WASHINGTON STATE DEPARTMENT OF ECOLOGY

January 2021

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) AND PHOSPHORUS TREATMENT For Contech Engineered Solutions Jellyfish® Filter

Ecology's Decision:

1. Based on Contech Engineered Solution's application submissions, Ecology hereby issues a General use level designation (GULD) for Basic (TSS) and Phosphorus Treatment for Contech's Jellyfish® Filter:
   - Sized at a hydraulic loading rate of no greater than 0.21 gpm/sf filter surface for hi-flo cartridges and 0.11 gpm/sf filter surface for draindown cartridges

Table 1. Jellyfish® cartridge hydraulic loading rates and sediment capture capacity[1] associated with various filter cartridge sizes.

Cartridge Length	Design Treatment Flow Rate	Design Sediment Mass Loading Capacity
15 inches	Hi-Flo 22 gpm Draindown 11 gpm	Hi-Flo 35 lbs Draindown 17 lbs
27 inches	Hi-Flo 40 gpm Draindown 20 gpm	Hi-Flo 63 lbs Draindown 31 lbs
40 inches	Hi-Flo 60 gpm Draindown 30 gpm	Hi-Flo 93 lbs Draindown 46 lbs
54 inches	Hi-Flo 80 gpm Draindown 40 gpm	Hi-Flo 125 lbs Draindown 63 lbs

[1] Design sediment mass loading capacity based on laboratory testing using silica sediment.

2. Ecology approves Jellyfish® Filter units at the design treatment flow rates shown in Table 1. Total Jellyfish Filter system design treatment capacity is the sum of the design treatment capacity of individual cartridges and must equal or exceed the water quality design flow rate. Calculate the water quality design flow rate that must be treated by an individual treatment system using the following procedures:
   - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
   - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.7.6 of the 2019 Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
   - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.
3. The GULD has no expiration date but may be amended or revoked by Ecology.

<u>Ecology's Conditions of Use:</u>

Jellyfish® Filter units shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain Jellyfish® Filter units in accordance with Contech's applicable manuals and documents and this Ecology Decision.
2. Contech uses sediment-loading capacity, in conjunction with the water quality design flow rate, to determine the target maintenance interval.
3. Jellyfish® Filters shall conform to specifications submitted to and approved by Ecology.
4. Maintenance: The required inspection/maintenance interval for stormwater treatment devices is often dependent on the efficiency of the device and the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.
   - The Jellyfish® Filter is designed for a target maintenance interval of 12 months. Maintenance includes floatable trash, debris, and oil removal; sediment removal; and the rinsing or replacement of filter cartridges.
   - A Jellyfish® Filter tested in Dundee, OR averaged a 3.2 month maintenance interval. Construction activities were ongoing in the drainage basin and near the monitoring site during the first two years of the study. Monitoring personnel observed significant amounts of roadway sediments and organic debris in the runoff, and TSS concentrations were higher than typical for roadway runoff. The runoff that occurred during the study may be unusual, and the maintenance interval the Jellyfish® Filter required may not be indicative of other, more typical, sites.

- Owner/s operators must inspect Jellyfish® Filter systems for a minimum of twelve months from the start of post-construction operation to determine site-specific inspection/maintenance schedules and requirements. Owners/operators must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in westerns Washington is October 1 to April 30. According to the SWMMEW, the wet season in eastern Washington is October 1 to June 30.) After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.
- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flow rate and/or a decrease in pollutant removal ability.

5. Install the Jellyfish® Filter in such a manner such that flows exceeding the maximum operating rate of the system are bypassed and will not resuspend captured sediment.
6. Discharges from the Jellyfish® Filter units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: CONTECH Engineered Solutions

Applicant's Address: 11835 NE Glenn Widing Dr
Portland, OR 97220

Application Documents:

- *Jellyfish® Filter Dundee, OR, General Use Level Designation Technical Evaluation Report*, Prepared by CONTECH Engineered Solutions, December 28, 2020
- Application Letter for CULD for Jellyfish Filter - Basic Treatment, Phosphorus Treatment, and Oil Treatment, dated April 27, 2012.
- Letter from Imbrium Systems dated September 4, 2012 regarding the draft CULD/PULD document.
- *TAPE Analysis of Jellyfish Filter UF Field Study Data*, prepared by Stormwater Management Services, LLC.
- *TARP Field Test Performance Monitoring of a Jellyfish Filter JF4-2-1. Performance Monitoring Report for JF4-2-1* Prepared By: University of Florida, Engineering School of Sustainable Infrastructure and Environment (ESSIE), University of Florida, Gainesville, FL 32611. Final Version: 01 November 2011.
- *Jellyfish Filter Systems Evaluation Report in Consideration for Pilot Level Designation (PLD) for Imbrium Systems Corporation*, by Gary R. Minton, PhD, PE, with Resource Planning Associates in Seattle, Washington May 7, 2008 (updated July 1, 2008).

- *NJCAT Technology Verification, Jellyfish Fine Sediment Filter*, by the New Jersey Corporation for Advanced Technology (NJCAT) Program Imbrium Systems Corporation, June 2008

Applicant's Use Level Request:

- General use level designation as a Basic (TSS) and Phosphorus Treatment device in accordance with Ecology's 2019 Stormwater Management Manual for Western Washington.

Applicant's Performance Claims:

Based on results from a laboratory and field-testing, the applicant claims the Jellyfish® Filter, operating at a hydraulic loading rate of no more than 0.21 gpm/sf for hi-flo cartridges and 0.11 gpm/sf for draindown cartridges, is able to remove:

- 80% of total suspended solids (TSS) for influent concentrations greater than 100 mg/L and achieve a 20 mg/L effluent for influent concentrations less than 100 mg/L.
- 50% of total phosphorus for influent concentrations 0.1 to 0.5 mg/L

Recommendations:

Ecology finds that:

- Contech Engineered Solutions has shown Ecology, through laboratory and field testing, that the Jellyfish® Filter is capable of attaining Ecology's Basic (TSS) and Total Phosphorus treatment goals.

Findings of Fact:

<u>Field Testing 2017-2020</u>
Contech completed field testing in Dundee, OR on a Jellyfish® Filter unit containing six 54-inch hi-flo cartridges and one 54-inch draindown cartridge. This combination of cartridges resulted in a design flow capacity of 520 gpm (1.16 cfs). Since Contech conducted the field evaluation they contracted with Herrera Environmental Consultants to provide third party oversight.

- The field evaluation was completed between March 2017 and April 2020. Throughout the evaluation a total of 23 individual storm events (18 flow-weighted composite samples and 5 peak flow grab samples) were sampled to evaluate system performance. All sampled events met the TAPE sampling event qualification criteria, while 21 of the 23 events met the influent requirements for TSS and/or total phosphorus. Peak flows during these 21 events ranged from 26% to 106% of the design treatment capacity of 520 gpm, with a mean peak flow rate of 67% of design.
- Of the 23 TAPE qualified events, 21 met the requirements for TSS analysis (16 flow weighted composite; 5 peak flow grab samples). Influent concentrations ranged from 24 mg/L to 755 mg/L, with a mean concentration of 208 mg/L. Concentrations that exceeded the upper end of TAPE influent range were capped at 200 mg/L prior to calculating the pollutant removal efficiency. For all samples with influent concentrations greater than 100 mg/L the bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean TSS reduction was 82%, meeting the 80% performance goal for Basic Treatment. The TAPE bootstrap calculator could not be used on samples with influent concentrations

between 20 mg/L to 100 mg/L due to the limited number of events available (n=6). For these events the mean and median effluent TSS concentrations were 19.7 and 18.1 mg/L respectively, again meeting the 20 mg/L effluent goal for Basic Treatment.

- Of the 23 TAPE qualified events, 18 met the requirements for total phosphorus analysis (13 flow-weighted composite; 5 peak flow grab samples). Influent concentrations ranged from 0.211 mg/L to 1.75 mg/L, with a mean concentration of 0.535 mg/L. Concentrations that exceeded the upper end of TAPE influent range were capped at 0.5 mg/L prior to calculating the pollutant removal efficiency. The LCL 95 mean percent removal goal was 70.1%, meeting the 50% performance goal for Phosphorus Treatment.
- Median particle sized distribution results from three samples showed 20% of sediment >250 µm, 31% of sediment between 62.5 to 250 µm, and 51% of sediment <62.5 µm. This demonstrates the influent to the Jellyfish consisted of primarily silt-sized particles (3.9 to 62.5 µm) and is thus representative of Pacific Northwest Stormwater.
- Contech encountered several unanticipated events and challenges that disrupted the sampling and/or resulted in lost data: the Jellyfish was taken offline twice to avoid atypical sediment loading that was the result of construction within the drainage basin; monitoring was suspended to repair or replace equipment that was damaged from vandalism and extreme weather; and, a cyber-attack on Contech storage drives resulted in a loss of approximately 15% of non-sampled flow and precipitation data.

Field Testing 2010-2011

Results (second-generation membrane filtration cartridges) – University of Florida (Gainesville, FL) installed and tested a Jellyfish JF4-2-1. The University conducted monitoring of the system from May 28, 2010 to June 27, 2011, with runoff from 15.01 inches of rainfall. The monitoring followed the Technology Acceptance Reciprocity Partnership (TARP) field test protocol, per the guidelines of the New Jersey Department of Environmental Projection (NJDEP). The New Jersey Corporation for Advanced Technology (NJCAT), on May 14, 2012 certified the Jellyfish Filter for 80 percent TSS removal.

- The JF4-2-1 operating at a maximum treatment flow rate of 200 gpm provided a median total suspended solids (TSS) removal of 89 percent, and a median suspended sediment concentration (SSC) removal of 99 percent. Influent TSS concentrations ranged from 16.3 to 261.0 mg/L. TSS concentrations in the range of 20-100 mg/L were reduced to less than 20 mg/L for 16 of 17 events. Average TSS removal for influent TSS between 100-200 mg/L was 90 percent.
- Other median pollutant removals included: total phosphorus, 59 percent; total nitrogen, 51 percent; total copper, 90 percent; and total zinc 70 percent.
- Total oil and grease influent concentrations ranged from 0.2 to 4.1 mg/L, with a median removal efficiency of 62 percent.
- No maintenance was required or carried out during the 13-month monitoring period. Curves of head loss versus flow rate were nearly identical for the system with fresh cartridges (beginning of monitoring) and dirty cartridges (end of monitoring period). The sump and filter cartridges captured 166 pounds of dry basis particulate matter.

- Runoff treated by the JF4-2-1 was from a nearby parking lot (approximately 75 percent pavement and 25 percent planting islands). Depending on storm event intensity and wind direction, the drainage area varied from 0.12 to 0.20 acres.

Laboratory Testing and Results

Imbrium conducted testing at the Monteco Limited Research & Development Centre (RDC) in Mississauga, Ontario with third party testing oversight provided by Prof. James Li of Ryerson University in Toronto. The laboratory set-up used a single cartridge fitted into a tank sized to be 1/7 the volume of a full-scale 7-cartridge Jellyfish Filter system. Based on the lab test results:

- A Jellyfish Filter system fitted with a single Jellyfish cartridge or multiple Jellyfish cartridges can remove greater than 86% Sil-Co-Sil 106 (mean particle size 22 microns) within a 95% confidence interval of +/- 1.3% at the system's 100% operating rate with influent sediment concentrations ranging from 100 to 300 mg/L. For systems using 12-inch diameter cartridges, each cartridge containing 91filtration tentacles of 54-inch length, the 100% operating rate is 50 gpm per cartridge operating at 12 inches driving head (i.e., 0.66 gpm/ft2). Each (of the) 91 filtration tentacles is composed of three 18-inch long segments for a total length of 54 inches with 76 ft2 of surface area (first generation membrane filtration cartridges).
- Test runs at 100 mg/L influent concentration resulted in effluent concentrations ranging from 12 to 21 mg/L. Ten of the 11 test runs had effluent less than 20 mg/L (as required for Basic Treatment).
- Sampling of effluent found an average D90 of about 14 microns indicating the Jellyfish Filter System is capable of removing most particles above 15 microns.

Other Jellyfish Filter Related Issues Recommended to be Addressed by the Company:

1. Conduct hydraulic testing to obtain information about maintenance requirements on a site with runoff that is more typical of the Pacific Northwest.

Technology Description: Download at: http://www.conteches.com/products/stormwater-management/treatment/jellyfish-filter

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Revision History

Date	**Revision**
August 2008	PULD granted
January 2012	PULD Extension granted
September 2012	CULD for Basic treatment; PULD for Oil and Phosphorus treatment.
January 2013	Modifications to format document in line with other Use Level Documents, Changes dates for QAPP, TER, and Expiration
August 2014	Revised contact information and due dates for QAPP, TER, and expiration
March 2015	Revised Contact Information to Contech from Imbrium
November 2016	Revised Contech contact information
March 2018	Revised TER delivery and Expiration dates, Changed text from Imbrium to Contech in selected locations
April 2019	Revised TER delivery and Expiration dates
September 2020	Revised TER delivery and Expiration dates
January 2021	GULD Granted