

PROPOSED ANIMAL HOSPITAL/ OTTAWA VALLEY WILD BIRD CARE CENTRE



SITE SERVICING AND STORM WATER MANAGEMENT REPORT for 8520 MCARTON ROAD, OTTAWA, ONTARIO

JULY 3, 2020

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**SITE SERVICING AND STORMWATER MANAGEMENT
REPORT**

for

**8520 MCARTON ROAD,
OTTAWA, ONTARIO**

Prepared BY

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SUBMITTED TO:

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1. INTRODUCTION

1.1 General:

The following report demonstrates, in brief, the site plan servicing and the stormwater management in support of a Site Plan Application for 8520 McArton Road, City of Ottawa, Ontario. Out of 7 hectares total area of the land, the 0.863 hectare development being proposed will potentially be the new location for the Ottawa Valley Wild Bird Centre. The development includes an animal hospital with rehabilitation centre, parking area, and all required services. Figure 1 shows summer and winter aerial views of the property.

The principal concept in the site plan servicing and the stormwater management is to integrate the site with the surrounding environment in a sustainable yet cost-effective approach. The report covers brief explanation of each service, detailed calculations in compliance with the City of Ottawa and provincial requirements and by-laws for submission with the engineering drawings for City of Ottawa site plan approval.

1.2 Report Structure:

The City of Ottawa and the Ontario Ministry of the Environment Guidelines were used where applicable.

This report is divided into four sections:

- i. Introduction.
- ii. Site Service: includes current site condition, proposed site, fire protection, and sanitary servicing.
- iii. Stormwater Management: includes design criterion, pre-development release rate, calculation of allowable release rate, calculation of post-development release rate, storage requirements, and proposed stormwater management plan.
- iv. Erosion and Sediment Control.
- v. Summary and Conclusions.
- vi. Three Appendices:
 - Appendix A: Calculation of Fire Flow Requirements
 - Appendix B: Stormwater Management Design Sheets/ Tables.
 - Appendix C: Stormceptor Sizing and Maintenance Report.

1.3 References:

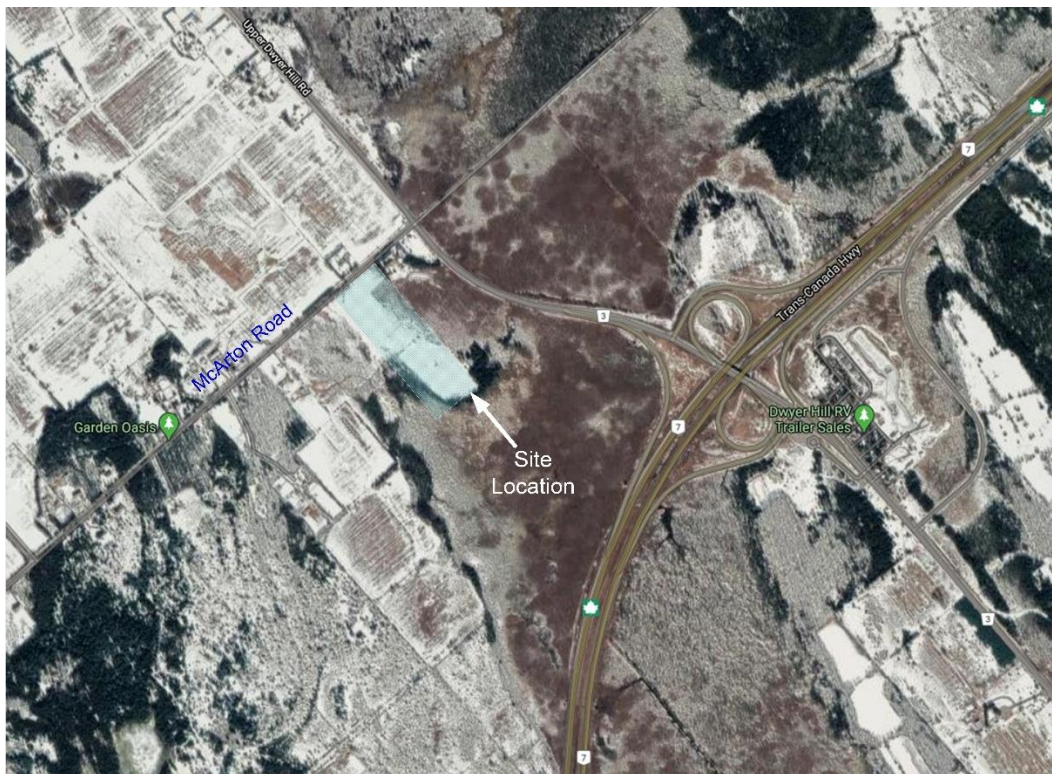
Various documents were referred to in preparing the current report, including:

- Ottawa Sewer Design Guidelines, City of Ottawa, SDG002, October 2012.

- Fire Underwriters Survey, Water Supply for Public Fire Protection, CGI Group Inc., 2007.
- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment (MOE), 2003.



Summer view



Winter View

Figure 1-1 – Site Location

2. SITE SERVICES

2.1 General

2.1.1 Current Site Condition

The property has an approximate surface area of 7 ha (17 acres) located at 8520 Mcarton Road in Ottawa, Ontario. The site is currently vacant and is covered by tall grasses and shrubs, with trees being on the western and southern extent of the site. The land has an irregular rectangular shape with about 191m wide (east-west) by 365 deep (north-south). The site is mostly flat. The overall site drainage goes to the east towards the existing wetlands, with some low-lying areas lacking surficial drainage due to the topography of the site. The average site slope is approximately 3% from an elevation of $+133.47 \pm 0.15$ meters above sea level (masl) to $+131.82 \pm 0.15$ masl.

2.1.2 Proposed Site

It is proposed to construct an institutional building that will serve as an animal/bird hospital for local wildlife with offices and educational centre. Besides, the site will contain a parking area for employees and clients. The footprint of the building will be 623.25 m² with an additional 312.4 m² outdoor fly zone near the building on the south and west sides. There will be one entrance to access the site from McArton road. A total of 24 parking spots are required as well as a fire route running from the Mcarton Road beside the east side of the building. The site will be serviced by a private well and a conventional septic system. Referring to the approved hydrogeological report (dated September 18, 2019) regarding the (30 m) required distance between the well and the septic system; drawing SS-1 shows:

- i. The distance between the well and the septic bed downgradient is 66.14 m;
- ii. The distance between well and the septic tank of the building is 33.6 m.
- iii. The distance between well and the septic tank of the Birds Aviaries is 56.2.

2.2 Water Supply and Well Water Quality

There is no municipal water available in this area of the city. The site will be serviced with water using a private well on site. The approximate location of the well was chosen on the north-west of the building (see drawing SS-1) based on the recommendations of the hydrogeological study prepared by Geofirma Engineering Ltd, dated September 18, 2018. Detailed information and hydraulic data and water quality are provided by Geofirma Engineering Ltd. final report titled "Hydrogeological Study/ 8520 McArton Road, Ottawa, Ontario", on April 30, 2020. As related to the water quality, the report shows a comparison of the water quality results to aesthetic, analytical and indicator parameters outlined in Procedure D-5-5 and the ODWS indicate the following:

- Hardness, reported at 283 mg/L and 290 mg/L, is above the operation guideline (OG) range of 80-100 mg/L. The ODWS states that hardness values greater than 200 mg/L,

but less than 500 mg/L, are considered poor but tolerable. Hardness is easily treated with standard water softener systems.

- Iron, reported at 0.4 mg/L for both samples, is just above the aesthetic objective (AO) of 0.3 mg/L. Iron concentrations up to 5 mg/L are easily treated with a water softener or manganese greensand filter.
- Laboratory reported color was 12 and 20 TCU for the 3-hour and 6-hour samples, respectively. However, color was measured at 0 TCU for both samples in the field and there was no visible color at the time of sampling. For these reasons, the elevated color reported in the lab samples is attributed to the elevated level of iron in the water, which decreased during the pump test, and is considered acceptable and treatable.
- The concentration of all other aesthetic, analytical and indicator parameters satisfy applicable criteria.

2.3 Fire Protection

A phone conversation with the City of Ottawa fire protection engineer (Allan Evans) took place on July 29, 2019, to discuss fire fighting requirements for the site. It was confirmed that the fire department would require a volume of 10,000 US gallons to be available on-site at any given time as a reservoir to combat fires. This volume is provided by a precast concrete tank of the capacity of 40,000 liters (see Figure A-1 of Appendix A for tank details). The top surface of the tank is to be at level 136.6 masl (as shown in drawing GR-1) to enable water flow by gravity from the tank to the hydrant. The container and the pipe connecting the tank to the hydrant will be heated using a geothermal system designed by the project's mechanical engineer to prevent water from freezing in the wintertime. Drawing SS-1 shows the location and elevation of the fire protection tank.

The required flow for the fire protection of the proposed site was estimated based on the Fire Underwriters Survey. The following equation from the latest version of the Fire Underwriters Survey (1999) was used for calculation of the supply rates required to be supplied by the hydrant.

$$F = 220 * C * \sqrt{A}$$

Where:

F = the required fire flow in liters per minute

C = coefficient related to the type of construction

A = the total floor area in square meters

Table 2-1 – Summary of Required Fire Protection Flow

Item	Design Value
Floors Above Grade	1 Floor
Construction Coefficient	0.8
Fire Protection Type	None
Building Height (m)	6.934 m
Building Area (m ²)	623.25
Required fire flow F (L/min)	5000
Reduction due to low Occupancy	- 25%
Increase due to Separation	0%
Fire Flow Requirement	4000 (L/min) or 66.7 (L/sec)

100 mm diameter pipe is proposed to connect the fire protection tank to the hydrant as shown in drawing SS-1. Table 6.1 of Appendix A shows the detailed calculation of the fire protection flow.

2.4 Sanitary Servicing

No sanitary sewers are servicing in this area of the city. The proposed sanitary system includes two septic tanks and two pumps, one septic tank and a pump for the building and one septic tank and a pump for the aviaries, which are to be connected into one leaching bed. The detailed design of the septic system will be conducted at a later stage. The septic system would consist of a conventional Class IV septic system, which its design will be reviewed and approved by the City of Ottawa at the time of construction. Refer to the servicing drawing SS-1 for the envelope of the septic system.

2.4.1 Sanitary Servicing for the Building

The building sewage demand estimated by the mechanical engineer based on the maximum and minimum daily water demand. According to the estimation, the maximum daily demand is 7.4 m³ (approximately 2000 gals per day) during peak season. The minimum daily demand is 4.5 cu.m (around 1200 gals per day). As per the Ontario Building Code, the septic tank size for the building is to be 18,500 L (see drawing SS-1 for the locations of the septic system parts).

2.4.2 Servicing for Outdoor Aviaries

In the proposed design, the Birds Aviaries have a wooden roof covering half of their area (50% of their total area). The aggregate wastewater demand results from the accumulated rainwater and the required water for washing the aviaries concrete floors and the walkway between the aviaries and the building. The rainwater from the wooden

roofs is drained directly (by individual gutters) to the grass area on the west and south green zones. The design of the combined storm-and-sewage system of the Birds Aviaries based on two assumptions: (i) the events of cleaning the aviaries and the peak rain are not simultaneous; and (ii) the peak rain generates the dominant water discharge. Hence, the sewers and the septic tank designed to serve both stormwater and sewage of the cleaning water of aviaries.

Area of the Aviaries (A_{BC}) = 302 m²

As the service life of the building in the Ontario Building Design Code is limited to 50 years, then only the rain intensity for 5 years storm is considered in this calculation.

Rain intensities for five years storm for $T_c = 15$ mins

Intensity, $I_5 = 998.071 / (T_c + 6.035)^{0.814}$ (5-year, City of Ottawa):

$$I_5 = 83.615 \text{ mm/hr}$$

Total rainwater accumulated over the concentration-time of 15 mins is:

$$Q = (A_{BC}/2) \times I_5 \times (T_d/60) = (302/2) \times (83.615/1000) \times (15/60) = 3.16 \text{ m}^3$$

The peak discharge per second is = $3.16 \times 10^3 / (15 \times 60) = 3.5 \text{ L/sec}$

125 mm diameter sanitary sewers are proposed with a minimum slope of 1.5 % having a Manning's full flow capacity of 3.5 L/sec. The pipes are progressively accumulating the wastewater from the aviaries floors by inlets (SWTC-A1 through STWC-A18 and STWC-B1). Three manholes are provided (SST-MH-1 through SST-MH-3).

As per the Ontario Building Code, the septic tank size for the building is 2.5 times of the wastewater demand, which is around 8000 liters. Since the majority of the wastewater is rainwater, and because of the nature of the birds' wastes, the septic tank size for the aviaries is reduced to 6,000 L (see drawing SS-1 for the locations of the septic system parts). The background assumption here is that peaks of the two demands of the water pumped to the leaching bed (from the building septic tank and from the Birds Aviaries septic tank) are not simultaneous.

3. STORMWATER MANAGEMENT

3.1 Design Criterion

The storm flow is calculated in conformance with the latest version of the City of Ottawa Design Guidelines (October 2012). The allowable release rate for the site is limited to a 5-year storm event using a time of concentration of 10 minutes and a runoff coefficient as calculated in Table 7.1 of Appendix B. Flows in excess of the 5-year and up to the 100-year rate are detained on-site using on-site storage.

Minor Design Criteria

- The storm flow, Stormceptor inlet, and site open storage are designed and/or size based on the Modified Rational Method for the 5-year storm using a 10 minute inlet time.
- Inflow rates into the minor system are limited to an allowable release rate, as noted above.

Major Design Criteria

- The major storm flow, Stormceptor inlet, and site open storage are designed and/or size to accommodate on-site detention with sufficient capacity to attenuate the 100-year design storm. Excess runoff above the 100-year event will flow over a proposed riprap as per OPSD 810.010 (TYPE B) shown in drawing SS-1, GR-1, and WS-1.
- On-site surface storage is provided for up to the 100-year design storm by grading the area around the swale forming instantaneous pond (storage) that allows slow flow release avoiding possible local flood. Calculations of the required on-site storage volumes are supported by detailed calculations provided in Appendix B.
- Calculation of the required storage volumes has been prepared based on the Modified Rational Method, as identified in Section 8.3.10.3 of the City's Sewer Guidelines. The details of the surface storage are illustrated on the site servicing and grading plans (SS-1 and GR-1).

Water Quality: Enhanced, 80% total suspended solids (TSS) removal, quality control is required for institutional developments as per the Rideau Valley Conservation Authority requirements. Detailed information and hydraulic data and water quality are provided by Geofirma Engineering Ltd. final report titled "Hydrogeological Study/ 8520 McArton Road, Ottawa, Ontario", on April 30, 2020.

Method of Analysis: The Modified Rational Method has been used to calculate the runoff rate from the drainage catchment to quantify the detention storage for all controlled measures. Refer to Appendix B for all stormwater calculations.

The stormwater management criteria for this development is based on the City of Ottawa Sewer Design Guidelines (2012), and the Ministry of the Environment (MOE) Stormwater Management Planning and Design Manual (2003).

3.2 Pre-Development Release Rate

Although there is no requirement to control runoff to pre-development conditions, calculations of pre-development peak flows were estimated to ensure that the allowable release rate was less than pre-development conditions. Under pre-development conditions, the site consisted entirely of grass. From the existing ground elevations shown on the grading plan, storm runoff flowed westerly to the gravel lane behind the site. The

pre-development runoff coefficient for the site was determined to be 0.75, with calculations shown below and in Appendix B.

Using time of concentration (T_c) of 15 minutes and an average runoff coefficient of 0.21, the pre-development release rates from the site is determined for the 5-year and 100-year storms using the Rational Method as follows:

$$Q_{PRE} = 2.78 C I A$$

Where:

Q_{PRE}	=	Pre-development Peak Discharge (L/sec)	
C_{AVG}	=	Average Runoff Coefficient	
I	=	Average Rainfall Intensity for a return period (mm/hr)	
	=	$998.071 / (T_c + 6.053)^{0.814}$ (5-year)	
	=	$1735.688 / (T_c + 6.014)^{0.820}$ (100-year)	
T_c	=	Time of concentration (mins)	
A	=	Drainage Area (hectares)	
Therefore: I_{5PRE}	=	$998.071 / (15 + 6.053)^{0.814}$	= 83.62 mm/hr
Q_{5PRE}	=	$2.78 (0.21) (83.62 \text{ mm/hr}) (0.892 \text{ ha})$	= 43.543 L/sec
I_{100PRE}	=	$1735.688 / (15 + 6.014)^{0.820}$	= 142.894 mm/hr
Q_{100PRE}	=	$2.78 (0.2625) (142.894 \text{ mm/hr}) (0.892 \text{ ha})$	= 93.015 L/sec

The 5-year and 100-year pre-development flows were estimated at 43.543 L/sec and 93.015 L/sec, respectively.

3.3 Calculation of Allowable Release Rate

The total site area is about 7ha. The only area around the proposed development is considered in this calculation as the remainder of the property towards the south will remain untouched. The total area of the site development portion is accounted for in this calculation is 0.892 ha.

The existing site is divided into two watersheds, EWS-01 and EWS-02. EWS-01 has a total area of 0.0075 ha, and it drains towards the roadside ditch. EWS-02 accounts for the majority of the development, with an area of 0.8842 ha. This watershed drains towards the exiting wetlands located towards the southeast portion of the property.

The allowable release rate from the site development area is based on the 5-year and 100-year storm event with a pre-development runoff coefficient of 0.21 and 0.2625,

respectively. The City of Ottawa Sewer Design Guidelines (2012) specifies a time of concentration of 10 mins in greenfield developments with low grades and a lack of conveyance for the major design criteria.

$$Q_{\text{ALLOW}} = 2.78 C I A$$

Where:

	Q_{ALLOW}	=	Peak Discharge (L/sec) Runoff	
	C_{AVG}	=	Average Runoff Coefficient	
	I_{ALLOW}	=	Average Rainfall Intensity for a return period (mm/hr)	
		=	$998.071 / (T_c + 6.053)^{0.814}$ (5-year)	
		=	$1735.688 / (T_c + 6.014)^{0.820}$ (100-year)	
	T_c	=	Time of concentration (mins)	
	A	=	Drainage Area (hectares)	
Therefore:	$I_{5\text{ALLOW}}$	=	$998.071 / (10 + 6.053)^{0.814}$	= 104.29 mm/hr
	$Q_{5\text{ALLOW}}$	=	$2.78 (0.21) (83.62 \text{ mm/hr}) (0.892 \text{ ha})$	= 54.3081 L/sec
	$I_{100\text{ALLOW}}$	=	$1735.688 / (10 + 6.014)^{0.820}$	= 178.56 mm/hr
	$Q_{100\text{ALLOW}}$	=	$2.78 (0.2625) (142.894 \text{ mm/hr}) (0.892 \text{ ha})$	= 116.23 L/sec

Hence, the allowable release rate from the site is 54.31 L/s for the 5-year storm event and 116.23 L/s for the 100-years storm event.

3.4 Calculation of Post-Development Release Rate

The site development area is divided into three (3) watersheds. WS-01 is a small uncontrolled area and will drain towards the roadside ditch. WS-03 will also be uncontrolled and will drain towards the wetlands by matching the existing drainage path of the property. Roof drainage will be directed towards the wide uncontrolled WS-03 using eavestroughs and downspouts as shown in drawing SS-1. WS-02 is to be controlled and will drain towards a proposed swale that will collect and convey the drainage towards an oil-grit separator (STC 750) using an inlet control device (ICD). This ICD will control the site runoff to the allowable release rate for all storm events up to and including 100-year storm event. The controlled flow will outlet to the STC and ultimately to the existing roadside ditch located north of the property. The required on-site storage will be provided through on-site surface ponding within the proposed swale shown in drawing SS-1 and GR-1. The controlled site drainage has been diverted towards the side-road ditch and away from the wetland to protect and preserve the wetland area. Refer to the Site

Servicing Plan SS-1 for the proposed stormwater management layout and Watershed plan WS-1 for proposed drainage catchment areas.

Using time of concentration (T_c) of 15 minutes and an average runoff coefficients as calculated in Table 7.4, the post-development release rates from the site are determined for the three watersheds for the 5-year and 100-year storms using the Rational Method as follows:

$$Q_{PRE} = 2.78 C I A$$

Where:

Q_{POST} = Pre-development Peak Discharge (L/sec)

C_{AVG} = Average Runoff Coefficient

I = Average Rainfall Intensity for a return period (mm/hr)

$$= 998.071 / (T_c + 6.053)^{0.814} \text{ (5-year)}$$

$$= 1735.688 / (T_c + 6.014)^{0.820} \text{ (100-year)}$$

T_c = Time of concentration (mins)

A = Drainage Area (hectares)

Therefore: $I_{5POST} = 998.071 / (15 + 6.053)^{0.814} = 83.62 \text{ mm/hr}$

$I_{100PRE} = 1735.688 / (15 + 6.014)^{0.820} = 142.894 \text{ mm/hr}$

Table 7.5 detail the calculations for the estimations of the 5-year and the 100-year post-development flows of the three watershed areas, while Table 3.# summarize these flows.

Table 3-1 – Summary of Post-Development Flows

No.	Area Name	Area (ha)	Storm: 5 Y	Storm: 100 Y
			Q_{5PRE} (L/Sec)	Q_{100PRE} (L/Sec)
1	EWS-01	0.0078	1.6318	3.4858
2	EWS-02	0.2594	28.1033	60.034
3	EWS-03	0.6254	41.8058	89.305
Overall Site		0.8926	71.5409	152.824

3.5 Storage Requirements

Comparing the post-development with the allowable release rates for the three watersheds; WS-01, WS-02, and WS-02, for time concentration of 10 mins and five years and 100 years design storms, the increase in the release rate due to the development is quantified. The watersheds WS-01 and WS-03 are of uncontrolled flow release toward the wide

undeveloped area, then to the wetland, where no surface storage is required. The watershed WS-02 involves a large paved zone, and hence its flow is controlled. Table 3.2 shows a summary of this comparison between the post-development and the allowable release rates. The increase of the runoff due to the development of watershed WS-02 are 19.269 L/Sec for five years design storm, and 41.24 L/Sec for 100 years design storm. Table 7.6 of Appendix B shows the detailed calculations of the excess runoff due to the proposed development.

Table 3-2 – Summary of Flows Runoff increase due to Post-Development

No.	Area Name	Area (ha)	Allowable Runoff		P-D Increase of Runoff	
			Q _{ALL5} (L/Sec)	Q _{ALL100} (L/Sec)	Q _{INC5} (L/Sec)	Q _{INC100} (L/Sec)
1	EWS-01	0.0078	0.475	1.016	1.561	3.340
2	EWS-02	0.2594	15.783	33.778	19.269	41.240
3	EWS-03	0.6254	38.051	81.437	14.531	31.099
Overall Site		0.8926	54.308	116.23	33.678	72.079

The required surface storage is calculated based on maintaining the same allowable release rate for watershed WS-02 for both the five years of design storm and the 100 years design storm. Table 7.7 shows the detailed calculations for the required surface storage volume using the Modified Rational Method. The table shows that 192.69 m³ storage volume is required for 5Y design storm and 412.4 m³ storage volume is required for 100Y design storm.

3.6 Proposed Stormwater Management Plan

3.6.1 Proposed Runoff Flow Quantity Controls

The runoff flow of the proposed development site will be managed by two means; grading toward the wetland for around 71% of the site area; and using proposed swale and control structures for the rest 29% of the site area. WS-01 and WS-03 having a total area of 0.6332 ha, will have an open (uncontrolled) drain into the wetland following the grading, as shown in drawing GR-1. However, the drainage of watershed EWS-02 is to be managed using a storm system.

The 5-year and 100-year storm events have been analyzed. It was found that the 5-year storm governs the storm design. Hence the storm system was designed accordingly. The storm system is formed from a proposed swale, surface storage, and a control structure (see drawings SS-1, GR-1, and WS-1). The runoff will be controlled by an ICD located at the headwall at the north end of the swale. During the 5-year event, the controlled portion of the site development area will release a peak runoff rate of 15.783 L/Sec. However, the controlled area will release a peak runoff rate of 33.778 L/Sec at a maximum head of 0.65 m.

The ICD is to be installed and centered in the inlet leading to the stormceptor. The 100-year high water level (HWL) is expected to be at 134.90 masl. With the use of this ICD, and the 15.783 L/Sec release rate, 192.69 m³ of storage volume needs to be provided on-site. The required storage will be provided as surface ponding storage in the proposed swale. The total storage volume provided is 198 m³. The total release rate from the controlled area of the site for the 100-year storm event will be 33.778 L/s, which requires 412.4 m³ of storage volume. The needed storage will also be provided as surface ponding storage in the proposed swale. The total storage volume provided is 416 m³.

3.6.2 Proposed Quality Controls

Enhanced quality control providing 80% TSS removal will be accomplished with the use of a stormceptor (STC-750). The STC-750 will be located east of the development area, which will then discharge to the existing roadside ditch. Rip-rap will be used to prevent erosion at the stormceptor outlet. The STC750 will provide 84% TSS removal based on the anticipated flow rates. Therefore, on-site quality control is achievable and has been designed accordingly. Refer to Site Servicing Plan drawing SS-1 for the stormceptor location and Appendix C for the stormceptor sizing, maintenance, and technical manual-Canada.

It is noted that it will be the responsibility of the owner to ensure the adequate operation & maintenance of the stormceptor. If inspection indicates the potential need for maintenance, access is provided via the manhole lid of the Stormceptor. Maintenance is accomplished with the use of a sump-vac. Refer to Appendix C for manufacturer maintenance schedule recommendations.

4. EROSION AND SEDIMENT CONTROL

During all construction activities, erosion and sedimentation shall be controlled by the following techniques:

- Install a light-duty silt fence barrier along the perimeter of the property to capture any sediments from leading into the ditch.
- Strawbales are to be placed at the downstream end of any existing swales to act as a filtering agent.
- A visual inspection shall be completed daily on sediment control barriers and any damage will be repaired immediately. Care is to be taken to prevent damage during construction operations.
- In some cases, barriers may be removed temporarily to accommodate the construction operations. The affected barriers are to be reinstated at night when construction is completed.

- The sediment control devices are to be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract,
- During the course of construction, if ADAD Inc. performs an inspection and believes that additional prevention methods are required to control erosion and sedimentation, the contractor shall install additional silt fences or other methods as required to the satisfaction of ADAD Inc. civil team.
- Sediment control measures are to remain in place throughout the entire construction phase and monitored / maintained on a regular basis until all disturbed areas have been fully restored or vegetated.

Refer to the erosion and sediment control plan (ES-1) for more details.

5. SUMMARY & CONCLUSIONS

Based on the information presented in this report, the proposed civil engineering design ensures that stormwater management requirements for this site are achievable. The following is a summary of the stormwater management plan for this site:

- The project consists of constructing a 623.25m² building along with 24 parking spots.
- The building will be serviced with a conventional septic system that will be designed and detailed at a later stage.
- The property will have water service using a drilled well.
- 40,000 liters (>10,000 US gallons) will be provided through a precast reinforced concrete tank elevated above ground level to enable gravity water flow for fire protection.
- The allowable release rate for the site development area is 54.31 L/Sec & 116.23 L/Sec for the 5 year and 100 year storms, respectively.
- The 100-year post development flow of controlled watershed EWS-02 is to be in the same quantitative level of the 100-year pre-development rate, and the 5-year post development flow is to be in the same quantitative level of the 5- year pre-development rate.
- The runoff flow of the proposed uncontrolled watersheds EWS-01 and EWS-02 of the development site will be managed by grading mainly toward the wetland.
- Using the Modified Rational Method, the uncontrolled watersheds EWS-01 and EWS-02 will release a peak runoff rate of 4.36 L/Sec and 112.54 L/Sec, respectively; while the controlled watershed EWS-02 will be organized by an ICD to a peak rate of 33.778 L/Sec during the 100-year storm event, thereby meeting the allowable release rate.

- Using the Modified Rational Method, the uncontrolled watersheds EWS-01 and EWS-02 will release a peak runoff rate of 2.04 L/Sec and 52.58 L/Sec, respectively; while the controlled watershed EWS-02 will be organized by an ICD to a peak rate of 15.783 L/Sec during the 5-year storm event, thereby meeting the allowable release rate.
- The ICD will be located within the stormceptor inlet with an invert of 134.00 masl, producing a HWL of 134.7 masl during the 100-year storm event.
- With a controlled release rate of 15.78 L/Sec, and 33.78 L/Sec, the required storage volume capacities are 192.69 m³ and 412.39 m³ for 5 Y Storm and 100 Y storm, respectively. Accordingly, a total storage volume of 420 m³ will be stored above ground as ponding within the proposed swale.
- Enhanced quality control of 80% TSS removal is required for this site. A stormceptor model STC-750, has been sized to provide 84% TSS removal thereby meeting quality control requirements.

6. APPENDIX A: CALCULATION OF FIRE FLOW REQUIREMENTS

Table 6-1 – Calculation of Fire Flow Requirements

The Calculations are Based on Fire Underwriters Survey, 1999.

- 1) An estimate of the Fire Flow required for a given fire area may be estimated by:

$$F = 220 * C * \sqrt{A}$$

Where:

F = the required fire flow in litres per minute

A = the total floor area in square metres

C = coefficient related to the type of construction

- 1.5 for wood construction (structure essentially combustible)
- 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
- 0.8 for noncombustible construction (unprotected metal structural components, masonry or metal walls)
- 0.6 for fire-resistive construction (fully protected frame, floors, roof)

No. of Floors = 1
 Area / Floor = 623.25 m²
 A = 623.25 m²
 C = 0.8
 F = 4,394 L/min Rounded to the nearest 1000 = 5,000 L/min

- 2) The value obtained in (1) may be reduced by as much as 25% for occupancies having a low contents fire hazard.

Non-combustible = -25%
 Limited Combustible = -15%
 Combustible = 0%
 Free Burning = 15%
 Rapid Burning = 25%
 Reduction due to low occupancy hazard = -25% X 5,000 = 3,750 L/min

- 3) The value above may be reduced by up to 50% for automatic sprinkler system.

Reduction due to automatic sprinkler system = 0% X 3,750 = 3,750 L/min

- 4) The value obtained in (2) may be increased for structures exposed within 45 metres by the fire area under consideration..

Separation (metres)	Condition	Charge
0m to 3.0m	1	25%
3.1m to 10.0m	2	20%
10.1m to 20.0m	3	15%
20.1m to 30.0m	4	10%
30.1m to 45.0m	5	5%
45.1m and more	6	0%

Exposure	Distance (m)	Condition	Charge
Front	6	0%	
Back	6	0%	
Side 1	6	0%	
Side 2	6	0%	

Increase due to separation = 0% X 3,750 = 0 L/min
 Fire Flow Requirement is = 3,750 L/min
 rounded to the nearest 1000 = 4,000 L/min Or 66.7 L/Sec

40,000 LITRE PRECAST WASTEWATER HOLDING TANK MODEL H40S

WILKINSON HEAVY PRECAST LIMITED

DUNDAS, ONTARIO

905-628-5611

www.wilkinsonheavyprecast.com

CONSTRUCTION DETAILS *

Concrete: 35 MPa at 28 Days, 5 to 8% Air Entrainment.

Reinforcing: 15 M bars at 300 mm centres each way in walls, floor and roof.
Eight extra 15 M bars around each roof access opening.
Minimum cover over reinforcing steel - 25 mm.

Weight: Top Section 13,300 kg
Bottom Section 16,500 kg
Total 29,800 kg

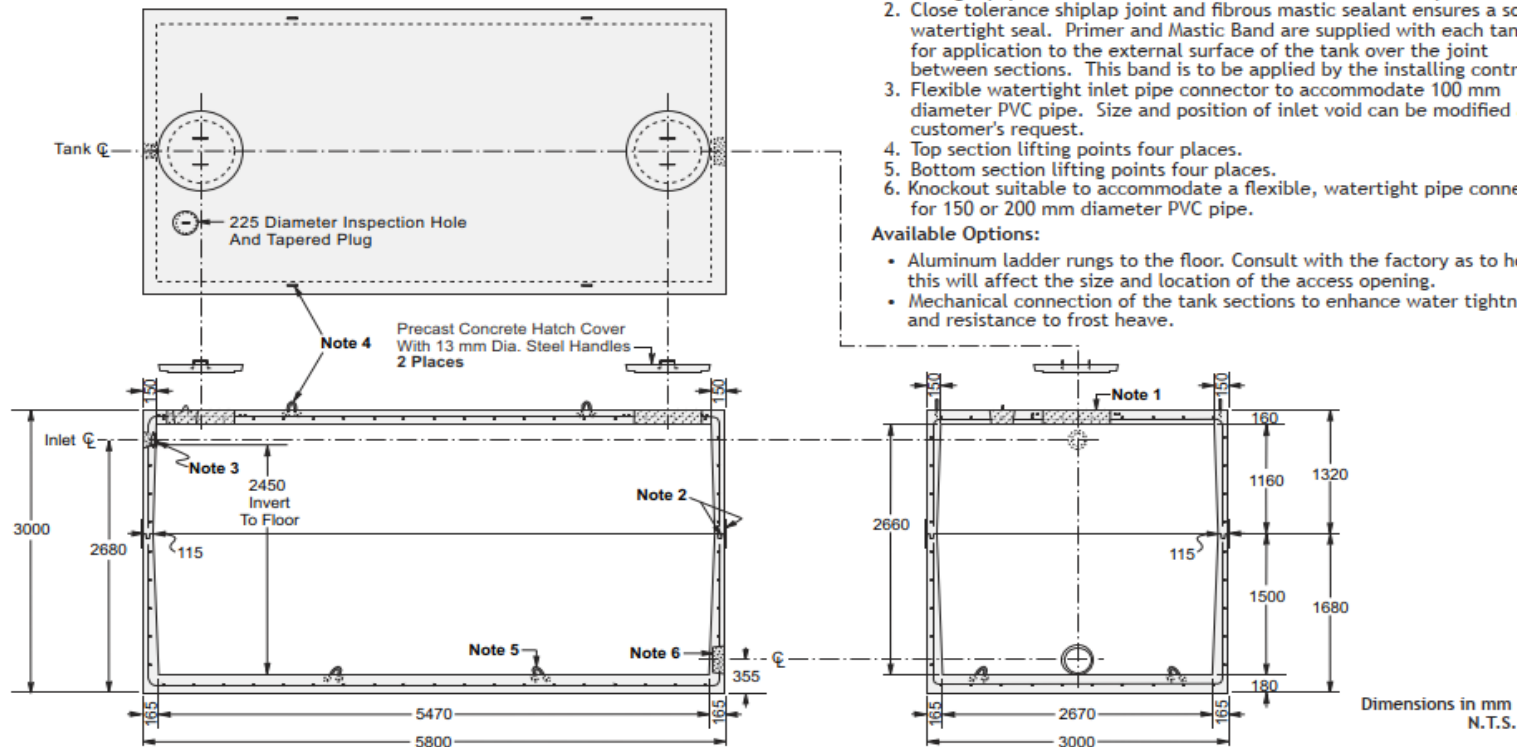
Actual Capacity: 15,068 Litres Per Vertical Metre.
40,082 Litres to Underside of Roof.
37,067 Litres to Invert of Inlet.

NOTES

1. Large 685 mm diameter roof access openings facilitate tank maintenance. Unless otherwise specified/ordered this tank will be shipped with 840 mm diameter concrete hatch covers. Please note that each cover weighs approximately 125 kg and must be handled only with suitable mechanical lifting equipment. See Access Riser section for available options.
2. Close tolerance shiplap joint and fibrous mastic sealant ensures a solid watertight seal. Primer and Mastic Band are supplied with each tank for application to the external surface of the tank over the joint between sections. This band is to be applied by the installing contractor.
3. Flexible watertight inlet pipe connector to accommodate 100 mm diameter PVC pipe. Size and position of inlet void can be modified at customer's request.
4. Top section lifting points four places.
5. Bottom section lifting points four places.
6. Knockout suitable to accommodate a flexible, watertight pipe connector for 150 or 200 mm diameter PVC pipe.

Available Options:

- Aluminum ladder rungs to the floor. Consult with the factory as to how this will affect the size and location of the access opening.
- Mechanical connection of the tank sections to enhance water tightness and resistance to frost heave.



* Commensurate with a 1.2 Metre burial over the top slab in firm soil away from any area of vehicular traffic.

For recommended installation procedures refer to Wilkinson Installation Guidelines and Lifting and Assembly Instructions.

WARNING ! IMPROPER INSTALLATION ESPECIALLY IN UNSTABLE SOILS CAN RESULT IN THE STRUCTURAL FAILURE OF THIS PRODUCT

14 April 2011

Figure 6-1 – Details of a Precast Concrete Fire Protection Tank with a 40,000 L Capacity

7. APPENDIX B: STORMWATER MANAGEMENT DESIGN SHEETS/ TABLES

Table 7-1 – Calculations of Average Runoff Coefficients (Pre-Development)

No.	Area Name	Area Type	Areas (m ²)	C _x	C _x Value	Sum of (A x C _x)
1	EWS-01	Asphalt/Pavers	78	C _{ASPH}	0.9	70.2
2	EWS-02	Grassed	8842	C _{GRASS}	0.2	1768.4
Overall Area						8920
Average Runoff Coefficients (Pre- Development) C_{AVG}						0.21

Table 7-2 – Calculations of Peak Runoff (Pre-Development)

Area Description	Area (ha)	Time of Concentration, T _c (min)	Storm: 5 Y			Storm: 100 Y		
			I ₅ (mm/hr)	C _{AVG5}	Q _{5PRE} (L/Sec)	I ₁₀₀ (mm/hr)	C _{AVG100}	Q _{100PRE} (L/Sec)
Overall Site	0.892	15	83.615	0.21	43.543	142.894	0.2625	93.015
Notes:								
1) Intensity, I = 998.071/(T _c +6.035) ^{0.814} (5-year, City of Ottawa)								
2) Intensity, I = 1735.688/(T _c +6.014) ^{0.820} (100-year, City of Ottawa)								
3) Cavg for 100-year is increased by 25%								

Table 7-3 – Calculations of Allowable Runoff (Pre-Development)

Area Description	Area (ha)	Time of Concentration, T _c (min)	Storm: 5 Y			Storm: 100 Y		
			I ₅ (mm/hr)	C _{AVG5}	Q _{5ALLOW} (L/Sec)	I ₁₀₀ (mm/hr)	C _{AVG100}	Q _{100ALLOW} (L/Sec)
Overall Site	0.892	10	104.29	0.21	54.3081	178.56	0.2625	116.231
Notes:								
1) Allowable Capture Rate is based on 5-year storm with T _c = 10 mins								
2) Intensity, I = 998.071/(T _c +6.035) ^{0.814} (5-year, City of Ottawa)								
3) Intensity, I = 1735.688/(T _c +6.014) ^{0.820} (100-year, City of Ottawa)								
4) Cavg for 100-year is increased by 25%								

Table 7-4 – Calculations of Average Runoff Coefficients (Post-Development)

No.	Area Name	Area Type	Areas (m ²)	C _x	C _x Value	Sum of (A x C _x)
1	EWS-01	Asphalt/Pavers	78	C _{ASPH}	0.9	70.2
2	EWS-02	Asphalt/Pavers	986	C _{GRASS}	0.9	887.4
3	EWS-02	Grassed	1608	C _{GRASS}	0.2	321.6
4	EWS-02	Total EWS-02	2594	C_{AVDEWS-02}	0.47	1209
5	EWS-03	Roofs	623.25	C _{ROOFS}	0.9	560.925
6	EWS-03	Birds Aviaries	159.15	C _{BCAGS}	0.9	143.235
7	EWS-03	Grassed	5471.6	C _{GRASS}	0.2	1094.32
8	EWS-03	Total EWS-02	6254	C_{AVDEWS-03}	0.29	1798.48
Overall Area						8926
Average Runoff Coefficients (Post-Development) C_{AVG}						0.34

Table 7-5 – Calculations of Peak Runoff (Post-Development)

No.	Area Name	Area (ha)	Time of Concentration T _c (min)	Storm: 5 Y			Storm: 100 Y		
				I ₅ (mm/hr)	C _{AVG5}	Q _{5PRE} (L/Sec)	I ₁₀₀ (mm/hr)	C _{AVG100}	Q _{100PRE} (L/Sec)
1	EWS-01	0.0078	15	83.6154	0.9	1.6318	142.894	1.13	3.4858
2	EWS-02	0.2594	15	83.6154	0.47	28.1033	142.894	0.5826	60.034
3	EWS-03	0.6254	15	83.6154	0.29	41.8058	142.894	0.36	89.305
Overall Site		0.8926	15	83.6154	0.34	71.5409	142.894	0.431	152.824

Notes:
 1) Intensity, I = 998.071/(T_c+6.035)^{0.814} (5-year, City of Ottawa)
 2) Intensity, I = 1735.688/(T_c+6.014)^{0.820} (100-year, City of Ottawa)
 3) Cavg for 100-year is increased by 25%

Table 7-6 – Calculations of Post-Development increase in Runoff Rate Based on Allowable Runoff

No.	Area Name	Area (ha)	Time of Concentration T _c (min)	Storm: 5 Y	Storm: 100 Y	Allowable Runoff		P-D Increase of Runoff	
				Q _{5PRE} (L/Sec)	Q _{100PRE} (L/Sec)	Q _{ALL5} (L/Sec)	Q _{ALL100} (L/Sec)	Q _{INC5} (L/Sec)	Q _{INC100} (L/Sec)
1	EWS-01	0.0078	10	2.035	4.356	0.475	1.016	1.561	3.340
2	EWS-02	0.2594	10	35.051	75.018	15.783	33.778	19.269	41.240
3	EWS-03	0.6254	10	52.582	112.536	38.051	81.437	14.531	31.099
Overall Site		0.8926	10	87.986	188.310	54.308	116.231	33.678	72.079

Table 7-7 – Storage Volumes for 5-year and 100-year Return Period Storms (Modified Rational Method)

Duration, T _D (min)	Release Rate = 30 L/Sec Return Period = 5 Years Intensity, I = 998.071/(T _D +6.035) ^{0.814} (5-year, City of Ottawa)					Release Rate = 65 L/Sec Return Period = 5 Years Intensity: I = 1735.688/(T _D +6.014) ^{0.820} (100-year, City of Ottawa)				
	Rainfall Intensity I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)
0	231.04	77.65	15.78	61.87	0.00	398.62	167.47	33.78	133.69	0.00
10	104.29	35.05	15.78	19.27	192.69	178.56	75.02	33.78	41.24	412.39
20	70.29	23.63	15.78	7.84	156.84	119.95	50.39	33.78	16.62	332.32
30	53.95	18.13	15.78	2.35	70.49	91.87	38.60	33.78	4.82	144.54
40	44.20	14.86	15.78	-0.93	-37.11	75.15	31.57	33.78	-2.21	-88.31
50	37.66	12.66	15.78	-3.12	-156.21	63.95	26.87	33.78	-6.91	-345.47
60	32.95	11.07	15.78	-4.71	-282.48	55.89	23.48	33.78	-10.30	-617.72
70	29.38	9.87	15.78	-5.91	-413.63	49.79	20.92	33.78	-12.86	-900.21
80	26.57	8.93	15.78	-6.85	-548.31	44.99	18.90	33.78	-14.88	-1190.1
90	24.29	8.16	15.78	-7.62	-685.65	41.11	17.27	33.78	-16.51	-1485.6
100	22.41	7.53	15.78	-8.25	-825.08	37.90	15.92	33.78	-17.85	-1785.4

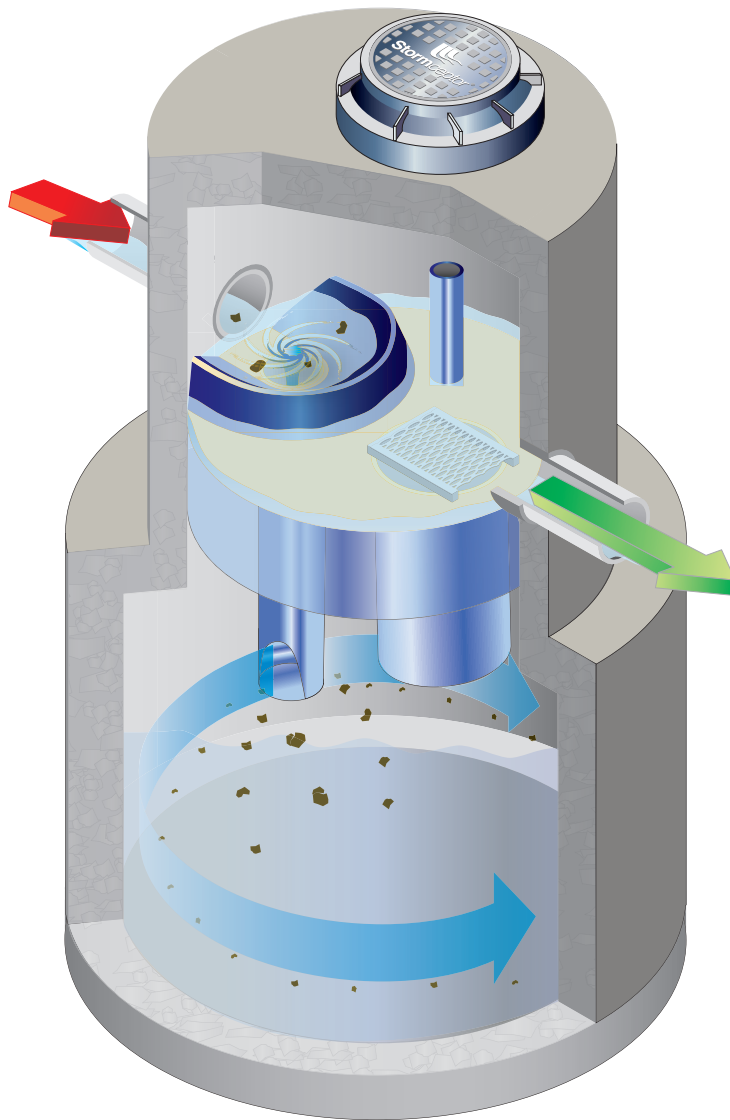
Notes:

- 1) Peak flow is equal to the product of 2.78 C I A
- 2) I = 998.071/(T_D+6.035)^{0.814} [5-year] I = 1735.688/(T_D+6.014)^{0.820} [100-year] City of Ottawa. From Ottawa Sewer Design Guidelines, Section 5.4.2, where TD = storm duration (mins)
- 3) Release Rate = Desired Capture (Release) Rate
- 4) Storage Rate = Peak Flow - Release Rate
- 5) Storage = Duration x Storage Rate
- 6) Maximum storage = Max Storage Over Duration

8. APPENDIX C: STORMCEPTOR SIZING , MAINTENANCE, AND TECHNICAL MANUAL- CANADA

Stormceptor[®]

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Indonesia Patent No. 0007058
Japan Patent No. 3581233
Japan Patent No. 9-11476
Korean Patent No. 0519212
Malaysia Patent No. 118987
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

Table of Contents

1 – Stormceptor Overview

2 – Stormceptor Operation & Components

3 – Stormceptor Identification

4 – Stormceptor Inspection & Maintenance

 Recommended Stormceptor Inspection Procedure

 Recommended Stormceptor Maintenance Procedure

5 – Contact Information (Stormceptor Licensees)

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a “Hydrodynamic Separator (HDS)” or an “Oil Grit Separator (OGS)”, engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- “STORMCEPTOR” is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site’s tailwater conditions)
- Series Unit (combines treatment in two systems)

Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

Figure 1.

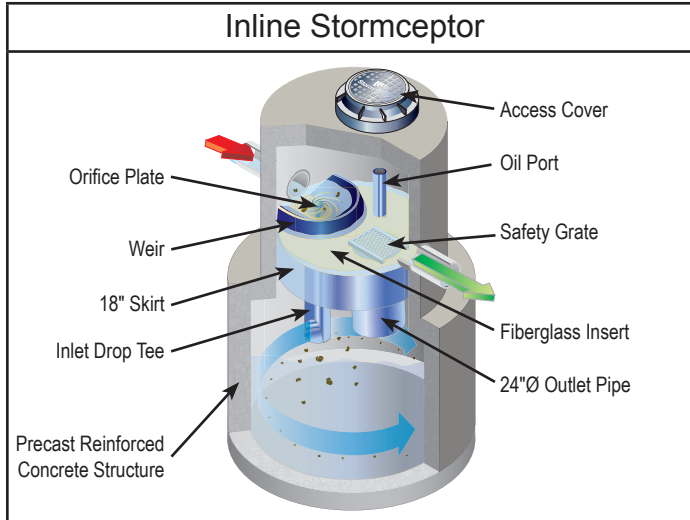
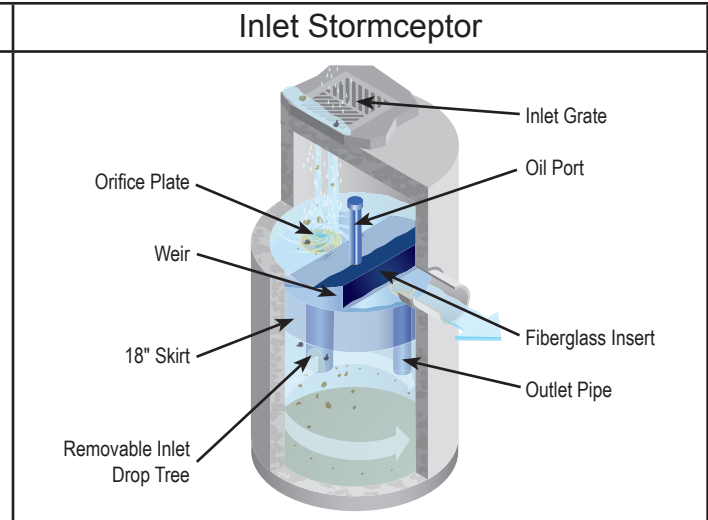


Figure 2.



- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/ approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe’s invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2**. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (in.)	EOS Model	Insert to Base (in.)	OSR Model	Insert to Base (in.)	Typical STF m (in.)
450	60	4-175	60	65	60	1.5 (60)
900	55	9-365	55	140	55	1.5 (61)
1200	71	12-590	71			1.8 (73)
1800	105	18-1000	105			2.9 (115)
2400	94	24-1400	94	250	94	2.3 (89)
3600	134	36-1700	134			3.2 (127)
4800	128	48-2000	128	390	128	2.9 (113)
6000	150	60-2500	150			3.5 (138)
7200	134	72-3400	134	560	134	3.3 (128)
11000*	128	110-5000*	128	780*	128	
13000*	150	130-6000*	150			
16000*	134	160-7800*	134	1125*	134	

Notes:

1. Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.

*Consist of two chamber structures in series.

Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (m)	EOS Model	Insert to Base (m)	OSR Model	Insert to Base (m)	Typical STF m (in.)
300	1.5	300	1.5	300	1.7	1.5 (60)
750	1.5	750	1.5	750	1.6	1.5 (61)
1000	1.8	1000	1.8			1.8 (73)
1500	2.8					2.9 (115)
2000	2.8	2000	2.8	2000	2.6	2.3 (89)
3000	3.7	3000	3.7			3.2 (127)
4000	3.4	4000	3.4	4000	3.6	2.9 (113)
5000	4.0	5000	4.0			3.5 (138)
6000	3.7	6000	3.7	6000	3.7	3.3 (128)
9000*	3.4	9000*	3.4	9000*	3.6	
11000*	4.0	10000*	4.0			
14000*	3.7	14000*	3.7	14000*	3.7	

Notes:

1. Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.

**Consist of two chamber structures in series.*

Table 2A. (US) Storage Capacities

STC Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft ³	EOS Model	Hydrocarbon Storage Capacity gal	OSR Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft ³
450	86	46	4-175	175	065	115	46
900	251	89	9-365	365	140	233	58
1200	251	127	12-590	591			
1800	251	207	18-1000	1198			
2400	840	205	24-1400	1457	250	792	156
3600	840	373	36-1700	1773			
4800	909	543	48-2000	2005	390	1233	465
6000	909	687	60-2500	2514			
7200	1059	839	72-3400	3418	560	1384	690
11000*	2797	1089	110-5000*	5023	780*	2430	930
13000*	2797	1374	130-6000*	6041			
16000*	3055	1677	160-7800*	7850	1125*	2689	1378

Notes:

1. Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

**Consist of two chamber structures in series.*

Table 2B. (CA & Int'l) Storage Capacities

STC Model	Hydrocarbon Storage Capacity	Sediment Capacity	EOS Model	Hydrocarbon Storage Capacity	OSR Model	Hydrocarbon Storage Capacity	Sediment Capacity
	L	L		L		L	L
300	300	1450	300	662	300	300	1500
750	915	3000	750	1380	750	900	3000
1000	915	3800	1000	2235			
1500	915	6205					
2000	2890	7700	2000	5515	2000	2790	7700
3000	2890	11965	3000	6710			
4000	3360	16490	4000	7585	4000	4700	22200
5000	3360	20940	5000	9515			
6000	3930	26945	6000	12940	6000	5200	26900
9000*	10555	32980	9000*	19010	9000*	9300	33000
11000*	10555	37415	10000*	22865			
14000*	11700	53890	14000*	29715	14000*	10500	53900

Notes:

1. Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

**Consist of two chamber structures in series.*

4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor’s patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit’s total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

What equipment is typically required for inspection?

- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Recommended Stormceptor Inspection Procedure:

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.

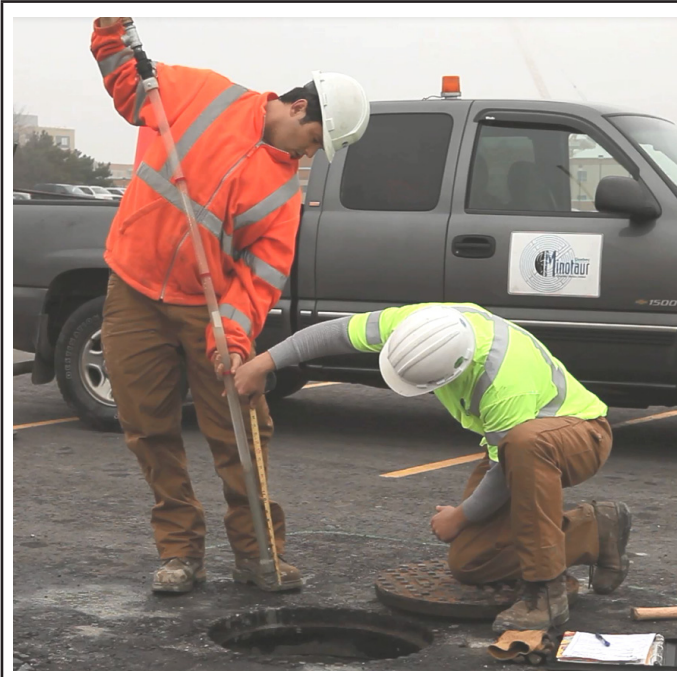
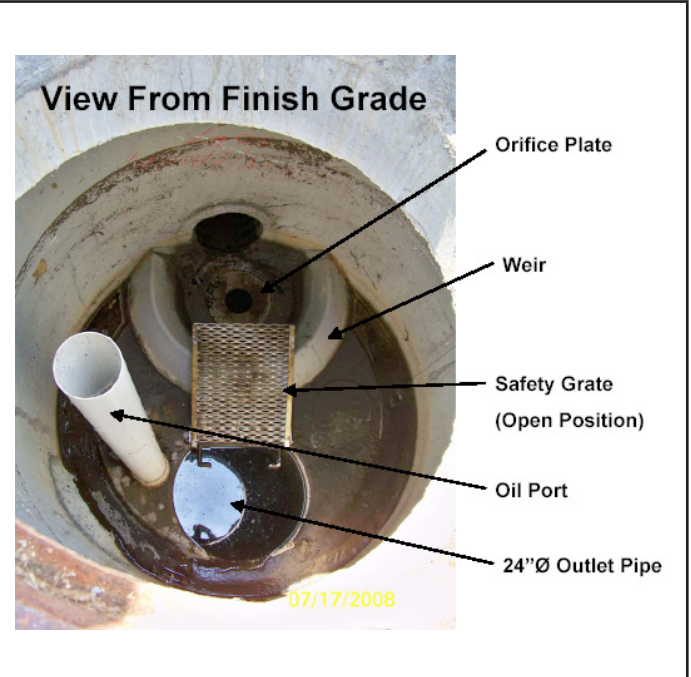


Figure 4.



What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically 3/4-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. **DO NOT ENTER THE STORMCEPTOR CHAMBER** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
 - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
 - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

Figure 5.

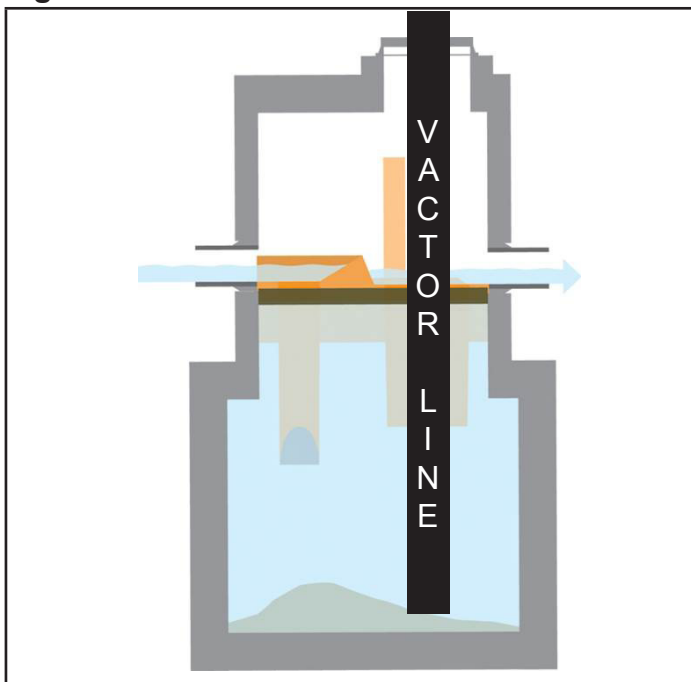
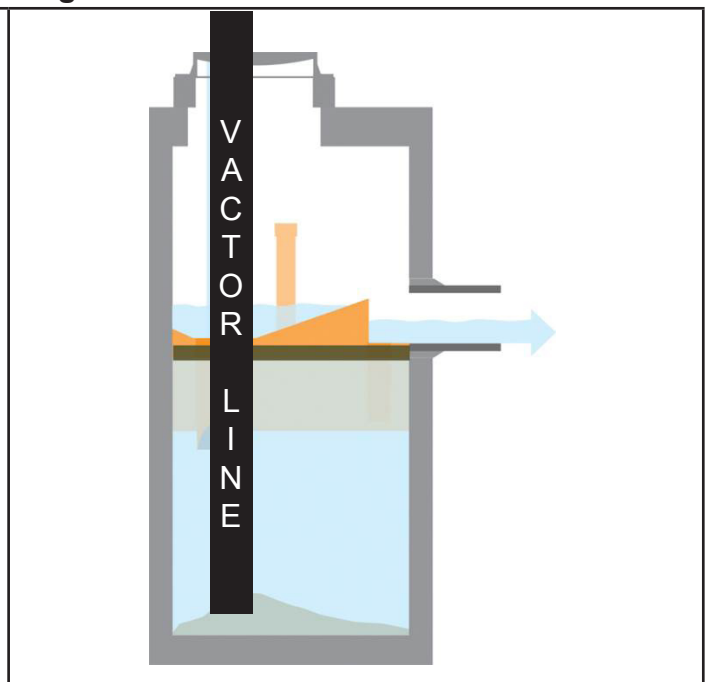


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

Figure 7.



Figure 8.



A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at

very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that the unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?

The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?

Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

Table 3A. (US) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (in)	EOS Model	Maintenance Sediment depth (in)	Oil Storage Depth (in)	OSR Model	Maintenance Sediment depth (in)
450	8	4-175	9	24	065	8
900	8	9-365	9	24	140	8
1200	10	12-590	11	39		
1800	15					
2400	12	24-1400	14	68	250	12
3600	17	36-1700	19	79		
4800	15	48-2000	16	68	390	17
6000	18	60-2500	20	79		
7200	15	72-3400	17	79	560	17
11000*	17	110-5000*	16	68	780*	17
13000*	20	130-6000*	20	79		
16000*	17	160-7800*	17	79	1125*	17

Note:

1. The values above are for typical standard units.

*Per structure.

Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (mm)	EOS Model	Maintenance Sediment depth (mm)	Oil Storage Depth (mm)	OSR Model	Maintenance Sediment depth (mm)
300	225	300	225	610	300	200
750	230	750	230	610	750	200
1000	275	1000	275	990		
1500	400					
2000	350	2000	350	1727	2000	300
3000	475	3000	475	2006		
4000	400	4000	400	1727	4000	375
5000	500	5000	500	2006		
6000	425	6000	425	2006	6000	375
9000*	400	9000*	400	1727	9000*	425
11000*	500	10000*	500	2006		
14000*	425	14000*	425	2006	14000*	425

Note:

1. The values above are for typical standard units.

*Per structure.

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor’s long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: _____

Allowable Sediment Depth: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Other Comments: _____

Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

Stormceptor Licensees:

CANADA

Lafarge Canada Inc.
www.lafargepipe.com
403-292-9502 / 1-888-422-4022
780-468-5910
204-958-6348

Calgary, AB
Edmonton, AB
Winnipeg, MB, NW. ON, SK

Langley Concrete Group
www.langleyconcretigroup.com
604-502-5236

BC

Hanson Pipe & Precast Inc.
www.hansonpipeandprecast.com
519-622-7574 / 1-888-888-3222

ON

Lécuyer et Fils Ltée.
www.lecuyerbeton.com
450-454-3928 / 1-800-561-0970

QC

Strescon Limited
www.strescon.com
902-494-7400
506-633-8877

NS, NF
NB, PE

UNITED STATES

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

AUSTRALIA & SOUTHEAST ASIA, including New Zealand & Japan

Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

Imbrium Systems Inc. & Imbrium Systems LLC

Canada 1-416-960-9900 / 1-800-565-4801
United States 1-301-279-8827 / 1-888-279-8826
International +1-416-960-9900 / +1-301-279-8827
Email info@imbriumsystems.com

www.imbriumsystems.com
www.stormceptor.com

Stormceptor[®]
-----**STC**

Technical Manual



Stormceptor Design Notes

- Only the STC 300i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 300i to STC 6000 may accommodate multiple inlet pipes.

Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences			
Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

Maximum inlet and outlet pipe diameters:

Inlet/Outlet Configuration	Inlet Unit STC 300i	In-Line Unit STC 750 to 6000	Series* STC 9000 to 14000
Straight Through	24 inch (600 mm)	42 inch (1050 mm)	60 inch (1500 mm)
Bend (90 degrees)	18 inch (375 mm)	33 inch (825 mm)	42 inch (1050 mm)

- The inlet an din-line Stormceptor units can accommodate turns to a maximum of 90 degrees.
- Minimum distance from top of grade to invert is 1.2 m
- Submerged conditions. A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative and provide the following information:
 - Top of grade elevation
 - Stormceptor inlet and outlet pipe diameters and invert elevations
 - Standing water elevation
- Stormceptor head loss, $K = 1.3$

For technical assistance and pricing, please contact:

Imbrium Systems Inc.

Tel: 800-565-4801

www.imbriumsystems.com

Design Worksheet

PROJECT INFORMATION

Date: _____ Project Number: _____ Project Name: _____ City/Town: _____ Development Type: _____ Province: _____	Total Drainage Area: _____ hectares Impervious _____ % Upstream Quantity Control (A2): YES NO Is the unit submerged (C4): YES NO Describe Land Cover: _____ Describe Land Use: _____
---	---

A. DESIGN FOR TOTAL SUSPENDED SOLIDS REMOVAL

Units are sized for TSS removal. All units are designed for spills capture for hydrocarbon with a specific gravity of 0.86.

A1. Identify Water Quality Objective:

Desired Water Quality Objective: _____	% Annual TSS Removal
--	----------------------

A2. If upstream quantity control exists, identify stage storage and discharge information:

	Elevation (m)	Storage (ha-m)	Discharge (m ³ /s)
Permanent Water Level	_____	_____	_____
5 year	_____	_____	_____
10 year	_____	_____	_____
25 year	_____	_____	_____
100 year	_____	_____	_____

A3. Select Particle Size Distribution:

Fine Distribution

Coarse Distribution

Particle Size um	Distribution %	Particle Size um	Distribution %
20	20	150	60
60	20	400	20
150	20	2000	20
400	20		
2000	20		

User Defined Particle Size Distribution

Identify particle size distribution
(please contact your local Stormceptor representative)

Particle Size um	Distribution %	Specific Gravity

A4. Enter all parameters from items A1 to A3 into PCSWMM for Stormceptor to select the model that meets the water quality objective.

SUMMARY OF STORMCEPTOR REQUIREMENTS FOR TSS REMOVAL

Stormceptor Model: _____	
Annual TSS Removed: _____	%
Annual Runoff Captured: _____	%

B. STORMCEPTOR SITING CONSIDERATIONS

B1. Difference Between Inlet and Outlet Invert Elevations:

Number of Inlet Pipes	Inlet Unit STC 300	In-line STC 750 to STC 6000	Series STC 10000 to STC 14000
One	75 mm	25 mm	75 mm
>1	75 mm	75 mm	N/A

B2. Other considerations:

Minimum Distance From Top of Grade to Invert Elevation	1.2 m
Bends:	The inlet and in-line Stormceptor units can accommodate turns to a maximum of 90 degrees
Multiple Inlet Pipe:	Yes for Inlet and In-Line Stormceptor Units. Please contact your local affiliate for more details
Inlet Covers	Only the STC 300 can accommodate a catch basin frame and cover.

B3. Standard maximum inlet and outlet pipe diameters:

Inlet/Outlet Configuration	Inlet Unit STC 300	In-line STC 750 to STC 6000	Series STC 10000 to STC 14000
Straight Through	600 mm	1050 mm	2400 mm
Bend	450 mm	825 mm	1050 mm

Please contact your local Stormceptor representative for larger pipe diameters.

B4. Submerged conditions:

A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative for further assistance.

STORMCEPTOR® QUOTATION AND ORDER FORM

Quotation No: _____

Date: _____

Project Information:

Project Number: _____

Project Name: _____

Closing Date: _____

Jobsite Address: _____

Municipality: _____

Contractor Information

Contact Name: _____

Company: _____

Phone No: _____

Fax No: _____

E-mail: _____

Consultant Information:

Contact Name: _____

Company: _____

Phone No: _____

Fax No: _____

E-mail: _____

Owner Information (Required for Maintenance):

Contact Name: _____

Company: _____

Phone No: _____

Fax No: _____

E-mail: _____

Land Use (Check one):

- Commercial Gas Station Government Industrial Military
 Street Residential Transportation Other

STORMCEPTOR INFORMATION

Structure No.: _____

Top of Grate Elev.: _____

Outlet Invert Elev.: _____

Inlet invert Elev.: _____

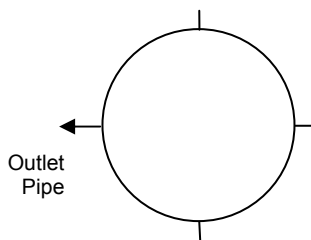
Outlet Pipe Material: _____

Inlet Pipe Material: _____

STORMCEPTOR MODEL REQUIRED (circle model number)

INLET SYSTEM

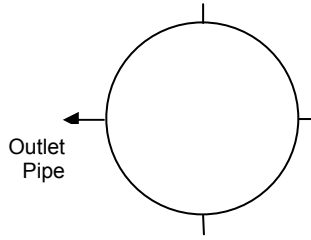
STC 300



Show Orientation of Inlet Pipe

IN-LINE SYSTEM

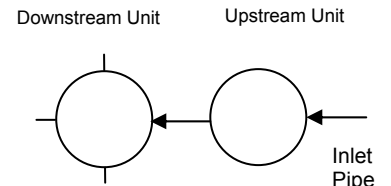
STC 750	STC 1000	STC 1500
STC 2000	STC 3000	STC 4000
STC 5000	STC 6000	



Show Orientation of Inlet Pipe

SERIES SYSTEM

STC 9000	STC 11000
STC 14000	



Show Orientation of Outlet Pipe on Downstream Unit

Please complete the attached form and fax to (416) 960-5637 or your local manufacturer
www.imbriumsystems.com

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1. About Stormceptor

The Stormceptor® (Standard Treatment Cell) was developed by Imbrium™ Systems to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

The development of the Stormceptor STC revolutionized stormwater treatment, and created an entirely new category of environmental technology. Protecting thousands of waterways around the world, the Stormceptor System has set the standard for effective stormwater treatment.

1.1. Distribution Network

Imbrium Systems has partnered with a global network of affiliates who manufacture and distribute the Stormceptor System.

Canada

Ontario	Hanson Pipe & Precast Ltd	888-888-3222 www.hansonpipeandprecast.com
Québec	Lécuyer et Fils Ltée	(800) 561-0970 www.lecuyerbeton.com
New Brunswick / Prince Edward Island	Strescon Limited	(506) 633-8877 www.strescon.com
Newfoundland / Nova Scotia	Strescon Limited	(902) 494-7400 www.strescon.com
Western Canada	Lafarge Canada Inc.	(888) 422-4022 www.lafargepipe.com
British Columbia	Langley Concrete Group	(604) 533-1656 www.langleyconcretegroup.com

1.2. Patent Information

The Stormceptor technology is protected by the following patents:

- **Australia Patent No.** 693,164 • 707,133 • 729,096 • 779401
- **Austrian Patent No.** 289647
- **Canadian Patent No** 2,009,208 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending)
- **China Patent No** 1168439
- **Denmark** DK 711879
- **German** DE 69534021
- **Indonesian Patent No** 16688
- **Japan Patent No** 9-11476 (Pending)
- **Korea** 10-2000-0026101 (Pending)
- **Malaysia Patent No** PI9701737 (Pending)
- **New Zealand Patent No** 314646
- **United States Patent No** 4,985,148 • 5,498,331 • 5,725,760 • 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690
- **Stormceptor OSR** Patent Pending • **Stormceptor LCS** Patent Pending

1.3. Contact Imbrium Systems

Contact us today if you require more information on other products:

Imbrium Systems Inc.

2 St. Clair Ave. West
Suite 2100
Toronto, On M4V 1L5

T 800 565 4801
info@imbriumsystems.com
www.imbriumsystems.com

2. Stormceptor Design Overview

2.1. Design Philosophy

The patented Stormceptor System has been designed focus on the environmental objective of providing long-term pollution control. The unique and innovative Stormceptor design allows for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

An integral part of the Stormceptor design is PCSWMM for Stormceptor - sizing software developed in conjunction with Computational Hydraulics Inc. (CHI) and internationally acclaimed expert, Dr. Bill James. Using local historical rainfall data and continuous simulation modeling, this software allows a Stormceptor unit to be designed for each individual site and the corresponding water quality objectives.

By using PCSWMM for Stormceptor, the Stormceptor System can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

2.2. Benefits

The Stormceptor System removes free oil and suspended solids from stormwater, preventing spills and non-point source pollution from entering downstream lakes and rivers. The key benefits, capabilities and applications of the Stormceptor System are as follows:

- Provides continuous positive treatment during all rainfall events
- Can be designed to remove over 80% of the annual sediment load
- Removes a wide range of particles
- Can be designed to remove a specific particle size distribution (PSD)
- Captures free oil from stormwater
- Prevents scouring or re-suspension of trapped pollutants
- Pre-treatment to reduce maintenance costs for downstream treatment measures (ponds, swales, detention basins, filters)
- Groundwater recharge protection
- Spills capture and mitigation
- Simple to design and specify
- Designed to your local watershed conditions
- Small footprint to allow for easy retrofit installations
- Easy to maintain (vacuum truck)
- Multiple inlets can connect to a single unit
- Suitable as a bend structure
- Pre-engineered for traffic loading (minimum CHBDC)
- Minimal elevation drop between inlet and outlet pipes
- Small head loss
- Additional protection provided by an 18" (457 mm) fiberglass skirt below the top of the insert, for the containment of hydrocarbons in the event of a spill.

2.3. Environmental Benefit

Freshwater resources are vital to the health and welfare of their surrounding communities. There is increasing public awareness, government regulations and corporate commitment to reducing the pollution entering our waterways. A major source of this pollution originates from stormwater runoff from urban areas. Rainfall runoff carries oils, sediment and other contaminants from roads and parking lots discharging directly into our streams, lakes and coastal waterways.

The Stormceptor System is designed to isolate contaminants from getting into the natural environment. The Stormceptor technology provides protection for the environment from spills that occur at service stations and vehicle accident sites, while also removing contaminated sediment in runoff that washes from roads and parking lots.

3. Key Operation Features

3.1. Scour Prevention

A key feature of the Stormceptor System is its patented scour prevention technology. This innovation ensures pollutants are captured and retained during all rainfall events, even extreme storms. The Stormceptor System provides continuous positive treatment for all rainfall events, including intense storms. Stormceptor slows incoming runoff, controlling and reducing velocities in the lower chamber to create a non-turbulent environment that promotes free oils and floatable debris to rise and sediment to settle.

The patented scour prevention technology, the fiberglass insert, regulates flows into the lower chamber through a combination of a weir and orifice while diverting high energy flows away through the upper chamber to prevent scouring. Laboratory testing demonstrated no scouring when tested up to 125% of the unit's operating rate, with the unit loaded to 100% sediment capacity (NJDEP, 2005). Second, the depth of the lower chamber ensures the sediment storage zone is adequately separated from the path of flow in the lower chamber to prevent scouring.

3.2. Operational Hydraulic Loading Rate

Designers and regulators need to evaluate the treatment capacity and performance of manufactured stormwater treatment systems. A commonly used parameter is the "operational hydraulic loading rate" which originated as a design methodology for wastewater treatment devices.

Operational hydraulic loading rate may be calculated by dividing the flow rate into a device by its settling area. This represents the critical settling velocity that is the prime determinant to quantify the influent particle size and density captured by the device. PCSWMM for Stormceptor uses a similar parameter that is calculated by dividing the hydraulic detention time in the device by the fall distance of the sediment.

$$v_{SC} = \frac{H}{\theta_H} = \frac{Q}{A_S}$$

Where:

v_{SC} = critical settling velocity, ft/s (m/s)

H = tank depth, ft (m)

θ_H = hydraulic detention time, ft/s (m/s)

Q = volumetric flow rate, ft³/s (m³/s)

A_S = surface area, ft² (m²)

(Tchobanoglous, G. and Schroeder, E.D. 1987. Water Quality. Addison Wesley.)

Unlike designing typical wastewater devices, stormwater systems are designed for highly variable flow rates including intense peak flows. PCSWMM for Stormceptor incorporates all of the flows into its calculations, ensuring that the operational hydraulic loading rate is considered not only for one flow rate, but for all flows including extreme events.

3.3. Double Wall Containment

The Stormceptor System was conceived as a pollution identifier to assist with identifying illicit discharges. The fiberglass insert has a continuous skirt that lines the concrete barrel wall for a depth of 18 inches (406 mm) that provides double wall containment for hydrocarbons storage. This protective barrier ensures that toxic floatables do not migrate through the concrete wall and the surrounding soils.

4. Stormceptor Product Line

4.1. Stormceptor Models

A summary of Stormceptor models and capacities are listed in Table 1.

Table 1. Canadian Stormceptor Models

Stormceptor Model	Total Storage Volume Imp. Gal (L)	Hydrocarbon Storage Capacity Imp. Gal (L)	Maximum Sediment Capacity Imp. Gal (L)
STC 300i	470 (1 775)	66 (300)	319 (1 450)
STC 750	895 (4 070)	46 (915)	660 (3 000)
STC 1000	1,070 (4 871)	46 (915)	836 (3 800)
STC 1500	1,600 (7 270)	46 (915)	1,365 (6 205)
STC 2000	2,420 (6 205)	636 (2 890)	1,300 (7 700)
STC 3000	3,355 (15 270)	636 (2 890)	1,694 (11 965)
STC 4000	4,450 (20 255)	739 (3 360)	3,627 (16 490)
STC 5000	5,435 (24 710)	739 (3 360)	4,606 (20 940)
STC 6000	6,883 (31 285)	864 (3 930)	5,927 (26 945)
STC 9000	9,758 (44 355)	2,322 (10 555)	7,255 (32 980)
STC 10000	10,734 (48 791)	2,322 (10 555)	8,230 (37 415)
STC 14000	14,610 (66 410)	2,574 (11 700)	11,854 (53 890)

NOTE: Storage volumes may vary slightly from region to region. For detailed information, contact your local Stormceptor representative.

4.2. Inline Stormceptor

The Inline Stormceptor, Figure 1, is the standard design for most stormwater treatment applications. The patented Stormceptor design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.

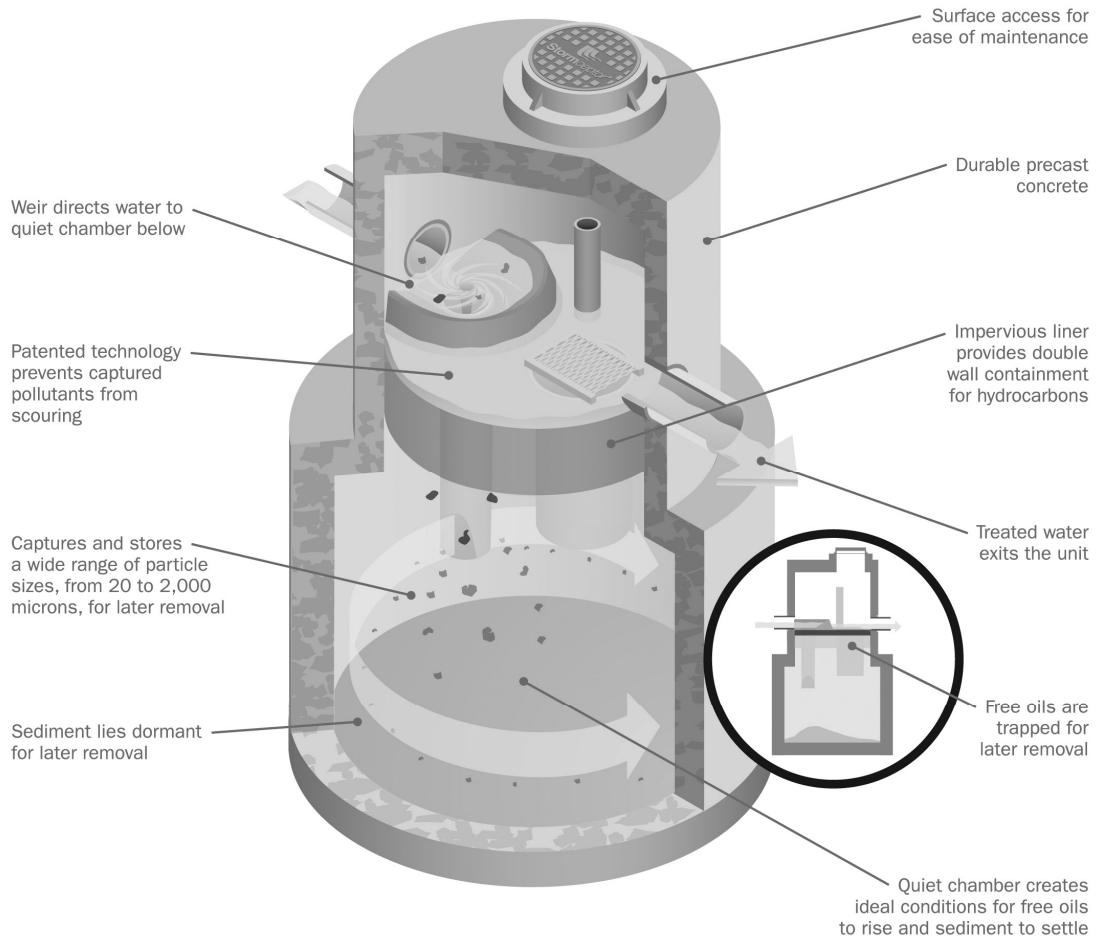


Figure 1. Inline Stormceptor

Operation

As water flows into the Stormceptor unit, it is slowed and directed to the lower chamber by a weir and drop tee. The stormwater enters the lower chamber, a non-turbulent environment, allowing free oils to rise and sediment to settle. The oil is captured underneath the fiberglass insert and shielded from exposure to the concrete walls by a fiberglass skirt. After the pollutants separate, treated water continues up a riser pipe, and exits the lower chamber on the downstream side of the weir before leaving the unit. During high flow events, the Stormceptor System's patented scour prevention technology ensures continuous pollutant removal and prevents re-suspension of previously captured pollutants.

4.3. Inlet Stormceptor

The Inlet Stormceptor System, Figure 2, was designed to provide protection for parking lots, loading bays, gas stations and other spill-prone areas. The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

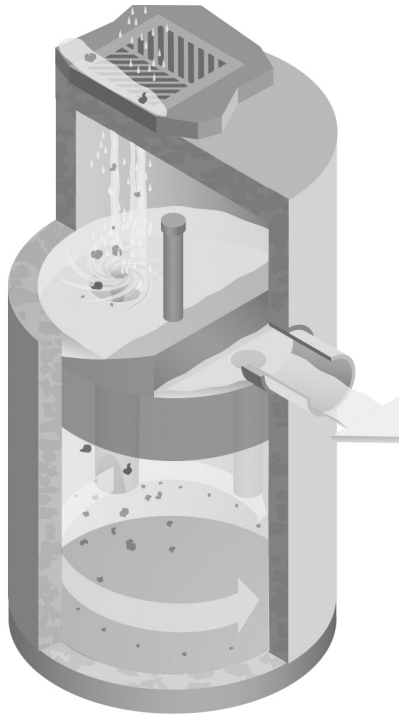


Figure 2. Inlet Stormceptor

The Inlet Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

4.4. Series Stormceptor

Designed to treat larger drainage areas, the Series Stormceptor System, Figure 3, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.

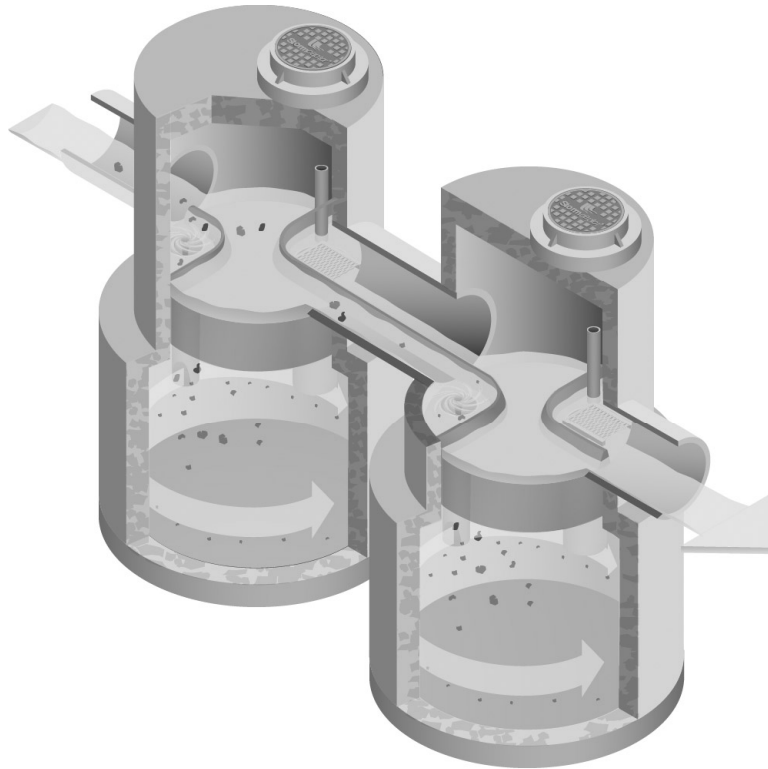


Figure 3. Series System

The Series Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

5. Sizing the Stormceptor System

The Stormceptor System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the Stormceptor model to meet the demands of each individual site in an efficient and cost-effective manner.

PCSWMM for Stormceptor is the support tool used for identifying the appropriate Stormceptor model. In order to size a unit, it is recommended the user follow the seven design steps in the program. The steps are as follows:

STEP 1 – Project Details

The first step prior to sizing the Stormceptor System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution.

STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

STEP 3 – Upstream Attenuation

The Stormceptor System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control devices such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a Stormceptor unit upstream of a detention facility. By placing the Stormceptor unit upstream of a detention structure, a benefit of less maintenance of the detention facility is realized.

STEP 4 – Particle Size Distribution

It is critical that the PSD be defined as part of the water quality objective. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for Stormceptor. The default particle size distribution is the Fine Distribution, Table 2, option.

Table 2. Fine Distribution

Particle Size	Distribution	Specific Gravity
20	20%	1.3
60	20%	1.8
150	20%	2.2
400	20%	2.65
2000	20%	2.65

If the objective is the long-term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site.

Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the U.S. National Oceanic and Atmospheric Administration, Environment Canada and regulatory agencies across North America. The rainfall data provided with PCSMM for Stormceptor provides an accurate estimation of small storm hydrology by modeling actual historical storm events including duration, intensities and peaks.

STEP 6 – Summary

At this point, the program may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each Stormceptor unit.

STEP 7 – Sizing Summary

Performance estimates of all Stormceptor units for the given site parameters will be displayed in a tabular format. The unit that meets the water quality objective, identified in Step 1, will be highlighted.

5.1. PCSWMM for Stormceptor

The Stormceptor System has been developed in conjunction with PCSWMM for Stormceptor as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal.

PCSWMM for Stormceptor is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids removal. The model has been calibrated to field monitoring results from Stormceptor units that have been monitored in North America. The sizing methodology can be described by three processes:

1. Determination of real time hydrology
2. Buildup and wash off of TSS from impervious land areas
3. TSS transport through the Stormceptor (settling and discharge) The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:
 - a. The hydrology of the local area is properly and **accurately** incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back-to-back storms, inter-event times)
 - b. The distribution of TSS with the hydrology is properly and **accurately** considered in the sizing
 - c. Particle size distribution is properly considered in the sizing
 - d. The sizing can be optimized for TSS removal
 - e. The cost benefit of alternate TSS removal criteria can be easily assessed
 - f. The program assesses the performance of all Stormceptor models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding PCSWMM for Stormceptor, contact your local Stormceptor representative, or visit www.imbriumsystems.com to download a free copy of the program.

5.2. Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time and wash off with the next rainfall. When rainfall patterns are

examined, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device.

Typical Sites

For standard site design of the Stormceptor System, PCSWMM for Stormceptor is utilized to accurately assess the unit's performance. As an integral part of the product's design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non-erodible surfaces.

Unstable Sites

While standard sites consist of stable concrete or asphalt surfaces, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as "unstable". These types of sites do not exhibit first flush characteristics, are highly erodible and exhibit atypical sediment loading characteristics and must therefore be sized more carefully. Contact your local Stormceptor representative for assistance in selecting proper unit size for such unstable sites.

6. Spill Controls

When considering the removal of total petroleum hydrocarbons (TPH) from a storm sewer system there are two functions of the system: oil removal, and spill capture.

'Oil Removal' describes the capture of the minute volumes of free oil mobilized from impervious surfaces. In this instance relatively low concentrations, volumes and flow rates are considered. While the Stormceptor unit will still provide an appreciable oil removal function during higher flow events and/or with higher TPH concentrations, desired effluent limits may be exceeded under these conditions.

'Spill Capture' describes a manner of TPH removal more appropriate to recovery of a relatively high volume of a single phase deleterious liquid that is introduced to the storm sewer system over a relatively short duration. The two design criteria involved when considering this manner of introduction are overall volume and the specific gravity of the material. A standard Stormceptor unit will be able to capture and retain a maximum spill volume and a minimum specific gravity.

For spill characteristics that fall outside these limits, unit modifications are required. Contact your local Stormceptor Representative for more information.

One of the key features of the Stormceptor technology is its ability to capture and retain spills. While the standard Stormceptor System provides excellent protection for spill control, there are additional options to enhance spill protection if desired.

6.1. Oil Level Alarm

The oil level alarm is an electronic monitoring system designed to trigger a visual and audible alarm when a pre-set level of oil is reached within the lower chamber. As a standard, the oil

level alarm is designed to trigger at approximately 85% of the unit's available depth level for oil capture. The feature acts as a safeguard against spills caused by exceeding the oil storage capacity of the separator and eliminates the need for manual oil level inspection. The oil level alarm installed on the Stormceptor insert is illustrated in Figure 4.

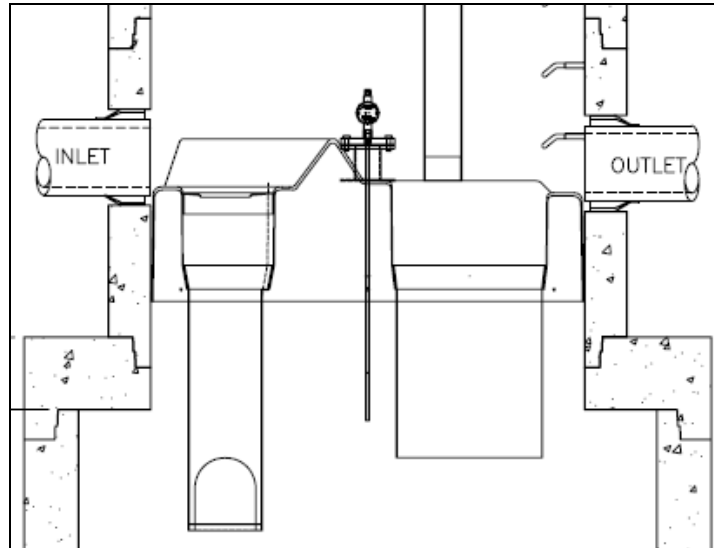


Figure 4. Oil level alarm

6.2. Increased Volume Storage Capacity

The Stormceptor unit may be modified to store a greater spill volume than is typically available. Under such a scenario, instead of installing a larger than required unit, modifications can be made to the recommended Stormceptor model to accommodate larger volumes. Contact your local Stormceptor representative for additional information and assistance for modifications.

7. Stormceptor Options

The Stormceptor System allows flexibility to incorporate to existing and new storm drainage infrastructure. The following section identifies considerations that should be reviewed when installing the system into a drainage network. For conditions that fall outside of the recommendations in this section, please contact your local Stormceptor representative for further guidance.

7.1. Installation Depth / Minimum Cover

The minimum distance from the top of grade to the crown of the inlet pipe is 24 inches (600 mm). For situations that have a lower minimum distance, contact your local Stormceptor representative.

7.2. Maximum Inlet and Outlet Pipe Diameters

Maximum inlet and outlet pipe diameters are illustrated in Figure 5. Contact your local Stormceptor representative for larger pipe diameters.

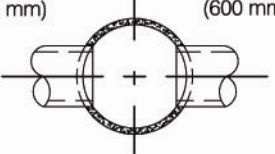
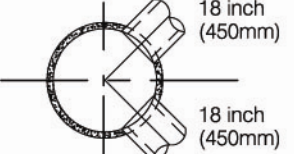
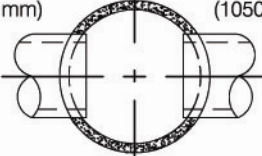
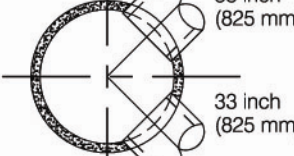

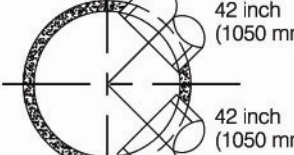
Upper Chamber Diameter	Maximum Pipe Diameters for Straight Through and 90° Bends (Based on Concrete Pipe)	
Inlet Stormceptor	24 inch (600 mm)  24 inch (600 mm)	 18 inch (450mm) 18 inch (450mm)
Inline Stormceptor	42 inch (1050 mm)  42 inch (1050 mm)	 33 inch (825 mm) 33 inch (825 mm)
Inline Stormceptor or Series Stormceptor	60 inch (1500 mm)  60 inch (1500 mm)	 42 inch (1050 mm) 42 inch (1050 mm)

Figure 5. Maximum pipe diameters for straight through and bend applications.

*The bend should only be incorporated into the second structure (downstream structure) of the Series Stormceptor System

7.3. Bends

The Stormceptor System can be used to change horizontal alignment in the storm drain network up to a maximum of 90 degrees. Figure 6 illustrates the typical bend situations for the Stormceptor System. Bends should only be applied to the second structure (downstream structure) of the Series Stormceptor System.

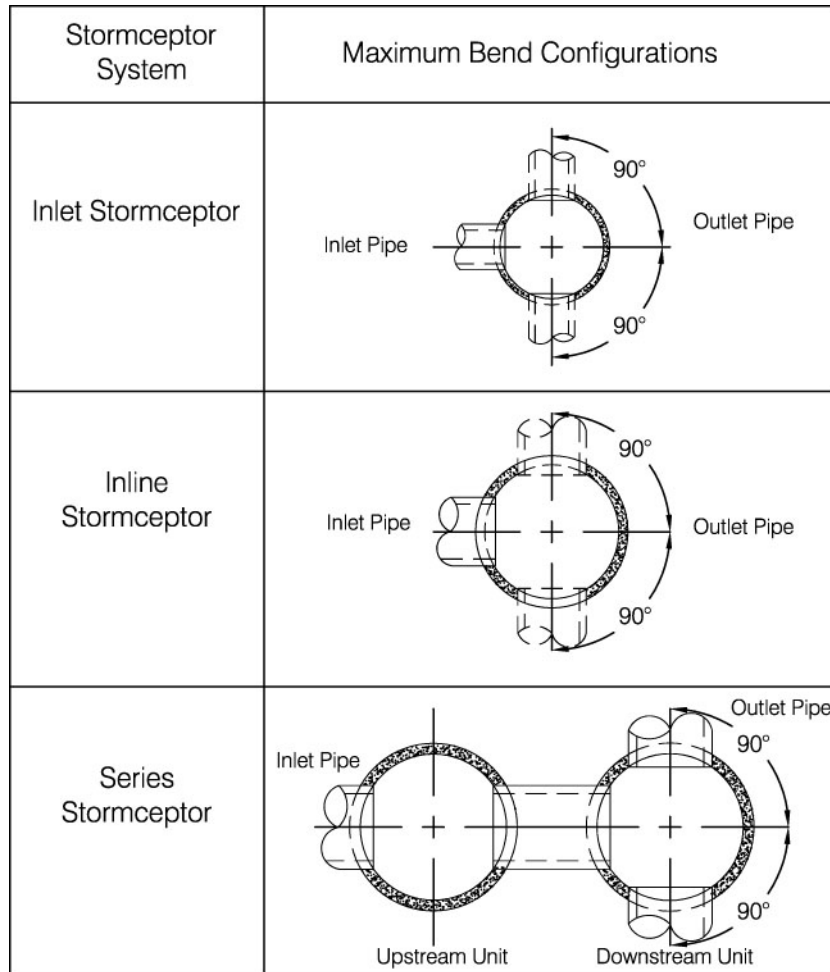


Figure 6. Maximum bend angles.

7.4. Multiple Inlet Pipes

The Inlet and Inline Stormceptor System can accommodate two or more inlet pipes. The maximum number of inlet pipes that can be accommodated into a Stormceptor unit is a function of the number, alignment and diameter of the pipes and its effects on the structural integrity of the precast concrete. When multiple inlet pipes are used for new developments, each inlet pipe shall have an invert elevation 3 inches (75 mm) higher than the outlet pipe invert elevation.

7.5. Inlet/Outlet Pipe Invert Elevations

Recommended inlet and outlet pipe invert differences are listed in Table 3.

Table 3. Recommended drops between inlet and outlet pipe inverts.

Number of Inlet Pipes	Inlet System	Inline System	Series System
1	3 inches (75 mm)	1 inch (25 mm)	3 inches (75 mm)
>1	3 inches (75 mm)	3 inches (75 mm)	Not Applicable

7.6. Shallow Stormceptor

In cases where there may be restrictions to the depth of burial of storm sewer systems. In this situation, for selected Stormceptor models, the lower chamber components may be increased in diameter to reduce the overall depth of excavation required.

7.7. Customized Live Load

The Stormceptor system is typically designed for local highway truck loading (HS-20 in the US and CHBDC in Canada). In instances of other loads, the Stormceptor System may be customized structurally for a pre-specified live load. Contact your local Stormceptor representative for customized loading conditions.

7.8. Pre-treatment

The Stormceptor System may be sized to remove sediment and for spills control in conjunction with other stormwater BMPs to meet the water quality objective. For pretreatment applications, the Stormceptor System should be the first unit in a treatment train. The benefits of pre-treatment include the extension of the operational life (extension of maintenance frequency) of large stormwater management facilities, prevention of spills and lower total life-cycle maintenance cost.

7.9. Head loss

The head loss through the Stormceptor System is similar to a 60 degree bend at a maintenance hole. The K value for calculating minor losses is approximately 1.3 (minor loss = $k \cdot 1.3v^2/2g$). However, when a Submerged modification is applied to a Stormceptor unit, the corresponding K value is 4.

7.10. Submerged

The Submerged modification, Figure 7, allows the Stormceptor System to operate in submerged or partially submerged storm sewers. This configuration can be installed on all models of the Stormceptor System by modifying the fiberglass insert. A customized weir height and a secondary drop tee are added.

Submerged instances are defined as standing water in the storm drain system during zero flow conditions. In these instances, the following information is necessary for the proper design and application of submerged modifications:

- Stormceptor top of grade elevation
- Stormceptor outlet pipe invert elevation
- Standing water elevation

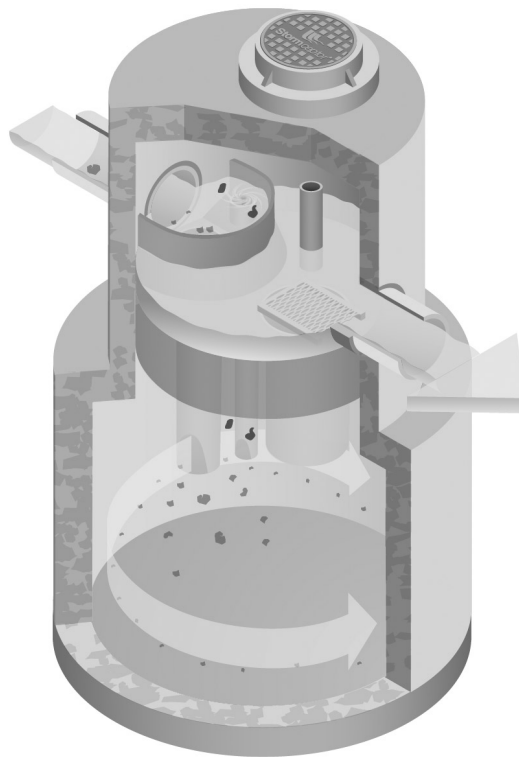


Figure 7. Submerged Stormceptor

8. Comparing Technologies

Designers have many choices available to achieve water quality goals in the treatment of stormwater runoff. Since many alternatives are available for use in stormwater quality treatment it is important to consider how to make an appropriate comparison between “approved alternatives”. The following is a guide to assist with the accurate comparison of differing technologies and performance claims.

8.1. Particle Size Distribution (PSD)

The most sensitive parameter to the design of a stormwater quality device is the selection of the design particle size. While it is recommended that the actual particle size distribution (PSD) for sites be measured prior to sizing, alternative values for particle size should be selected to represent what is likely to occur naturally on the site. A reasonable estimate of a particle size distribution likely to be found on parking lots or other impervious surfaces should consist of a wide range of particles such as 20 microns to 2,000 microns (*Ontario MOE, 1994*).

There is no absolute right particle size distribution or specific gravity and the user is cautioned to review the site location, characteristics, material handling practices and regulatory requirements when selecting a particle size distribution. When comparing technologies, designs using different PSDs will result in incomparable TSS removal

efficiencies. The PSD of the TSS removed needs to be standard between two products to allow for an accurate comparison.

8.2. Scour Prevention

In order to accurately predict the performance of a manufactured treatment device, there must be confidence that it will perform under all conditions. Since rainfall patterns cannot be predicted, stormwater quality devices placed in storm sewer systems must be able to withstand extreme events, and ensure that all pollutants previously captured are retained in the system.

In order to have confidence in a system's performance under extreme conditions, independent validation of scour prevention is essential when examining different technologies. Lack of independent verification of scour prevention should make a designer wary of accepting any product's performance claims.

8.3. Hydraulics

Full scale laboratory testing has been used to confirm the hydraulics of the Stormceptor System. Results of lab testing have been used to physically design the Stormceptor System and the sewer pipes entering and leaving the unit. Key benefits of Stormceptor are:

- Low head loss (typical k value of 1.3)
- Minimal inlet/outlet invert elevation drop across the structure
- Use as a bend structure
- Accommodates multiple inlets

The adaptability of the treatment device to the storm sewer design infrastructure can affect the overall performance and cost of the site.

8.4. Hydrology

Stormwater quality treatment technologies need to perform under varying climatic conditions. These can vary from long low intensity rainfall to short duration, high intensity storms. Since a treatment device is expected to perform under all these conditions, it makes sense that any system's design should accommodate those conditions as well.

Long-term continuous simulation evaluates the performance of a technology under the varying conditions expected in the climate of the subject site. Single, peak event design does not provide this information and is not equivalent to long-term simulation. Designers should request long-term simulation performance to ensure the technology can meet the long-term water quality objective.

9. Testing

The Stormceptor System has been the most widely monitored stormwater treatment technology in the world. Performance verification and monitoring programs are completed to the strictest standards and integrity. Since its introduction in 1990, numerous independent field tests and studies detailing the effectiveness of the Stormceptor System have been completed.

- Coventry University, UK – 97% removal of oil, 83% removal of sand and 73% removal of peat
- National Water Research Institute, Canada, - scaled testing for the development of the Stormceptor System identifying both TSS removal and scour prevention.
- New Jersey TARP Program – full scale testing of an STC 750/900 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The New Jersey Department of Environmental Protection laboratory testing protocol was followed.
- City of Indianapolis – full scale testing of an STC 750/900 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour.
- Westwood Massachusetts (1997), demonstrated >80% TSS removal
- Como Park (1997), demonstrated 76% TSS removal
- Ontario MOE SWAMP Program – 57% removal of 1 to 25 micron particles
- Laval Quebec – 50% removal of 1 to 25 micron particles

10. Installation

The installation of the concrete Stormceptor should conform in general to state highway, provincial or local specifications for the installation of maintenance holes. Selected sections of a general specification that are applicable are summarized in the following sections.

10.1. Excavation

Excavation for the installation of the Stormceptor should conform to state highway, provincial or local specifications. Topsoil removed during the excavation for the Stormceptor should be stockpiled in designated areas and should not be mixed with subsoil or other materials. Topsoil stockpiles and the general site preparation for the installation of the Stormceptor should conform to state highway, provincial or local specifications.

The Stormceptor should not be installed on frozen ground. Excavation should extend a minimum of 12 inches (300mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

10.2. Backfilling

Backfill material should conform to state highway, provincial or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300mm) in depth and compacted to state highway, provincial or local specifications.

11. Stormceptor Construction Sequence

The concrete Stormceptor is installed in sections in the following sequence:

1. Aggregate base
2. Base slab
3. Lower chamber sections
4. Upper chamber section with fiberglass insert
5. Connect inlet and outlet pipes
6. Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate)
7. Remainder of upper chamber
8. Frame and access cover

The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

12. Maintenance

12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs are provided for entry into the unit, if required

12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the table 4.

Table 4. Sediment Depths indicating required servicing.

Sediment Depths Indicating Required Servicing *	
Model (CAN)	Sediment Depth inches (mm)
300i	9 (225)
750	9 (230)
1000	11 (275)
1500	16 (400)
2000	14 (350)
3000	19 (475)
4000	16 (400)
5000	20 (500)
6000	17 (425)
9000	16 (400)
10000	20 (500)
14000	17 (425)
* based on 15% of the Stormceptor unit's total storage	

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port
2. Remove any oil separately using a small portable pump
3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

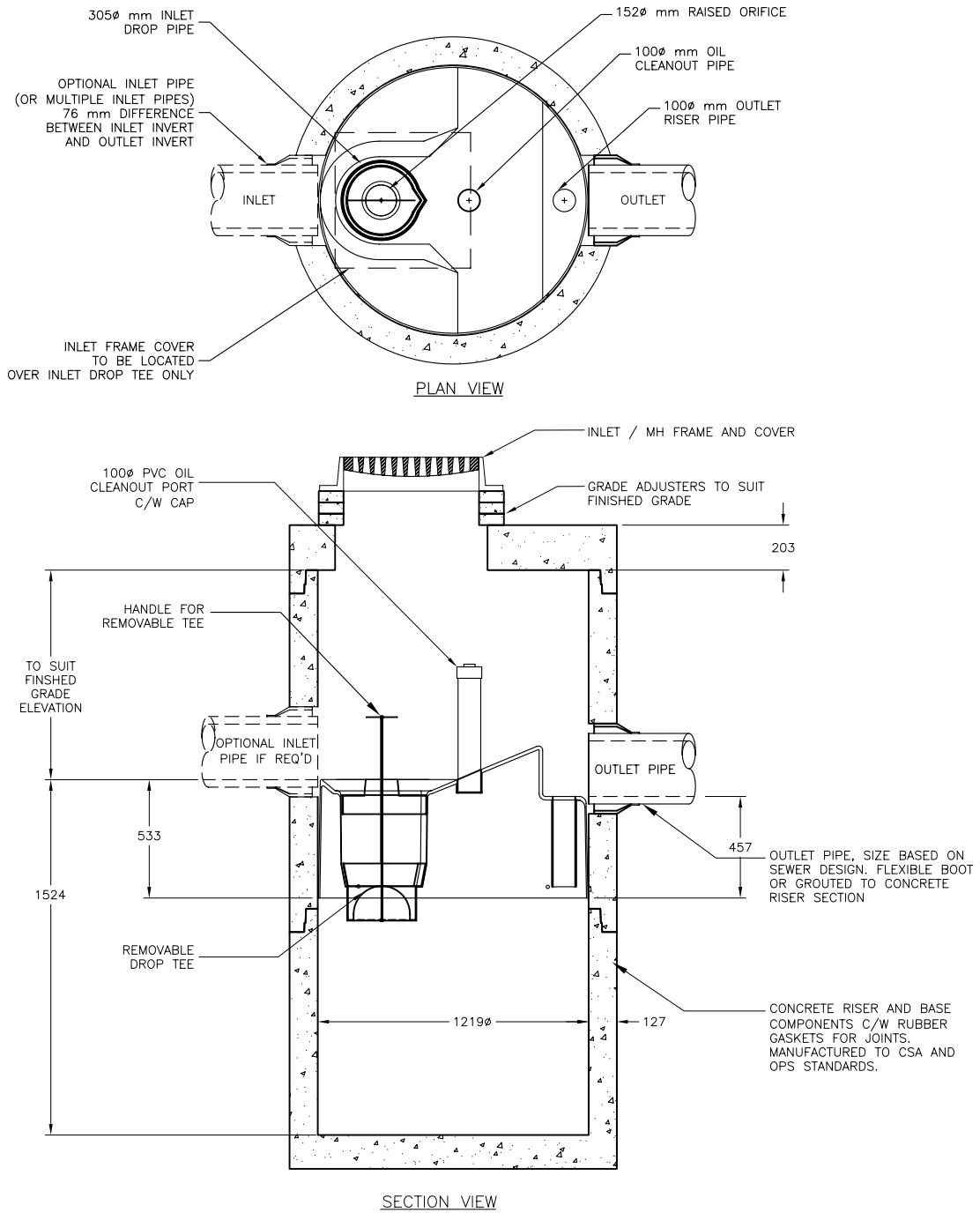
12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 ppm). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.


The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.

Appendix 1 Stormceptor Drawings

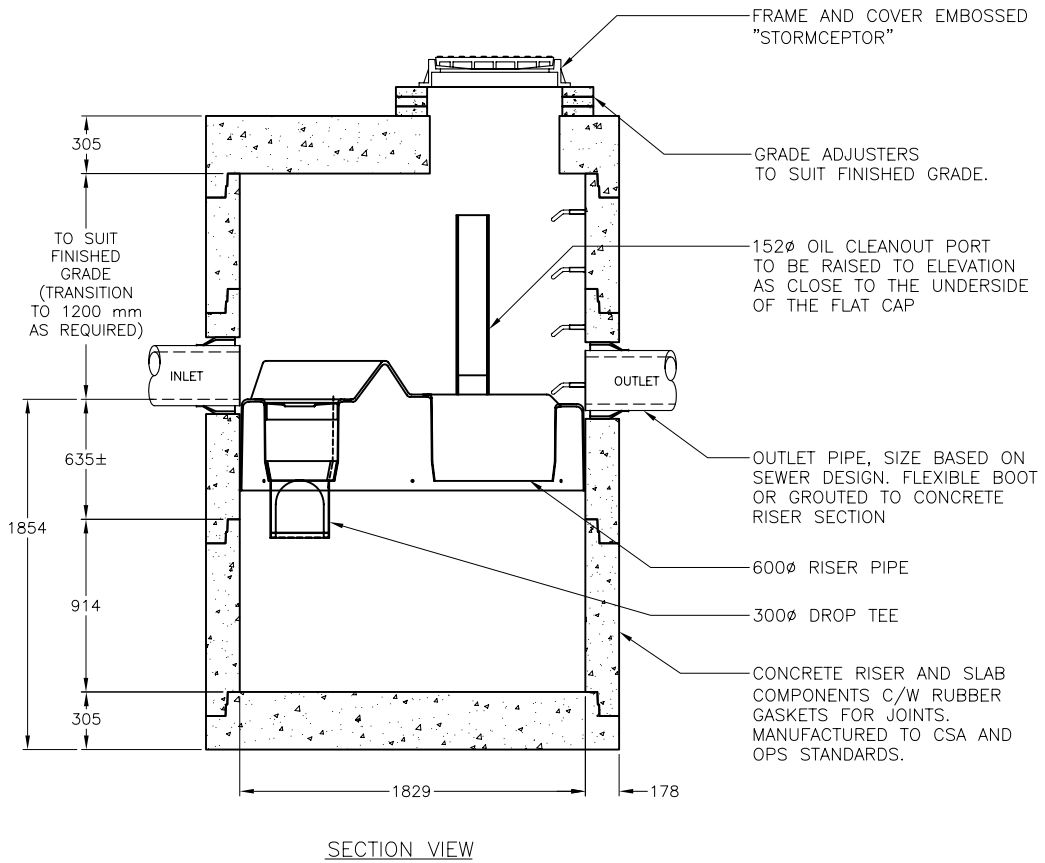
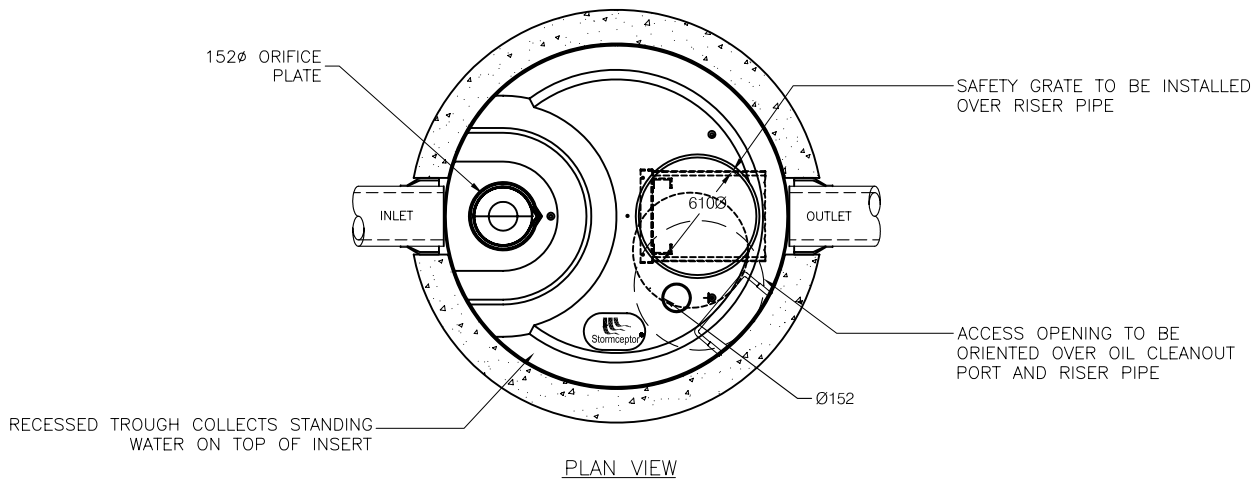
DRAWING NOT TO BE USED FOR CONSTRUCTION



THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS
 Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647 |
 Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending) |
 China Patent No. 1,168,439 | Denmark DK 711,879 | German DE 69,534,021 | Indonesian Patent No 16,688 | Japan Patent No. 9-11476 (Pending) |
 Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
 United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690


STORMCEPTOR STC INLET MODEL STC 300i	SCALE 1:30					 FILE: stc300.dwg DRAWN BY: B.L. DATE: 15 Aug 07		
REV	Y	M	D	DRN	CHK	DESCRIPTION	REV.:	1 OF 1

DRAWING NOT TO BE USED FOR CONSTRUCTION

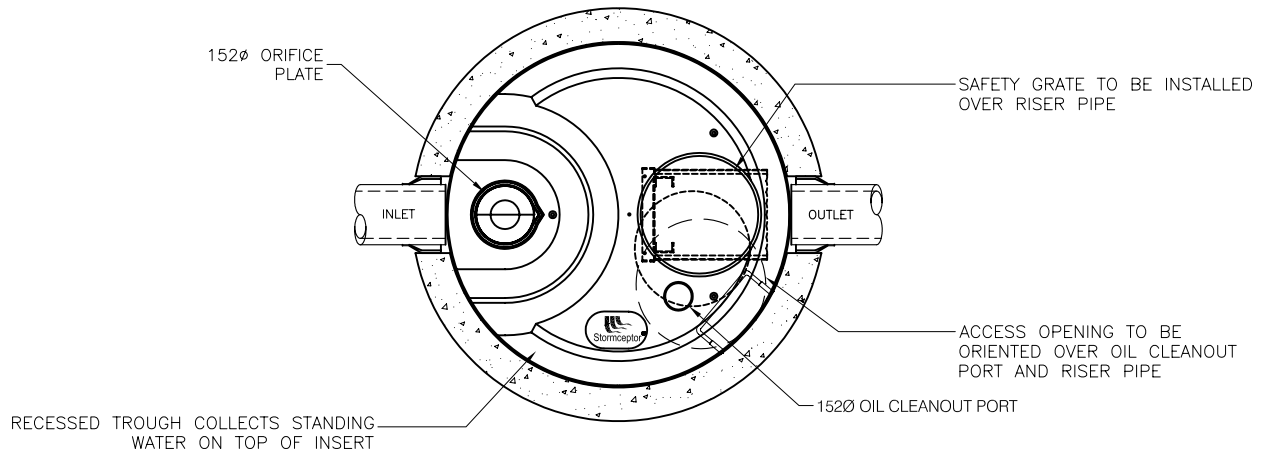


THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS

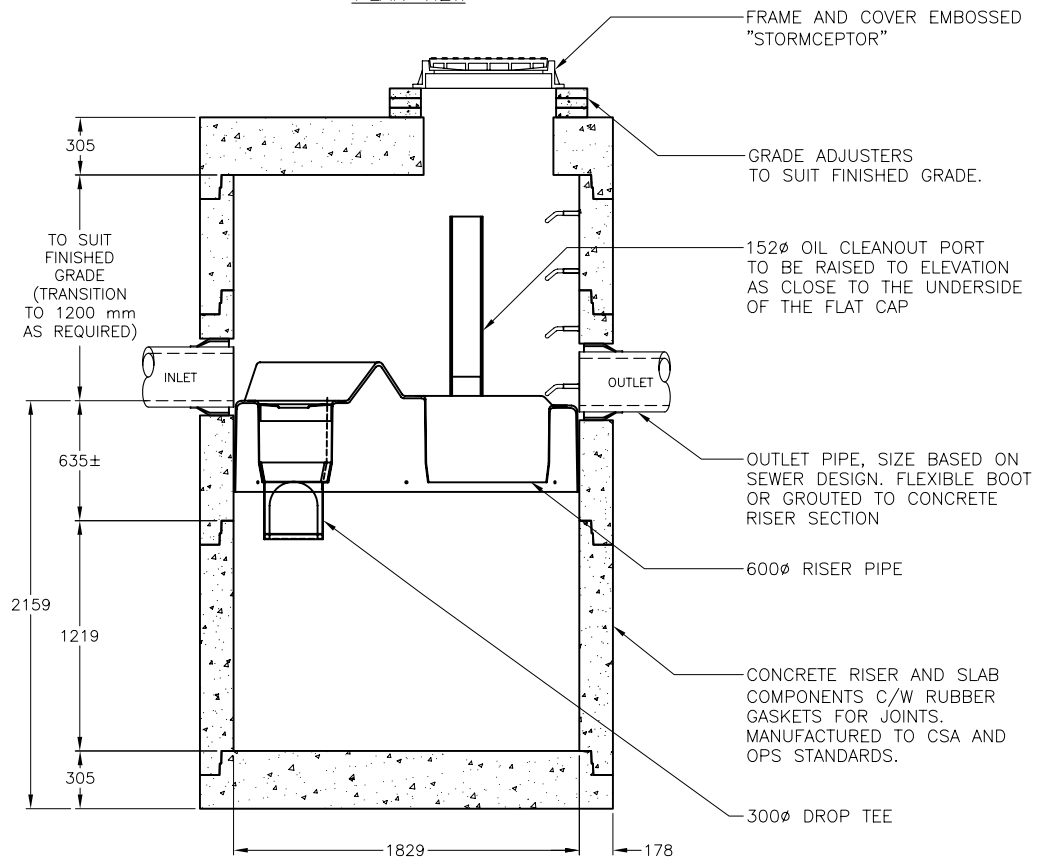
Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647 |
 Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending) |
 China Patent No. 1,168,439 | Denmark DK 711,879 | German DE 69,534,021 | Indonesian Patent No 16,688 | Japan Patent No. 9-11476 (Pending) |
 Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
 United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690

STORMCEPTOR STC INLINE MODEL STC 750	SCALE 1:40						
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							DATE: 8 Aug 07
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REV	Y	M	D	DRN	CHK	DESCRIPTION	1 OF 1

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PLAN VIEW



SECTION VIEW

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS

Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647 |
 Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending) |
 China Patent No. 1,168,439 | Denmark DK 711,879 | German DE 69,534,021 | Indonesian Patent No 16,688 | Japan Patent No. 9-11476 (Pending) |
 Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
 United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690

**STORMCEPTOR STC
 INLINE MODEL
 STC 1000**

SCALE 1:40

Stormceptor
.....STC

FILE: stc1000.dwg

DRAWN BY: B.L.

DATE: 8 Aug 07

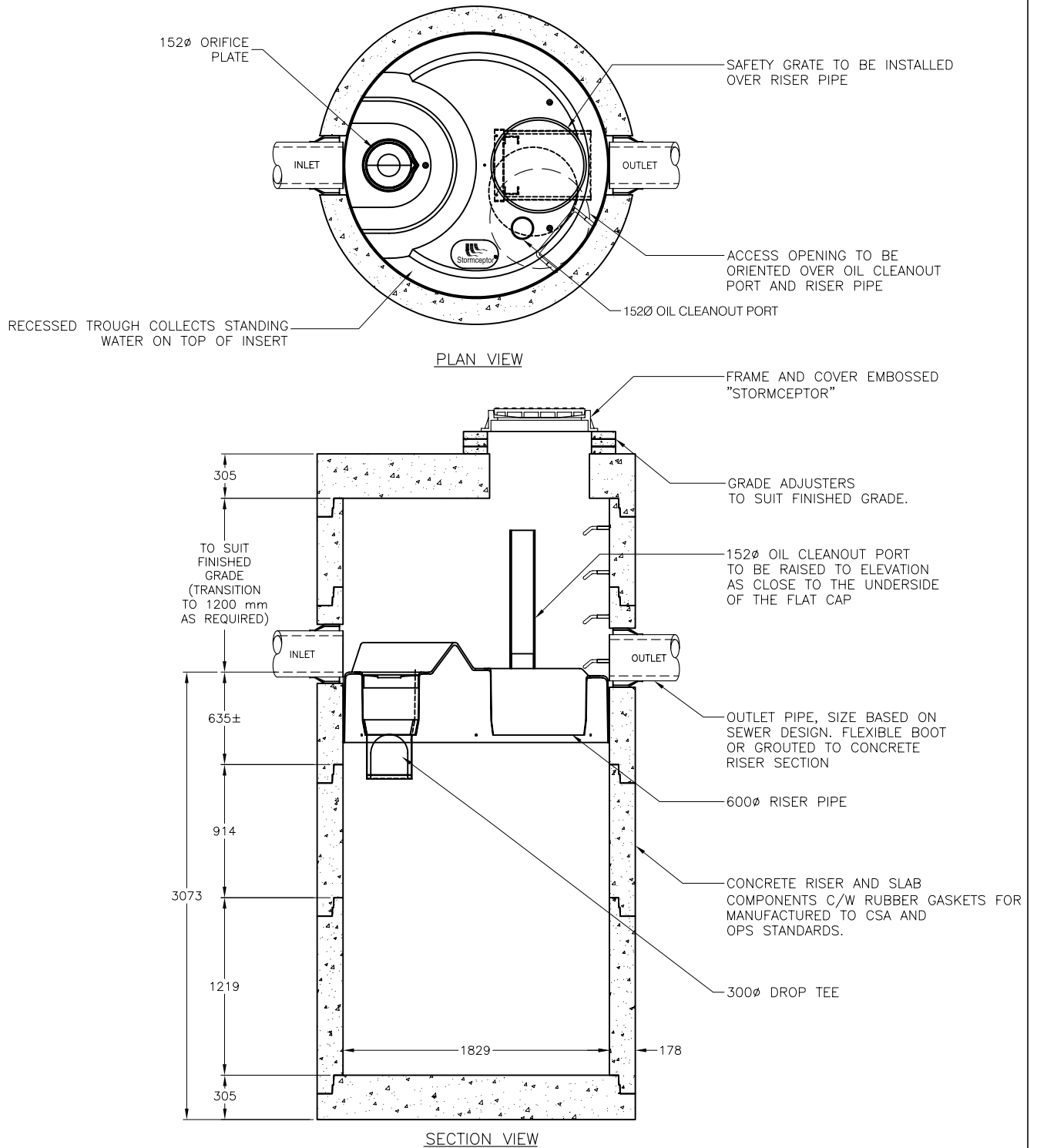
1 OF 1

REV	Y	M	D	DRN	CHK

DESCRIPTION

REV.:

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**STORMCEPTOR STC
INLINE MODEL
STC 1500**

SCALE 1:40

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DESCRIPTION

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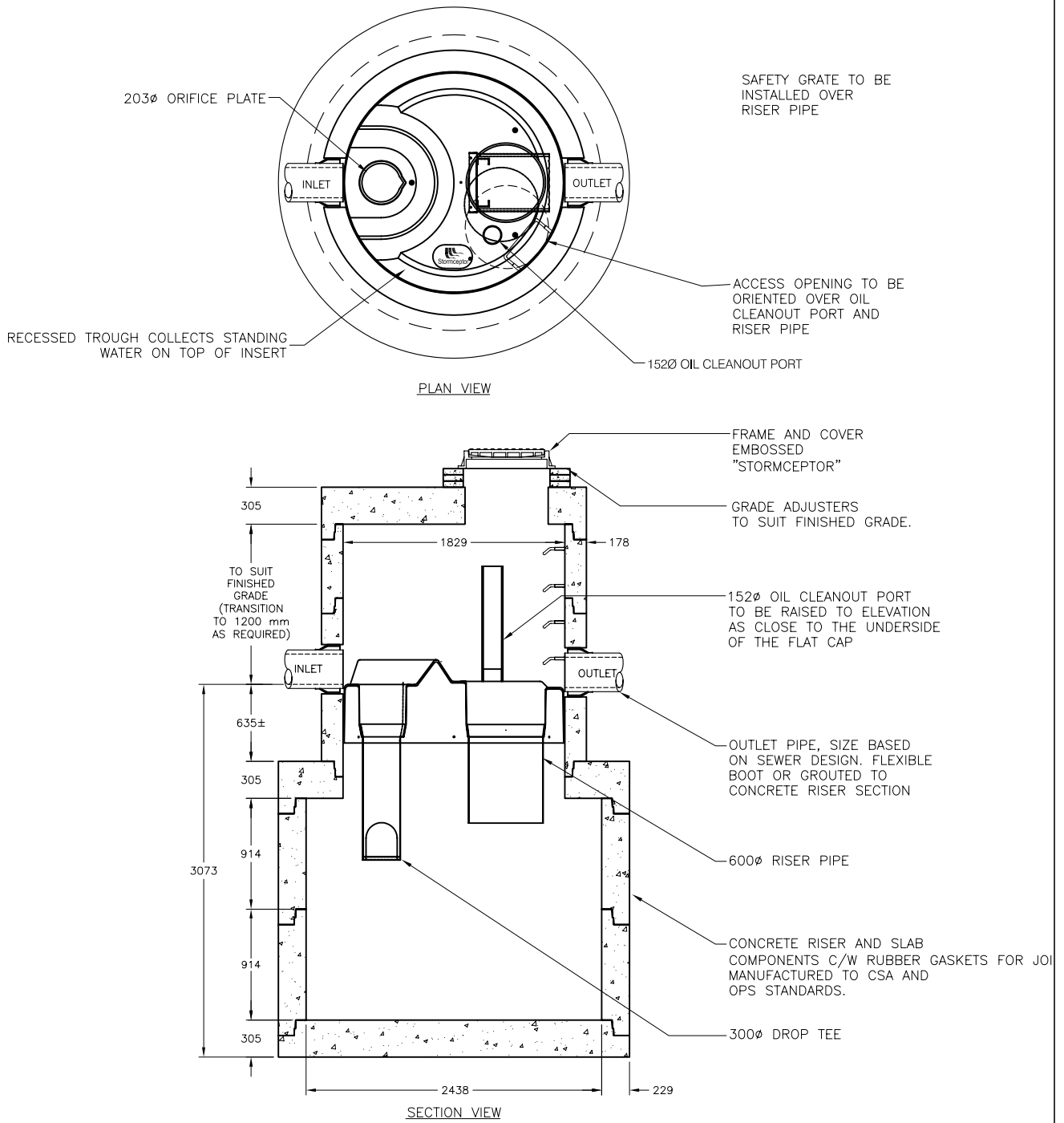
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DATE: 17 Aug 07

REV.:


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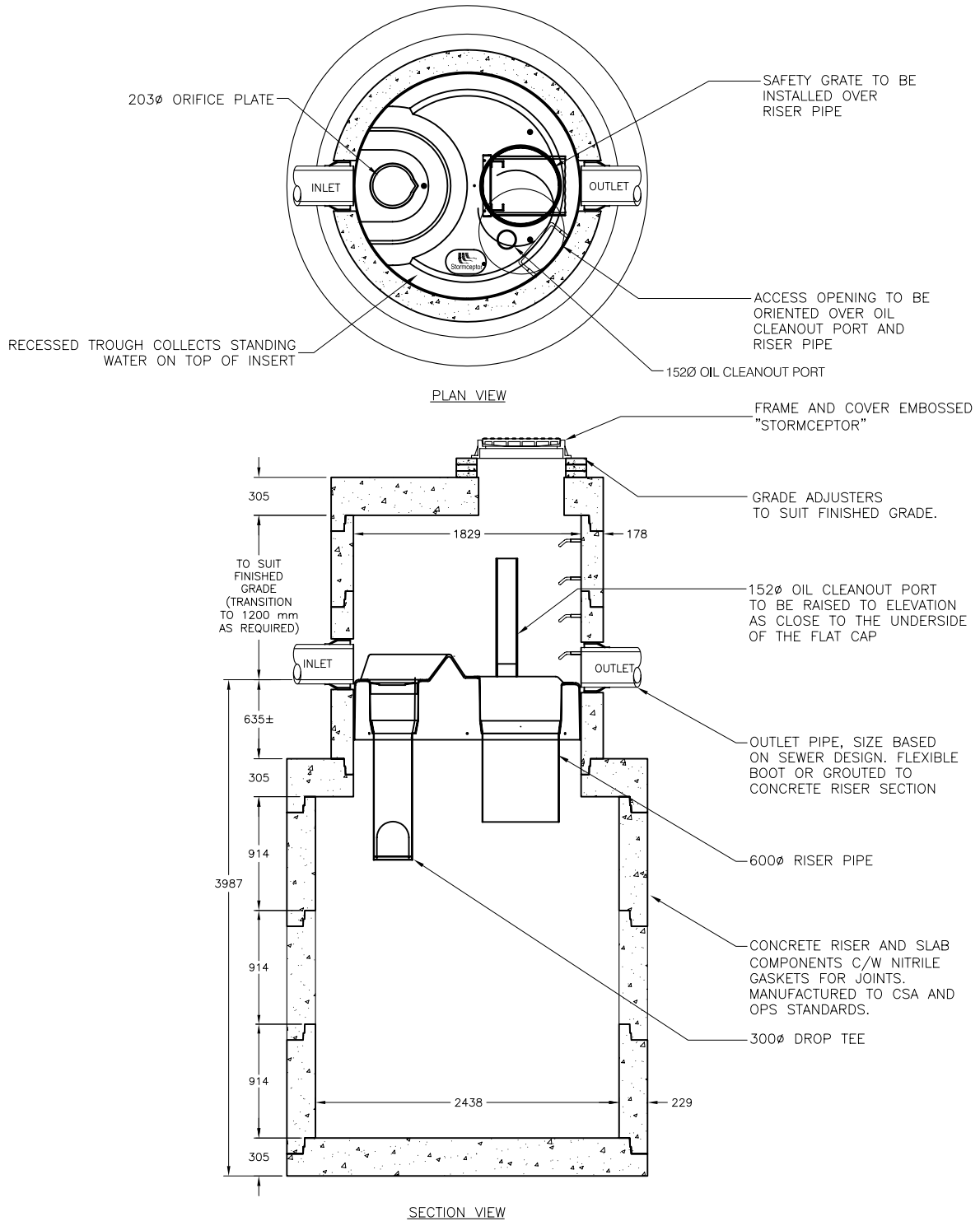


THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS

Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647 |
 Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending) |
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 Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
 United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690


STORMCEPTOR SYSTEM INLINE MODEL STC 2000	SCALE 1:50					 FILE: stc2000.dwg DRAWN BY: B.L. DATE: 8 Aug 07		
REV	Y	M	D	DRN	CHK	DESCRIPTION	REV.:	1 OF 1

DRAWING NOT TO BE USED FOR CONSTRUCTION

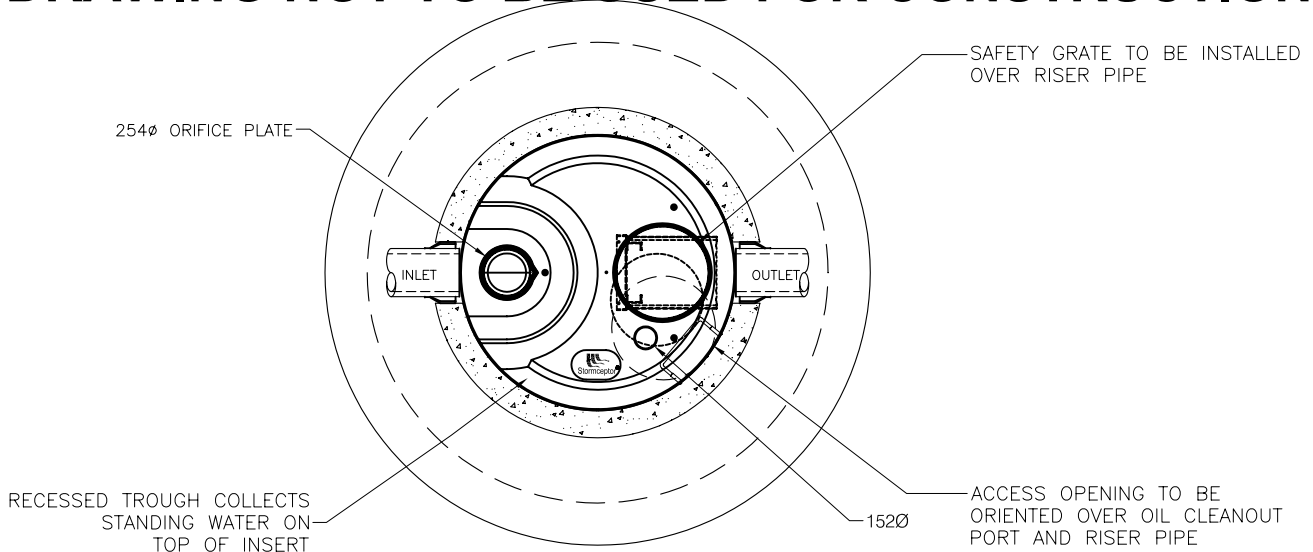


THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS

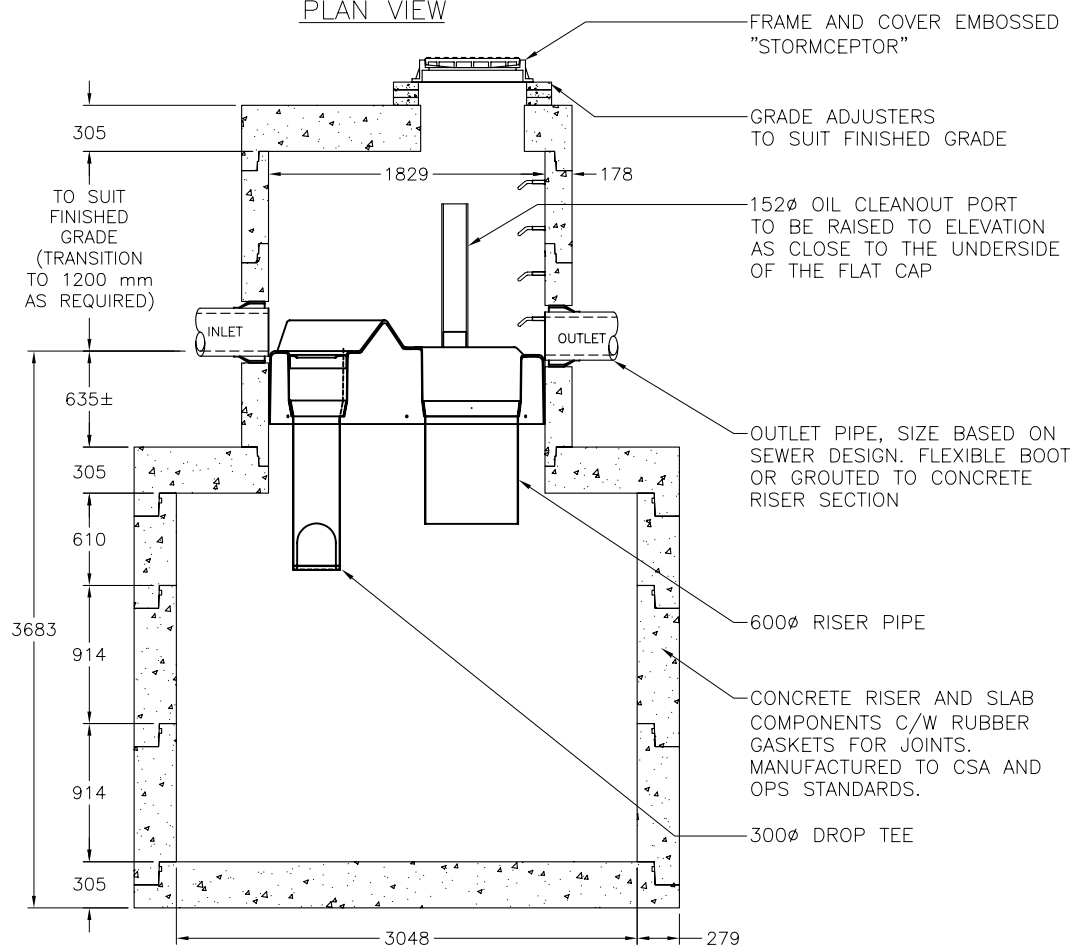
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 Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
 United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690

STORMCEPTOR SYSTEM INLINE MODEL STC 3000	SCALE 1:50					 FILE: stc3000.dwg DRAWN BY: B.L. DATE: 29 AUG 07	
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REV	Y	M	D	DRN	CHK	DESCRIPTION	

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PLAN VIEW



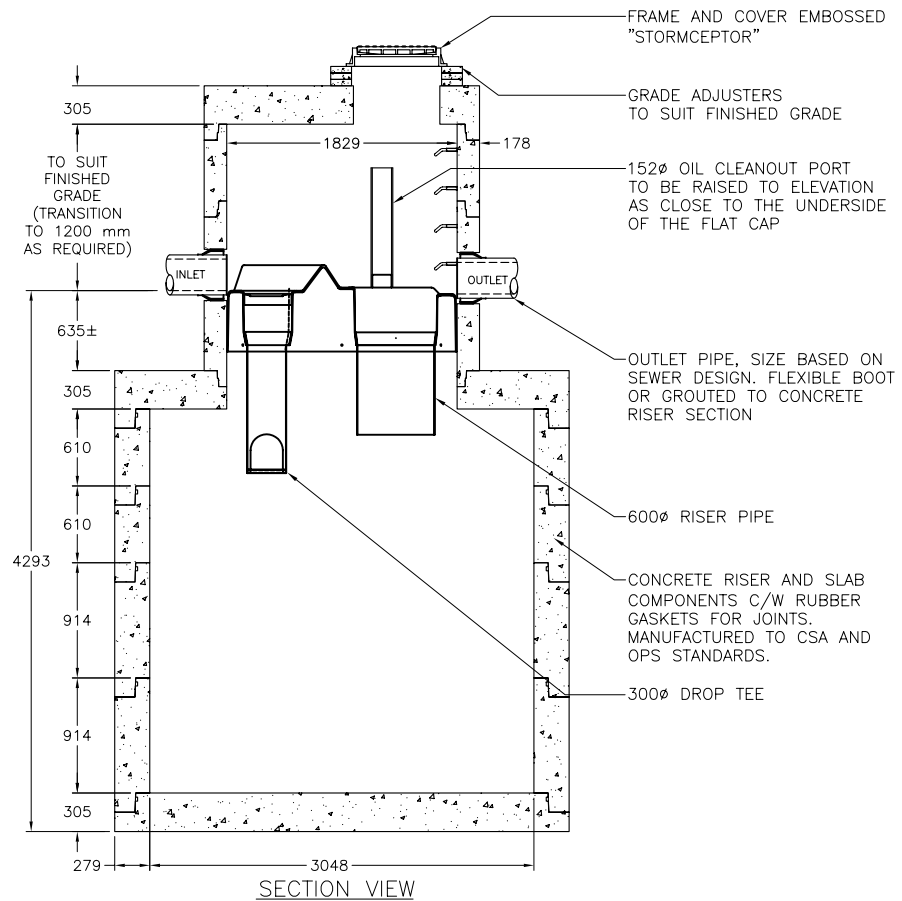
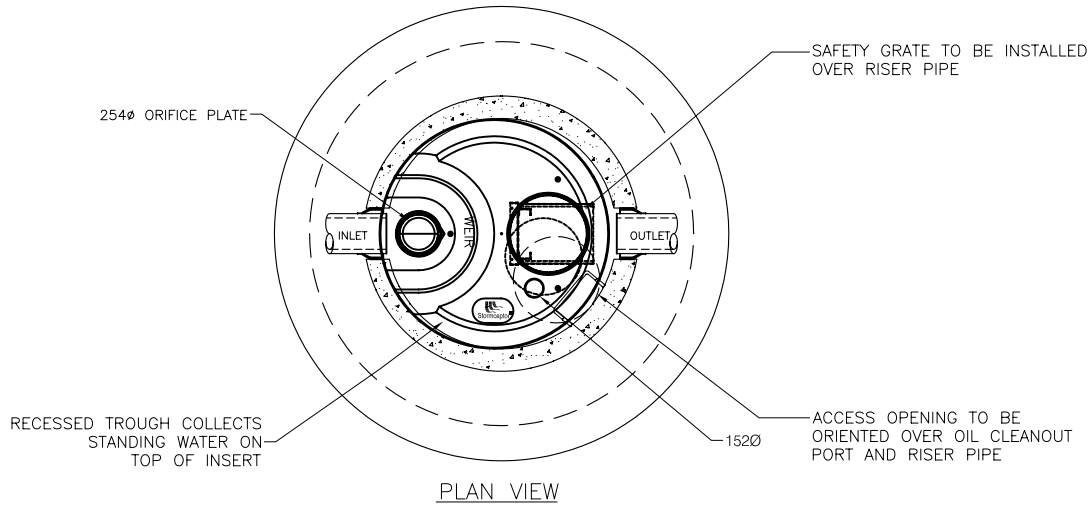
SECTION VIEW

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS

Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647 |
 Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending) |
 China Patent No. 1,168,439 | Denmark DK 711,879 | German DE 69,534,021 | Indonesian Patent No 16,688 | Japan Patent No. 9-11476 (Pending) |
 Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
 United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690

STORMCEPTOR STC INLINE MODEL STC 4000	SCALE 1:50					 FILE: STC4000.DWG DRAWN BY: B.L. DATE: 8 Aug 07		
REV	Y	M	D	DRN	CHK	DESCRIPTION	REV.:	1 OF 1

DRAWING NOT TO BE USED FOR CONSTRUCTION



THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS

Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647 |
 Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending) |
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 Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
 United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690

STORMCEPTOR STC
INLINE MODEL
STC 5000

SCALE 1:60

Stormceptor
*****STC

FILE: stc5000.dwg

DRAWN BY: B.L.

DATE: 8 Aug 07

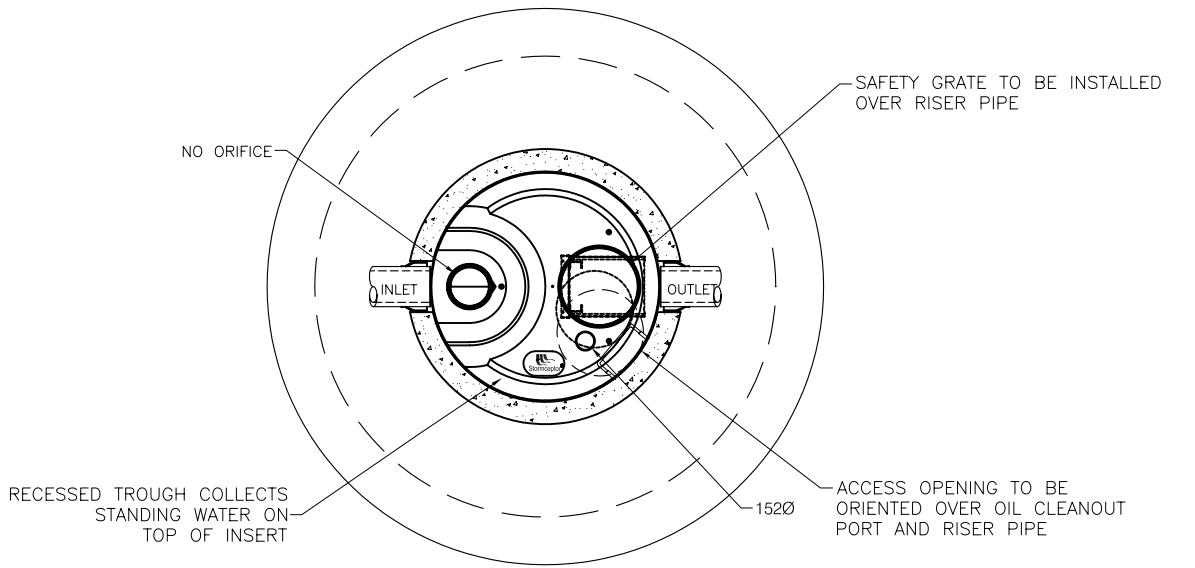
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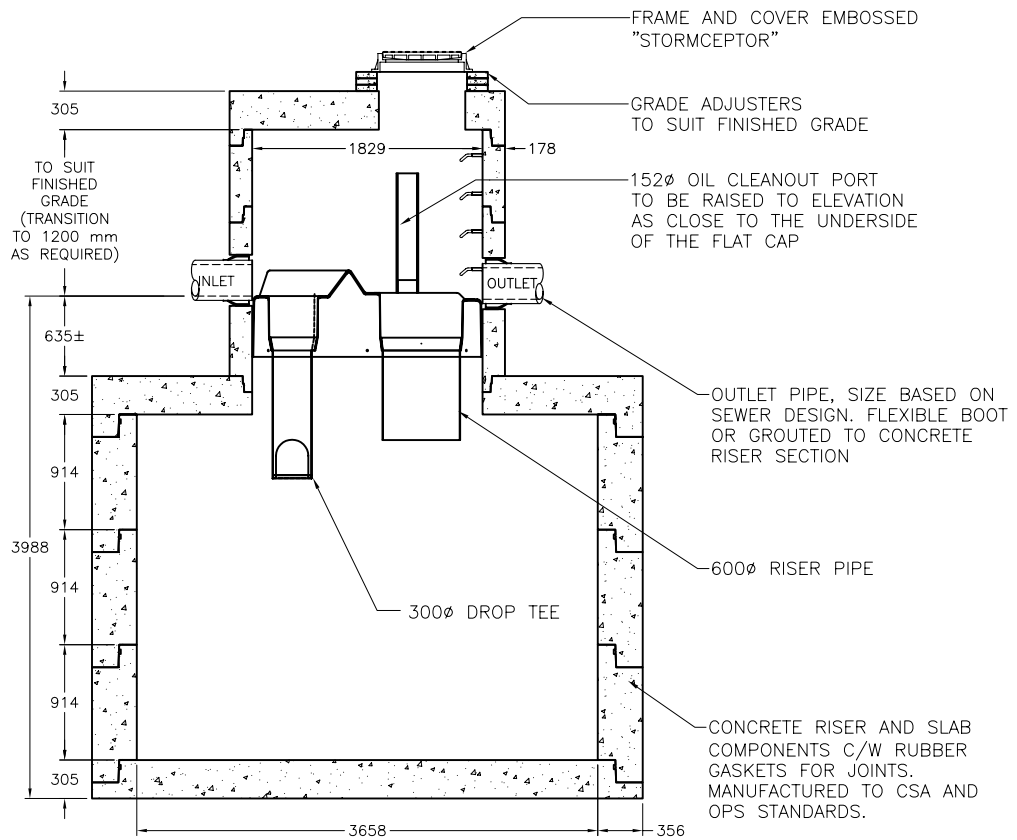
DESCRIPTION

REV.:

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PLAN VIEW



SECTION VIEW

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS

Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647 |
 Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending) |
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 Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
 United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690

STORMCEPTOR STC
INLINE MODEL
STC 6000

SCALE 1:60

Stormceptor
-----STC

FILE: stc6000C.dwg

DRAWN BY: B.L.

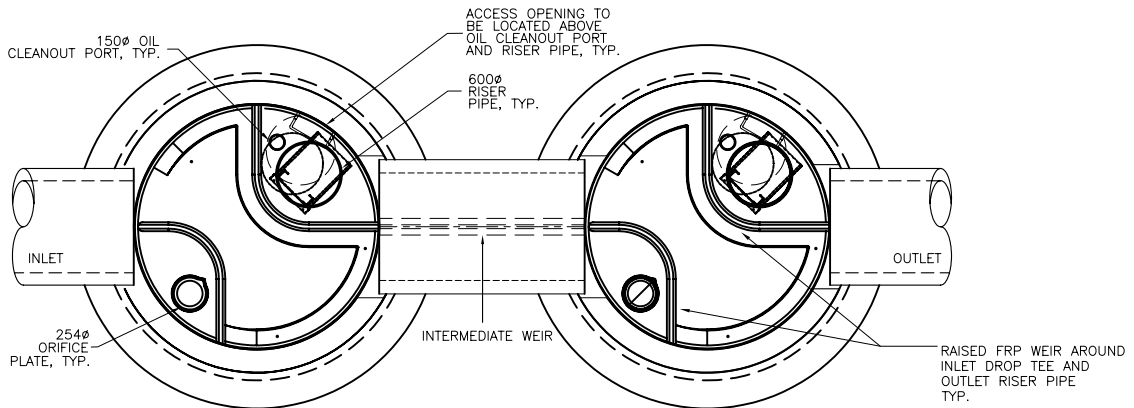
DATE: 8 Aug 07

1 OF 1

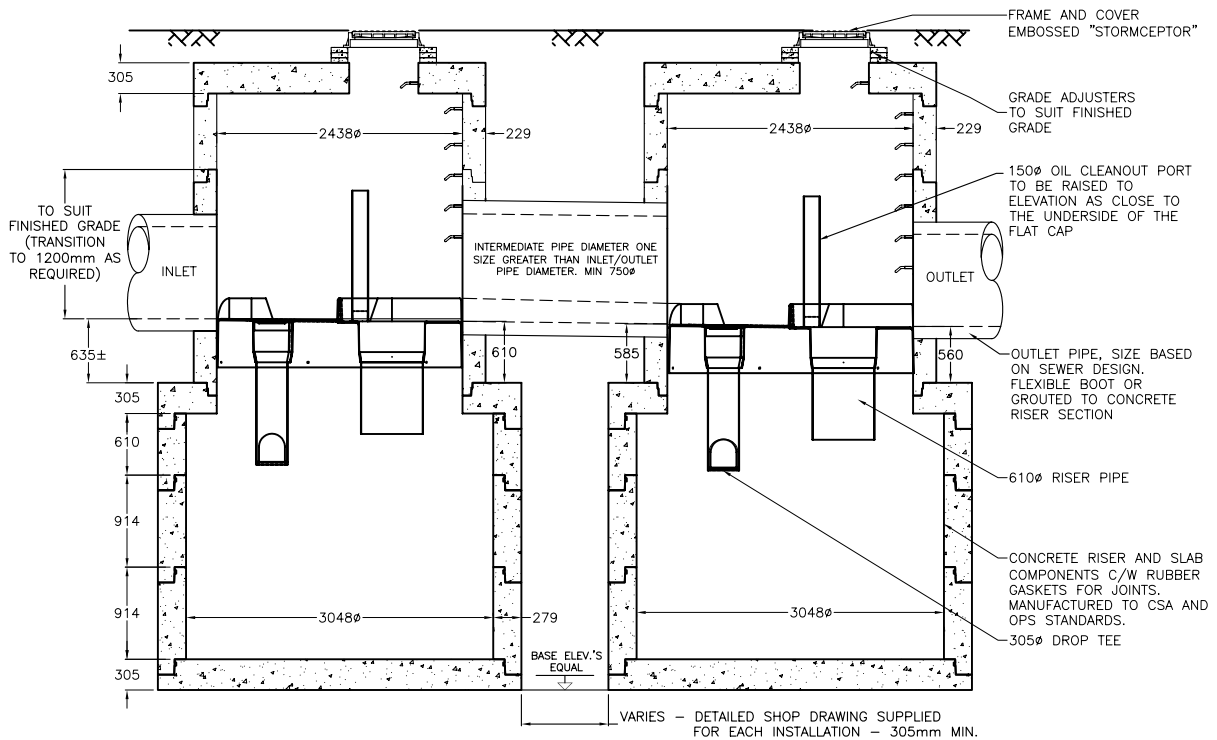
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PLAN VIEW



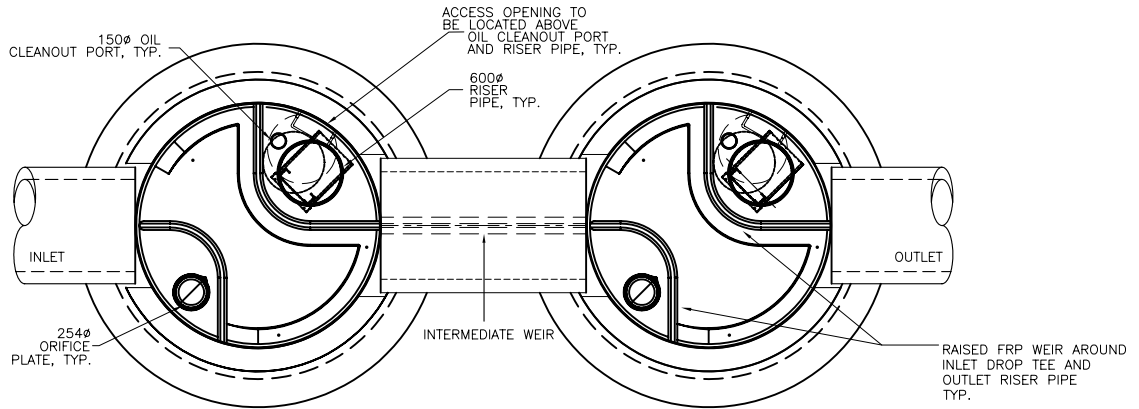
SECTION VIEW

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS

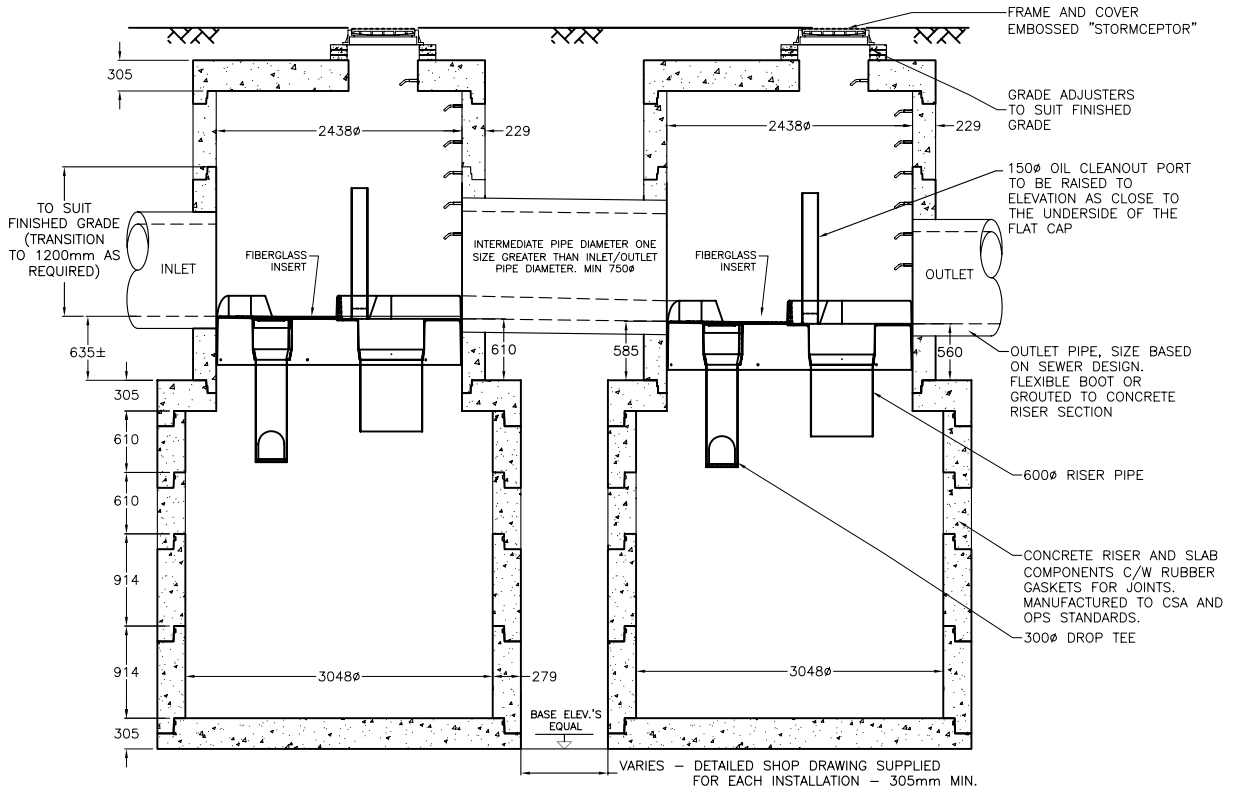
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 China Patent No. ZL 97 1 13074.4 | European Patent Treaty No. 95 307 996.9 | Japan Patent No. 9-11476 (Pending) |
 Korea Patent No. 10-2000-002601 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
 United States Patent No. 4,985,148; 5,498,331; 5,725,760; 5,753,115; 5,849,181; 6,068,765

STORMCEPTOR STC SERIES MODEL STC 9000	SCALE 1:75					 FILE: stc9000.dwg DRAWN BY: B.L. DATE: 8 Aug 07	1 OF 1		
	REV	Y	M	D	DRN			CHK	DESCRIPTION

DRAWING NOT TO BE USED FOR CONSTRUCTION




PLAN VIEW



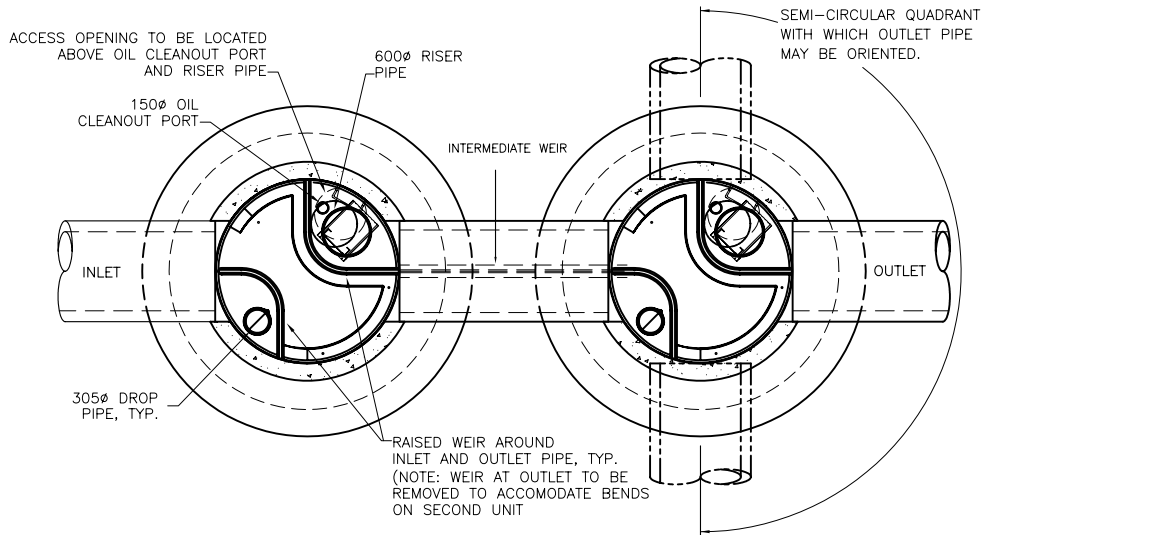
SECTION VIEW

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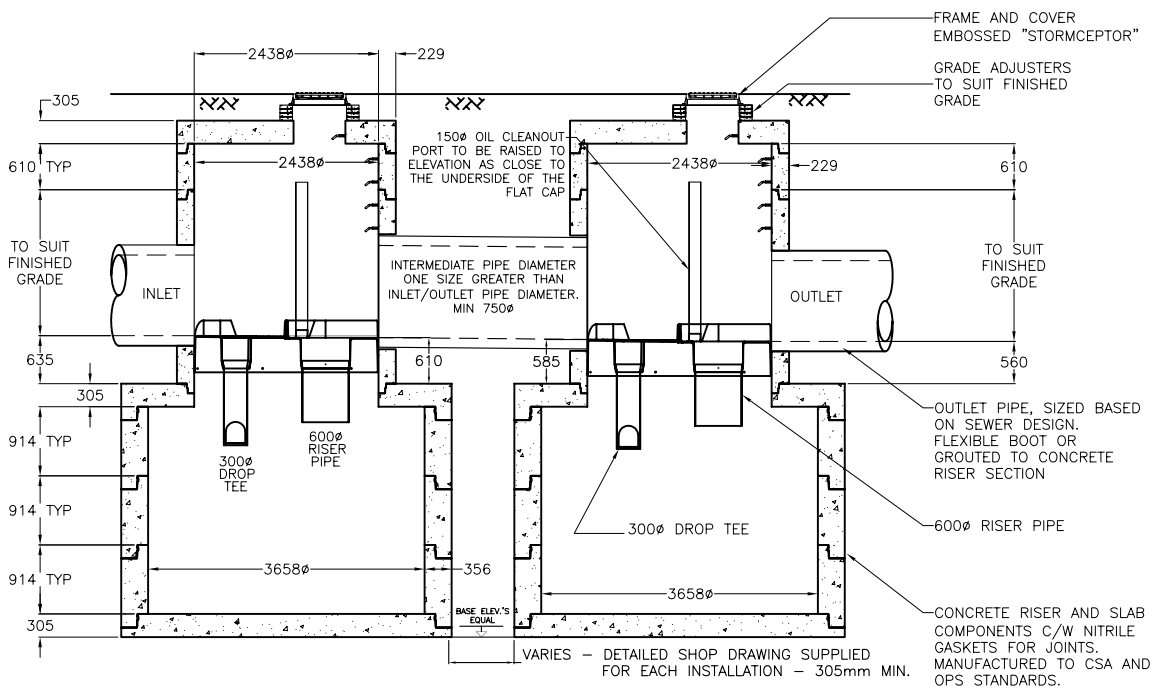
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 Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending) |
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 Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
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STORMCEPTOR SYSTEM SERIES MODEL STC 10000	SCALE 1:75					 FILE: stc10000.dwg DRAWN BY: B.L. DATE: 8 Aug 07		
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PLAN VIEW



SECTION VIEW

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS

Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647 |
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STORMCEPTOR STC SERIES MODEL STC 14000	SCALE 1:100					 FILE: stc14000.dwg DRAWN BY: B.L. DATE: 8 Aug 07	1 OF 1		
	REV	Y	M	D	DRN			CHK	DESCRIPTION

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