removable from the operating floor.
 - .6 The mechanical screen shall incorporate an efficient sealing design arrangement to prevent screenings from bypassing the screen panels. This is achieved by means of polyethylene sealing strips attached to the frame sides and stainless steel sealing wings mounted on the chains. Sealing wings made of material other than stainless steel shall not be allowed.
 - .7 Two rows of sealing brushes covered with a rubber flap across the bottom of the screen shall also be provided. Design made with single row of sealing brush shall not be allowed.
 - .8 The clearance between elements, as well as between element wings and lateral-sealing strips shall not exceed 2 mm.
 - .9 Elements shall be rigid in order to provide a high resistance to impact and eliminate issues related to torsion caused by uneven loading. The screen shall be capable of withstanding a maximum hydraulic static differential as described in equipment specifications.
 - .10 Every third perforated plate element shall be equipped with studs located along its horizontal centerline. These studs are designed to lift large rags or sheets that may be found in the influent.
- .7 Chain Driving System
- .1 The unit shall incorporate two top mounted driving chain sprockets fastened to the main drive shaft. These chain wheels shall drive endless chains.
 - .2 The chain shall have a pitch of 200 mm and a breaking load adapted to the application. It shall be supplied with solid pins and bushings. Designs employing the use of roller chains or designs with roller chains that incorporate hollow pins as roller shafts will not be allowed. Solid/hollow riveted pins shall not be allowed.
 - .3 Driving chain sprockets shall be split type and have 10 teeth. Half of the teeth shall be used to drive the chain. The remaining 5 teeth shall provide a spare driving system, thus extending the sprocket's life expectancy. Sprockets shall be mounted on a drive shaft. The drive shaft shall be straight and of sufficient size to operate without distortion.
 - .4 Two (2) self-aligning ball bearings, assembled in a flange mounted case shall support the main drive shaft on the sides of the chain take up assembly. A chain take up assembly shall be provided with the bearing supports and be mounted at the screen frame sides.
 - .5 The bottom of the unit frame shall incorporate two revolving element guides. They will move at the same speed as the elements to reduce wear to a minimum on all exposed components. Each 19 mm thick bottom guide will be carried on a stub shaft incorporating a greasable sealed "Nylatron" sleeve. Each lower stub shaft shall be bolted in place to allow easy removal. Grease lines shall run from the lower shaft to the upper most operating floor to allow easy lubrication.
 - .6 A lateral guide fitted with a slide on the upstream and return side of the frame shall support each of the two (2) chains. These guides shall provide rigid support to the filtering panel assembly.
- .8 Self Adjusting Cleaning Brush
- .1 The collected screenings shall be removed from the screen panels by a heavy duty, high-speed Nylon fineset rotating brush.
 - .2 The brush shall have a minimum diameter of 451 mm and have, when in operation, a surface contact ratio of 50:1 with element.

- .3 The rotating brush shall be assembled on a straight shaft of sufficient size to operate without distortion.
 - .4 The brush shaft shall be mounted on a self-adjusting support assembly including a pivoting shaft with self-aligning ball bearings. These bearings shall be mounted on pillow blocks located on each side of the structural frame top plate.
 - .5 Lever assembly arms shall be fixed on the pivoting shaft ends. Gas springs attached to the levers shall insure a constant pressure on the perforated plate elements to provide optimum contact and cleaning.
- .9 Wash Water System
- .1 The unit shall be provided with an additional cleaning apparatus. A sparge system shall be used to backwash the screen panels.
 - .2 The backwash shall clean the perforations and project the dislodged screenings towards the discharge chute.
 - .3 The sparge system shall consist of an element washing manifold equipped with a set of spray nozzles.
 - .4 This system requires a connection to water at a flow and pressure as described in equipment specifications.
 - .5 The following components will be supplied with each unit to control the wash water:
 - One (1) manual ball valve
 - One (1) solenoid valve
 - One (1) "Y" strainer
 - One (1) connection fitting
- .10 Drive Unit
- .1 The chain and brush drive shafts shall be driven by means of dedicated speed-reducing gearboxes and motors. The motors shall not be overloaded under normal operating conditions and shall be designed for heavy duty 24 hours per day service duty.
 - .2 The motors shall have an external protection to meet the local environmental conditions. The motor shall also be of the normal starting torque and low starting current type.
 - .3 The gear reducers shall be of the parallel-helical type. It shall include anti-friction bearings with high overhang load properties, and double lip temperature oil seals riding on a precision ground shafts. Gears shall be made of hardened, heat treated forged steel as per AGMA standards. The gearing shall be oil lubricated. The gear reducers shall have an internal and external protection to meet the local environmental conditions (corro-protected).
- .11 Control System
- .1 The Screen control system shall be supplied by the screen manufacturer. It shall provide total automatic machine operation with protection against overload conditions, which might damage the equipment.
 - .2 The control system shall be automatically operated by an intelligent programmable control relay. The required start/stop signals, timers and logic shall be included to control the equipment based on its sequence of operation.
 - .3 The control system shall be rated for the following classifications:

- Main control cabinet: NEMA-4X SS304 enclosure or indoor installation in Non-hazardous area
- Local control station: NEMA-7 enclosure for installation in Class I, Division I, Group D area

.12 Sequence of Operation

.1 Automatic Mode

During all automatic operation, when a start signal is received for the screen, the brush motor shall start 3 seconds before the elements motor shall start. Both the elements and brush motors shall remain in operation during the automatic sequences and shall stop simultaneously at the end of the automatic sequences. Elements motor shall be able to operate at different speeds to accommodate real-time hydraulic conditions.

.1 Normal Sequence:

When a high water differential level is detected (normally pre-set at 8.0 in (200 mm)), the screen shall start and run for a preset time then stop. When the screen receives the next high differential signal, it shall run for the same preset time. This sequence shall be repeated several times (depending on the water level and number of elements) in order to reduce energy consumption and operating cost. The solenoid valve shall not open during this period.

After a preset number of high differential signals (steps), the system shall start a cleaning cycle.

.2 High-level Sequence:

This circuit shall override all other start signals. The HWL signal shall make all motors of the screen run continuously. This circuit shall also switch the perforated elements drive motor on high speed during the full HWL condition duration. Once the water level drops below the high level set point, the system shall start a cleaning cycle. Levels set to suit site conditions.

.3 Timed Sequence:

When the adjustable clock gives a start signal, the screen shall start a cleaning cycle. Screen shall start at least once per day.

.4 Cleaning Cycle Sequence:

This timed cycle shall allow for a complete revolution of the perforated elements around the two axes to clean the elements. The element backwash solenoid valve shall open whenever the screen runs on a cleaning cycle. The cleaning cycle can also be triggered with the MAN.TEST operators.

.2 Manual Mode

The equipment components can be operated manually using the control panel operators, and from the local control station installed at direct proximity of the equipment.

.3 Thermal Protection

The overload protection circuit shall cut the power off to the motor and to the control circuit of the motor starter, should the following conditions occur:

- .1 Overheat of the motor
- .2 Short circuiting

.3 Loss of phase

The overload protection shall be sized according to the motor nameplate full load rating. Upon detection of an over load, the dedicated motor shall stop and the “Motor Fault” alarm indicator light shall be activated. The protection circuit shall be reset manually inside the control panel. The control system shall be reset manually by a push button.

.4 Jamming Protection (elements motor only)

- .1 A current metering system shall protect the equipment component against jamming. A continuous current reading (CMT) shall be monitored by an adjustable relay (CMR).
- .2 The motor starting current being higher than the setting of the CMR, the jamming protection shall be put out of service by a time delay (TCM), for a predetermined adjustable motor start period, long enough to allow the current to fall below the CMR setting when it reaches its normal full load level.
- .3 Upon detection of an over current, the dedicated motor shall automatically stop and the associated “Motor Fault” alarm indicator light shall be activated. The control system shall be reset manually by a push button.

.13 Main Control Panel

The following basic components shall be assembled in the system main control panel enclosure and pre-wired to identified terminal blocks. This enclosure shall provide upfront panel door operation. Panel hook up shall be made on site by contractor.

- .1 Main fusible type disconnect switch sized for the application shall be front panel mounted c/w NEMA-4X operating handle and interlock.
- .2 Elements motor Variable Frequency Drive and full voltage non-reversible brush motor starter (IEC rated) sized for the application with manual starter, circuit and adequate magnetic overload and over current protection.
- .3 “REMOTE/OFF/ON/MANUAL TEST” selector switch complete with spring loaded return from “MAN. TEST” to “ON”.
- .4 “EMERGENCY STOP” mushroom push button, pad lockable
Dry contacts shall be available for external status and alarm feedback.
- .5 Safety barrier for digital signal (float switch).
- .6 Operator devices shall be 22 mm diameter, type NEMA-4/12:
 - General: Power ON (white light), General E-Stop (mushroom button), General Alarm (red light), General Reset (black push-button).
 - Equipment Status: Elements Motor Running (green light), Elements Motor Fault (red light), Brush Motor Running (green light), Brush Motor Fault (red light), Washing Solenoid Valve Opened (green light), High Water Level (amber light).
 - Equipment manual controls: Screen Manual / Off / Auto (selector switch).

.14 Local Components

The scope of supply shall include the following field mounted components:

- .1 One (1) Element backwash solenoid valve
- .2 One (1) H.W.L. “High Water Level” float switch

- .3 One (1) Differential level system, ultrasonic type, consisting of an “upstream” and a “downstream” ultrasonic level sensor: level sensor shall be Milltronics or approved equal.

.15 Local Control Station

Each unit shall be supplied with a local control station located near the unit. The following components shall be assembled and pre-wired to identified terminal blocks.

- .1 “OFF / REMOTE / MAN.TEST” selector switch c/w spring loaded return from "MAN.TEST" to “REMOTE”
- .2 “EMERGENCY STOP” Push button, pad-lockable

When manually operated in LOCAL mode, all automatic operations of the equipment are deactivated. Manual operation of the equipment requires an operator at direct proximity of the equipment at all time. The local control station shall provide “on/off” switches with “red/green” lights for each of screen drive, wash water system, and cleaning brush.

.16 Spare Parts

The supply shall include the following spare parts and special components:

- .1 One (1) lot of oil and grease recommended by the manufacturer, for 12 months of operation
- .2 Two (2) perforated screening panels
- .3 Three (3) chain links and pins
- .4 One (1) bottom brush
- .5 One (1) top screen panel cleaning brush
- .6 One (1) sleeve grease gun complete with discharge snap-on connector to the grease lines to the lower sleeves
- .7 One (1) set of any special tools required for maintaining the equipment

Spare parts shall be delivered at the same time as the equipment and must be placed in individually sealed boxes to protect them from damage and corrosion from long periods of storage.

.17 ACCEPTABLE PRODUCT

- .1 John Meunier ESCALATOR® Fine Screen Model Number ESH6-17XA Supplied by Veolia or Approved Equal

Equivalence products must be made of the same specified materials, if any, and must provide the same performance.

2.2 SCREW WASHER COMPACTOR

.1 System Description:

- .1 Screw Washer Compactor shall consist essentially of an inlet hopper, a perforated screw housing with drainage section, washing section and dewatering / compaction section, a variable pitch screw driven by a geared motor, a collecting trough and a discharge duct.
- .2 Units incorporating drums, belts, centerless ribbon screws, hydraulic systems, pistons, counterweights and units using shear pins as overload protection shall not be acceptable.
- .3 Each unit shall be factory assembled and tested prior to its delivery and ready for installation. It shall not require field assembly of any components such as reducer or motor,

except where partial disassembly is required by transportation regulations or for protection of components.

- .2 Design Parameters:
- | | |
|---------------------------|--|
| Inlet feed rate | Up to 2.0 m ³ /h |
| Material to convey | Screenings |
| Conveyor nominal diameter | 200 mm dia. |
| Installation angle | Horizontal |
| Discharge angle | 45 degrees |
| Discharge height | 1500 mm (min.) |
| Solids volume reduction | Up to 70% |
| Output dryness | Up to 60% |
| Organics removal | Up to 90% |
| Classification | Class I, Division I, Group D (Explosion Proof) |
- .3 Specifications:
- | | |
|---------------------------------|---|
| Quantity | One (1) |
| .1 Compactor screw | |
| Type | Shafted spiral screw, standard full pitch |
| External diameter | As recommended by manufacturer |
| Shaft diameter | As recommended by manufacturer |
| .2 Screw housing | |
| Internal diameter | As recommended by manufacturer |
| Thickness | 4.8 mm (min.) |
| Perforation size | 6 mm dia. |
| .3 Collecting trough | |
| Thickness | 3 mm (min.) |
| Drain diameter | 100 mm dia. (4 in) NPT(M) |
| .4 Inlet hopper | |
| Thickness | 3 mm (min.) |
| Hopper lower opening length | As recommended by manufacturer |
| .5 Washing system | |
| Wash water quality | Potable Water |
| Washing flow | 0.6 L/s at 340 kPa |
| Main line connection size | 25 mm dia. (1.0 in) |
| Washing zone connection size | 12.7 mm dia. (0.5 in) |
| Compaction zone connection size | 19 mm dia. (0.75 in) |
| Solenoid valve enclosure | NEMA-7 |
| .6 Discharge duct | |
| Thickness | 3 mm (min.) |
| Outlet nominal diameter | 200 mm dia. (min.) |

	Discharge opening orientation	Vertical
.7	Drive unit	
	Main Power Supply	575 V, 3 Ph, 60 Hz
	Screw Drive Motor	1.5 kW (Premium efficiency)
	Screw Rotation Speed	11 RPM
	Enclosure	TEFC, Explosion-proof Class B design, Class F insulation
	Motor Service Factor	1.15 minimum
	Reducer Service Factor	1.4 minimum
.8	Materials	
	Screw flights	316 stainless steel
	Screw shaft	316 stainless steel
	Roller bearing housing	ASTM A-36 carbon steel* (plate) C-1020 carbon steel* (mechanical tubing)
	Screw housing	316 stainless steel
	Collecting trough	316 stainless steel
	Inlet hopper	316 stainless steel
	Spray wash manifold	316 stainless steel
	Spray nozzles	Brass
	Solenoid valve body	Brass
	Manual ball valves body	Brass
	Discharge duct	316 stainless steel
	Supporting base	316 stainless steel
	Fasteners & Hardware	316 stainless steel

* These parts shall be sand blasted per SP-6 and painted with two coats of Macropoxy paint.

- .4 Compactor Screw
 - .1 The nominal screw diameter shall be adapted to the application requirements.
 - .2 Spiral on the complete length of the screw to prevent jamming.
 - .3 The flight thickness of the screw shall range from 6.35 mm to 12.7 mm in the drainage section and end with a thickness of 25.4 mm in the dewatering / compaction section. The leading face of the last 1.5 flight section shall be provided with hard facing material. The flights shall cover the complete length of the screw shaft.
 - .4 The screw shall be welded on a shaft to eliminate the negative effects of stress and warping.
 - .5 A wiper blade made of leather shall be fastened to the periphery of each flight in the drainage section.
- .5 Screw Housing
 - .1 The screw housing shall be formed from a steel plate into a tube.
 - .2 The tube shall have a top opening to allow screenings into the compactor.

- .3 Guide elements / wear bars shall be fitted inside the compacting section to prevent the screenings from swirling inside the housing.
- .4 The lower section of the housing shall be provided with holes. These openings shall allow the water to drain freely and shall be designed to limit premature clogging.
- .6 Collecting Trough
 - .1 The collecting trough shall be made of steel sheet.
 - .2 It shall be designed to completely enclose the screw housing and shall be equipped with a drain.
 - .3 The collecting trough shall be fitted with two lateral inspection ports on each side having dimensions of 75 mm x 500 mm for occasional maintenance purposes.
 - .4 The supporting base of the compactor shall be firmly anchored to the operating floor.
- .7 Inlet Hopper
 - .1 The inlet hopper shall be made of steel sheet.
 - .2 It shall be bolted on the collecting trough over the screw housing top opening.
 - .3 The sidewall shall be inclined at least 60° from the horizontal axis to prevent screenings build up on the hopper walls.
- .8 Washing System
 - .1 The screenings washing system shall be installed in the screw housing.
 - .2 The washing system shall be designed to clean the collected material in the washing section. This area located prior to the dewatering / compaction section is equipped with two spray nozzles.
 - .3 A washing/flushing manifold with spray nozzles shall be installed in the collecting trough on top of the screw housing dewatering / compaction section to clear any accumulation of material that may be present around the screw housing and in the collecting trough by flushing them to the drain.
 - .4 The following components will be supplied with each unit to control the wash water:
 - .1 Main washing system line
 - One (1) manual ball valve 25 mm dia. (1.0 in) NPT(F)
 - One (1) solenoid valve 25 mm dia. (1.0 in) NPT(F)
 - One (1) “Y” strainer 25 mm dia. (1.0 in) NPT(F)
 - .2 Washing zone
 - One (1) manual globe valve 10 mm dia. 0.375 in NPT(F)
 - .3 Compaction zone
 - One (1) manual ball valve 19 mm dia. 0.75 in NPT(F)
- .9 Discharge Duct
 - .1 The discharge duct shall be made of stainless steel plate.
 - .2 It shall be flanged and bolted at the outlet end of the compaction section. The inclination shall be 60° above the horizontal and its length shall be as required to achieve the minimum discharge height.
 - .3 It shall also be designed to avoid jamming with compacted screenings.

.10 Roller Bearing Housing

- .1 The roller bearing housing shall be totally enclosed and greased filled. It shall include two (2) roller bearings to limit radial and axial loads from the screw.
- .2 The bearing assembly shall guide and support the screw shaft to provide a minimal gap between the screw flight and the housing to ensure proper cleaning of the drainage section. It shall also limit the load on the screw housing to minimize the friction at any time during normal operation.
- .3 The housing shall be isolated from the screw housing by means of oil seals. These seals shall provide efficient protection against water penetration into the bearing housing and against oil leaks. The assembly shall be designed for heavy-duty service.

.11 Drive Unit

- .1 The main drive shaft shall be driven by means of a gear reducer and motor. The gear motor shall not be overloaded under normal operating conditions and shall be designed for heavy duty 24 hours per day service duty.
- .2 The motor shall have an external protection to meet the local environmental conditions. The motor shall also be of the normal starting torque and low starting current type.
- .3 The gear reducer shall be of the parallel-helical type. It shall include anti-friction bearings with high overhang load properties, and double lip temperature oil seals riding on precision ground shafts. Gears shall be made of hardened, heat treated forged steel as per AGMA standards. The gearing shall be oil lubricated. The gear reducer shall have an internal and external protection to meet the local environmental conditions (corro-protected).

.12 Bagging System

- .1 The bagging system shall provide a clean odour-free means of protecting and containing the solids discharged from the screen vertical discharge outlet. A pleated plastic sleeve "bag" shall be fitted on the bag sleeve holder before the end of the plastic sleeve is pulled off and tied in a knot. Solids being discharged from the equipment outlet will be collected in the "bag" until operators decide that the bag is full. The plastic sleeve shall then be cut and the exposed end pulled-off and tied in knots.
- .2 Each bagging system shall include a mounting adapter fitted to the vertical discharge chute, a bagging system assembly, bag and fasteners.
- .3 The mounting adapter shall provide a smooth transition in diameter to fit the bagger system on the discharge chute. The adapter shall provide a means to fix the bagger assembly. Bagger assembly welded to the vertical discharge chute shall not be acceptable.
- .4 Each bagging system shall include a bagger chute with mounting flange, bag sleeve holder, rubber band and fasteners.
- .5 The bagging system shall be supplied with One (1) 152 microns thick bag, 90 m long.

.13 Control System

- .1 The Washer Compactor control system shall be supplied by the screen manufacturer. It shall provide total automatic machine operation with protection against overload conditions, which might damage the equipment.
- .2 The control system shall be automatically operated by the screen intelligent programmable control relay. The required start/stop signals, timers and logic shall be included to control the equipment based on its sequence of operation.

- .3 The local control station shall be rated for the following classifications:
- Local control station: NEMA-7 enclosure for installation in Class I, Division I, Group D area (Explosion Proof)

.14 Sequence Of Operation

.1 Automatic Mode

The equipment will automatically start simultaneously with the upstream equipment.

- .1 Normal Operation Sequence: After the upstream equipment has stopped, the compactor shall keep running to allow for complete material evacuation from the inlet zone. The compacting cycle duration shall be adjustable. The compacting cycle can also be triggered with the MAN.TEST operators.
- .2 Cleaning Sequence: The cleaning sequence can also be triggered with the MAN.TEST operators if there is a need to run this sequence at any time. When the screen falls into cleaning cycle, the washer compactor shall also activate. Compactor shall start at least once per day.
- .3 Jamming Sequence: Should the power requirement of the compacting process exceed the preset point on the current monitor relay, an overload protection system shall automatically reverse the rotation of the screw for a short time. Forward rotation is re-established, restoring the original compaction cycle. If the first reverse cycle clears the screw, the compactor will then finish its cycle normally.
- .4 Should the first reverse cycle be unsuccessful, it shall be repeated as necessary or up to at least five times to eliminate the blockage. In the event of a blockage that cannot be eliminated, the unit will then trip on over current, an alarm light will be lit, and an alarm relay will send a signal to the SCADA system, and the compactor will be turned off.
- .5 If the washer-compactor unit shuts down due to a blockage, the Control System shall also stop the operation of the screening system, and send an alarm signal for this as well.

.2 Manual Mode

The equipment components can be operated manually using the control panel.

.3 Thermal Protection

The overload protection circuit shall cut the power off to the motor and to the control circuit of the motor starter, should the following conditions occur:

- .1 Overheat of the motor
- .2 Short circuiting
- .3 Loss of phase

The overload protection shall be sized according to the motor nameplate full load rating. Upon detection of an over load, the dedicated motor shall stop and the "Motor Fault" alarm indicator light shall be activated. The protection circuit shall be reset manually inside the control panel. The control system shall be reset manually by a push button.

.4 Jamming Protection

A current metering system shall protect the equipment components against jamming. A continuous current reading (CMT) shall be monitored by an adjustable relay (CMR).

The motor starting current being higher than the setting of the CMR, the jamming protection shall be put out of service by a time delay (TCM), for a predetermined adjustable motor start period, long enough to allow the current to fall below the CMR setting when it reaches its normal full load level.

Upon detection of an over current, the dedicated motor shall automatically stop and the associated "Motor Fault" alarm indicator light shall be activated. The control system shall be reset manually by a push button.

.15 Main Control Panel

The following basic components shall be assembled in the system main control panel enclosure and pre-wired to identified terminal blocks. This enclosure shall provide upfront panel door operation. Panel hook up shall be made on site by the contractor.

- .1 Main fusible type disconnect switch sized for the application shall be front panel mounted c/w NEMA-4X operating handle and interlock;
- .2 Full voltage reversible motor starter (IEC rated) sized for the application with manual starter, circuit and adequate magnetic overload and over-current protection;
- .3 Dry contacts shall be available for external status and alarm feedback;
- .4 Operator devices shall be 22 mm diameter, type NEMA-4/12:
 - General: Power ON (white light), General E-Stop (mushroom button), General Alarm (red light), General Reset (black push-button).
 - Equipment Status: Compactor Motor Running (green light), Compactor Motor Fault (red light), Washing Solenoid Valve Opened (green light).
 - Equipment manual controls: Manual / OFF/ Auto (selector switch).

.16 Local Components

The scope of supply shall include the following field mounted components:

- .1 One (1) Washing system solenoid valve

.17 Local Control Station

Each unit shall be supplied with a local control station located near the unit. The following components shall be assembled and pre-wired to identified terminal blocks.

- .1 "LOCAL / REMOTE / MAN.TEST" selector switch c/w spring loaded return from "MAN.TEST" to "REMOTE" position
- .2 "FORWARD / OFF / REVERSE" selector switch c/w spring loaded return to "OFF" position
- .3 "EMERGENCY STOP" Push button, pad-lockable

When manually operated in LOCAL mode, all automatic operations of the equipment are deactivated. Manual operation of the equipment requires an operator at direct proximity of the equipment at all time.

.18 Spare Parts

The following spare parts/supplies shall be provided as part of the Contract requirements, and are included in the tendered lump sum price for the screenings system:

- .1 One (1) lot of oil and grease as recommended by the manufacturer (12 month supply)
- .2 One (1) wear bars set
- .3 Two (2) sets leather wipers
- .4 Two (2) sets of spare gaskets for inspection ports
- .5 One (1) set of any special tools required for maintaining the equipment
- .6 One (1) 152 microns thick bag, 90 m long.

Spare parts shall be delivered at the same time as the equipment and must be placed in individually sealed boxes to protect them from damage and corrosion from long periods of storage.

.19 **ACCEPTABLE PRODUCT**

- .1 John Meunier ROTOPAC® Type RPW Model Number RPW-200XD Supplied by Veolia or Approved Equal.

Equivalence products must be made of the same specified materials, if any, and must provide the same performance.

2.3 WASTE DISPOSAL CONTAINERS

.1 System Description:

- .1 Waste Disposal Containers shall be used to collect the debris resulting from the Washer Compactor System.

.2 Design Parameters:

- .1 The Contractor shall provide four (4) containers with the following specifications:
 - .2 Unit Capacity :1 cubic meter
 - .3 Container to be fabricated meeting local solid waste collection standards
 - .4 Container dimensions to be in accordance with local waste collection standards
 - .5 Container construction:
 - .1 Body: Polyethylene
 - .2 Bottom: Steel gauge 12 reinforced profiles
 - .3 Container lifting frame: Metal frame with two (2) side pockets c/w epoxy coating, to permit lifting from a standard front-end collection vehicle. Final dimensions to be in accordance with local waste collection standards.
 - .4 Top frame: Metal frame c/w epoxy coating with two (2) welded handles on each side.
 - .5 Swivel wheels: Four (4) heavy duty castors with manual lock, 200 mm diameter.
 - .6 Drain: 50 mm diameter PVC ball valve.
- .6 Lid construction
 - .1 Lid: Robust Double-Wall Polyethylene
 - .2 Tilt rod: 31.5mm diameter
 - .3 Rod lock system for a pair of lids

Part 3 Execution

3.1 INSTALLATION, ERECTION AND APPLICATION

- .1 The Contractor shall install and commission the equipment following the approved drawings and the manufacturer's instructions. The installation contractor is responsible for the following:
 - .1 All manpower and lifting equipment to unload and install the screw pump equipment.
 - .2 Aligning and anchoring the screen system and washer compactor into position.
 - .3 All civil structures, foundations, supports and concrete and grout work.
 - .4 Supplying and installing all lubricants necessary for start-up and commissioning.
 - .5 Final touch-up paint as necessary, test running and commissioning.
 - .6 Piping.
 - .7 All electrical work, including electrical controls, starters, disconnects, relays, junction boxes, conduit and electrical wiring.
 - .8 Temporary power supply during construction.
 - .9 Installation and start-up.
 - .10 Storage of delivered equipment.
 - .11 In-place storage or maintenance of equipment, if equipment cannot be put into Regular service after installation.
 - .12 Bulkheads and dewatering of work areas.
 - .13 Water for test purposes.
 - .14 Final painting as specified.

3.2 FIELD VERIFICATION AFTER UNLOADING

- .1 The Contractor in the presence of the Supplier must inspect each equipment. The purpose of this inspection is to verify that all components have no alignment, deformation or other problems that could create an operational issue.
- .2 A test procedure must be submitted to the Departmental Representative for the verification of mechanical, electrical, hydraulic and equipment control performance.

3.3 TESTING AND COMMISSIONING

- .1 Refer to Section 01 91 41 – Commissioning - Training
- .2 The Contractor shall notify the Departmental Representative at least forty-eight (48) hours in advance of any future start-up. The Supplier or Equipment Manufacturer is required to provide qualified personnel to travel to the site in order to provide the following services with regard to the screening system:
 - .3 One (1) inspection day after the installation of the screening system to verify its correct installation, including connections between components and other systems such as water and power supplies.
 - .4 One (1) commissioning day, to verify the proper operation of the system under all conditions for which it has been designed, testing as required, and to confirm that it is operating in accordance with the Specifications. These tests must be carried out with wastewater. This procedure includes, but is not limited to:

- .1 Electrical:
 - Check engine, amperage, voltage and direction of rotation.
- .2 Mechanical:
 - Verification of assembly and installation of equipment, lifting functions and vibration testing of equipment and piping.
- .3 Hydraulic:
 - Verification for the hydraulic capacity of the equipment.
- .4 Instrumentation and control:
 - Verification of the sequence of operation;
 - Verification of manual and automatic modes;
 - Verification of interlocks, faults and alarms.
- .5 One (1) training day, to provide training to the Owner's Operation Staff with regard to the proper operating procedures for the screening system, equipment maintenance requirements, troubleshooting, replacement of wear items, review of the O & M Manuals, and conveying other information required for the proper, safe, and efficient operation of this equipment. Schedule and deliver training in accordance with training plan approved in writing by Engineer.
- .6 During the commissioning period, the Contractor shall provide, at his expense, qualified labour for the operation of the equipment, as well as all the elements required to operate the equipment properly.
- .7 During this period, the equipment is operated under different operating conditions, as requested by the Departmental Representative to ensure that all systems can function as intended. Any deficiencies found during this period of operation are corrected to meet the requirements of the contract, and the equipment is tested again to the satisfaction of the Departmental Representative.
- .8 The Contractor is entirely responsible for the equipment and its operation during this period. If there is damaged equipment during start-up, control failures or disruption due to equipment failure, the Contractor shall repair or replace this equipment to the satisfaction of the Departmental Representative at his own cost, including any additional cost to complete the full commissioning.
- .9 During the commissioning period, the Contractor shall make all changes and adjustments to the equipment at his own expense, and demonstrate to the Departmental Representative that the equipment is capable of functioning correctly, according to the conditions set out in the Specifications.
- .10 The commissioning of the equipment must be coordinated with the contractors of other construction lots who must also commission their equipment.
- .11 The chemicals products required for commissioning are at the expense of the Contractor.

3.1 CLEANING

- .12 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .13 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

PWGSC
SEWAGE TREATMENT
UPGRADES
SPRINGHILL INSTITUTION
SPRINGHILL, NS
PROJECT NO. R.061876.001

WWTP SCREENING AND
DISPOSAL EQUIPMENT

SECTION 10 85 00
PAGE 21

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 05 50 00 Metal Fabrications
- .2 Section 10 81 01 Supply and Installation of WWTP Aeration System
- .3 Section 22 20 13 Pressure Piping
- .4 Section 31 23 33.01 Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .2 ASTM A536, Standard Specification for Ductile Iron Castings.
 - .3 ASTM F714, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
 - .4 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .2 AWWA
 - .1 AWWA C105, Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - .2 AWWA C110, Ductile-Iron and Gray-Iron Fittings.
 - .3 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - .4 AWWA C504, Rubber-Seated Butterfly Valves, 3 In. (75 mm) through 72 In. (1,800 mm).
 - .5 AWWA C153, Ductile-Iron Compact Fittings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit detailed shop drawings of all equipment and all material in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes, valves and fittings from damage.
 - .3 Replace defective or damaged materials with new.

- .4 Load and unload pipe and accessories by lifting with hoists or skidding to prevent shock and damage.
- .5 Do not drop pipe or drag along ground.
- .6 Pipe handled on skid-ways will not be skidded or rolled against pipe already on the ground.

Part 2 Products

2.1 MATERIALS

- .1 Buried Air Pipes
 - .1 To be of the size and type shown on the drawings of latest revision. HDPE pipe diameters as shown on the drawing are based on IPS size.
 - .2 High density polyethylene (HDPE) DR 17 pressure pipe: to ASTM F714 and D3350.
- .2 Buried to Above Ground Pipes
 - .1 To be of the size and type shown on the drawings of latest revision. HDPE pipe diameters as shown on the drawing are based on IPS size.
 - .2 High density polyethylene (HDPE) DR 17 pressure pipe: to ASTM F714 and D3350.
- .3 Aeration Blow-Off Connections
 - .1 All aeration blow-off connections including buried to above ground air pipes will be of the size and type as shown on the drawings of latest revision. HDPE pipe diameters as shown on the drawing are based on IPS size.
 - .2 High density polyethylene (HDPE) DR 17 pressure pipe: to ASTM F714 and D3350.
- .4 Butterfly Valves for Air Laterals (Above Ground)
 - .1 Sized in accordance with drawings and complete with flange end connections with the following specifications:
 - .1 One (1) Piece Body: Ductile Iron to ASTM A536 or Cast Iron to ASTM A126 Class B;
 - .2 Type: Lug Type;
 - .3 Seat Material: EPDM;
 - .4 Disc Material: 316 Stainless Steel;
 - .5 Shaft Material: Stainless Steel 18-8 type 304;
 - .6 Taper pine Disc shall not be pinned to shaft;
 - .7 Key: 316 Stainless Steel;
 - .8 Coating: Fused bonded epoxy coating suitable for exterior application.
 - .9 Nuts and Bolts: Stainless Steel 316;
 - .10 Operator: Leaver Type 304 stainless steel with 10 position S.S. plate;
 - .11 Acceptable Product: Series (31) Bray butterfly valve, Keystone Butterfly Valve Model F 920 Lug or approved equivalent.

- .2 One (1) galvanized steel support shall be installed under each butterfly valve as shown on the drawings.
- .5 Joints and Joint Restraints
 - .1 Joints between HDPE pipe and HDPE fittings: to be made by fusion butt-welding.
 - .2 Drilling and fusion of fittings and piping: to be made on site or at the Manufacturer's factory by the pipe Manufacturer.
 - .3 All HDPE components (pipe and fittings, and fusion operation) are to be by the same pipe Manufacturer.
 - .4 All joints and joint restraint system components and couplings: ductile-iron with high strength low alloy steel tee bolts and nuts (except where noted otherwise) tightened using a torque wrench to the Manufacturer's Specifications, completely wrapped with 8-Mil poly according to AWWA C105.
- .6 Fittings for HDPE Pipes
 - .1 Fittings to be fused welded to the pipe and be made of the same material and Manufacturer of the pipe system as described in Article 2.1.2 (Buried to Above Ground Pipes).
 - .2 Flange for butterfly valve: made from a two (2) piece system.
 - .1 The two (2) piece system consists of a fused flange and a stainless steel flange (for above and below ground), as manufactured by KWH pipe, or approved equivalent. HDPE fitting diameters as shown on the plan are based on IPS size.
 - .3 Installation of fittings (fusion to pipe): to be made by the pipe Manufacturer.
- .7 Marker Tape
 - .1 Metal marker tape, 50 mm wide, carrying the message "CAUTION – AIR PIPING BURIED".
- .8 Equipment
 - .1 Utilize laser beam instrumentation and techniques and approved laser sighting triangle to determine intermediate line and grade for all pipes except where and when the Departmental Representative may allow other methods to be used.
 - .2 Provide all necessary labour, materials and equipment for the pressure test, including suitable pump and measuring tank, pressure hoses and connections, plugs, caps, gauges, valves and all other apparatus necessary for filling the main, pumping at the required test pressure, and recording the pressure and leakage losses.
 - .3 Supply all labour, water, and facilities required to carry out testing and flushing of air pressure pipes. Water will not be provided by the Owner.

Part 3 Execution

3.1 INSTALLATION OF AIR PIPING

- .1 Air pipes shall be installed according to the types and sizes and in locations as indicated on the drawings.

- .1 In laying out the air piping system, the Departmental Representative will establish only the locations of air laterals.
- .2 Lay pipe at a minimum 1.0 meter cover. The Contractor is responsible for locating this line at the connection points.
- .3 Use approved laser alignment equipment installed in the pipe, just above the pipe, or in the bottom of the manhole to control line and grade while laying pipe.
 - .1 Installation of the laser beam contrary to the aforementioned requires approval of the Departmental Representative.
- .4 Use approved laser sighting triangle or template in setting each pipe.
- .2 Install air pressure pipes according to recommendations of the pipe Manufacturer and recognized good practice.
- .3 Provide and use proper implements, tools and facilities for safe and efficient execution of the work.
- .4 Carefully lower pipe and fittings into trench in such a manner as to prevent damage to them. Under no circumstances shall pipe or fittings be dropped into trench.
- .5 Thoroughly inspect pipe before and after laying. Immediately remove from the site any defective or damaged pipe and replace with new material.
- .6 Lay pipe in prepared trenches beginning at lowest point with bell of pipe pointing upgrade.
- .7 When pipe laying is not in progress, plug open ends of pipe using a watertight plug.
- .8 Lay pipe true to line and grade with uniform bearing under the full length of the barrel of the pipe.
- .9 Suitably excavate to receive the bell or collar, which shall not bear upon the sub-grade or bedding.
- .10 Remove and re-lay any pipe not in true alignment or showing undue settlement after laying.
- .11 No pipe will be laid on a foundation into which frost has penetrated, or at any time when the Departmental Representative may deem that there is a danger of the formation of ice or the penetration of frost at the bottom of the excavation.
- .12 Keep trenches where pipe laying is in progress dry. Do not lay pipe in water or upon wet bedding.
- .13 Thoroughly clean and protect pipes from dirt and water as the pipes are laid.
- .14 Thoroughly embed and secure pipe in place so as to prevent any movement or disturbance of the pipe before laying next pipe length.
- .15 Do not walk on or work over the pipes after they have been laid until there is at least 300 mm of cover over them, except as necessary in refilling the trench and compacting the bedding material.
- .16 Make mechanical joint connections, and tighten and torque bolts in accordance with the manufacturer's instructions and recognized good practice.
- .17 Provide joint restraints for all tees and bends on air pressure pipes.
- .18 Install marker tape 600 mm above the top of the air main header pipe.

3.2 JOINTING OF PIPE

- .1 Wipe clean ends of pipe, rubber gaskets, fittings, etc., immediately before joining the pipes to remove foreign matter from the joints.
- .2 Make joints in accordance with the pipe Manufacturer's instructions.
- .3 Where pressure air pipes are to be laid on a curve or curved alignment to avoid obstructions, the amount of deflection allowed shall not exceed that required for satisfactory connection of the joint. Maximum deflections in pipe joints shall be according to recommendations of pipe manufacturer.

3.3 TESTING

- .1 Test all air piping after installation.
- .2 All piping must pass the specified tests before being measured for payment. The cost of testing will be included in the tendered price for the installation of pipe and accessories.
- .3 Test as directed by the Departmental Representative after backfilling sections of pipelines, prior to the placement of roadway base material or surface restoration.
- .4 Thoroughly flush the pipeline to remove all loose material within the pipe before pressure testing.
- .5 The pipeline will be tested in sections not exceeding 350 meters unless otherwise permitted by the Departmental Representative.
- .6 Strut and brace all caps, bends, tees, valves and other parts to prevent movement when pressure is applied.
- .7 Apply pressure to the pipeline using suitable compressed air equipment with a pressure gauge.
- .8 The test section shall be subjected to a minimum air pressure of 138 kPa (20 PSI) for two (2) hours for air pressure pipes.
- .9 At the commencement of the test, increase the air pressure to the pressure specified for inspection. Turn off the compressed air equipment and the feed valves and record the pressure drop during the two (2) hour test.
- .10 The leakage is deemed as the amount of pressure drop in the piping over a period of two (2) hours.
- .11 No pipe installation will be accepted until the leakage is less than 7 kPa (1 PSI) of pressure drop during the test.
- .12 Should any test disclose leakage greater than that specified above, locate and repair the defects in the pipeline and fittings, and repeat the test until the leakage is within the specified allowance.

3.4 FLUSHING OF AIR PRESSURE PIPES

- .1 Thoroughly flush all air pressure pipes.
- .2 Flush using adequate volume and pressure to remove all loose material within the pipe.
- .3 Provide a screen or other acceptable apparatus at the lower end of the section being flushed to retain and dispose of all debris flushed from the pipe. Remove from adjacent sections, any debris not so retained.

- .4 Under no circumstances shall dirt be flushed into existing pipes.
- .5 Air piping shall be thoroughly drained after successful testing.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 10 90 00 Air Piping Systems.
- .2 Section 31 23 33.01 Excavating Trenching and Backfilling.
- .3 Section 31 32 19.02 Geomembranes.
- .4 Section 33 05 16 Manholes and Catchbasin Structures.
- .5 Section 33 31 13 Sanitary Sewerage Piping.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 WARRANTY

- .1 The baffle shall come with a minimum two (2) year full (not pro-rated) warranty against defects in workmanship and installation effective as of the date of Substantial Completion. This warranty shall provide the Owner with 100% warranty coverage for not less than 2 years. This signed and sealed warranty certificate to be submitted no later than Substantial Completion. The warranty shall cover defects in workmanship and materials, which shall be repaired or replaced at no cost to the Owner and shall include all work incidental thereto.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Safety Rope System
 - .1 Earth anchors: Manta Ray Duckbill Guy Anchors, Model No. 68-DBU or approved equivalent.
 - .2 Rope: Polypropylene, sized as shown on the drawings.

- .3 Cable: 3 mm dia. galvanized steel cable, supplied with the earth anchors.
- .4 Buoy: closed cell polystyrene or PVC, 250 mm diameter, colour safety orange,
- .2 Anchor Posts for Floating Baffles
 - .1 Provide 200 mm diameter schedule 40 galvanized steel post at each end of the baffle with appropriate devices for fastening the baffle cable to the posts. Post to be concrete encased as shown on the drawings, or as otherwise specified by the baffle manufacturer. Each post shall have a plastic cover in safety yellow with at least one (1) circumferential reflective band; covers to be Bollardguard or approved equal.
- .3 Floating Baffles:
 - .1 Approved Products:
 - .1 Director I manufactured by Environetics
 - .2 Slickbar MK-10
 - .3 Thermafab Curtain System using XR-5 8130 Reinforced Geomembrane, as manufactured by Seaman Corporation
 - .4 Approved equivalent
 - .2 Pre-fabricated hydraulic barrier requiring no on-site fabrication other than assembly of completed section and related components, ready for installation.
 - .3 Floating baffle material: polyester reinforced polymeric alloy membrane material ENV-3602-12-XR-5 or approved equal, to be designed for UV resistance and capable of withstanding the exposure and stresses proposed application.
 - .4 The floating baffle shall come complete with two tension members seamed under the flotation collar and the bottom edge of the curtain. The curtain shall also come with ballasts which are to include lifting lines. Provide all concrete required for these ballasts.
 - .5 Fasteners, connectors, cables, etc.: Stainless Steel Aircraft Cable type.
 - .6 Chains: galvanized steel.
 - .7 Provide intermediate anchors to limit the lateral movement of the baffle to no more than 2.0 m.
 - .8 The baffle shall come complete with a single or multiple flow-through windows sized for a peak flow rate of 2,160 m³/day (25 L/s). This window shall be reinforced. Flow through velocity of the window shall not exceed 0.9 m/s.
 - .9 The baffle shall be designed to fit the sides of the lagoon by tapering at the lagoon slope. The side slopes on the dikes are 3H:1V.
 - .10 The baffle shall come with a flotation collar sealed in the baffle material.
 - .11 If the baffle is to be manufactured in sections, the connection is to be made with a mechanical stainless steel bolt-through connector.
- .4 Boat and trailer, c/w Electric Motor and Accessories:
 - .1 Approved Products:
 - .1 Carolina Skiff Model J1250
 - .2 Polar Kraft Model Dakota V1260
 - .3 Maritime Skiff Model 1840
 - .2 Hull: closed cell foam fibreglass composite

- .3 Hull Type: flat
- .4 Exterior: Gelcoat
- .5 Interior: Webbed Gelcoat
- .6 Weight capacity: Minimum 3 person (350 kg)
- .7 Boat to be provided with the following equipment:
 - .1 Galvanized trailer and winch/cable/pulley system
 - .2 Electric trolling motor: 12 Volt, 22.7 kg thrust, transom mount, variable speed, complete with marine battery.
 - .3 Oar locks
 - .4 Two (2) Oars
 - .5 1 snatch block
 - .6 Four (4) Personal Flotation Devices (PFDs) rated to 90 kg minimum, approved by Transport Canada, Canadian Coast Guard, Fisheries and Oceans Canada or any combination of the above.
 - .7 Bailer
 - .8 10 kg mushroom anchor and minimum 18 metres of 7 mm polypropylene rope.
 - .9 Buoyant heaving line, minimum 15 metres.
 - .10 Boat winch with S.S. brackets including swivel point.
- .5 Concrete Splash Pads:
 - .1 Concrete and construction methods for the concrete splash pads shall be in accordance with Section 03 10 00 -Concrete Forming and Accessories and Section 03 30 00 - Cast-in-place Concrete, Reinforced Concrete for Control Chamber Cast In-Place Dividing Wall.

Part 3 Execution

3.1 INSTALLATION

- .1 Safety Rope System
 - .1 Install safety rope system around the lagoon perimeters as shown on the drawings.
 - .2 Anchor safety rope system to galvanized steel earth anchors at the top inside edge of the dikes at intervals as shown on the drawings with a maximum of 20 metres.
 - .3 Anchor rope to a 3 mm dia. galvanized steel cable supplied with the earth anchors.
 - .4 Attach buoy at the end of each rope and place in the water.
 - .5 Attach 8 mm polypropylene marine rope from one buoy to another all around the cell, with a sturdy knot ensuring resistance to ice movement, wave action, or pulling to 250 kg minimum.
- .2 Anchor Posts for Floating Baffles:
 - .1 Install plumb and in a vertical position as shown on the drawings and as specified.
 - .2 Install and secure covers as per the manufacturer's recommendations.

- .3 Protect posts from damage during the construction period, and any required repairs will be the Contractor's responsibility throughout the warranty period, at no additional cost to the Owner.
- .3 Floating Baffles:
 - .1 Install as shown on the drawings and as specified, in accordance with manufacturer's recommendations.
 - .2 Install baffle after the lagoon cells have been filled.
 - .3 The manufacturer's representative shall verify and approve the installation.
- .4 Concrete Splash Pads:
 - .1 Concrete and construction methods for the concrete splash pads shall be in accordance with Section 03 10 00 -Concrete Forming and Accessories and Section 03 30 00 - Cast-in-place Concrete.
 - .2 Protect lagoon HDPE and clay liners where concrete pads may be required under various components. Damages to the liner during construction and its repair shall be done by the Contractor, at no additional cost to the Contract

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION