ITEM 604.5103 10 M - STORMWATER TREATMENT SYSTEM (Vortechnics Unit)

DESCRIPTION.

The work shall include all labor, materials, equipment and incidentals required to install all precast concrete stormwater treatment systems (manufactured by Vortechnics, Inc.) and appurtenances in accordance with the Drawings and these specifications. The stormwater treatment system shall also be routinely inspected, cleaned and maintained for the duration of the contract.

MATERIALS.

The Contractor shall provide the manufacturer's standard sheets, installation details, and operations and maintenance manuals to the Engineer prior to installation. Detailed fabricator shop drawings shall be supplied to the Materials Bureau prior to fabrication of the stormwater treatment systems into precast concrete units.

1. Concrete for precast stormwater treatment systems shall conform to ASTM C857 and C858. Precast units shall be fabricated at facilities approved by the Department.

2. Cement shall be Type II Portland cement conforming to ASTM C150.

3. Internal aluminum plate components shall be aluminum alloy 5052-H32 in accordance with ASTM B209.

4. Sealant to be utilized at the base of the swirl chamber shall be 60 durometer extruded nitrile butadiene rubber (Buna N) and shall be provided to the concrete precaster for installation.

5. Brick or masonry used to build the manhole frame to grade shall conform to ASTM C32 or ASTM C139 and shall be installed in conformance with all local requirements.

6. Casting for manhole frames and covers shall be in accordance with ASTM A48, CL.30B and AASHTO M105. The manhole frame and cover shall be equivalent to Campbell Foundry Pattern #1009A or #1012D.

7. A bitumen sealant in conformance with ASTM C990 shall be utilized in the sealing of the joint between the swirl chamber and the vault at the long wall tangent points. The butyl material shall be 19mm thick by 19mm wide.

8. Additional sealant to be utilized at the base of the swirl chamber and along the baffle walls shall be Sikaflex-1a polyurethane elastomeric sealant.

CONSTRUCTION DETAILS.

The wall thickness shall not be less than 152 mm or as shown on the dimensional drawings. In all cases the wall thickness shall be no less than the minimum thickness necessary to sustain HS20-44 (MS18) loading requirements as determined by a Licensed Professional Engineer.

Sections shall have tongue and groove or ship-lap joints with a butyl mastic sealant conforming to ASTM C990. All sections shall be cured by an approved method. Sections shall not be shipped until the concrete has attained a compressive strength of 28 MPa or until 5 days after fabrication and/or repair, whichever is the longer.

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Pipe openings shall be sized to accept pipes of the specified size(s) and material(s), and shall be sealed by the Contractor with a hydraulic cement conforming to ASTM C595M.

Quality Control Inspection. The quality of materials, the process of fabrication, and the finished sections shall be subject to inspection by the Engineer. Such inspection may be made at the place of fabrication, or on the work site after delivery, or at both places, and the sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of fabrication. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. All sections that have been damaged beyond repair during delivery will be rejected and, if already installed, shall be repaired to the Engineer's acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.

All sections shall be inspected by the Contractor for general appearance, dimensions, soundness, etc. The surface shall be dense, close textured and free of blisters, cracks, roughness and exposure of reinforcement.

Imperfections may be repaired, subject to the acceptance of the Engineer, after demonstration by the fabricator that strong and permanent repairs result. Repairs shall be carefully inspected before final acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 28 MPa at the end of 7 days and 34 MPa at the end of 28 days when tested in 76 mm diameter by 152 mm long cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs.

Submittals. The Contractor shall be provided with dimensional drawings and, when specified, utilize these drawings as the basis for preparation of shop drawings showing details for construction, reinforcing, joints and any cast-in-place appurtenances. Shop drawings shall be annotated to indicate all materials to be used and all applicable standards for materials, required tests of materials and design assumptions for structural analysis. Structural design calculations and shop drawings shall be certified by a Professional Engineer retained by the system manufacturer or Contractor and licensed in the State of New York. Shop drawings shall be prepared at a scale of not less than 1:75. Six (6) hard copies of said shop drawings shall be submitted to the Engineer for review and approval.

The Contractor shall submit to the Engineer, prior to installation of the stormwater treatment system, an affidavit regarding patent infringement rights stating that any suit or claim against the Owner due to alleged infringement rights shall be defended by the Contractor who will bear all the costs, expenses and attorney's fees incurred thereof.

The following documentation must be submitted by the Contractor and approved by the Engineer prior to the fabrication and delivery of any materials.

1. *Laboratory Data*. The stormwater treatment system supplier shall provide documentation of Total Suspended Solids (TSS) removal efficiency from laboratory testing conducted on the supplier's full-scale system. The documentation shall include:

   A. TSS removal efficiency versus operating rate for the full operating range of the stormwater treatment system for a 50-micron particle size.

   B. TSS removal calculations for each system specified herein. The calculations must demonstrate that the system(s) is capable of achieving a net annual TSS removal efficiency as required by local regulations and as based upon a 50-micron particle size and the best available rainfall data for the project site location.

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2. *Field Test Data.* The stormwater treatment system supplier shall provide documentation of TSS removal efficiency from field testing conducted on an installed system. The documentation shall be in accordance with the following:

   A. The testing and documentation shall have been conducted by an independent third party.

   B. The testing and documentation shall include at least ten storms.

   C. The testing and documentation must show TSS removal results that meet or exceed the performance requirements for the system(s) specified herein.

3. *Manufacturing Experience*. The stormwater treatment supplier shall provide evidence of at least five years of successful product design and use. The supplier shall provide an installation list of projects, model sizes installed and installation dates where the same type systems as specified herein have been designed and produced by the supplier.

Performance. Each stormwater treatment system shall adhere to the following performance specifications: Design Treatment Capacity of 495-710 L/s and Sediment Storage of 5.43 cubic meter

Each stormwater treatment system shall include a circular aluminum "swirl chamber" (or "grit chamber") with a tangential inlet to induce a swirling flow pattern that will accumulate and store settleable solids in a manner and a location that will prevent re-suspension of previously captured particulates.

Each stormwater treatment system shall be of a hydraulic design that includes flow controls designed and certified by a professional engineer using accepted principles of fluid mechanics that raise the water surface inside the tank to a pre-determined level in order to prevent the re-entrainment of trapped floating contaminants.

Each stormwater treatment system shall be capable of removing 80% of the net annual Total Suspended Solids (TSS) load based on a 50-micron particle size. Annual TSS removal efficiency models shall be based on documented removal efficiency performance from full scale laboratory tests. Annual TSS removal efficiency models shall only be considered valid if they are corroborated by independent third party field testing. Said field testing shall include influent and effluent composite samples from a minimum of ten storms at one location. Individual stormwater treatment systems shall have the Design Treatment Capacity specified above, and shall not re-suspend trapped sediments or re-entrain floating contaminants at flow rates up to and including the specified Design Treatment Capacity.

Individual stormwater treatment systems shall have usable sediment storage capacity of not less than the corresponding volume listed above. The systems shall be designed such that the pump-out volume is less than 1/2 of the total system volume. The systems shall be designed to not allow surcharge of the upstream piping network during dry weather conditions.

A water-lock feature shall be incorporated into the design of the stormwater treatment system to prevent the introduction of trapped oil and floatable contaminants to the downstream piping during routine maintenance and to ensure that no oil escapes the system during the ensuing rain event. Direct access shall be provided to the sediment and floatable contaminant storage chambers to facilitate maintenance. There shall be no appurtenances or restrictions within these chambers.

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The stormwater treatment system manufacturer shall furnish documentation that supports all product performance claims and features, storage capacities and maintenance requirements.

Stormwater treatment systems shall be completely housed within one rectangular structure.

Manufacturer. Each stormwater treatment system shall be of a type that has been installed and used successfully for a minimum of five years. The manufacturer of said system shall have been regularly engaged in the engineering design and production of systems for the physical treatment of stormwater runoff during the aforementioned period.

Installation. Each Stormwater Treatment System shall be constructed according to the sizes shown on the Drawings and as specified herein. Install at elevations and locations shown on the Drawings or as otherwise directed by the Engineer.

1. Place the precast base unit on a granular subbase of minimum thickness of 152mm after compaction or of greater thickness and compaction if specified elsewhere. The granular subbase shall be checked for level prior to setting and the precast base section of the trap shall be checked for level at all four corners after it is set. If the slope from any corner to any other corner exceeds 0.5% the base section shall be removed and the granular subbase material re-leveled.

2. Prior to setting subsequent sections place bitumen sealant in conformance with ASTM C 990-91 along the construction joint in the section that is already in place.

3. After setting the base and wall or riser sections, prepare to install the swirl chamber. Place the 19mm thick by 19mm wide butyl mastic seal vertically on the outside of the swirl chamber starting 25 mm above the bottom of the swirl chamber and continuing to a height equal to the elevation of the bottom of the upper aperture of the swirl chamber. The butyl mastic seal should abut the downstream side of the pre-drilled mounting holes that attach the swirl chamber to the long walls of the concrete vault. Next, install the extruded Buna N seal on the bottom edge of the 180 degree downstream section of the swirl chamber by first applying a bead of Sikaflex-1a polyurethane elastomeric sealant into the extruded slot then slide the seal onto the swirl chamber. The extruded seal should extend 76mm upstream of the mounting holes, toward the inlet end of the vault. Set the swirl chamber into position and keep the seal approximately 13mm above the floor of the concrete vault. Apply a continuous bead of Sikaflex-1a sealant under the cupped bottom of the seal. Set the circular swirl chamber on the floor of the vault and anchor it by bolting the swirl chamber to the side walls of the concrete vault at the three (3) tangent points and at the inlet tab using HILTI brand stainless steel drop-in wedge anchors or equivalent 9.5mm diameter by 70mm minimum length at heights of approximately 76mm off the floor and at 381mm intervals to approximately the same height of the butyl mastic sealant (at locations of pre-drilled holes in aluminum components). Apply a continuous bead of Sikaflex-1a sealant to the intersection of the inside bottom edge of the extruded seal and the vault floor.

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4. Prior to setting the precast roof section, bitumen sealant equal to ASTM C 990 shall be placed along the top of the oil baffle wall, using more than one layer of mastic if necessary, to a thickness at least 25mm greater than the nominal gap between the top of the baffle and the roof section. The nominal gap shall be determined either by field measurement or the shop drawings. After placement of the roof section has compressed the butyl mastic sealant in the gap, finish sealing the gap with an approved non-shrink grout on both sides of the gap using the butyl mastic as a backing material to which to apply the grout. Apply non-shrink grout or Sikaflex-1a sealant to each end of the oil baffle wall and the flow control wall at the upstream intersection with the sidewalls of the concrete vault. Do not seal the top of the flow control wall unless specified on the shop drawings to do so.

5. After setting the precast roof section of the stormwater treatment system, set precast concrete manhole riser sections, to the height required to bring the cast iron manhole covers to grade, so that the sections are vertical and in true alignment with a 6 mm maximum tolerance allowed. Backfill in a careful manner, bringing the fill up in 152 mm lifts on all sides. If leaks appear, clean the inside joints and caulk with lead wool to the satisfaction of the Engineer. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of Stormwater Treatment Systems shall conform to ASTM specification C 891 'Standard Practice for Installation of Underground Precast Utility Structures'.

6. Holes made in the concrete sections for handling or other purposes shall be plugged with a nonshrink grout or by using grout in combination with concrete plugs.

7. Where holes must be cut in the precast sections to accommodate pipes, do all cutting before setting the sections in place to prevent any subsequent jarring which may loosen the mortar joints. The Contractor shall make all pipe connections.

METHOD OF MEASUREMENT.

This work shall be measured as the number of SWTS units installed in accordance with this specification, the contract documents, and approved by the Engineer.

BASIS OF PAYMENT.

The Unit Price Bid shall include the cost of furnishing all labor, materials, and equipment necessary to install each unit to the satisfaction of the Engineer. Seventy-five percent of the price bid for this item shall be paid upon satisfactory installation of the stormwater treatment system units. The remaining percentage shall be paid after the stormwater treatment system is satisfactorily cleaned at the completion of the contract.

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