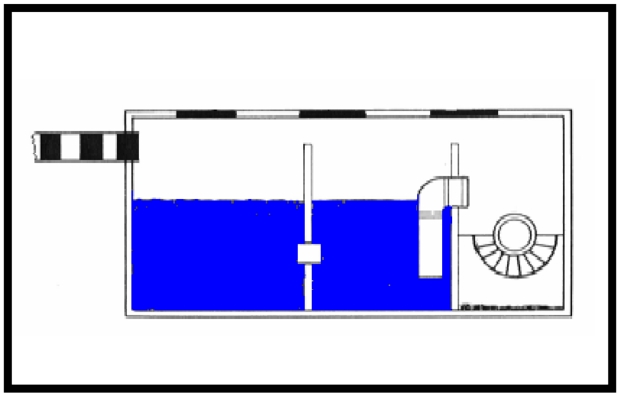
4.4.7 Oil-Grit (Gravity) Separator

Limited Application Water Quality BMP



Description: The oil/grit separator is a device designed to remove settleable solids, oil and grease, debris and floatables from stormwater runoff. This is done through gravitational settling and trapping of pollutants. Oil-grit separators are also called gravity separators or oil/water separators.

KEY CONSIDERATIONS

DESIGN GUIDELINES:

- Maximum drainage area of 1 acre.
- Access for maintenance is required.
- Performance dependent on design and frequency of inspection and cleanout of unit.
- Openings to device must be 1/16 inch or less to prevent mosquito intrusion and breeding.
- Install as an off-line device unless separator can be sized to handle a small drainage area.
- Install inspection/collection manhole on downstream side to provide easy access for sampling of effluent.

ADVANTAGES / BENEFITS:

- Good for sites where larger, or above-ground BMPs are not an option, or for retrofitting small urbanized lots.
- Can be used as pretreatment for other BMPs.
- Longevity is high, with proper maintenance.
- Standardized designs allow for easy installation.

DISADVANTAGES / LIMITATIONS:

- Cannot alone achieve the 80% TSS removal target.
- Limited performance data.
- Dissolved pollutants are not removed.
- Frequent maintenance required.

MAINTENANCE REQUIREMENTS:

- Inspect the gravity separator unit.
- Clean out sediment, oil and grease, and floatable debris using catch basin cleaning equipment (vacuum pumps).

STORMWATER MANAGEMENT SUITABILITY

Stormwater Quality:	**Yes**
Channel Protection:	**No**
Detention/Retention:	**No**

Accepts hotspot runoff: *Yes, but two feet of separation distance required to water table when used in hotspot areas*

COST CONSIDERATIONS

Land Requirement:	**Low**
Capital Cost:	**Med - High**
Maintenance Burden:	**Med - High**

LAND USE APPLICABILITY

Residential/Subdivision Use:	**No**
High Density/Ultra Urban Use:	**Yes**
Commercial/Industrial Use:	**No**

POLLUTANT REMOVAL

Total Suspended Solids:	**40%**

4.4.7.1 General Description

Oil-grit separators (also called oil/water separators or gravity separators) are hydrodynamic separation devices that are designed to remove grit and heavy sediments, oil and grease, debris and floatable matter (e.g., litter) from stormwater runoff through gravitational settling and trapping. There are two basic types of oil-grit separators, as displayed in Figure 4-71, in Section 4.4.7.8. Conventional separators rely upon gravity, physical characteristics of oil and sediments, and good design parameters to achieve pollutant removal. Coalescing plate interceptor (CPI) separators contain closely-spaced plates which greatly enhance the removal efficiency for oils and greases. In addition, a wide variety of separator systems are commercially-available in a variety of layouts, for which vendors have design data and procedures. Example schematics for both types of oil-water separators are displayed in Section 4.4.7.8.

Conventional oil-grit separator units contain a permanent pool of water and typically consist of an inlet chamber, separation/storage chamber, a bypass chamber, and an access port for maintenance purposes. Runoff enters the inlet chamber where heavy sediments and solids drop out. Then the flow moves into the main separation chamber, where further settling of suspended solids takes place. Oil and grease are skimmed and stored in a waste oil storage compartment for future removal. After moving into the outlet chamber, the clarified runoff is then discharged to the site's stormwater conveyance system. Oil-grit separators are sized based on the Water Quality Peak Flow Rate (Q_{wq}), which occurs during the water quality design storm. This contrasts with most other stormwater structural controls, which are sized based on capturing and treating a specific volume.

CPI separators include coalescing tubes or plates that provide an additional media in which minute oil globules can agglomerate to aid in the separation process. Oil that agglomerates around the coalescing tubes/plates can easily be skimmed through the gravity process. CPI separators must be utilized in "hotspot" areas where oil, grease, or other petroleum products are potential pollutants (e.g., fueling areas, gas stations, etc.).

The performance of oil-grit separator systems is based primarily on the relatively low solubility of petroleum products in water and the difference between the specific gravity of water and the specific gravities of petroleum compounds. Separators are not designed to separate other products such as solvents, detergents, or dissolved pollutants. The typical oil-grit separator unit may be enhanced with a pretreatment swirl concentrator chamber, oil draw-off devices that continuously remove the accumulated light liquids, and flow control valves that regulate the flow rate into the unit. Separators are available as prefabricated proprietary systems from a number of different commercial vendors. Some of the enhancements added by commercial vendors are presented in the example schematics presented in section 4.4.7.8.

4.4.7.2 Stormwater Management Suitability

Oil-grit separators are designed solely as stormwater quality treatment and do not have the ability to provide channel protection or flood protection. An important consideration when designing an oil-grit separator system for a site is how to bypass large storm events that exceed the design flow capacity around the separator without damaging the unit, exceeding the design flow capacity, or resuspending collected pollutants. Since resuspension of accumulated sediments and oil droplets is possible during heavy storm events, oil-grit separator units are typically installed off-line with a bypass installed to minimize pollutant wash-out or resuspension.

<u>Water Quality (WQv)</u>
To treat stormwater runoff, oil-grit separators rely on gravity and trapping to filter pollutants. An oil-grit separator cannot alone achieve the 80% TSS removal criteria. Therefore, separators are frequently used as the upstream pretreatment measure in a series of BMPs, ahead of a detention basin or constructed wetland.

4.4.7.3 Pollutant Removal Capabilities

Testing of gravity separators has shown that they can remove between 40% and 50% of the TSS loading when used in an off-line configuration (Curran, 1996 and Henry, 1999). Gravity separators also provide removal of debris, hydrocarbons, trash and other floatables. They provide only minimal removal of nutrients and organic matter.

The total suspended solids design pollutant removal rate of 40% is a conservative average pollutant reduction percentage for design purposes derived from sampling data, modeling and professional judgment

4.4.7.4 Application and Feasibility Criteria

One of the most important selection criteria when considering an oil-grit separator is the long-term maintenance and operation costs, and the need for regular inspections and cleanout. Inspection and maintenance needs for such systems can be considered high relative to other stormwater BMPs. Therefore, the oil-grit separator system should only be constructed if the property owner or tenant of the site has both the physical and fiscal ability to perform regular inspection and maintenance of the system on a long-term basis. This is one of the constraints that will be considered by the local municipality when oil-grit separators are proposed as a BMP for a development or redevelopment site.

Oil-grit separators are best used in commercial, industrial and transportation land uses and are intended primarily as a pretreatment measure for high-density or ultra-urban sites, or for use in hydrocarbon hotspots, such as gas stations and areas with high vehicular traffic. However, separators cannot be used for the removal of dissolved or emulsified oils or for pollutants such as coolants, soluble lubricants, glycols and alcohols. Suitable applications of an oil-grit separator include:

- pretreatment for other structural controls;
- parking lots, streets, driveways, truck loading areas;
- runways, marinas, loading wharves;
- gasoline stations, refueling areas;
- automotive repair facilities, oil-change businesses, fleet maintenance yards;
- recycling or salvage yards which accept automotive equipment; and,
- commercial vehicle washing facilities.

4.4.7.5 Planning and Design Standards

The design standards for oil-grit (gravity) separators are presented below. Design specifications developed by a commercial vendor for prefabricated proprietary systems can also be utilized, but must be approved where such specifications differ and/or are less stringent from the standards presented below. The local jurisdiction shall have the authority to require additional design conditions if deemed necessary.

A. LOCATION AND SITING

- Any individual oil-grit separator shall have a contributing drainage area no greater than 1 acre.
- It is desirable to maintain reasonable dimensions by bypassing larger storm flows in excess of the design flow rates. Thus, it is preferred that oil-grit separators be located off-line. An off-line separator can be an existing or proposed manhole with a baffle or other control (shown in Figure 4-71).
- Oil-grit separator systems can be installed in almost any soil or terrain. Since these devices are underground, appearance is not an issue and public safety risks are low.
- The design loading rate for oil-grit separators is low; therefore, they can only be cost-effectively sized to detain and treat the water quality volume, or other low flows if required by local municipalities. It is usually not economical or feasible to size an oil-grit separator to treat large design storms. Oil-grit separators require frequent maintenance for the life of the separator unit. Maintenance can be minimized (and performance can be increased) by careful planning and design, particularly upstream and downstream of the separator unit.

- Each oil-grit separator shall be placed in an easement that is recorded with the deed. The easement shall be defined at the outer edge of oil-grit separator. Minimum setback requirements for the easement shall be as follows unless otherwise specified by the local jurisdiction:
  - From a property line – 10 feet;
  - From a public water system well – TDEC specified distance per designated category;
  - From a private well – 100 feet; if well is downgradient from a land use that requires a Special Pollution Abatement Permit, then the minimum setback is 250 feet;
  - From a septic system tank/leach field – 50 feet.

B. PHYSICAL SPECIFICATIONS / GEOMETRY

- Design procedures for commercially available oil-grit separators are usually given by the manufacturer in simplified tables or graphs based on field testing and observed pollutant removal rates. Pollutant removal rates higher than those indicated in Section 4.4.7.3 must be proven using the criteria for proprietary BMPs presented in Section 4.4.5 of this manual.
- Oil-grit separators must be constructed with watertight joints and seals.
- The separation chamber shall provide for three separate storage volumes, as follows:
  (1) A volume for separated oil storage at the top of the chamber;
  (2) A volume for settleable solids accumulation at the bottom of the chamber; and,
  (3) A volume required to give adequate flow-through detention time for separation of oil and sediment from the stormwater flow.
- Ideally, a gravity separator design will provide an oil draw-off mechanism to a separate chamber or storage area. This design is required where a gravity separator is utilized to treat oil, grease and/or petroleum hotspots.
- Oil-grit separators are typically designed to bypass runoff flows in excess of the water quality volume peak flow. Some designs have built-in high flow bypass mechanisms, whereas others require a diversion structure or flow splitter located upstream of the device in the drainage system. Bypass mechanisms must minimize potential for captured pollutants from being washed-out or resuspended by large flows. Regardless of the bypass mechanism, an adequate outfall/outlet must be provided for both the discharge from the separator itself, and the bypassed discharge. Runoff shall be discharged in a non-erosive manner.
- The device shall be designed such that the velocity through the separation chamber does not exceed the entrance velocity.
- A trash rack shall be included in the design to capture floating debris, preferably near the inlet chamber to prevent debris from becoming oil impregnated.
- The total wet storage of the gravity separator unit shall be no less than 400 cubic feet per contributing impervious acre.
- The theoretical sizing of a conventional oil-grit separator requires the use of Stokes Law for the computation of rise velocity of oil droplets:

Equation 4.4.7.1

$$V_p = \frac{1.79 \times 10^{-8} (S_w - S_p) {D_p}^2}{N}$$

where: V_p = upward rise velocity of petroleum droplet (ft/s)
S_w = specific gravity of water (0.998 to 1.000)
S_p = specific gravity of the petroleum droplet (typically 0.85 to 0.95)
D_p = diameter of petroleum droplet to be removed (microns)
N = absolute viscosity of water (poises)

The expected temperature is generally chosen for cold winter months. Typical values for the specific gravity and absolute viscosity of water at various temperatures are shown in the following table:

Temperature	S_w	N
32° F	0.999	0.01794
40° F	1.000	0.01546
50° F	0.999	0.01310
60° F	0.999	0.01129
70° F	0.998	0.00982

Sizing a Conventional Oil-Grit Separator:

- Using V_p above, a conventional oil-grit separator can be sized as follows:

Equation 4.4.7.2

$$D = \left(\frac{Q}{RV_H} \right)^{0.5}$$

Equation 4.4.7.3

$$W = RD$$

Equation 4.4.7.4

$$L = \frac{V_H D}{V_P}$$

Equation 4.4.7.5

$$V_H = \frac{V_P D}{L} = 15(V_P)$$

where: D = depth of unit (feet), generally between 3 and 8 feet
W = width of unit (feet), usually twice the depth
L = length of unit (feet), usually fifteen times the depth
Q = design flow rate (cfs), i.e., the water quality peak flow rate, Q_{wq}
R = width to depth ratio, generally a value of 2 is recommended
V_H = allowable horizontal velocity (ft/s), maximum 0.05 ft/s
V_p = upward rise velocity of oil droplet (ft/s)

- The total depth shall be adjusted by adding 1 foot of freeboard to the depth calculated using the equations above, or equations provided by a manufacturer.
- Top baffles should extend downward by 0.85D, and bottom baffles should extend upward by 0.15D, where D is the depth of the unit (in feet). The distribution baffle should be located at a distance of 0.10L from the inlet of the unit, where L is the length of the unit (in feet).

Sizing a Coalescing Plate Interceptor (CPI) Separator:

- CPI separators require considerably less space than a conventional separator to obtain the same effluent quality. A CPI separator is able to process smaller oil droplets by collecting them upon polyurethane plates or other materials. It is recommended that the design engineer consult vendors for a plate package that will meet site and flow criteria. Manufacturers will typically identify the capacity of various standard units.
- Using V_p above, a CPI separator can be sized as follows:

Equation 4.4.7.6

$$A_P = \frac{Q}{EV_P \cos(H)}$$

where: A_p = total surface area of coalescing plates (square ft)
Q = design flow rate (cfs), i.e., the water quality peak flow rate, Q_{wq}
E = efficiency of coalescent plates (typically 0.35 to 0.95)
V_p = upward rise velocity of oil droplet (ft/s)
H = angle of coalescing plates measured from horizontal (degrees), from 0° to 60°

- A plate angle of 45° to 60° is optimal, allowing sediment to slide off the plate and settle at the bottom of the chamber. At an angle of 0°, the plates would be horizontal and sediment will settle on the plates, reducing its effectiveness.
- Select a likely plate length and width, and then compute the number of plates needed using the following equation.

Equation 4.4.7.7

$$N = \frac{A_P}{W_P L_P}$$

where: N = number of plates required
A_p = total surface area of coalescing plates (ft^2)
W_p = width of plates (ft)
L_p = length of plates (ft)

- The space between the plates is usually about 1-inch. Placing plates closer together reduces the total required volume, but may instead allow debris such as twigs, plastics or paper to clog the plates.
- Calculate the chamber geometry and volume to contain the coalescing plates. Add a minimum of 1 foot below the plates to account for sediment storage. Add 6 to 12-inches above the plates for oil accumulation. Finally, add 1 foot above the oil accumulation allowance for freeboard.
- The CPI separator shall include a forebay chamber to collect floatable debris and evenly distribute flow if more than one plate is needed. Larger units may have a device to remove and store oil from the water surface, such as a skimmer or vacuum.

Manufactured (i.e., Proprietary) Oil-Grit Separators:

- Several manufacturers of oil-grit separators are identified in the references for this section. Manufactured separators should be selected on the basis of good design, suitability for the desired pollution control goals, durabilty, ease of installation, ease of maintenance, and reliability. The products listed in the reference section and/or shown in schematics are not the only products available, nor should their presence in this manual be construed as an endorsement of these products. They are merely shown as manufactured separators that are known to operate in Tennessee.
- Manufacturers generally provide design methods, installation guidelines, and proof of effectiveness for each application where used. These structures tend to include innovative methods of providing high flow bypass. However, it is incumbent upon the landowner to carefully investigate the suitability and overall trustworthiness of each manufacturer and/or subcontractor.

C. MAINTENANCE ACCESS

- A minimum 20 foot wide maintenance right-of-way easement shall be provided for the oil-grit separator from a driveway, public or private road. The maintenance access easement shall have a maximum slope of no more than 15% and shall have a minimum unobstructed drive path having a width of 12 feet, appropriately stabilized to withstand maintenance equipment and vehicles. The right-of-way shall be located such that maintenance vehicles and equipment can access the oil-grit separator.

4.4.7.6 Design Example

Basic Data

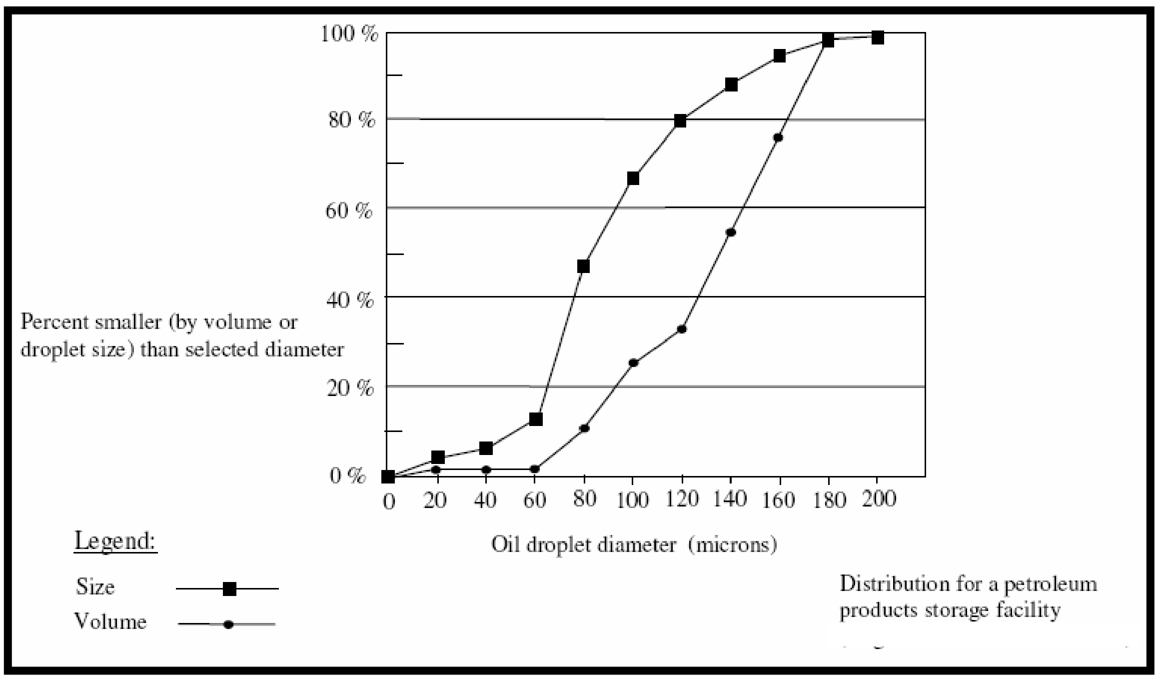
A conventional oil-grit separator unit is desired for use on a 1 acre parking lot.

- S_p = specific gravity of the petroleum droplet = 0.90
- V_p = 0.00080 ft/s for water temperature of 32°F (1 foot in 21 minutes)
- V_p = 0.00127 ft/s for water temperature of 60°F (1 foot in 13 minutes)
- Impervious percentage (I) = 90%
- Area (A) = 1 acre
- Time of concentration (t_c) = 6 minutes

Consider the effluent goal as 10 parts per million (ppm) and the design influent concentration is estimated to be 50 ppm (or equivalent to 50 mg/l), so that an oil removal efficiency of 80% is the desired target. From Figure 4-69 below, this can be achieved by removing all oil droplets with diameters of 90 microns or larger.

Figure 4-69. Typical Size and Volume Distribution of Oil Droplets

(Source: City of Knoxville, 2003)



Step 1: Calculate the Water Quality Peak Flow Rate (Q_{wq}):

(See Chapter 3 for equation information)

Compute the Runoff Peak Volume (Q_{wv}) in inches for 1.04-inch rainfall (P = 1.04):

$$Q_{wv} = PRv = 1.04Rv = 1.04(0.015 + (0.0092)(90)) = 0.93 \text{ inches}$$

Compute modified CN:

$$CN = 1000/[10+5P+10 Q_{wv} - 10(Q_{wv}^2+1.25Q_{wv}P)^{½}]$$
$$= 1000/[10+5(1.1)+10(0.93)-10(0.93^2+1.25(0.93)1.1)^{½}]$$
$$= 98.4 \quad \text{(Use CN = 98)}$$

For CN = 98 and an estimated time of concentration (t_c) of 6 minutes (0.1 hours), compute the Q_{wq} for a 1.1 inch storm.

I_a = 0.041 (from Table 3-13 in Chapter 3), therefore $I_a/P = 0.041/1.1 = 0.037$.

Using Figure 3-6 in Chapter 3, q_u can be estimated for a Type II storm as approximately 1000 csm/in or more (use 1000 csm/in because of limits in Figure 3-6).

q_u = 1000 csm/in, and therefore:

$Q_{wq} = q_u A\ Q_{wv}$ = (1000 csm/in) (1.0ac/640ac/mi2) (0.93in) = 1.45 cfs

Step 2: Size the oil-grit separator:

The allowable horizontal velocity (V_H) is:

$V_H = 15V_p = 15(0.00080) = 0.012$ ft/s

Compute the required depth (D), width (W) and length (L) of the unit (R = 2):

$D = (Q_{wq}/RV_H)^{0.5} = (1.45/(2)(0.012))^{0.5} = 7.8$ ft
$W = RD = 2(7.8) = 14.8$ ft
$L = (V_H D)/V_p = (0.012x7.8)/0.00080 = 117$ ft

The very large size separator size (8' x 16' x 111') computed above is an indication of the fact that oil and water do not separate easily. By careful design of upstream and downstream reaches, it is possible to reduce turbulent flows, drop heights, mixing or swirling stormwater runoff, and excessive velocities. The large unit sized above also indicates the importance of subbasin size to unit size. It is important to keep drainage areas small (i.e., less than 1 acre); this will keep oil-grit separators to manageable sizes.

4.4.7.7 Maintenance Requirements and Inspection Checklist

Note: Section 4.4.7.7 must be included in the Operations and Maintenance Plan that is recorded with the deed.

Regular inspection and maintenance is critical to the effective use of oil-grit (gravity) separators as stormwater best management practices. It is the responsibility of the property owner to maintain all stormwater facilities in accordance with the minimum design standards and other guidance provided in this manual. The local municipality has the authority to impose additional maintenance requirements where deemed necessary.

This page provides guidance on maintenance activities that are typically required for oil-grit (gravity) separators, along with a suggested frequency for each activity. Individual gravity separators may have more, or less, frequent maintenance needs, depending upon a variety of factors including the occurrence of large storm events, overly wet or dry (i.e., drought) regional hydrologic conditions, and any changes or redevelopment in the upstream land use. Each property owner shall perform the activities identified below at the frequency needed to maintain oil-grit separators properly at all times.

Inspection Activities	**Suggested Schedule**
• Inspect the gravity separator unit for clogging, accumulated debris, sediment, and/or oil and grease.	Regularly (at least every three months)
Maintenance Activities	**Suggested Schedule**
• Clean out sediment, oil and grease, and floatables, using catch basin cleaning equipment (vacuum pumps). Manual removal of pollutants may be necessary.	As Needed

Additional Maintenance Considerations and Requirements

- Additional maintenance requirements for a proprietary system should be obtained from the manufacturer and included in the Operations and Maintenance Plan for the site.
- Consider using a licensed commercial subcontractor, who may have special equipment and abilities to perform periodic cleanout on oil-grit separators.
- Cleanout may require the implementation of confined-space procedures and equipment as required by OSHA regulations, such as non-sparking electrical equipment, oxygen meter, flammable gas meter, etc.
- Proper disposal of oil, solids and floatables removed from the gravity separator must be ensured. Floating oil, grease and petroleum substances removed using special vacuum hoses; should be treated as hazardous waste. Sediments may also contain heavy metals or other toxic substances and should be handled as hazardous waste.
- Removal of sediment depends upon accumulation rate, available storage, watershed size, nearby construction, industrial or commercial activities upstream, etc. The sediment composition should be identified by testing prior to disposal. Some sediment may contain contaminants for which the Tennessee Department of Environment and Conservation (TDEC) requires special disposal procedures. Consult TDEC's Division of Water Pollution Control if uncertain about what the sediments contain or if it is known to contain contaminants. Generally, give special attention or sampling to sediments accumulated in industrial or manufacturing facilities, fueling centers or automotive maintenance areas, large parking areas, or other areas where pollutants are suspected to accumulate.
- There is usually uncertainty about what types of oil or petroleum products may be encountered. A significant percentage of petroleum products are attached to fine suspended solids, and therefore, are not easily removed by settling.
- The local municipality encourages the use of the inspection checklist presented below for guidance in the inspection and maintenance of the oil-grit separator. Additional items should be added to the list, based on the inspection and maintenance information provided by the manufacturer of the separator unit. The local municipality can require the use of this checklist or other form(s) of maintenance documentation when and where deemed necessary in order to ensure the long-term proper operation of the unit. Questions regarding inspection and maintenance should be referred to the local municipality.

INSPECTION CHECKLIST: OIL-GRIT (OIL/WATER OR GRAVITY) SEPARATOR

Location: ____ Owner Change since last inspection? Y N
Type of Separator Unit (provide Manufacturer and Unit Name/ID if known): ______________________
Owner Name, Address, Phone: ____
Date: __________ Time: ____________ Site conditions:______________________________

Inspection Items	Satisfactory (S) or Unsatisfactory (U)	Comments/Corrective Action
Signs of clogging?		
Debris (trash) accumulation?		
Oil accumulation?		
Sediment accumulation?		
Standing water upstream of unit?		
Erosion downstream of unit?		
Other (describe)?		
Other (describe)?		
Other (describe)?		
Other (describe)?		
Hazards		
Have there been complaints from residents?		
Public hazards noted?		

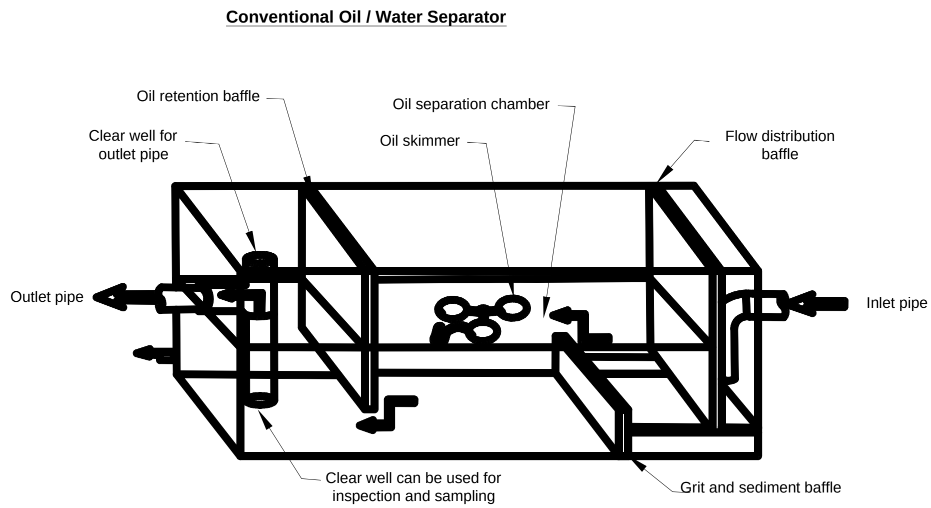
If any of the above inspection items are **UNSATISFACTORY**, list corrective actions and the corresponding completion dates below:

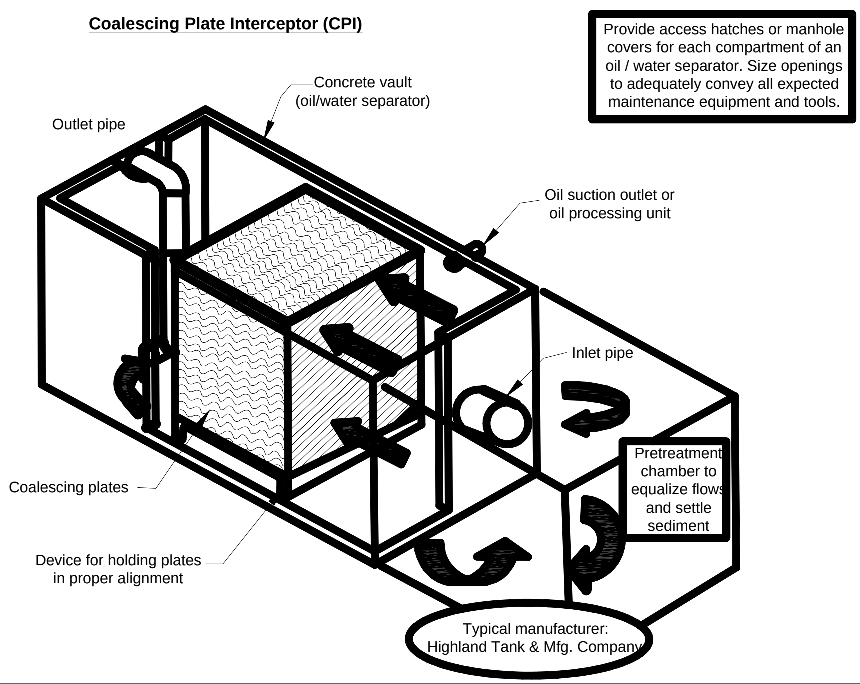
Corrective Action Needed	Due Date

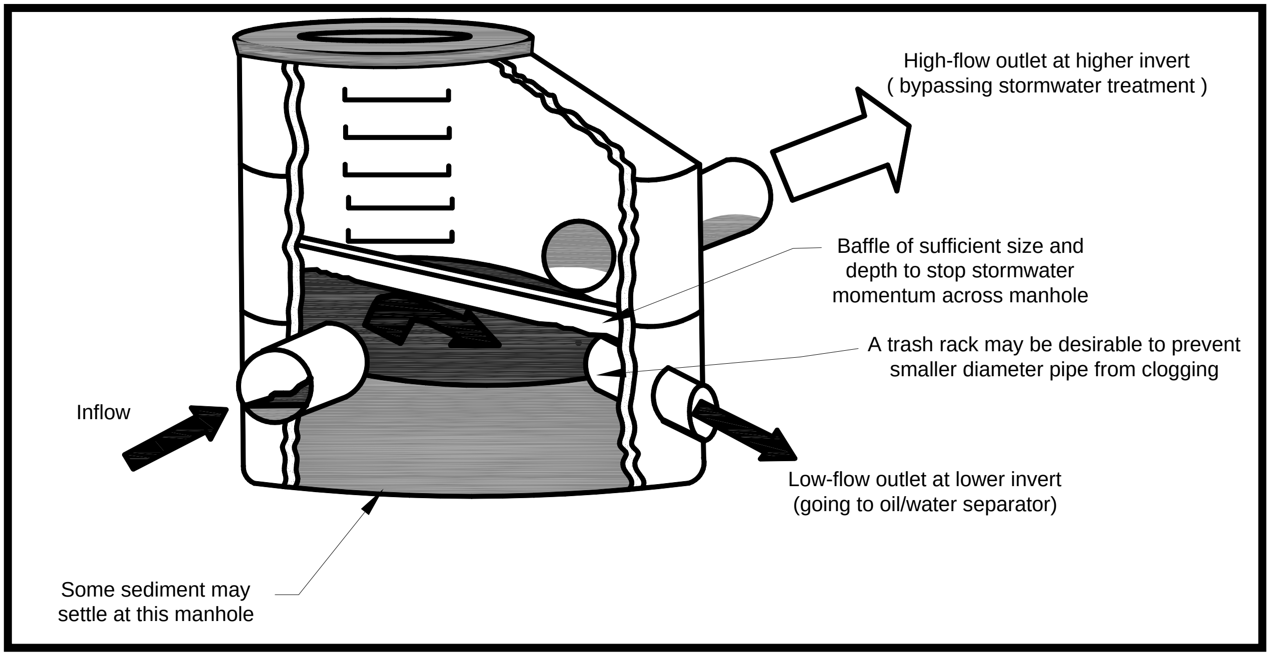
Inspector Signature:______________________ Inspector Name (printed)______________________

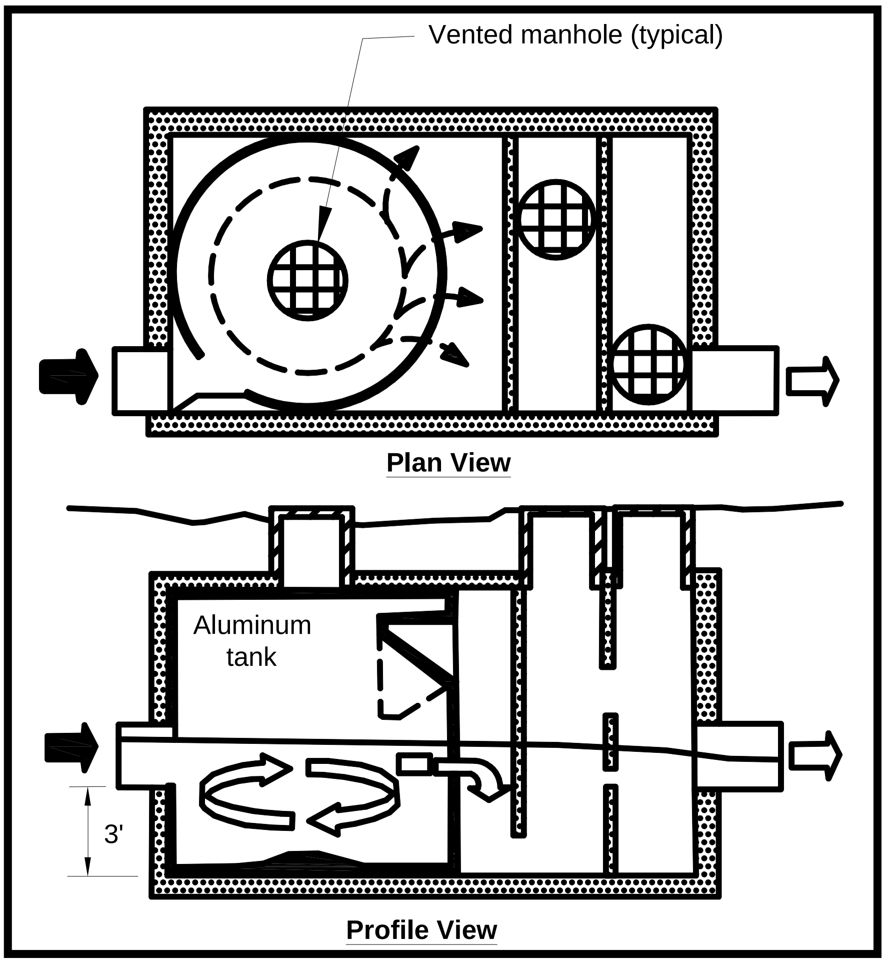
4.4.7.8 Example Schematics

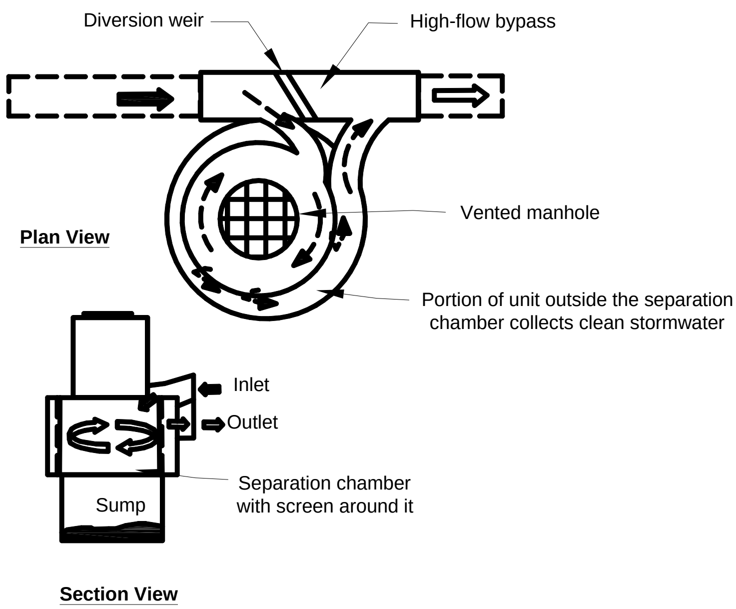
Figure 4-70. Typical Oil-Grit (Oil/Water) Separators
(City of Knoxville, 2003)





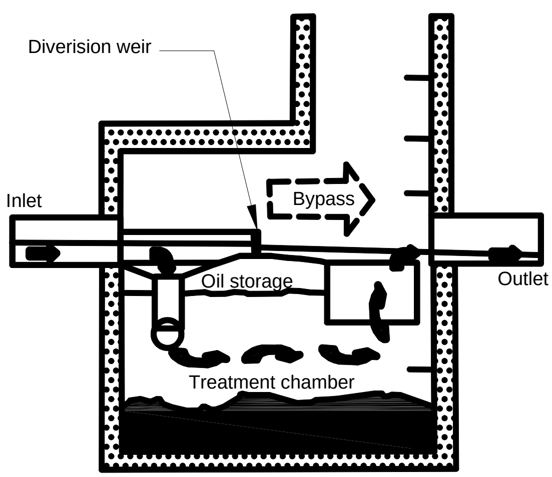

High-flow outlet at higher invert
(bypassing stormwater treatment)
Baffle of sufficient size and
depth to stop stormwater
momentum across manhole
A trash rack may be desirable to prevent
smaller diameter pipe from clogging
Inflow
Low-flow outlet at lower invert
(going to oil/water separator)
Some sediment may
settle at this manhole


Vented manhole (typical)
Plan View
Aluminum
tank
3'
Profile View



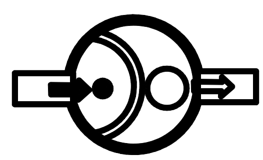
Notes:

1. This figure represents the continuous deflection stormwater treatment as manufactured by CDS Technologies. Units can also be retrofitted onto existing storm drains.
2. Units are manufactured from either fiberglass or precast concrete.
3. Manufacturer recommends the use of sorbent material within CDS separtion chamber to improve capture of oil and grease. Usage rate is typically several pounds of sorbent per acre per year.

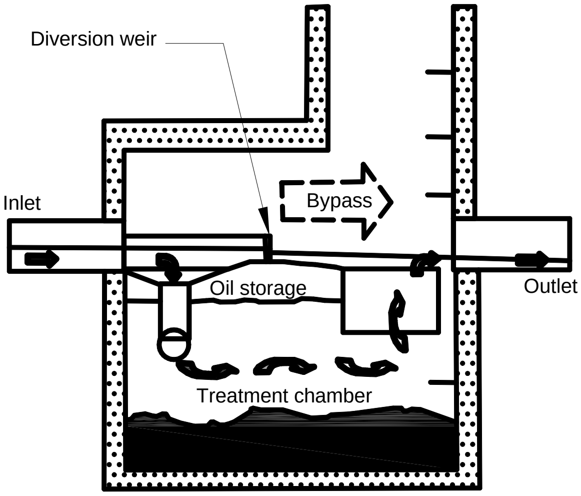


Notes:

1. This figure represents a single-unit system designed to process stormwater runoff on -line ,as manufactured by Stormceptor Corporation.
2. Unit consists of an insert placed into a standard concrete manhole. Basic size is 72" diameter, with larger sections used for the treatment chambers as needed.



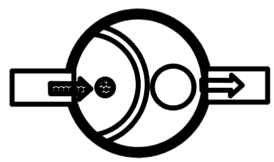
Plan view



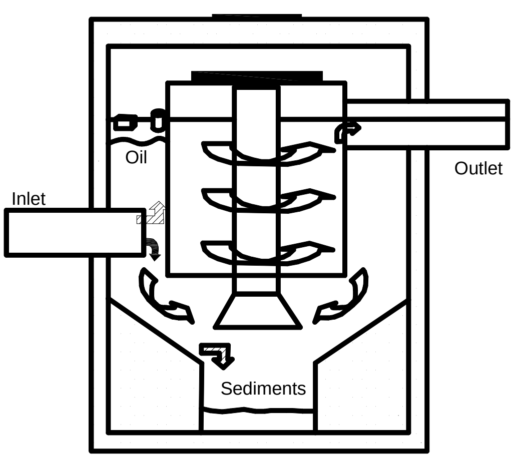
Notes:

1. This figure represents a single-unit system designed to process stormwater runoff on -line, as manufactured by Stormceptor Corporation.

2. Unit consists of an insert placed into a standard concrete manhole. Basic size is 72" diameter, with larger sections used for the treatment chambers as needed.



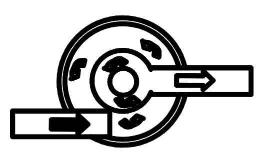
Plan view



Notes:

1. This figure shows a single unit to treat stormwater runoff, manufactured by H.I.L Technologies, Inc.

2. Unit consists of polyethylene components supported by a stainless frame, inserted into a standard concrete manhole. Concrete manhole sizes vary from 4' to 10'.



Plan view

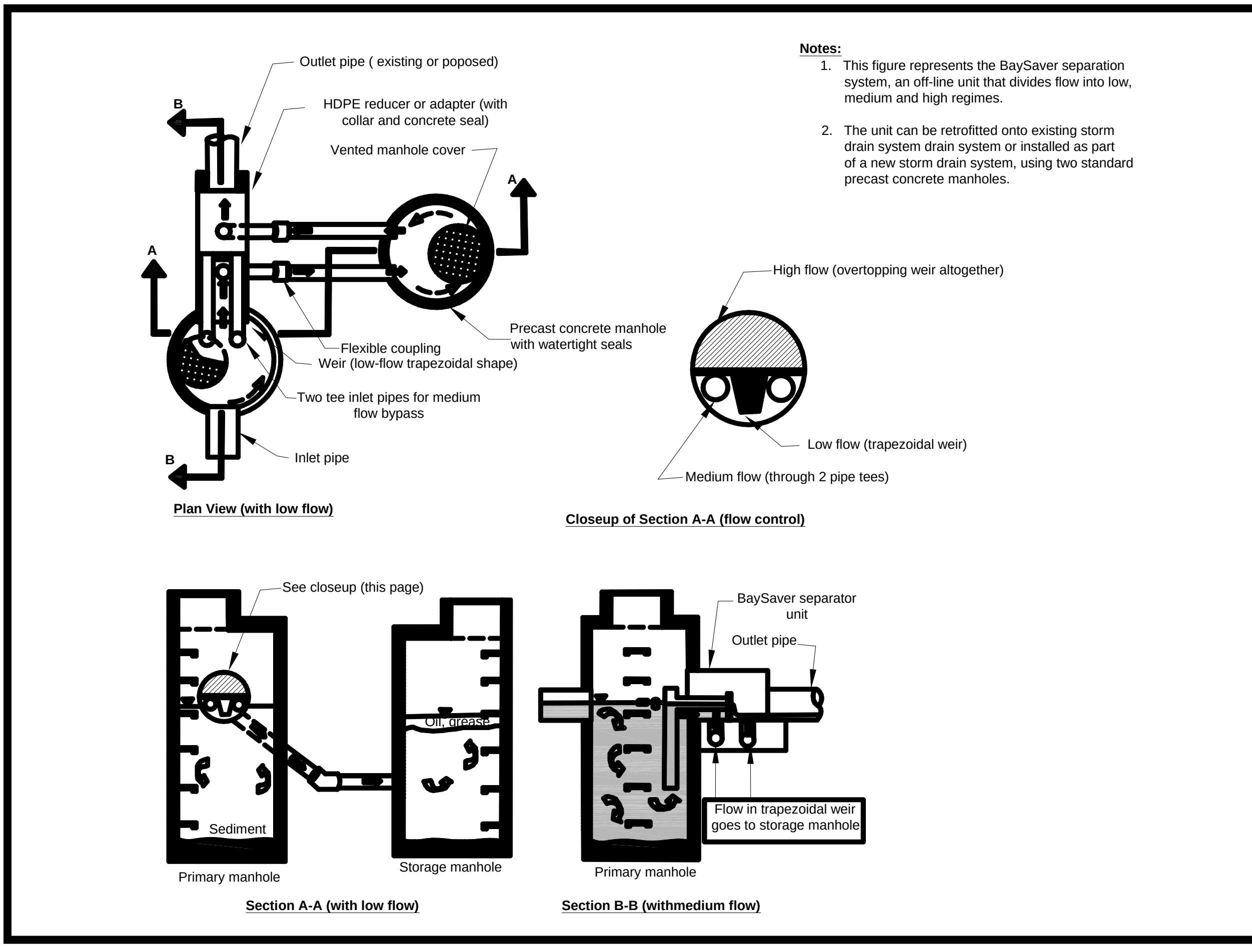
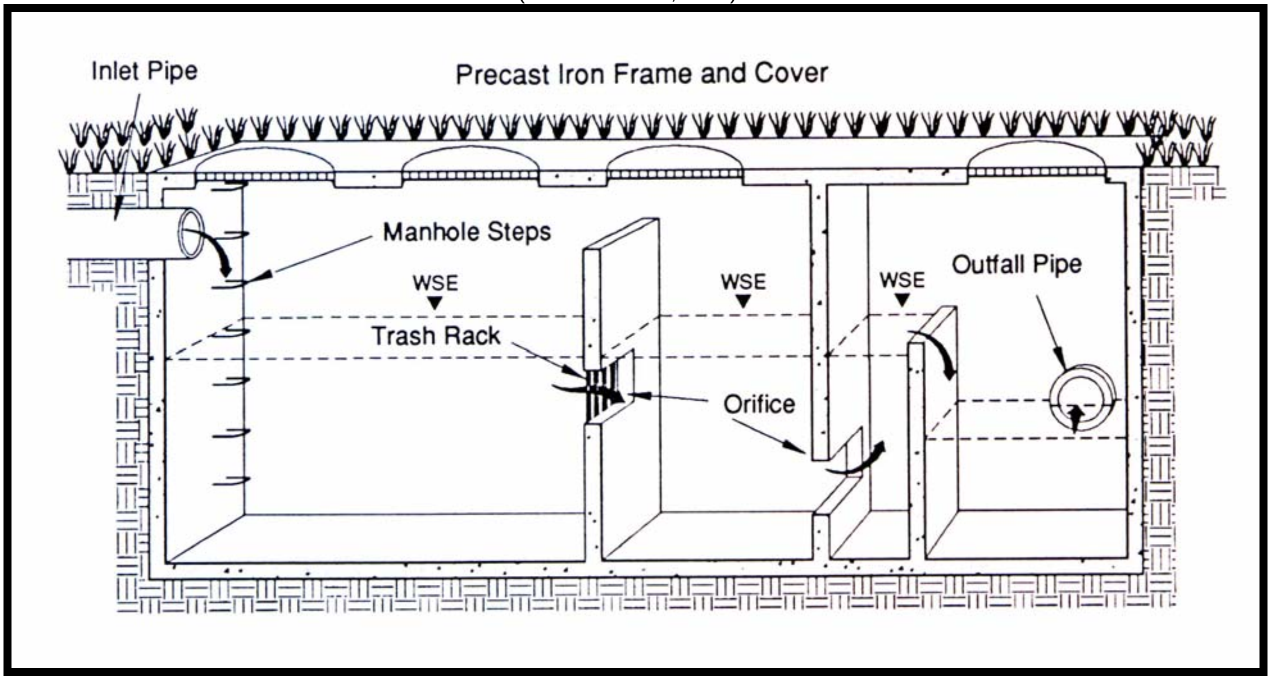

Outlet pipe (existing or poposed)
HDPE reducer or adapter (with collar and concrete seal)
Vented manhole cover
B
A
A
B
Flexible coupling
Weir (low-flow trapezoidal shape)
Precast concrete manhole with watertight seals
Two tee inlet pipes for medium flow bypass
Inlet pipe
Plan View (with low flow)
Notes:
1. This figure represents the BaySaver separation system, an off-line unit that divides flow into low, medium and high regimes.
2. The unit can be retrofitted onto existing storm drain system drain system or installed as part of a new storm drain system, using two standard precast concrete manholes.
High flow (overtopping weir altogether)
Low flow (trapezoidal weir)
Medium flow (through 2 pipe tees)
Closeup of Section A-A (flow control)
See closeup (this page)
Oil, grease
Sediment
Primary manhole
Storage manhole
Section A-A (with low flow)
BaySaver separator unit
Outlet pipe
Flow in trapezoidal weir goes to storage manhole
Primary manhole
Section B-B (withmedium flow)

Figure 4-71. Schematic of an Example Gravity (Oil-Grit) Separator
(Source: NVRC, 1992)



4.4.7.9 References

Atlanta Regional Council (ARC). *Georgia Stormwater Management Manual Volume 2 Technical Handbook.* 2001.

City of Knoxville. *Knoxville Best Management Practices Manual.* City of Knoxville Stormwater Engineering Division, March 2003.

City of Nashville, Tennessee. *Metropolitan Nashville and Davidson County Stormwater Management Manual, Volume 4 Best Management Practices.* 2006.

Knox County, Tennessee. *Knox County Stormwater Management Manual Volume 2, Technical Guidance*. 2006.

Metropolitan Council. *Minnesota Urban Small Sites BMP Manual.* Metropolitan Council Services, St. Paul Minnesota, 2001.

4.4.7.10 Suggested Reading

California Storm Water Quality Task Force. *California Storm Water Best Management Practice Handbooks,* 1993.

4.4.7.11 Oil/Grit Separator Manufacturers

Highland Tank (CPI unit)	www.highlandtank.com
Vortechnics, Inc.	www.vortechnics.com
CDS Technologies	www.cdstech.com.au/us/
Stormceptor Corporation	www.stormceptor.com
H.I.L. Technology, Inc.	www.hil-tech.com
BaySaver, Inc.	www.baysaver.com
Aquashield, Inc.	www.squashieldinc.com
Environment 21, LLC	www.env21.com

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