Vortechs®

Technical Bulletin 3

Sizing for Net Annual Sediment Removal

One of the greatest threats to aquatic ecosystems is chronic pollution caused by stormwater runoff. Sediments and other associated pollutants accumulate over time seriously degrading surface water quality. For this reason, Contech Engineered Solutions LLC recommends sizing stormwater best management practices (BMPs) to provide a specific net reduction of pollutants on an annual basis. A typical net annual removal efficiency target is 80%, but depending on sensitivity of the receiving water body or the presence of other best management practices (BMPs), greater or lesser load reduction may be required.

This Technical Bulletin provides a simple two-step sizing methodology that will produce the most appropriate, and most cost effective Contech Engineered Solutions system for your site.

Step #1 – Sizing for a Specific Net Annual Load Reduction

Contech Engineered Solutions system performance is dependent on the local rainfall intensity distribution and other site-specific factors. In order to account for regional rainfall differences, Contech Engineered Solutions developed the Rational Rainfall Method™ of sizing. Central to the method is the design ratio, which changes according to regional differences in precipitation patterns, as well as site and model characteristics. Maximum design ratios for different geographic regions across North America have been determined through analysis of historical precipitation records archived by the National Climatic Data Center.

To determine the minimum Contech Engineered Solutions system model that will meet your treatment objective, perform the following steps:

A. Determine the net annual removal efficiency target and time of concentration that best match your site.

B. Determine the design ratio for your site location that corresponds to your treatment goal and time of concentration. The design ratio for the chosen model should not exceed the target design ratio (see below equation). Please contact your local Contech Engineered Solutions representative for the appropriate design ratio number.

Imperial:

$$\text{Target Design Ratio} \geq \frac{C_dA * 448.83 \text{ gpm/cfs}}{\text{Grit Chamber Area}}$$

Metric:

$$\text{Target Design Ratio} \geq \frac{C_dA * 2.78}{\text{Grit Chamber Area}}$$

Where:

A = Drainage Area (acres/hectares)
C_d = Runoff Coefficient

C. Calculate the necessary swirl chamber area and corresponding Contech Engineered Solutions system model using the following equation:

Imperial:

$$\text{Minimum Swirl Chamber Area} \geq \frac{C_dA * 448.83 \text{ gpm/cfs}}{\text{Design Ratio}}$$

Metric:

$$\text{Minimum Swirl Chamber Area} \geq \frac{C_dA * 2.77}{\text{Design Ratio}}$$

CONTECH® ENGINEERED SOLUTIONS

D. Based on the required swirl chamber area calculated in Step C, choose the appropriate Vortechs® model number from Table 3.1.

   This is the smallest model that can be expected to achieve your treatment goal. To decide if this Contech Engineered Solutions system will be "on-line", without a bypass, or "off-line", with a bypass, proceed to Step #2.

Vortechs® Model	Grit Chamber Area	
	ft^2	m^2
1000	0 - 7	0 - 0.66
2000	7 - 13	0.66 - 1.7
3000	13 - 20	1.7 - 1.8
4000	20 - 28	1.8 - 2.6
5000	28 - 38	2.6 - 3.6
7000	38 - 50	3.6 - 4.7
9000	50 - 64	4.7 - 5.9
11000	64 - 79	5.9 - 7.3
16000	79 - 113	7.3 - 10.5

Table 3.1

Step #2 – On-Line vs. Off-Line Configuration

The Contech Engineered Solutions system has been tested at operating rates up to 100 gpm/ft2 (70 L/m2) of swirl chamber surface area, which corresponds to the peak treatment capacity for each model, and has been found to provide positive removal efficiencies of suspended solids throughout this range. Flow rates exceeding the treatment capacity of the system may cause resuspension of previously captured materials, therefore, it is recommended that flows in excess of the peak treatment capacity for each respective model be bypassed.

The appropriate configuration of the model selected in Step #1 is determined as follows:

A. Calculate the flow rate resulting from an infrequent (10 to 25-year recurrence interval) storm on your site.

B. Compare this flow rate to the peak treatment capacity (Table 3.2) of the model selected in Step #1.

   1. If it is less, the model selected in Step #1 is appropriate on-line.

   2. If it is more, either:

      a. The model selected in Step #1 should be configured with a bypass (provided by Contech Engineered Solutions) in an off-line orientation, or
      b. A system should be selected from Table 3.2 with a treatment capacity equal to or greater than the flow from above. This system should be configured on-line without a bypass.

Vortechs® Model	Peak Treatment Flow	
	cfs	L/s
1000	1.6	45
2000	2.8	80
3000	4.5	130
4000	6.0	170
5000	8.5	240
7000	11	310
9000	14	400
11000	17.5	500
16000	25	710

Table 3.2

The choice between an off-line model and an on-line model is usually determined by economics. For example the cost savings gained by using the smaller off-line unit must be weighed against the cost of additional manholes typically required to split and rejoin bypassed flows. For pricing information please contact your Contech Engineered Solutions representative.

CONTECH ENGINEERED SOLUTIONS