



January 2013

GENERAL USE LEVEL DESIGNATION FOR BASIC TREATMENT

For

Royal Environmental Systems, Inc. ecoStorm/ecoStorm *plus* Treatment Train

Ecology's Decision:

1. Based on Royal Environmental's application submissions, including the Final Technical Evaluation Report (TER) dated July 2012, and recommendations by the Board of External Reviewers (BER), Ecology hereby issues a general use level designation (GULD) for the ecoStorm/ecoStorm *plus* treatment train:
 - As a basic stormwater treatment device for total suspended solids (TSS) removal,
 - Using the Standard concrete filter for the ecoStorm *plus*,
 - As part of a treatment train that includes an upstream ecoStorm unit.
2. Ecology approves the ecoStorm/ecoStorm *plus* treatment train units using the Standard concrete filter for treatment at the water quality design flow rate per filter listed below. The water quality design flow rates are calculated 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 2.2.5 of the 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. This designation has no expiration date, but Ecology may amend or revoke it, and it is subject to the conditions specified below.

Ecology's Conditions of Use:

1. The ecoStorm component of the treatment train shall comply with the following conditions:

- **Design, assemble, install, operate, and maintain the ecoStorm units in accordance with Royal Environmental Systems Inc.'s applicable manuals and documents and the Ecology Decision.**
- **Owners must install appropriately sized ecoStorm unit or units upstream of the ecoStorm plus unit(s).**
- **ecoStorm units range from 4 to 12 feet in diameter with a design treatment flow of 30 GPM (0.067 cfs) per sf. See table below.**

| ecoStorm Model Number | Diameter (feet) | Surface Area (sf) | Treatment Flow Rate (gpm) | Maximum number of ecoStorm <i>plus</i> units ^a |
|-----------------------|-----------------|-------------------|---------------------------|---|
| 0.5 | 4 | 12.57 | 377 | 2 |
| 0.75 | 5 | 19.63 | 588 | 3 |
| 1 | 6 | 28.27 | 848 | 4 |
| 1.5 | 7 | 38.48 | 1,153 | 6 |
| 2 | 8 | 50.27 | 1,508 | 8 |
| 3 | 10 | 78.54 | 2,356 | 13 |
| 4 | 12 | 113.1 | 3,393 | 18 |

sf: square feet

gpm: gallons per minute

^a Calculated as ecoStorm flow rate/ecoStorm *plus* design flow (0.40 cfs). Can also be calculated using a surface area ratio of 0.7 ecoStorm/ecoStorm *plus*.

2. The ecoStorm plus component of the treatment train shall comply with the following conditions:

- **Design, assemble, install, operate, and maintain ecoStorm plus units in accordance with Royal Environmental Systems Inc.'s applicable manuals and documents and the Ecology Decision.**
- **Size the ecoStorm *plus* units at a design rate of 180 gallons per minute (0.40 cfs) per 5-ft. diameter filter (19.63 square feet surface area).**

3. Operators must lower Effluent pH from the ecoStorm plus unit if necessary to meet water quality standards using passive pH adjustment with ascorbic acid tablets or sodium bisulfate or by installing a CO2 sparging system or other equivalent method.

4. Replacement ecoStorm plus filters shall be available for installation within 3 days after identifying that the filters need replacement.

The following conditions apply to the combined treatment system (ecoStorm/ecoStorm *plus* treatment train):

- 1. To determine site-specific maintenance schedules for installed ecoStorm/ecoStorm *plus* treatment trains, the presence and frequency of all system bypasses shall be monitored by a water sensor (presence/absence or level) and logging device.**
- 2. The required maintenance interval for stormwater treatment devices is often dependent upon 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 treatment device.**
 - Testing results provided to Ecology for the Basic Treatment GULD approval indicate that the treatment system required backflushing on average every 1.3 months and filter replacement after 9.3 months on average at the specific test installation. Indicators of the need for maintenance included:**
 - Decreased flow through filter**
 - Increased incidence of bypass**
 - Visual build-up of material on surface of filter**
 - This particular maintenance interval does not necessarily determine the overall maintenance frequency for all ecoStorm/ecoStorm *plus* treatment trains.**
 - Owners/operators must inspect ecoStorm/ecoStorm *plus* treatment trains systems for a minimum of twelve months from the start of post-construction operation to determine site-specific maintenance schedules and requirements. Inspection frequency shall be as stated below. 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 pursuant to manufacturer’s guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.**
- 3. Records of maintenance, bypass flows, and local rain gage data shall be submitted to Ecology on a quarterly basis until site-specific maintenance schedules for the installed ecoStorm/ecoStorm *plus* treatment train can be determined. Bypass data must be downloaded at least monthly to evaluate system performance relative to the goal of treating 91 percent of the average annual runoff volume.**
- 4. Owners of ecoStorm/ecoStorm *plus* treatment trains shall submit a letter to Ecology committing to a schedule of required maintenance inspections as follows:**
 - From October 1st to April 30th: inspections shall occur once every two weeks or after every 2 inches of rainfall, whichever occurs first.**

- From May 1st to September 30th inspections shall occur at least monthly and/or in conjunction with a storm event of > 0.5 inches in 24 hours.

5. Discharges from the ecoStorm/ecoStorm *plus* treatment train shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: Royal Environmental Systems Inc.

Applicant's Address: 30622 Forest Blvd, PO Box 430
Stacy, MN, 55079

Application Documents:

- Draft ecoStorm/ecoStorm *plus* Treatment Train Evaluation Technical Evaluation Report, Herrera Environmental Consultants (October 2011)
- Final ecoStorm/ecoStorm *plus* Treatment Train Evaluation Technical Evaluation Report, Herrera Environmental Consultants (August 2012)
- Responses to BER comments, Water Tectonics and Herrera Environmental Consultants (August 2012)
- ecoStorm *plus* CULD Request: Supplemental information/clarification as requested in Ecology's December 21, 2010 letter and use level designation extension request. Memorandum prepared by WaterTectonics (January 19, 2011).
- Request for Conditional Use Level Designation for the ecoStorm *plus*TM unit, memorandum prepared by Royal Environmental Systems, Inc. (October 21, 2010).
 - a. ecoStorm *plus*TM Product Information for Washington State Department of Ecology Use Designation Determination (September 29, 2010)
 - b. Herrera Environmental Consultants Memorandum – Update on Water Tectonics TAPE process for the ecoStorm *plus* filter system (September 8, 2010)
 - c. Water Tectonics, Inc. – Internal Memorandum McRedmond ecoStorm *plus* Data Collection, (October 5, 2010)
 - d. Herrera Environmental Consultants – McRedmond TSS Discrete Analysis (2010 Data)
 - e. Herrera Environmental Consultants – McRedmond TSS Composite Analysis (2010 Data)
 - f. Herrera Environmental Consultants – Third Party Technical Review City of Redmond ecoStorm *plus* Monitoring Project, January 8, 2010 (2009 Data)
- QAPP ecoStorm *plus*TM McRedmond RWQF – Addendum 4 (March 1, 2010)
- QAPP ecoStorm *plus*TM McRedmond RWQF – Addendum 3 (September 1, 2009)
- QAPP ecoStorm *plus*TM McRedmond RWQF – Addendum 2 (August 1, 2009)
- QAPP ecoStorm *plus*TM McRedmond RWQF – Addendum 1 (April 8, 2009)

- Quality Assurance Project Plan (QAPP) *ecoStorm plus*TM McRedmond Regional Water Quality Facility (RWQF), prepared by Water Tectonics and Royal Environmental Systems, Inc. (March 18, 2008)
- *ecoStorm plus*TM Quality Assurance Project Plan (QAPP) for Basic, Enhanced & Phosphorus Treatment (Rev04), prepared by Water Tectonics and Royal Environmental Systems, Inc. (August, 28, 2007)
- Product Information for Washington State Department of Ecology Use Designation Determination, prepared by Water Tectonics (July 2006)
- *ecoStorm plus* Lab Scale Testing Final Report, prepared by Water Tectonics (July 2006)
- Report on investigations into retention of pollutants in rainfall runoff from a concrete plant using a *ecoStorm plus* filter pit prepared by: Dr. Dierkes (August 2004)

Applicant's Use Level Request:

General Use Level Designation as a Basic Treatment device.

Applicant's Performance Claims:

- Average of 80% removal of TSS.

Findings of Fact:

1. Monitoring for this project occurred at the McRedmond Regional Water Quality Facility (McRedmond Facility) installed in 2007 at the Luke McRedmond Park in Redmond, Washington.
2. WaterTectonics collected water quality data from 31 storm events (15 composite sampling events and 16 discrete sampling events) over a 27-month period (March 2009 through June 2011).
3. WaterTectonics collected a total of 15 valid TSS composite samples: 10 samples were in the 20 to 99 mg/L influent TSS range, 3 samples were in the 100 to 200 mg/L influent TSS range, and 2 samples were in the > 200 mg/L TSS range. Since a majority of the samples were in the 20 to less than 100 mg/L influent range, this was the only performance goal statistically evaluated.
4. To evaluate this goal, WaterTectonics computed a bootstrapped estimate of the upper 95 percent confidence limit around the mean from the 10 valid samples in the 20 to less than 100 mg/L influent TSS range; they compared this value (9.7 mg/L) to the 20 mg/L effluent goal. Because the upper confidence limit is lower than the effluent goal of 20 mg/L, it can be concluded that the *ecoStorm/ecoStorm plus* treatment train met the basic treatment goal with a confidence level of 95 percent.
5. Although there were not enough samples in the other two size ranges to demonstrate statistical significance, the mean TSS percent removal was 84 percent in the 100 to 200 mg/L influent TSS range and 85 percent in the > 200 mg/L TSS range.

6. In order to evaluate pollutant removal performance as a function of flow rate, WaterTectonics performed a regression analysis using pooled effluent TSS concentration data from composite and discrete samples collected from the ecoStorm/ecoStorm *plus* treatment train. Aliquot-weighted flow rates for the composite sampling ranged from 39.3 to 318 gpm. Instantaneous flow rates for the discrete sampling ranged from 12.3 to 257 gpm. This analysis showed there was no significant relationship between flow rate and effluent TSS concentrations, demonstrating that the measured pollutant removal performance can be applied to the range of flow rates monitored during this study (12.3 to 318 gpm).
7. WaterTectonics evaluated data from the continuous pH record to determine if there were differences in average daily pH influent and effluent values before and after initiation of CO₂ sparging. The average daily influent pH value was 6.85 before and after sparging. However, the average daily effluent pH value was reduced from 9.25 before CO₂ sparging to 8.01 after CO₂ sparging.

Other ecoStorm/ecoStorm *plus* Treatment Train Related Issues to be Addressed By the Company:

1. Develop easy-to-implement methods of determining when an ecoStorm/ecoStorm *plus* treatment train requires maintenance (cleaning and filter replacement).

Technology Description: Download at www.royalenterprises.net

Contact Information:

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Revision History

| Date | Revision |
|---------------|---|
| December 2009 | PULD granted |
| February 2011 | CULD granted |
| July 2012 | GULD granted for Basic Treatment, added Revision Table |
| January 2013 | Modified Design Storm Description, revised format to match Ecology standard |