SOUTHWEST REGIONAL OFFICE
CLEAN WATER PROGRAM

Application Type	**Renewal**	**NPDES PERMIT FACT SHEET ADDENDUM**		Application No.	**PA0204889**
Facility Type	**Industrial**			APS ID	**595773**
Major / Minor	**Minor**			Authorization ID	**1283035**

Applicant and Facility Information

Applicant Name	**Allegheny County Port Authority**	Facility Name	**Harmar Garage**
Applicant Address	345 Sixth Avenue, Floor 3	Facility Address	2851 Freeport Road
	Pittsburgh, PA 15222-2527		Pittsburgh, PA 15238-1415
Applicant Contact	Keith Wargo	Facility Contact	Dean Pregal
Applicant Phone	(412) 566-5106	Facility Phone	(412) 566-5170
Client ID	69898	Site ID	244593
SIC Code	4111	Municipality	Harmar Township
SIC Description	Trans. & Utilities - Local and Suburban Transit	County	Allegheny
Date Published in PA Bulletin	September 28, 2019	EPA Waived?	Yes
Comment Period End Date	October 28, 2019	If No, Reason	

Purpose of Application: Application for a renewal of an NPDES permit for discharge of treated Industrial

Internal Review and Recommendations

On September 17, 2019, the Draft permit PA0204889 for Allegheny County Port Authority's Harmar Garage facility was sent via electronic mail to Keith Wargo and Dean Pregal which also provided notice that PA Bulletin public notice would run in the September 28, 2019 Bulletin. The end of the 30-day public comment period is October 28, 2019. On October 25, 2019, the Department received comments in response to the Draft permit the Harmar Garage. Below is a summary of the comments received:

Comment 1: TSS Effluent Limits for Outfall 001 and Outfall 002

The Draft NPDES Permit contains proposed 30 mg/L monthly average and 60 mg/L daily maximum effluent limits for total suspended solids at Outfalls 001 and 002. Page 7 of the draft NPDES Permit Fact Sheet, dated September 10, 2019 (the "Draft Fact Sheet") indicates that the Department is imposing these TSS limits as best professional judgment ("BPJ") technology-based effluent limitations ("TBELs") as there are no applicable federal Effluent Limitation Guidelines applicable to this facility.

PAAC is concerned that the Department did not adequately address all of the factors at 40 CFR Part 125.3(d) that must be considered when establishing BPJ effluent limits. The Draft Fact Sheet contains the statement "(the limits are) achievable through technology designed to remove solids from the wastewater," but does not specify the model technology upon which the limits are based and does not address all factors at 40 CFR 125.3(d) for establishing BPJ BCT effluent limits as required by the NPDES permitting regulations. Additionally, the fact sheets and statements of basis from the 1995 and 2002 NPDES permits reviewed by PAAC during this comment period do not contain a consideration of the factors at 40 CFR 125.3(d).
In the view of PAAC, an inadequately supported effluent limit should not be continued in the final renewal permit under antibacksliding or any other provisions of the NPDES permitting program. In the absence of adequate supporting information required under 40 CFR Part 125.3 (d), PAAC believes the renewal NPDES permit should be issued with "monitor only" conditions for TSS.

Approve	Return	Deny	Signatures	Date
✓			Curtis Holes, P.E. / Environmental Engineering Specialist	11/20/19
✓			Michael E. Fifth, P.E. / Environmental Engineer Manager	11/20/19

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Nonetheless, even if the BPJ limits of 30 mg/l monthly average and 60 mg/l were properly developed, antibacksliding does not prohibit relaxing the Outfall 001 and Outfall 002 TSS effluent limits. Neither of the two statutory antibacksliding provisions apply in this case:

- *The BPJ limits are not being relaxed pursuant a subsequently promulgated Effluent Limitation Guideline, and;*
- *The BPJ limit is not based upon a state standard (not based on state water quality standard and not based upon a state treatment standard).*

Accordingly, the regulatory antibacksliding provisions at 40 CFR 122.44(1) are considered. Under 40 CFR 122.44(1), an effluent limit can be relaxed if a condition for permit modification at 40 CFR 122.62 is met. In this case, the following conditions at 40 CFR 122.62 are met:

<u>(a)(1) Alteration to the facility</u>. The TSS effluent limits of 30 mg/l monthly average and 60 mg/l daily maximum have been in place since at least the 1995 NPDES permit. Following the selection of the existing TSS effluent limits, the following significant changes have been made:

- *solids separator units for treating site storm water were installed ahead of the oil/water separators tributary to Outfalls 001 and 002 in 2010;*
- *the facility became inactive; and,*
- *an area in the southeast portion of the property was vegetated for erosion control.*

These are substantial alterations to the facility that may impact TSS discharge concentrations.

<u>(a)(2) New information</u>. The discharge concentrations since installation of the solids separator units in 2010, and at other dates for the active PAAC garages, is new information not available at the time the TSS limits were initially selected. Additionally, the engineering aspects of the solids separator that was approved and installed under a WQM permit could not have been available to the Department when the limits were initially selected. As shown by the attached document from the manufacturer of the solids separator, the unit removal efficiency and resulting TSS effluent concentration are dependent on the influent TSS concentration from the storm event and the particle size of the suspended solids. See Attachment A. While PAAC has strived to continually improve its housekeeping and maintenance, it cannot reasonably control the particle size of the influent TSS.

<u>(a)(16) Revised BPJ limits</u>. The following statement is included at 40 CFR 122.62(a)(16):

> *"When the discharger has installed the treatment technology considered by the permit writer in setting effluent limitations imposed under section 402(a)(1) of the CWA and has properly operated and maintained the facilities but nevertheless has been. unable to achieve those effluent limitations. In this case, the limitations in the modified permit may reflect the level of pollutant control actually achieved (but shall not be less stringent than required by a subsequently promulgated effluent limitations guideline)."*

As acknowledged in the Draft NPDES Permit Fact Sheet, the Harmar Garage has not been used for maintenance activities since April 2011 and has primarily been used for storage of decommissioned buses since that time. As a result, the bus traffic and associated activities are greatly reduced as compared to the active PAAC garages. Accordingly, recent TSS discharges from the Harmar Garage are likely not representative of an operational garage, which the Harmar Garage may become again over the course of renewal permit term. A comparison of average and median TSS concentrations from the three active garages and the Harmar Garage is provided below. All facilities are equipped with the same treatment technology (i.e., oil water separators and in-ground Contech Vortechs centrifugal solids separators, approved for installation by PADEP through Part II "WQM" permits).

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TSS Discharge Concentrations (mg/L)
January 2017 — August 2019
("Garage Yard" Outfalls)

Facility	***Average (mg/L)***	***Median (mg/L)***
West Mifflin Outfalls 001 and 002 (Active facility), n = 117	*17.3*	*9.0*
Collier Outfall 001 (Active facility), n = 62	*37.4*	*16.0*
Ross Outfall 001 (Active facility), n = 57	*26.4*	*15.0*
Harmar Outfalls 001 and 002 (Inactive facility), n = 120	*11.0*	*4.0*

As shown, the inactive Harmar Garage produces, on average, lower TSS concentrations than the active garages. Accordingly, once operations resume, PAAC expects the Harmar discharge concentrations to be similar to that of the active garages. Graphs of TSS monitoring data for Harmar Garage Outfalls 001 and 002 and Ross Garage Outfall 001 are attached (see Attachment B). Considering the TSS data from the Ross Garage shown in the Attachment B graphs, consistent compliance with the 30 mg/L and 60 mg/L effluent limits will likely not be achieved once operations at the Harmar Garage resume. Even at the currently reduced activities of the Harmar garage, the TSS effluent limits have been periodically exceeded since 2017.

PAAC has properly operated and maintained the solids separator units at both the Harmar and Ross Garages. Beginning in at least 2017, the following BMPs and operation and maintenance practices have been implemented:

- *installation of storm drain inlet filter inserts, which are replaced twice per year;*
- *quarterly cleaning of the solids separators;*
- *cleaning of the oil/water separators as necessary.*

Nonetheless, as shown in the Ross Garage Outfall 001 graphs in Attachment B, it is unlikely the Harmar Garage will be able to consistently achieve the 30 mg/L and 60 mg/L effluent limits once operations resume. PAAC believes that requiring further TSS reductions is not warranted or reasonable. The Contechs Vortechs solids separators installed at the PAAC facilities have been the subject of successful full-scale trial studies performed with funding from USEPA and have been installed at numerous other sites throughout the United States.

Based upon the discharge quality actually achieved through BMP implementation and proper operation and maintenance of the control devices since January 2017 at the active Ross Garage Outfall 001, PAAC believes that a TSS daily maximum effluent limit of 135 mg/L at Harmar Outfalls 001 and 002 would be justified should numeric effluent limits be imposed. This value is the calculated 99th percentile of the daily data from January 2017 to August 2019 at the active Ross Garage Outfall 001, assuming a lognormal distribution. See Attachment C for calculations. No monthly average limit is necessary because the discharge is not a continuous discharge. See 40 CFR Part 125.45(d) and (e).

PAAC also notes the Department modified the TSS effluent limits for the PAAC Collier and West Mifflin Garages during the most recent NPDES permit renewals from 30 mg/L monthly average and 60 mg/L daily maximum, to 100 mg/L daily maximum with no monthly average limit.

Comment 1 Department Response

The Department notes that the TSS limitations included in the Draft Permit are not new or proposed; they have in fact been in effect and supported by the record for over 20 years. Recently, the Department's permitting procedures regarding industrial ("IW") stormwater discharges have evolved. In the past, stormwater discharges associated with industrial activity were often regulated as industrial waste, with limits derived in part by the efficacy of various standard treatment technologies and Best Management Practices (BMPs). In this case, those treatment technologies consisted of gravity settling of solids. While this methodology remains appropriate in most respects due to the comparable pollutants and pollutant loads in IW stormwater and

Internal Review and Recommendations

industrial wastewater, the philosophy does not fully consider the dynamic variability (volume, frequency, and quality) of IW stormwater discharges. This variability is more difficult to manage than many continuous wastewater discharges. Since the issuance of DEP's updated PAG-03 Stormwater Permit, it is common for IW stormwater discharges to be limited to 100 mg/L of TSS. This level reflects EPA's stormwater benchmark concentration and also matches the corrective action level for the Department's current PAG-03 General Permit (Version 9/2016) for discharges of stormwater associated with industrial activity.

Any loosening of effluent limitations in renewed NPDES permits must be supported by the record of decision and consistent with Federal anti-backsliding regulations at 40 CFR 122.44(l). These regulations restrict the loosening of effluent limitations unless the circumstances on which the previous permit were based have materially and substantially changed since the time the permit was issued. Accordingly, the Department argues that IW stormwater at the Harmar Garage Facility is appropriately limited to 100 mg/L.

In the absence of any Effluent Limitation Guidelines ("ELG's") regarding this type of wastewater, technology limitations are developed based on Best Professional Judgment ("BPJ"). Authority to establish BPJ limits on a case-by-case basis is derived from Section 402(a)(1) of the Clean Water Act and 40 CFR § 125.3(a)(2)(B). The maximum daily effluent limit of 100 mg/L TSS is proposed under BPJ. Maximum Daily limits are readily achievable through the application of BMPs and solids removal technologies.

In establishing effluent limitations on a case-by-case basis, the appropriate technology for the applicant is considered. When evaluating appropriate BPJ limits for a permittee, the Department considers six factors as required by 40 CFR § 125.3. The six factors are: (1) the age of the equipment and facility, (2) the process employed, (3) the engineering aspects of the application of various types of control technique, (4) process changes, (5) the cost of achieving such effluent reduction and, (6) non-water quality environmental impact (including energy requirements). Factors specific to each level of control technology include costs, pollutant reduction benefits and economic achievability. Each of these factors are discussed below as they relate to the PAT Harmar Garage Facility.

1. <u>Equipment and Facility Age</u> – Discharges from Port Authority's Harmar Garage Facility are currently treated by an oil/water separator and solids separator. The equipment is properly installed and up to date. As such, equipment age is not an applicable consideration and costs have already been incurred to meet the existing effluent limitations. The facility is not currently active, but the facility might become active during the 5-year term of the NPDES Permit. Comparing activities at other Port Authority active garages, the facilities historically had issues with TSS until BMPs were updated and installed. Once BMPs were updated, the facilities typically are below 100 mg/L with only an anomalous outlier result, as <u>reflected</u> in Attachment B of the attached Port Authority's Comment Letter. With the exception of this one outlier, the Department believes that the existing pollution control equipment in conjunction with increased housekeeping, street sweeping, and regular system maintenance is adequate to control the suspended solids concentrations at the Harmar Garage Facility during either the inactive or active operations. If Port Authority is unable however to achieve compliance with the proposed TSS effluent limitations, it may be necessary to install additional supplementary treatment or evaluate the frequency of BMP maintenance. The cost of this supplementary treatment has not been evaluated in this report since the most efficient solutions do not require additional treatment solutions. In any case, treatment systems designed to control the effluent quality for similar discharges are widely available, proven effective and commonly used.

2. <u>The Process Employed</u> – The Port Authority may utilize a combination of best management practices and treatment technologies for sediment removal. BPJ effluent limitations are not based upon the installation of nor limited by the availability of specific treatment systems. As mentioned in the previous paragraph, the Department anticipates compliance with the proposed effluent limitations through implementation of BMPs including housekeeping and regular system maintenance. As such, any expenses associated with BMP implementation are minimal or previously incurred.

3. <u>Engineering Aspects of Control Techniques</u> – Stormwater pollutants are currently controlled through BMPs and unit treatment processes. Additional engineering solutions may be necessary if the facility is unable to meet its proposed effluent limitations. This action may require consultation with a design engineer, additional permitting and the procurement of additional equipment. The technologies currently in use at the facility and other technologies that may be needed to meet the proposed effluent limitations are commonly available.

4. <u>Process Changes</u> – The Port Authority may need to modify its processes to include more frequent street sweeping and expand its employee training efforts to identify and control its solids discharges. These process changes have already been proposed at the facility therefore additional measures may not be necessary.

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5. The Cost of Achieving Such Effluent Reduction – PAT has already procured and installed the grit removal and oil/water separators. The Department recommends that PAT adopt additional BMPs; the cost of which would be negligible compared to the installation of supplementary treatment. The cost of implementing these BMPs is not expected to be burdensome.

6. Non-water quality environmental impact – There are no non-water quality impacts known for the discharges from this facility.

The permit has been redrafted to include a TSS limits of 100 mg/L daily maximum and reporting only for the average monthly discharge concentrations at Outfalls 001 & 002.

Comment 2: Monthly average effluent limit of 3.5 mg/L dissolved iron

The monthly average effluent limit for dissolved iron of 3.5 mg/L should be removed from the renewal NPDES permit. The discharge is not a continuous discharge and therefore monthly average effluent limits are unnecessary. See 40 CFR Part 122.45(d) and (e). Furthermore, the treatment standard for dissolved iron under 25 PA Code Chapter 95 is 7.0 mg/L daily maximum. There is no treatment standard of 3.5 mg/L dissolved iron as a monthly average under the applicable Pennsylvania regulation, and the Department has not provided the requisite justification for the 3.5 mg/L monthly average limit under 40 CFR Part 125.3(c) and (d). Accordingly, the limit should be removed.

Comment 2 Department Response

Section III.C.3.h on Page 13 of the Water Quality Toxics Management Strategy (Doc. # 361-0100-003) discusses the procedure for developing effluent limitations. These procedures state that an MDL may be set at 2 times the AML. This rationale provides the basis for maintaining the proposed effluent limitations. There were no modifications made to the Draft permit in response to this comment.

Comment 3: BOD5 and COD monitoring

Under the draft renewal NPDES permit, monitoring for both COD and BOD5 is proposed to continue. PAAC believes that monitoring for both parameters is duplicative in that both parameters are a measure of oxygen demand and both parameters can be used to assess the effectiveness of site BMPs and the treatment units. Determining the difference between oxygen demand resulting from biochemical oxidation and the demand from chemical oxidization does not appear to be useful in this instance. PAAC proposes to remove the monitoring requirement for BOD5 and retain the monitoring requirement for COD.

Comment 3 Department Response

Considering the request however, the Department proposes the following modification. BOD_5 monitoring will be removed and COD monitoring will remain, however, this pollutant will be added to the list of parameters requiring submission of a Corrective Action Plan in the event that benchmark values are exceeded during two successive monitoring periods. There are numerous materials and fluids associated with Transportation Facilities that may exert COD loads. The benchmark value for COD will be 120 mg/L with associated Corrective Action Plan requirements will remain. Part C, Condition II(F) has been modified in response to this comment.

Three (3) revisions have been completed on the Draft NPDES permit and the permit will be redrafted for an additional 30-day public comment period.

ATTACHMENTS

Attachment A – Vortechs Guide

Attachment B – TSS Monitoring Data Summary

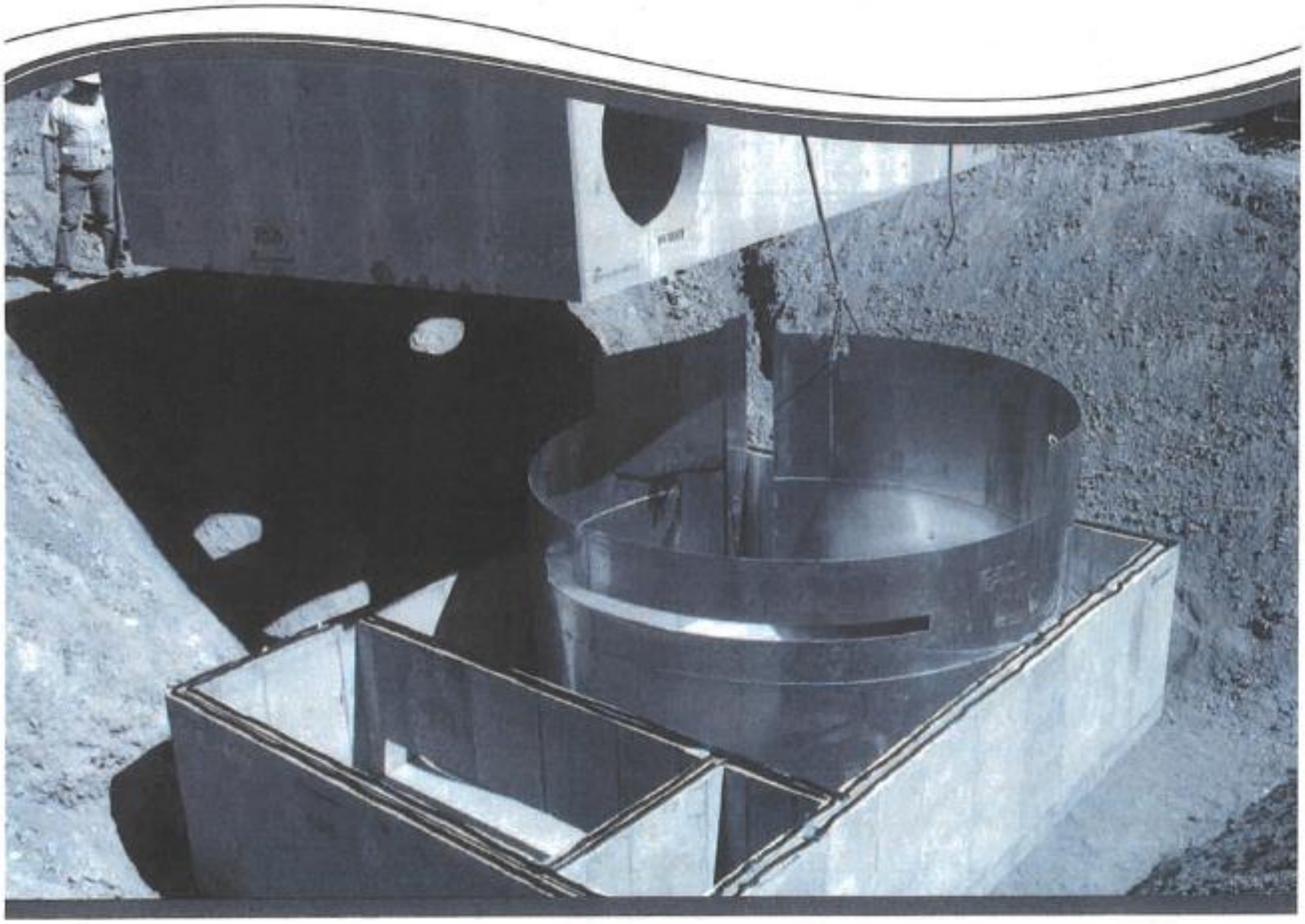
Attachment C – Calculated 99th Percentile TSS

Attachment A – Vortechs Guide

ATTACHMENT A

CONTECH ENGINEERED SOLUTIONS

Vortechs® Guide
Operation, Design, Performance and Maintenance



Vortechs

ATTACHMENT A

Vortechs®

The Vortechs system is a high-performance hydrodynamic separator that effectively removes finer sediment (e.g. 50-microns (µm), oil, and floating and sinking debris. The swirl concentration operation and flow controls work together to minimize turbulence and provide stable storage of captured pollutants. Precast models can treat peak design flows up to 30-cfs (850-L/s); cast-in-place models handle even greater flows. A typical system is sized to provide a specific removal efficiency of a predefined particle size distribution (PSD).

Operation Overview

Stormwater enters the swirl chamber inducing a gentle swirling flow pattern and enhancing gravitational separation. Sinking pollutants stay in the swirl chamber while floatables are stopped at the baffle wall. Vortechs systems are usually sized to efficiently treat the frequently occurring runoff events and are primarily controlled by the low flow control orifice. This orifice effectively reduces inflow velocity and turbulence by inducing a slight backwater that is appropriate to the site.

During larger storms, the water level rises above the low flow control orifice and begins to flow through the high flow control. Any layer of floating pollutants is elevated above the invert of the Floatables Baffle Wall, preventing release. Swirling action increases in relation to the storm intensity, while sediment pile remains stable. When the storm drain is flowing at peak capacity, the water surface in the system approaches the top of the high flow control. The Vortechs system will be sized large enough so that previously captured pollutants are retained in the system, even during these infrequent events.

As a storm subsides, treated runoff decants out of the Vortechs system at a controlled rate, restoring the water level to a dry-weather level equal to the invert of the inlet pipe. The low water level facilitates easier inspection and cleaning, and significantly reduces maintenance costs by reducing pump-out volume.

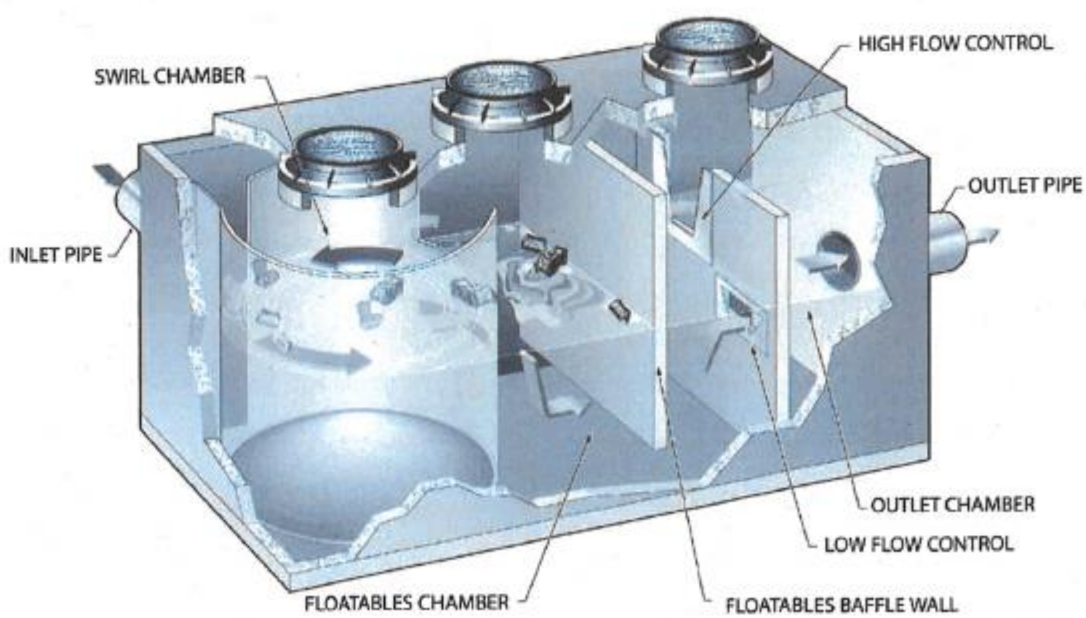
Design Basics

Each Vortechs system is custom designed based on site size, site runoff coefficient, regional precipitation intensity distribution, and anticipated pollutant characteristics. There are two primary methods of sizing a Vortechs system. The first is to determine which model size provides the desired removal efficiency at a given flow for a defined particle size or PSD. The second and more in depth method is the summation of Rational Rainfall Method™ which uses a summation process described below in detail and is used when a specific removal efficiency of the net annual sediment load is required.

Typically Vortechs systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for either 50-µm particles, or a particle gradation found in typical urban runoff (see performance section of this manual for more information).

The Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.



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Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes or hourly and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed Vortechs system are determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Once a system size is established, the internal elements of the system are designed based on information provided by the site engineer. Flow control sizes and shapes, sump depth, oil spill storage capacity, sediment storage volume and inlet and outlet orientation are determined for each system. In addition, bypass weir calculations are made for off-line systems.

Flow Control Calculations

Low Flow Control

The low flow control, or orifice, is typically sized to submerge the inlet pipe when the Vortechs system is operating at 20% of its treatment capacity. The orifice is typically a Cippoletti shaped aperture defined by its flat crest and sides which incline outwardly at a slope of 1 horizontal to 4 vertical.

$$Q_{orifice} = C_d \cdot A \cdot \sqrt{2gh}$$

Where:

$Q_{orifice}$ = flow through orifice, cfs (L/s)

C_d = orifice coefficient of discharge = 0.56 (based on lab tests)

A = orifice flow area, ft^2 (m^2) (calculated by orifice geometry)

h = design head, ft (m) (equal to the inlet pipe diameter)

g = acceleration due to gravity (32.2-ft/s^2 (9.81-m/s^2)

The minimum orifice crest length is 3-in (76-mm) and the minimum orifice height is 4-in (102-mm). If flow must be restricted beyond what can be provided by this size aperture, a Fluidic-Amp™ HydroBrake flow control will be used. The HydroBrake allows the minimum flow constriction to remain at 3-in (76-mm) or greater while further reducing flow due to its unique throttling action.

High Flow Control

The high flow control, or weir, is sized to pass the peak system capacity minus the peak orifice flow when the water surface elevation is at the top of the weir. This flow control is also a Cippoletti type weir.

The weir flow control is sized by solving for the crest length and head in the following equation:

$$Q_{weir} = C_d \cdot L \cdot (h)^{3/2}$$

Where:

Q_{weir} = flow through weir, cfs (L/s)

C_d = Cippoletti weir coefficient = 3.37 (based on lab testing)

h = available head, ft (m) (height of weir)

L = design weir crest length, ft (m)

Bypass Calculations

In most all cases, pollutant removal goals can be met without treating peak flow rates and it is most feasible to use a smaller Vortechs system configured with an external bypass. In such cases, a bypass design is recommended by Contech Engineered Solutions for each off-line system. To calculate the bypass capacity, first subtract the system's treatment capacity from the peak conveyance capacity of the collection system (minimum of 10-year recurrence interval). The result is the flow rate that must be bypassed to avoid surcharging the Vortechs system. Then use the following arrangement of the Francis formula to calculate the depth of flow over the bypass weir.

$$H = (Q_{bypass} / (C_d \cdot L))^{2/3}$$

Where:

H = depth of flow over bypass weir crest, ft (m)

Q_{bypass} = required bypass flow, cfs (L/s)

C_d = discharge coefficient = 3.3 for rectangular weir

L = length of bypass weir crest, ft

The bypass weir crest elevation is then calculated to be the elevation at the top of the Cippoletti weir minus the depth of flow.

Hydraulic Capacity

In the event that the peak design flow from the site is exceeded, it is important that the Vortechs system is not a constriction to runoff leaving the site. Therefore, each system is designed with enough hydraulic capacity to pass the 100-year flow rate. It is important to note that at operating rates above 100-gpm/ft^2 (68-Lps/m^2) of the swirl chamber area (peak treatment capacity), captured pollutants may be lost.

When the system is operating at peak hydraulic capacity, water will be flowing through the gap over the top of the flow control wall as well as the orifice and the weir.

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Performance

Full Scale Laboratory Test Results

Laboratory testing was conducted on a full scale Vortechs model 2000. The 150-µm curve demonstrates the results of tests using particles that passed through a 60-mesh sieve and were retained on a 100-mesh sieve. The 50-µm curve is based on tests of particles passing through a 200-mesh sieve and retained on a 400-mesh sieve (38-µm). A gradation with an average particle size (d50) of 80-µm, containing particles ranging from 38–500-µm in diameter was used to represent typical stormwater solids. (Table 1)

Particle Size Distribution (µm)	Percentage of Sample Make-Up
<63	42%
63 - 75	4%
75 - 100	9%
100 - 150	7%
150 - 250	11%
>250	27%

Table 1: Particle gradation of typical urban runoff used for efficiency curve

As shown, the Vortechs system maintains positive total suspended solids (TSS), defined by the tested gradations, removal efficiencies over the full range of operating rates. This allows the system to effectively treat all runoff from large, infrequent design storms, as well as runoff from more frequent low-intensity storms.

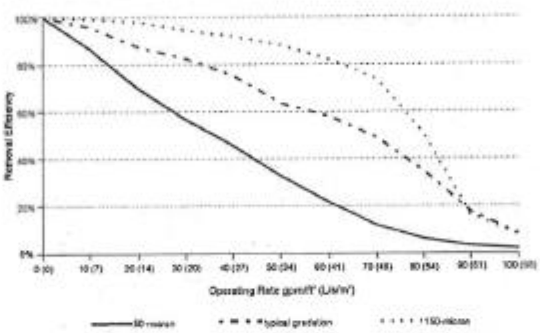

Figure 1: Vortechs model 2000 Removal Efficiencies

Typical Vortechs systems are designed to treat peak flows from 1.6-cfs (45-L/s) up to 30-cfs (850-L/s) online without the need for bypass. However, external bypasses can be configured to convey peak flows around the system if treatment capacity is exceeded. The system can also be configured to direct low flows from the last chamber of the system to polishing treatment when more stringent water quality standards are imposed. In all configurations, high removal efficiencies are achieved during the lower intensity storms, which constitute the majority of annual rainfall volume.

Full report available at www.conteches.com/vortechs.

Laboratory Testing

Full reports available at www.conteches.com/vortechs

Technical Bulletin 1: Removal Efficiencies for Selected Particle Gradations

Technical Bulletin 2: Particle Distribution of Sediments and the Effect on Heavy Metal Removal

Technical Bulletin 3: Sizing for Net Annual Sediment Removal

Technical Bulletin 3a: Determining Bypass Weir Elevation for Off-Line Systems

Technical Bulletin 4: Modeling Long Term Load Reduction: The Rational Rainfall Method

Technical Bulletin 5: Oil Removal Efficiency

Field Monitoring

Following are brief summaries of the field tests completed to date.

Full reports available at www.conteches.com/vortechs

DeLorme Mapping Company

Yarmouth, ME

Contech Engineered Solutions

Prior to this premier field test of the Vortechs system, Contech developed an extensive body of laboratory data to document total suspended solids (TSS) removal efficiency. Contech performed this field study in order to compare the performance predicted using laboratory data to the performance of a correctly sized system in the field.

The study site was the headquarters of DeLorme Mapping in Yarmouth, Maine. The building, driveway, parking lot and ancillary facilities were constructed in 1996. A Vortechs model 11000 was installed to treat runoff from the 300-space, 4-acre (1.62-ha) parking lot.

Testing Period	May 1999 to Dec 1999
# of Storms Sampled	20
Mean Influent Concentration	328-mg/L
Mean Effluent Concentration	60-mg/L
Removal Efficiency	82%

The main purpose of the DeLorme study was to verify that the sizing methodology developed from our full-scale laboratory testing was valid and an accurate means of predicting field performance. The results of the study confirmed our sizing methodology.

Village Marine Drainage

Lake George, NY

New York State Department of Environmental Conservation, Division of Water

The New York State DEC used funds obtained in a Section 319 grant to initiate a study of the effectiveness of the Vortechs system to remove sediment and other pollutants transported

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by stormwater to Lake George, Lake George Village, New York. "Since the 1970s, when there was a rapid increase in the rate and concentration of development along the southwestern shores of Lake George, we have been concerned about the impact of stormwater discharges into the lake," said Tracy West, co-author of the study.

Testing Period	Feb 2000 to Dec 2000
# of Storms Sampled	13
Mean Influent Concentration	801-mg/L
Mean Effluent Concentration	105-mg/L
Removal Efficiency	88%

The study concluded that the Village and Town of Lake George should consider installing additional Vortechs systems in areas where sedimentation and erosion have been identified as non-point source pollution problems.

Harding Township Rest Area
Harding Township, NJ
RTP Environmental Associates

This third party evaluation was performed under a U.S. Environmental Protection Agency grant, administered by the New Jersey Department of Environmental Protection. A. Roger Greenway, principal of RTP Environmental Associates, Inc., conducted the study in conjunction with Thonet Associates, which assisted with data analysis and helped develop best management practices (BMP) recommendations.

The Vortechs model 4000 was sized to handle a 100-year storm from the 3 acre (1.21 ha) paved parking area at the Harding Rest Stop, located off the northbound lane of I-287 in Harding Township, New Jersey.

Testing Period	May 1999 to Nov 2000
# of Storms Sampled	5
Mean Influent Concentration (TSS)	493-mg/L
Mean Effluent Concentration (TSS)	35-mg/L
Removal Efficiency (TSS)	93%
Mean Influent Concentration (TPH)	16-mg/L
Mean Effluent Concentration (TPH)	5-mg/L
Removal Efficiency (TPH)	67%

The study concluded that truck rest stops and similar parking areas would benefit from installing stormwater treatment systems to mitigate the water quality impacts associated with stormwater runoff from these sites.

Timothy Edwards Middle School
South Windsor, CT
UCONN Department of Civil & Environmental Engineering

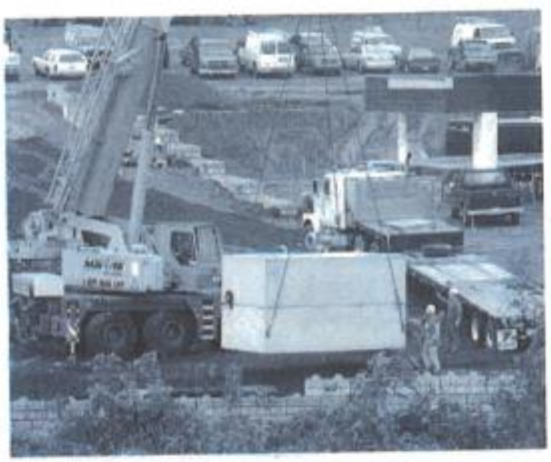
This study of the Vortechs system was published as a thesis by Susan Mary Board, as part of the requirements for a Master of Science degree from the University of Connecticut. Her objective was to determine how well the Vortechs system retained pollutants from parking lot runoff, including total suspended solids (TSS), nutrients, metals, and petroleum hydrocarbons.

A Vortechs model 5000 was installed in 1998 to treat runoff from the 82-space parking lot of Timothy Edwards Middle School. The entire watershed was approximately 2 acres (0.81 ha), and was 80% impervious.

Testing Period	Jul 2000 to Apr 2001
# of Storms Sampled	weekly composite samples taken
Mean Influent Concentration	324-mg/L
Mean Effluent Concentration	73-mg/L
Removal Efficiency	77%

Additionally, the Vortechs system was particularly effective in removing zinc (85%), lead (46%), copper (56%), phosphorus (67%) and nitrate (54%).

The study concluded that the Vortechs system significantly reduced effluent concentrations of many pollutants in stormwater runoff.



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ATTACHMENT A

Maintenance

The Vortechs system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit, e.g., unstable soils or heavy winter sanding will cause the swirl chamber to fill more quickly but regular sweeping will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant deposition and transport may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. Inspections should be performed twice per year (i.e. spring and fall) however more frequent inspections may be necessary in equipment washdown areas and in climates where winter sanding operations may lead to rapid accumulations. It is useful and often required as part of a permit to keep a record of each inspection. A simple inspection and maintenance log form for doing so is provided on the following page, and is also available on conteches.com.

The Vortechs system should be cleaned when inspection reveals that the sediment depth has accumulated to within 12 to 18 inches (300 to 450 mm) of the dry-weather water surface elevation. This determination can be made by taking two measurements with a stadia rod or similar measuring device; one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.

Cleaning

Cleaning of the Vortechs system should be done during dry weather conditions when no flow is entering the system. Clean-out of the Vortechs system with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system. If such a truck is not available, a "clamshell" grab may be used, but it is difficult to remove all accumulated pollutants using a "clamshell".

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use adsorbent pads to solidify the oil since these pads are usually much easier to remove from the unit individually and less expensive to dispose of than the oil/water emulsion that may be created by vacuuming the oily layer. Floating trash can be netted out if you wish to separate it from the other pollutants.

Cleaning of a Vortechs system is typically done by inserting a vacuum hose into the swirl chamber and evacuating this chamber of water and pollutants. As water is evacuated, the water level outside of the swirl chamber will drop to a level roughly equal to the crest of the lower aperture of the swirl chamber.

Floating pollutants will decant into the swirl chamber as the water level is drawn down. This allows most floating material to be withdrawn from the same access point above the swirl chamber. Floating material that does not decant into the swirl chamber during draw down should be skimmed from the baffle chamber. Sediment may accumulate outside the swirl chamber. If this is the case, it may be necessary to pump out other chambers. It is advisable to check for sediment accumulation in all chambers during inspection and maintenance.

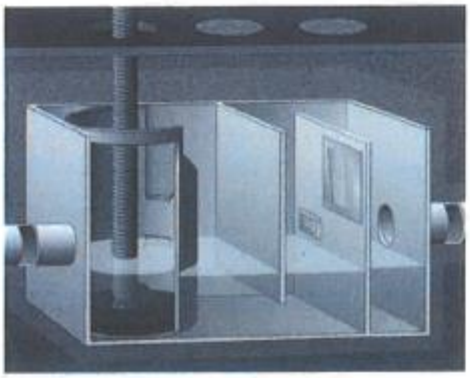
These maintenance recommendations apply to all Vortechs systems with the following exceptions:

1. It is strongly recommended that when cleaning systems larger than the Model 16000 the baffle chamber be drawn down to depth of three feet prior to beginning clean-out of the swirl chamber. Drawing down this chamber prior to the swirl chamber reduces adverse structural forces pushing upstream on the swirl chamber once that chamber is empty.
2. Entry into a Vortechs system is generally not required as cleaning can be done from the ground surface. However, if manned entry into a system is required the entire system should be evacuated of water prior to entry regardless of the system size.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure proper safety precautions. If anyone physically enters the unit, Confined Space Entry procedures need to be followed.

Disposal of all material removed from the Vortechs system should be done in accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

Contech has created a network of Certified Maintenance Providers (CCMP's) to provide maintenance on Vortechs systems. To find a CCMP in your area please visit www.conteches.com/maintenance.



ATTACHMENT A

Vortechs Inspection & Maintenance Log

Vortech Model: ____________________ **Location:** ______________________________

Date	Water depth to sediment	Floatable layer thickness	Describe maintenance performed	Maintenance personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than eighteen inches the system should be cleaned out. Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

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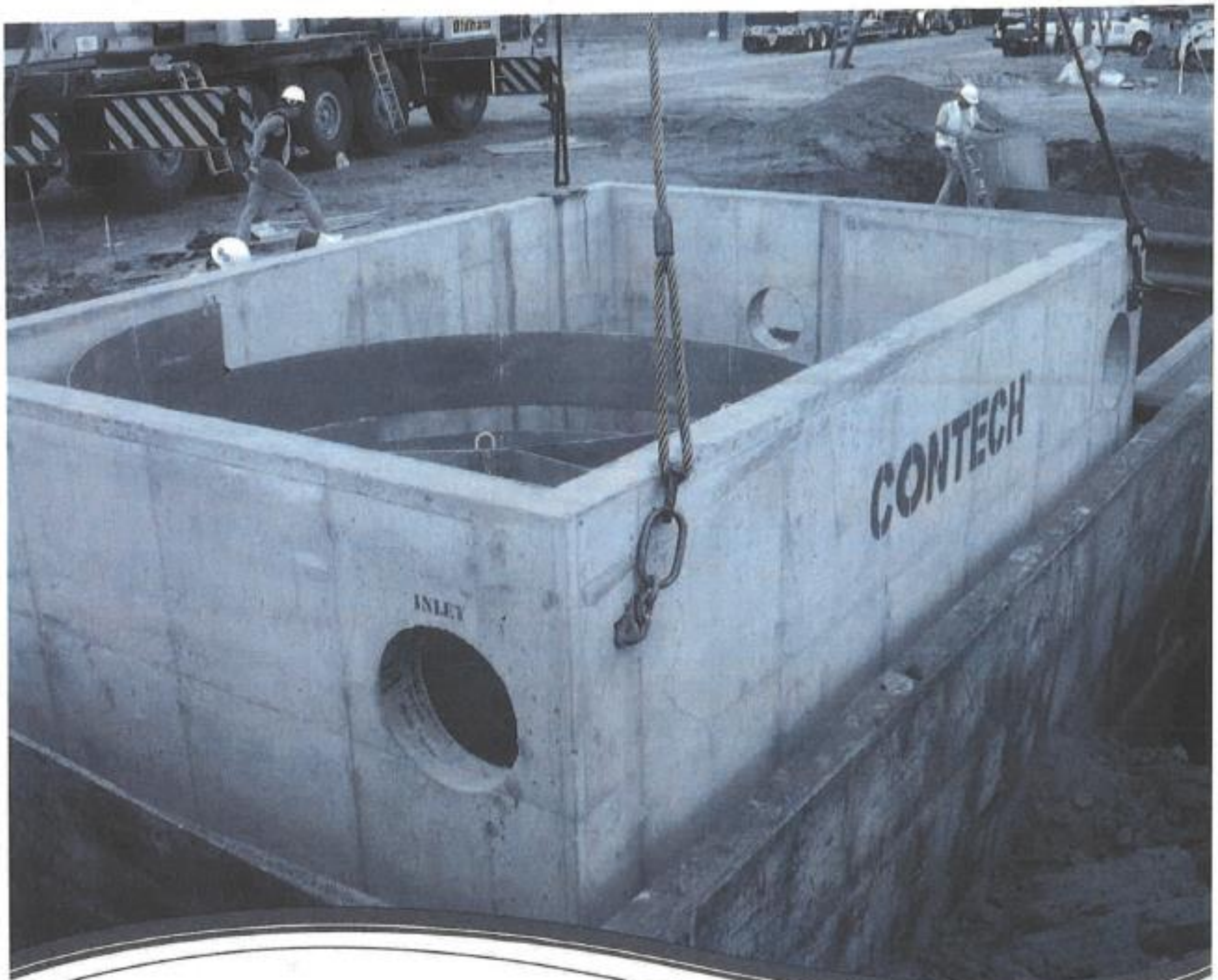

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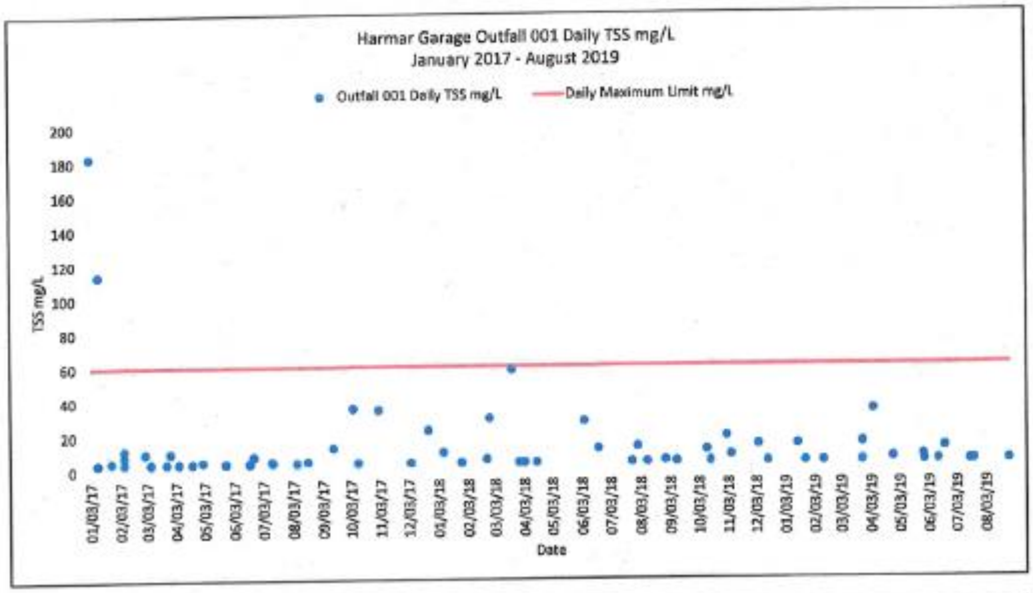
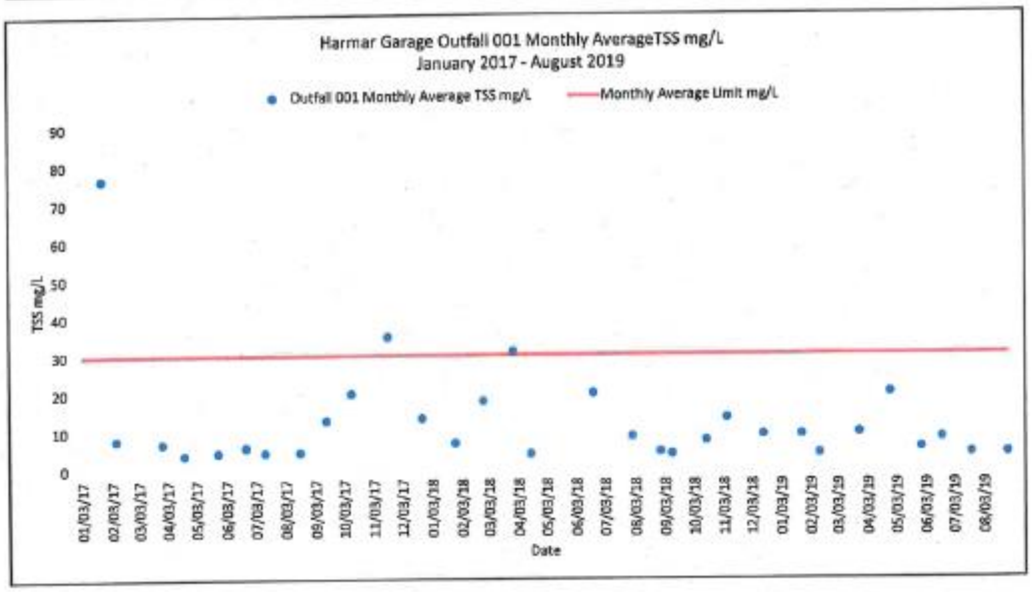
vs_manual 04/17 PDF Revision

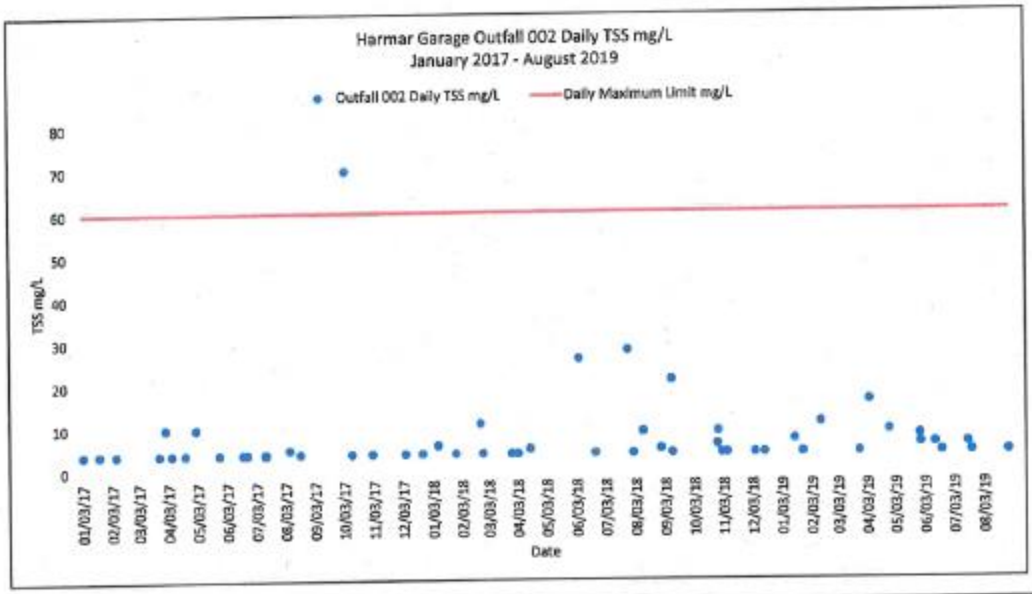
Attachment B – TSS Monitoring Data Summary

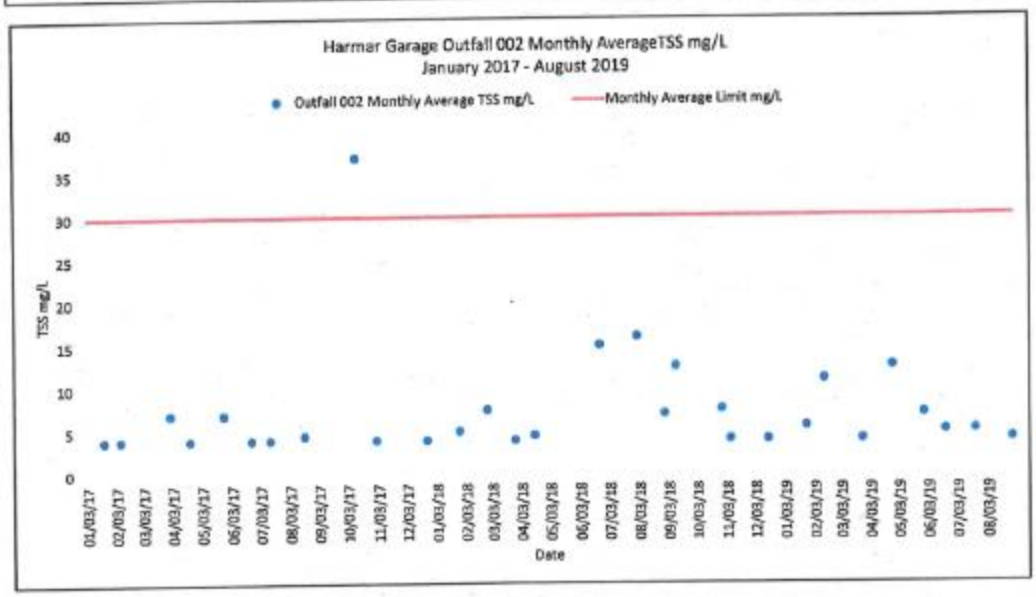
ATTACHMENT B





ATTACHMENT B





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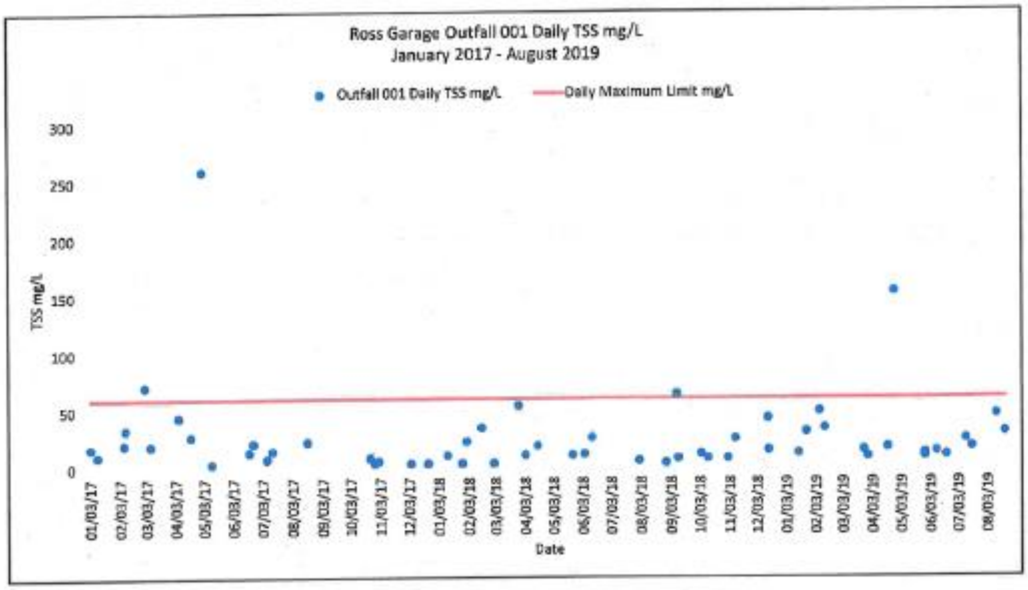
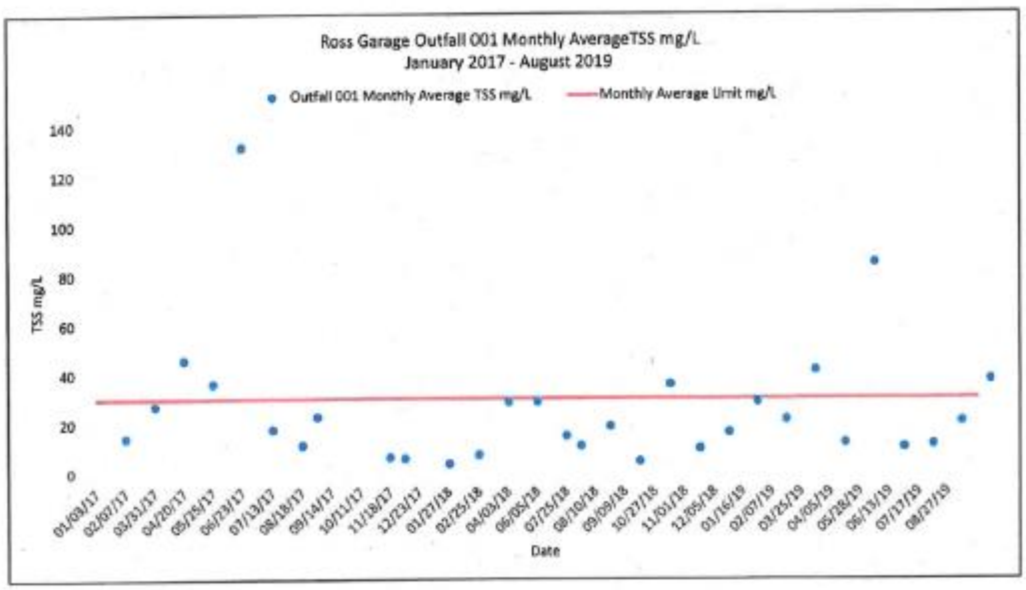
ATTACHMENT B





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Attachment C – Calculated 99th Percentile TSS

ATTACHMENT C
Calculated 99th Percentile of Ross Outfall 001 TSS Discharges
2017 - August 2019

Pollutant	TSS mg/L	
Date	Result	ln TSS
01/03/17	18	2.890372
01/10/17	11	2.397895
02/07/17	21	3.044522
02/09/17	34	3.526361
03/01/17	72	4.276666
03/07/17	20	2.995732
04/06/17	45	3.806662
04/19/17	28	3.332205
05/01/17	260	5.560682
05/11/17	4	1.386294
06/19/17	14	2.639057
06/23/17	22	3.091042
07/07/17	8	2.079442
07/13/17	15	2.70805
08/18/17	23	3.135494
10/23/17	9	2.197225
10/28/17	4	1.386294
11/01/17	6	1.791759
12/05/17	4	1.386294
12/23/17	4	1.386294
01/12/18	11	2.397895
01/27/18	4	1.386294
02/01/18	23	3.135494
02/16/18	35	3.555348
03/01/18	4	1.386294
03/27/18	54	3.988984
04/03/18	11	2.397895
04/16/18	19	2.944439
05/23/18	11	2.397895
06/05/18	12	2.484907
06/13/18	26	3.258097
08/01/18	6	1.791759
08/29/18	4	1.386294
09/09/18	64	4.158883
09/10/18	8	2.079442
10/04/18	12	2.484907
10/11/18	8	2.079442
11/01/18	8	2.079442
11/09/18	25	3.218876
12/14/18	43	3.7612
12/15/18	15	2.70805
01/16/19	12	2.484907
01/24/19	31	3.433987
02/07/19	49	3.89182
02/12/19	34	3.526361
03/25/19	15	2.70805
03/29/19	9	2.197225
04/19/19	17	2.833213
04/26/19	153	5.030438
05/28/19	9	2.197225
05/28/19	12	2.484907
06/10/19	13	2.564949
06/20/19	10	2.302585
07/11/19	24	3.178054
07/17/19	17	2.833213
08/13/19	45	3.806662
08/22/19	30	3.401197

LM	2.789035
LS	0.910262
z	2.326
99%tile	135 mg/L

(replaced ND values with PQL of 4 mg/l)