

Special Specification 7202

Stormwater Treatment Unit – Membrane Filter



1. DESCRIPTION

Furnish and install the stormwater treatment system, complete and operable as shown and as specified herein, in conformance with the requirements of the plans and Contract documents. The stormwater treatment system will consist of an underground precast structure that houses a filter treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration. Design of stormwater treatment units must be in accordance with the Texas Commission on Environmental Quality manual "RG-348: Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices," and included in the overall hydraulic model for the project.

2. MATERIALS

Provide new materials that comply with the details shown on the plans and in accordance with the following:

- Item 420, "Concrete Substructures"
- Item 421, "Hydraulic Cement Concrete"
- Item 429, "Concrete Structure Repair"
- Item 440, "Reinforcement for Concrete"
- Item 471, "Frames, Grates, Rings, and Covers" and
- materials used for stormwater treatment units and appurtenances must be capable of withstanding aggressive biological, chemical, and loading environments, typical of the geographic area in which the units are being installed, including freeze-thaw weather cycles, earth pressure and hydrostatic pressures. Concrete must achieve a minimum 28-day compressive strength of 4,000 pounds per square inch (psi).

- 2.1. **Precast Structure.** Furnish Class C (HPC) concrete for stormwater treatment structure unless otherwise shown on the plans. Construct precast stormwater treatment structure in accordance with Item 420, "Concrete Substructures," or ASTM C 478. Air entrained concrete will not be required in precast concrete members. Use Type II Portland cement in accordance with DMS-4600, "Hydraulic Cement."
- 2.2. **Mortar.** Furnish mortar composed of one part hydraulic cement and two parts clean sand, hydrated lime, or lime putty may be added to the mix to a maximum of 10% by weight of the total dry mix.
- 2.3. **Traffic Load.** Provide concrete box and riser that meet HL93 AASHTO LRFD live loading requirements.
- 2.4. **Sealing.** Apply Conseal CS-101 or approved equal sealant as shown on the plans, as recommended by the manufacturer, or as directed.
- 2.5. **Frames, Grates, Rings, and Covers.** Furnish materials as shown on the plans and in accordance with Item 471, "Frames, Grates, Rings, and Covers."
- 2.6. **Treatment Unit.** The device must be cylindrical or rectangular and constructed from precast concrete riser and slab components or monolithic precast structures, installed in accordance with ASTM C 891 and to any required state highway, municipal or local specifications.
- 2.6.1. **Cartridge Deck.** The cylindrical concrete device must include a fiberglass insert. The rectangular concrete device must include a coated aluminum insert. In either instance, the insert must be bolted and sealed

watertight inside the precast concrete chamber. The insert serves as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges; (d) a conduit for conveyance of treated water to the effluent pipe.

- 2.6.2. **Membrane Filter Cartridges.** Filter cartridges must be comprised of cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge is 11-2.75-in. (70-mm) diameter elements. The length of each filter element must be a minimum 15 in. (381 mm). Each cartridge must be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge must be secured by a cartridge lid that is threaded onto the receptacle. The maximum treatment flow rate of a filter cartridge must be controlled by an orifice in the cartridge lid and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum flux rate is 0.21 gpm/ft² (0.142 lps/m²). Each lightweight membrane filter cartridge allows for manual installation and removal. Each filter cartridge must have filtration membrane surface area and dry installation weight in accordance with Table 1.

**Table 1
Filter Cartridge**

Filter Cartridge Length (in./mm)	Filtration Membrane Surface Area (ft ² / m ²)	Filter Cartridge Dry Weight (lbs./ kg)
15/381	106/9.8	10/4.5
27/685.8	190/17.7	14.5/6.6
40/1016	282/26.2	19.5/8.9
54/1371.6	381/35.4	25/11.4

- 2.6.3. **Backwashing Cartridges.** The filter device must have a weir extending above the cartridge deck that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir must collect a pool of filtered water during inflow events that subsequently automatically backwashes the high flow rate cartridges when the inflow event subsides. All filter cartridges must allow for use of a manual backwashing or filtration membrane rinsing procedure to restore flow capacity and sediment capacity, and extend cartridge service life.
- 2.6.4. **Maintenance Access to Captured Pollutants.** The filter device must contain an opening that provides suitable maintenance access for removal of accumulated floatable pollutants and sediment.
- 2.6.5. **Bend Structure.** The device should be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90° or less in the stormwater conveyance system.
- 2.6.6. **Double-Wall Containment of Hydrocarbons.** The cylindrical precast concrete device must provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 in. (305 mm) below the cartridge deck, and the precast vessel wall. Alternatively, a cylindrical device constructed of fiberglass (FRP) does not require double-wall containment as fiberglass is resistant to hydrocarbon penetration.
- 2.6.7. **Baffle.** The filter device must provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle must serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle must be a flexible continuous skirt in the cylindrical device. The baffle should be a straight concrete or aluminum wall in the rectangular device.
- 2.6.8. **Sump.** The device must include a minimum 24 in. (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the Engineer.

3. PERFORMANCE

- 3.1. An approved Water Pollution Abatement Plan (WPAP) must be provided wherein the design of stormwater treatment units must be shown to be in accordance with the Texas Commission on Environmental Quality manual "RG-348: Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices" and be listed in the July 2012 Addendum or later as showing an 86% removal efficiency or greater. In addition, to substantiate removal rates, the Contractor must submit full scale third-party field testing data in accordance with the Technology Acceptance Reciprocity Protocols Tier II certification, to the Engineer of Record for approval.

Each stormwater treatment unit must maintain the peak capacity of the network through an internal pressure relief mechanism or an external bypass. The affect the stormwater treatment unit and bypass has on the hydraulic model of the hydraulic grade line must be clearly calculated and shown. The stormwater treatment unit must not allow surcharge of the upstream piping network during dry weather conditions and handle an associated peak treatment flow greater than or equal to the design treatment flow as designated on the plans while retaining the trapped floatables and sediment up to and including the peak treatment flow rates.

Each stormwater treatment unit must contain a pretreatment grit chamber for sediment removal and a floatable chamber with mechanisms for oils, organic debris, and trash removal. The stormwater treatment unit must provide direct access to the sediment and floatable containment storage chambers to facilitate maintenance. There must not be any internal components that obstruct maintenance access to the contaminant storage chambers.

Each stormwater treatment unit must provide a means of preventing the introduction of trapped oil and floatable contaminants to the downstream piping during routine maintenance; a means to ensure that no oil escapes the system during the ensuing rain event.

4. CONSTRUCTION

The manufacturer must submit shop drawings detailing the structure, filters cartridges, and accessory equipment. Drawings must include principal dimensions, filter placement, location of piping, and unit foundation. The manufacturer must submit a maintenance manual, and provide proof of at least 5 yr. of satisfactory experience with stormwater treatment structures on Department projects. In order further substantiate removal rates, the Contractor must submit full scale third-party field testing data in accordance with the Technology Acceptance Reciprocity Protocols Tier II certification, to the Engineer of Record for approval. Submittals must be signed and sealed by a professional engineer licensed in the State of Texas, and include detailed hydraulic analysis calculating any affect the stormwater treatment unit has on the hydraulic model as well as approved TCEQ calculations to the Engineer of Record and the Department, a minimum of two weeks before the scheduled letting date.

Before installation, all precast stormwater treatment units must be inspected for general appearance, dimensions, soundness, etc. The concrete surface should be dense, close textured, and free of blisters, cracks, roughness, and exposure of reinforcement. Repair any damaged concrete boxes in accordance with Item 429, "Concrete Structure Repair." Remove and replace any damaged stormwater treatment system beyond repair, as directed, at no extra cost. Complete stormwater treatment system installation in conformance with the plans and specifications. For ground systems, place the base unit on the granular subbase of minimum thickness of 6 in. after compaction. The granular subbase must be checked for level before setting and the base section of the unit must 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 must be removed and granular subbase material re-leveled, also for ground systems, backfill to original ground elevation in accordance with Item 400, "Excavation and backfill for Structures."

Maintain the stormwater treatment system until the project is accepted by providing monthly routine inspection and scheduling cleaning before the system is activated. Inspection of the stormwater treatment units is required at least twice a year. Cleaning with the use of a vactor truck or pump is to occur when 12 in. of sediment has accumulated on the vault or manhole floor, or when a known hazardous spill has occurred,

or as directed. A vacuum truck company, licensed for solid wastes disposal, should be contracted to clean out the unit.

5. MEASUREMENT

Stormwater Treatment units, satisfactorily completed in conformance with the plans and specifications, will be measured by each, of the type specified, complete in place.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for as follows:

- 6.1. **Stormwater Treatment Unit.** Payment for complete Stormwater Treatment Unit will be made at the unit price bid for "Stormwater Treatment Unit" by the each. These prices are full compensation for furnishing concrete, reinforcing steel, grout, aluminum and castings, frames grates, rings and covers, treatment units, connection pipes, excavation, and backfill and for all other materials, tools, equipment, labor, incidentals, cleaning, and maintenance as necessary to install stormwater treatment units, complete in place, in conformance with the plans and specifications.