



Stormwater Management Facility Operation & Maintenance (O&M) Manual

LOT 1, OWL MARKETPLACE FILING NO. 1

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This Manual is designed to outline the operation and maintenance of the Stormwater Quality BMP The SNOUT, manufactured by Best Management Products, Inc. It is located within the proposed private CDOT Type C Storm Inlet at the southwest corner of the property. The SNOUT is providing stormwater quality pretreatment for the site due to the classification as a high-risk development.

Compliance with Stormwater Facility Maintenance Requirements

Property owners are responsible for maintaining stormwater facilities on their property to ensure they operate effectively. Occasionally, this responsibility may be delegated to others through specific agreements. The maintenance obligation for a stormwater facility may be specified on the Final Drainage Letter and the Private Detention Basin/Stormwater Quality Best Management Practice Maintenance Agreement and Easement for the property. Property owners should have knowledge of their responsibilities regarding stormwater facility upkeep.

Inspection & Maintenance – Annual Reporting

Requirements for the inspection and maintenance of stormwater facilities, as well as reporting requirements are included in this Stormwater Management Facility Operation and Maintenance (O&M) Manual.

Verification that the Stormwater facilities have been properly inspected and maintained; submittal of the required Inspection Forms and Inspector qualifications shall be provided to El Paso County on an annual basis. The annual reporting form shall be provided to El Paso County prior to December 31st each year.

Preventative Measures to Reduce Maintenance Costs

The most effective way to maintain the water quality facility is to prevent pollutants from entering the facility in the first place. Most common pollutants include sediment, trash & debris, chemicals, dog waste, runoff from stored materials, illicit discharges into the storm drainage system, and many others. A thorough and intentional maintenance program will include measures to address these potential contaminants and will save money and time in the long run. Key points to consider in your maintenance program include:

- Educate property owners/residents to be aware of how their actions affect water quality, and how they can help reduce maintenance costs.
- Keep properties, streets and gutters, and parking lots free of trash, debris, and lawn clippings.
- Ensure the proper disposal of hazardous wastes and chemicals.
- Plan lawn care to minimize the use of chemicals and pesticides.
- Sweep paved surfaces and put the sweepings back on the lawn.
- Be aware of automobiles leaking fluids. Use absorbents such as cat litter to soak up drippings – dispose of properly.
- Re-vegetate disturbed and bare areas to maintain vegetative stabilization.

- Clean out the upstream components of the storm drainage system, including inlets, storm sewers and outfalls.
- Do not store materials outdoors (including landscaping materials) unless properly protected from runoff.

Access and Easements

All stormwater management facilities located on the site have a designated access location. Refer to the Drainage Map located in Appendix B for access locations.

Safety

Keep safety considerations at the forefront of inspection procedures at all times. Likely hazards should be anticipated and avoided. Never enter a confined space (outlet structure, manhole, etc) without proper training or equipment. A confined space should never be entered without at least one additional person present.

If a toxic or flammable substance is discovered, leave the immediate area and contact **911**.

Potentially dangerous (e.g., fuel, chemicals, hazardous materials) substances found in the areas must be referred to **Pikes Peak Regional Emergency Management** immediately for response by the Hazardous Materials Unit. The emergency contact number is **(719) 385-5957**.

Vertical drops may be encountered in areas located within and around the facility. Avoid walking on top of retaining walls or other structures that have a significant vertical drop. If a vertical drop is identified within the pond that is greater than 36" in height, make the appropriate note/comment on the maintenance inspection form.

If any hazard is found within the facility area that poses an immediate threat to public safety, contact 911 immediately.

Field Inspection Equipment

It is imperative that the appropriate equipment is taken to the field with the inspector(s). This is to ensure the safety of the inspector and allow the inspections to be performed as efficiently as possible. Below is a list of the equipment that may be necessary to perform the inspections of all Stormwater Management Facilities:

- Protective clothing and boots.
- Safety equipment (vest, hard hat, confined space entry equipment).
- Communication equipment.
- Operation and Maintenance Manual for the site including the stormwater management facility location on Drainage Map.
- Clipboard.
- Stormwater Facility Maintenance Inspection Forms
- Manhole Lid Remover
- Flashlight

- Tape Measure
- Shovel

Some of the items identified above need not be carried by the inspector (manhole lid remover, shovel, and confined space entry equipment). However, this equipment should be available in the vehicle driven to the site.

Inspecting Stormwater Management Facilities

The quality of stormwater entering the waters of the state relies on the proper operation and maintenance of permanent best management practices located upstream of these discharges. Stormwater management facilities must be periodically inspected to ensure that they function as designed. The inspection will determine the appropriate maintenance that is required for the facility.

A. Inspection Procedures

All stormwater management facilities are required to be inspected by a qualified individual at a minimum of once per year.

B. Inspection Report

The person(s) conducting the inspection activities shall complete the appropriate inspection report for the specific facility. If more than one facility is located on the site, use multiple inspection forms. Inspection forms are located in Appendix A.

The following information explains how to fill out the Inspection Forms:

General Information

This section identifies the facility location, person conducting the inspection, the date and time the facility was inspected, and approximate days since the last rainfall. Property classification is identified as single-family residential, multi-family residential, commercial, or other.

The reason for the inspection is also identified on the form depending on the nature of the inspection. All facilities should be inspected on an annual basis at a minimum. In addition, all facilities should be inspected after a significant precipitation event to ensure the facility is draining appropriately and to identify any damage that occurred as a result of the increased runoff.

Inspection Scoring

For each inspection item, a score must be given to identify the urgency of required maintenance. The scoring is as follows:

0 = No deficiencies identified.

1 = Monitor – Although maintenance may not be required at this time, a potential problem exists that will most likely need to be addressed in the future. This can include items like minor erosion, concrete cracks/spalling, or minor sediment accumulation. This item should be revisited at the next inspection.

2 = Routine Maintenance Required – Some inspection items can be addressed through the routine maintenance program. This can include items like vegetation management or debris/trash removal.

3 = Immediate Repair Necessary – This item needs immediate attention because failure is imminent or has already occurred. This could include items such as structural failure of a feature (outlet works, forebay, etc), significant erosion, or significant sediment accumulation. This score should be given to an item that can significantly affect the function of the facility.

N/A This is checked by an item that may not exist in a facility. Not all facilities have all of the features identified on the form (forebay, micro-pool, etc.).

Inspection Summary/Additional Comments

Additional explanations to inspection items, and observations about the facility not covered by the form, are recorded in this section.

Overall Facility Rating

An overall rating must be given for each facility inspected. The overall facility rating should correspond with the highest score (0, 1, 2, 3) given to any feature on the inspection form.

C. Verification of Inspection and Form Submittal

The Stormwater Management Facility Inspection Form provides a record of inspection of the facility. Verification of the inspection of the stormwater facilities, the facility inspection form(s), and Inspector Qualifications shall be provided to El Paso County on an annual basis. The verification and the inspection form(s) shall be reviewed and submitted by the property owner or property manager.

Maintaining Stormwater Management Facilities

Stormwater management facilities must be properly maintained to ensure that they operate correctly and provide the water quality treatment for which they were designed. Routine maintenance conducted on the facilities via scheduled times throughout the year can help avoid more costly rehabilitative maintenance that results when facilities are not adequately maintained.

A. Maintenance Categories

Stormwater management facility maintenance programs are separated into three broad categories of work. These categories are based largely on the Mile High Flood District's Maintenance Program for regional drainage facilities. The categories are separated based upon the magnitude and the type of maintenance activities performed. A description of each category follows:

Routine Work

Routine work on the facility is typically scheduled maintenance, which involves mowing and debris removal from stormwater management facilities during the growing season. This includes clearing out debris and material that may be obstructing the outlet structure well screens and trash racks, as well as controlling weeds, treating mosquitoes, and managing algae. These activities are typically conducted multiple times throughout the year. No prior communication with the Town of Johnstown is necessary; however, completed inspection forms must be submitted for each maintenance and inspection activity.

Restoration Work

Most restoration work involves isolated or small-scale maintenance work to address operational issues. It can be performed by a small team with basic tools and equipment. Prior communication with El Paso County is necessary and completed maintenance forms must be submitted for each activity.

Rehabilitation Work

This project involves large-scale maintenance and improvements to address stormwater management failures. It requires consultation with El Paso County, possible engineering design and construction plans, specialized equipment, surveying, construction permits, and external contractors and consultant assistance. Prior communication with the Johnstown Public Works Department is necessary and completed maintenance forms must be submitted for each activity.

B. Maintenance Personnel

Maintenance personnel must be qualified to properly maintain stormwater management facilities. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs and potential injury.

The websites below have information on training classes and may have information on individuals or companies related to inspection and maintenance of stormwater management facilities. El Paso County cannot recommend or endorse any of the individuals, companies, or institutions.

<http://stormwatercenter.colostate.edu> (Colorado State University)

<http://www.rmecosha.com/catalog.aspx> (Red Rocks Community College)

C. Maintenance Forms

The Stormwater Management Facility Maintenance Form provides a record of maintenance activities. Maintenance Forms for each facility type are provided in Appendix A. Maintenance Forms shall be completed by the contractor completing the required maintenance items. The form shall then be reviewed by the property owner or an authorized agent of Murphy USA, Inc. and submitted on an annual basis to El Paso County.

APPENDIX A

ANNUAL INSPECTION AND MAINTENANCE REPORTING FORM



The SNOUT Inspection Form

Inspection Date: _____

Inspector: _____

Subdivision/Business Name: _____

Property Address: _____

City & State: _____

Weather: _____

Date of Last Rainfall: _____ Amount: _____ Inches

Property Classification: Residential Multi Family Commercial Other:
(Circle One)

Reason For Inspection: Routine Compliant After Significant Rainfall Event
(Circle One)

INSPECTION SCORING - For each facility inspection item, insert one of the following

0 = No deficiencies identified

2 = Routine maintenance required

1 = Monitor (potential for future problem)

3 = Immediate repair necessary

N/A = Not applicable

Separator Unit

_____ Sediment/Debris Accumulation

_____ Trash Accumulation

_____ Structural Damage

_____ Petroleum/Chemical Sheen

_____ Graffiti/Vandalism

_____ Public Hazards

_____ Other

Inspection Summary/Additional Comments: _____

Overall Facility Rating (Circle One)

0 = No Deficiencies Identified

2 = Routine Maintenance Required

1 = Monitor (potential for future problem exists)

3 = Immediate Repair Necessary



Thew SNOUT Maintenance Form

Completion Date: _____

Subdivision/Business Name: _____

Property Address _____

City & State: _____

Contact Name: _____

Property Classification:
(Circle One)

Residential

Multi Family

Commercial

Other:

Maintenance Category:
(Circle All that Apply)

Routine

Restoration

Rehabilitation

MAINTENANCE ACTIVITIES PERFORMED

Routine Work

_____ Removal of Floatables/Oil from Surface of Water with Vac Hose or Skimmer Net

_____ Measure Depth of Sediment with Sludge Judge (or similar sediment probe) and Record in Maintenance Log

_____ Vac Sediment/Debris from Sump Floor

Restoration Work

_____ Structural Repair

_____ Inflow Point(s)

_____ Replace Bio-Skirt

Rehabilitation Work

_____ Replacement of SNOUT

Other: _____

Estimated Total Manhours: _____

Equipment / Material Used: _____

Comments / Additional Info: _____

APPENDIX B

PROPOSED DRAINAGE MAP

APPENDIX C

MANUFACTURER'S MAINTENANCE RECOMMENDATIONS



Design and Maintenance Considerations for SNOUT[®] Stormwater Quality Systems

Background:

The SNOUT system from Best Management Products, Inc. (BMP, Inc.) is based on a vented hood that can reduce floatable trash and debris, free oils, and other solids from stormwater discharges. In its most basic application, a SNOUT hood is installed over the outlet pipe of a catch basin or other stormwater quality structure with a deep sump (see Installation Drawing). The SNOUT forms a baffle that traps floatable debris and free oils on the surface, while permitting heavier solids to sink to the bottom of the sump. The clarified intermediate layer is forced out of the structure through the open bottom of the SNOUT by displacement from incoming flow. The resultant discharge contains considerably less unsightly trash and other gross pollutants, and can also offer reductions of free-oils and finer solids.

As with any structural stormwater quality design, maintenance considerations will have a dramatic impact on SNOUT system performance over the life of the facility. The most important factor to consider when designing structures with a SNOUT is the depth of the sump. Sump is defined as the depth from the invert of the outlet pipe to the bottom of the structure. *Simply put, the deeper the sump, the more effective the unit will be both in terms of pollutant removals and reducing frequency of maintenance.* More volume in a structure means more quiescence, thus allowing the pollutants a better chance to separate out. Secondly, more volume means fewer cycles between maintenance, because the structure has a greater capacity. Of equal importance to good performance is putting SNOUTs in multiple structures. The closer one captures pollution to where it enters the infrastructure (e.g. at the inlet), the less mixing of runoff there is, and the easier it will be to separate out pollutants. Putting SNOUTs and deep sumps in all inlets that can be easily maintained develops a powerful structural treatment train with a great deal of effective storage volume, where even finer particles may have chance to settle out.

Design Notes:

- The SNOUT size is ALWAYS greater than the nominal pipe size. The SNOUT should cover the pipe OD and optimally the grouted area around the pipe (e.g. for a 12" pipe, an 18" SNOUT is the correct choice).
- As a rule of thumb, BMP, Inc. recommends *minimum* sump depths based on outlet pipe inside diameters of 2.5 to 3 times the outlet pipe size.
- For best performance, the inlet pipe and outlet pipe should have inverts close to the same elevation (a six inch or less deviation is optimal).
- Special note for smaller pipes: A minimum sump depth of 36 inches for all

pipe sizes 12 inches ID or less, and 48 inches for pipe 15-18 inches ID is required if collection of finer solids is desired.

- The plan dimension of the structure should be up to 6 to 7 times the flow area of the outlet pipe. Increasing area beyond that has a minimal impact on performance. However, the structure wall where the SNOUT is mounted must accommodate the size of the SNOUT (either the correct diameter or enough width).
- To optimize pollutant removals establish a “treatment train” with SNOUTs placed in as many inlets where it is feasible to do so (this protocol applies to most commercial, institutional or municipal applications and any application with direct discharge to surface waters).
- At a minimum, SNOUTs should be used in every third structure for less critical applications (less critical areas might include flow over grassy surfaces, very low traffic areas in private, non-commercial or non-institutional settings, single family residential sites).
- Use Bio-Skirts® for increased hydrocarbon reduction. Bio-Skirts are highly recommended for fueling or vehicle service stations, convenience stores, restaurants, loading docks, marinas, beaches, schools or high traffic applications. Each Bio-Skirt can retain about one gallon of oils.
- Use the Stainless TrashScreen for “Full Trash Capture” requirements.
- Use BMP Turbo Plates™ for increased sediment capture.
- The “R” series SNOUTs (12R, 18R, 24R, 30R, 30R/96, 42RTB/60, 52RTB/72, 52RTB/84 and 72RTB/96) are available for round manhole type structures of up to 96” ID; the “F” series SNOUTs (LP318F, 12F, 18F, 24F, 30F, 36F, 48F, 72F and 96F) are available for flat walled structures; the “NP” series SNOUTs (NP1218R, NP1524R, NP1830R, and NP2430R) are available for smaller diameter structures up to 30” ID.

Example Structure Sizing Calculation:

A SNOUT equipped structure with a 15 inch ID outlet pipe (1.23 sqft. flow area) will offer best performance with a minimum plan area of 7.4 sqft. and 48 inch sump. Thus, a readily available 48 inch diameter manhole-type structure, or a rectangular structure of 2 feet x 4 feet will offer sufficient size when combined with a sump depth of 48 inches or greater.

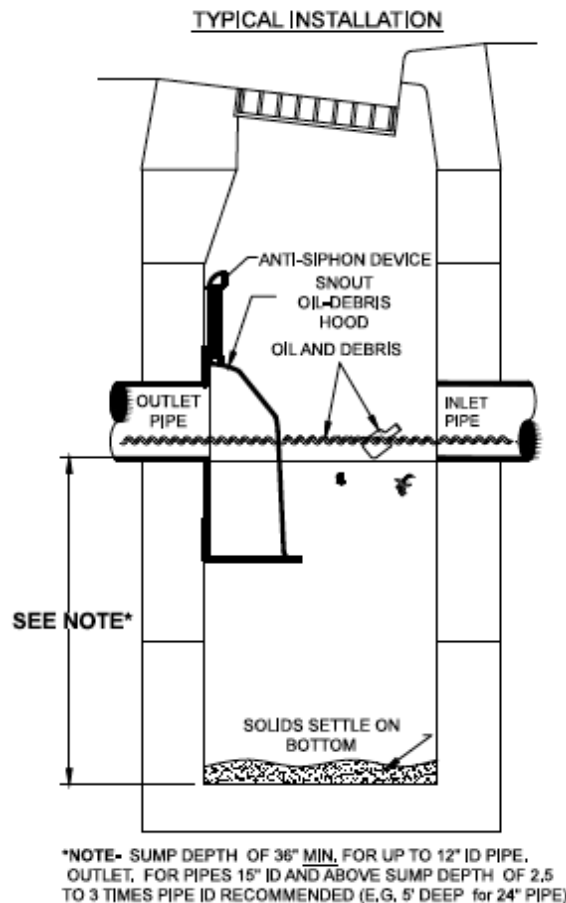
Maintenance Recommendations:

- Monthly monitoring for the first year of a new installation after the site has been stabilized is a recommended practice.
- Measurements should be taken after each rain event of .5 inches or more, or monthly, as determined by local weather conditions.
- Checking sediment depth and noting the surface pollutants in the structure will be helpful in planning maintenance.
- The pollutants collected in SNOUT equipped structures will consist of floatable debris and oils on the surface of the captured water, and grit and sediment on the bottom of the structure.
- It is best to schedule maintenance based on the solids collected in the sump.
- Optimally, the structure should be cleaned when the sump is half full (e.g. when 2 feet of material collects in a 4 foot sump, clean it out).
- Structures should also be cleaned if a spill or other incident causes a larger

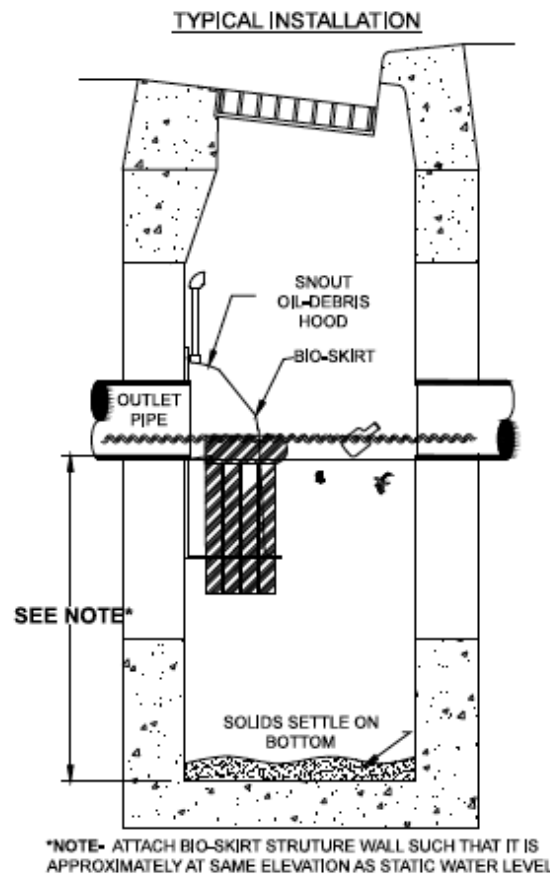
- than normal accumulation of pollutants in a structure.
- Maintenance is best done with a vacuum truck.
 - If Bio-Skirts are being used in the structure to enhance hydrocarbon capture, they should be checked on a monthly basis for the first year, and serviced or replaced when more than 2/3 of the boom is submerged, indicating a nearly saturated state. Assuming a typical pollutant-loading environment exists, Bio-Skirts should be serviced* annually or replaced as necessary.
 - In the case of an oil spill, the structure should be checked and serviced and Bio-Skirts (if present) replaced or serviced immediately.
 - All collected wastes must be handled and disposed of according to local environmental requirements.
 - To maintain the SNOUT hoods, an annual inspection of the anti-siphon vent and access hatch are recommended. A simple flushing of the vent, or a gentle rodding with a flexible wire are all that's typically needed to maintain the anti-siphon properties. Opening and closing the access hatch once a year ensures a lifetime of trouble-free service.

*To extend the service life of a Bio-Skirt, the unit may be “wrung out” to remove oils and washed in an industrial washing machine with warm water. The Bio-Skirt may then be re-deployed if the material maintains it's structural integrity. A maintained Bio-Skirt can last for several years. Each Bio-Skirt can hold about on gallon of oils.

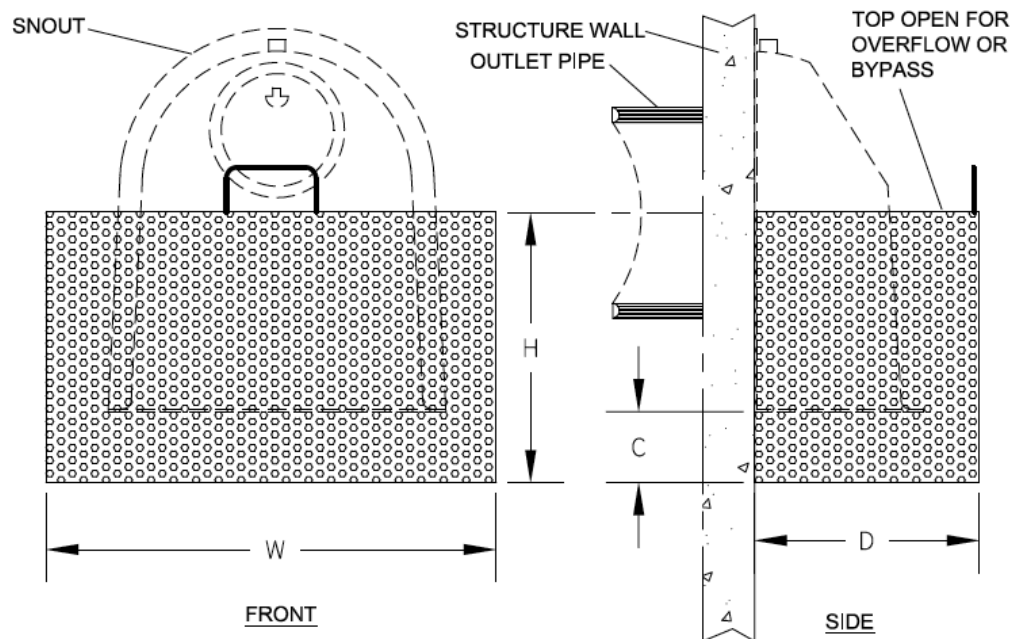
SNOUT INSTALLATION:



BIO-SKIRT INSTALLATION:

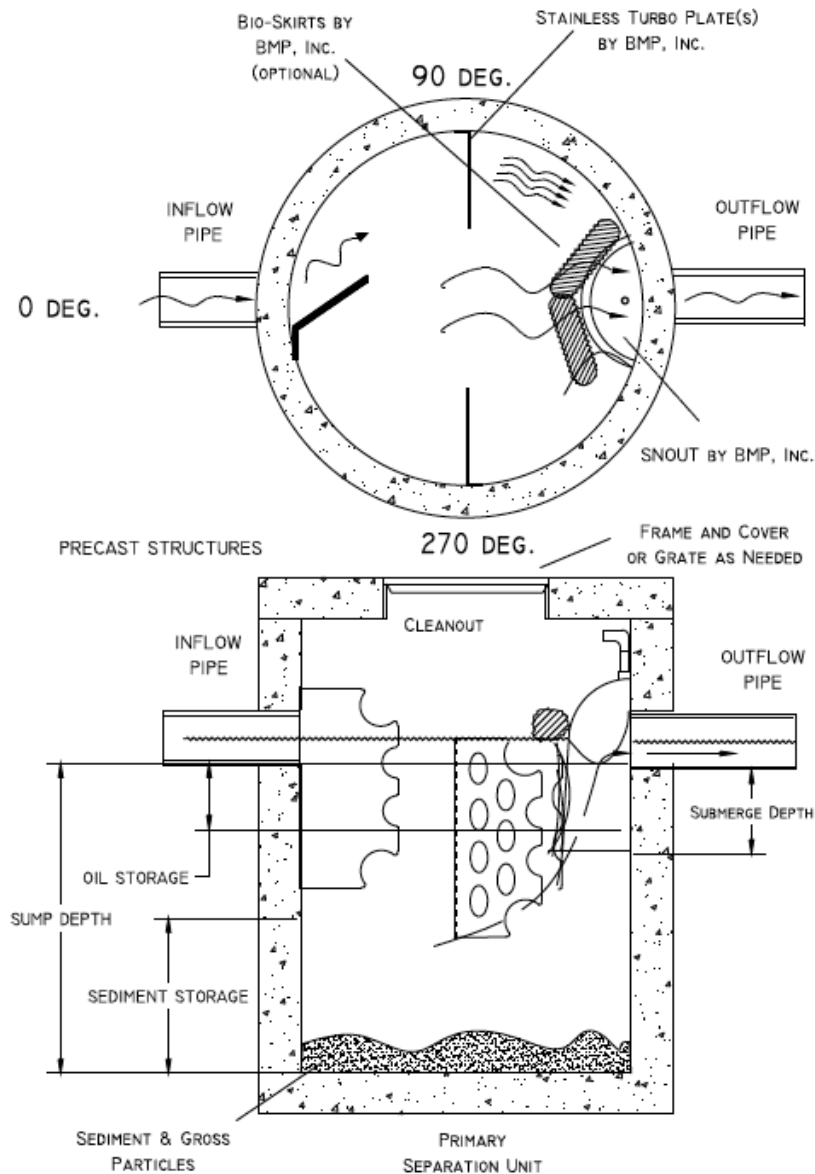


STAINLESS TRASHSCREEN INSTALLATION:



TURBO PLATE INSTALLATION:

SNOUT TURBO PLATE-OIL-GRIT SEPARATOR



Contact Information: Please contact T. J. Mullen at 800-504-8008, tjm@bmpinc.com or Matt White at 888-434-0277, mwhite@bmpinc.com for design assistance.

Website: www.bmpinc.com

The SNOUT, Bio-Skirt and TrashScreen are protected by: US Patents 6126817, 7857966, 7951294 and 8512556. More US patents are pending and BMP holds Canadian patents for much of the technology patented in the US. Canadian Patents numbers include 2285146, 2688012, 2690156 and 2740678. The SNOUT®, Bio-Skirt® Turbo Plate™ and Stainless TrashScreen™ are trademarks of Best Management Products,