

Construction Site and Post-Construction Runoff Controls
Stormwater Permit and Stormwater Quality Plan Guidelines

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1.0 Introduction

The Texas Commission on Environmental Quality (TCEQ) and the Environmental Protection Agency (EPA) regulate pollution sources to local water ways. One such regulation is focused on the control of pollutants that enter our local waterways as stormwater runoff. The regulators have taken a broad approach to controlling such pollutants. The TCEQ was granted authority by the EPA to issue and enforce permits to control stormwater pollutants that enter “Waters of the State”.

The TCEQ has three different types of stormwater permits including the construction general permit (CGP). The CGP, permit number TXR150000, regulates large and small construction projects. Large construction projects include projects that result in the land disturbance of greater than 5 acres or a project that is a part of a common plan of development that will disturb greater than 5 acres. Small sites disturb less than 5 acres but more than 1 acre of land or a smaller site that is a part of a common plan of development that disturbs greater than 1 acre but less than 5 acres. The CGP requires that regulated construction site operators develop and implement a Stormwater Pollution Prevention Plan (SWPPP or SWP3) to reduce the discharge of pollutants from construction sites.

The TCEQ also regulates the discharge of stormwater from municipal separate storm sewer systems (MS4s). The City was issued a Phase II MS4 permit under the Texas Pollution Discharge Elimination System (TPDES) general permit number TXR040000. The MS4 permit requires that the City regulate construction and post construction site runoff into the MS4. All part of the City’s drainage system is considered to be the MS4 including but not limited to roadways, curbs and gutters, inlets, roadside ditches, underground storm sewer, culverts, outfall pipes and other City owned stormwater conveyances. The following is an excerpt from the MS4 permit that outlines the City’s required activities in order to comply with the permit.

4. *Construction Site Stormwater Runoff Control*

The MS4 operator, to the extent allowable under State and local law, must develop, implement, and enforce a program to reduce pollutants in any stormwater runoff to the small MS4 from construction activities that result in a land disturbance of greater than or equal to one acre or if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more of land. The MS4 operator is not required to develop, implement, and/or enforce a program to reduce pollutant discharges from sites where the construction site operator has obtained a waiver from permit requirements under NPDES or TPDES construction permitting requirements based on a low potential for erosion.

- (a) *The program must include the development and implementation of, at a minimum, an ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under state and local law.*
- (b) *Requirements for construction site contractors to, at a minimum:*
 - (1) *implement appropriate erosion and sediment control BMPs; and*

(2) *control waste such as discarded building materials, concrete truck washout water, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality.*

(c) *The MS4 operator must develop procedures for:*

(1) *site plan review which incorporate consideration of potential water quality impacts;*

(2) *receipt and consideration of information submitted by the public; and*

(3) *site inspection and enforcement of control measures to the extent allowable under state and local law.*

5. *Post-Construction Stormwater Management in New Development and Redevelopment*

To the extent allowable under state and local law, the MS4 operator must develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre of land, including projects less than one acre that are part of a larger common plan of development or sale that will result in disturbance of one or more acres, that discharge into the small MS4. The program must ensure that controls are in place that would prevent or minimize water quality impacts. The permittee shall:

(a) *Develop and implement strategies which include a combination of structural and/or non-structural BMPs appropriate for the community;*

(b) *Use an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under state and local law; and*

(c) *Ensure adequate long-term operation and maintenance of BMPs.*

In order to comply with these requirements, the City has adopted an ordinance to regulate runoff from construction activities. The ordinance requires that owners of construction sites that disturb more than 1 acre of land or owners of smaller sites that are a part of a common plan of development that will disturb more than one acre of land must apply for a stormwater permit. The City stormwater permit requires the development of a stormwater quality plan for construction sites. The plan must include control measures in accordance to these guidelines in order to be approved. The following sections will describe these requirements, the application process and other technical information necessary for permit compliance.

1.1 City Stormwater Permit Compliance Process Overview

A. Develop a Stormwater Quality Plan (SWQP) or Stormwater Pollution Prevention Plan (SWP3)

The owner of a construction project shall consider the City and TCEQ stormwater permits during the construction planning process. The TCEQ permit and City permits are independent and must be applied for separately from each agency. The permits regulate essentially the same aspects of construction and construction site runoff and therefore the SWP3 required by the TCEQ permit may be submitted in place of the Stormwater Quality Plan in order to meet the City's stormwater permit requirements.

B. Complete the City permit application forms

The next required activity is to complete the City permit application form and SWP3 checklist, included in section 6.0 of this document. The City also requires that a copy of the TCEQ construction site notice be attached to the City SWP3 checklist. For large construction sites, a copy of the TCEQ permit application, Notice of Intent (NOI), is also required as an attachment to the SWP3 checklist. The permit application must be submitted to the building permits office in order to apply for a City building permit or stormwater permit. Once submitted, the City will review the permit application and SWP3 including permanent control measures to ensure the required elements are addressed.

C. Initial Site Preparations

Once the City has issued a stormwater permit and any other necessary permits, construction activities may begin once the SWP3 or Stormwater Quality Plan (SWQP) is implemented. Before any grading or land clearing begins, the temporary erosion controls and off-site tracking controls must be installed and functional. Any construction activities beginning before controls are in place will be in violation of the City's ordinance regulating construction site runoff. During grading and or site preparations, careful attention to the adequacy of the selected and installed control measures must be considered. The temporary erosion controls should control offsite transport of sediment from all disturbed areas within the construction site boundary.

D. Inspection and maintenance of controls during construction.

During construction, all of the required stormwater control measures must be maintained in proper functioning order. The site must be inspected by the site operator or owner according to the TCEQ permit. The inspection must be documented and maintained with the SWP3. The City will inspect construction sites during construction to ensure the implementation of the SWP3 and compliance with the City permit. Construction site operators will be expected to understand the SWP3 and cooperate with City inspectors during inspections.

E. Final stabilization of the site and termination of permit coverage.

In order for the construction site to be considered stabilized and the permit coverage to be terminated the following conditions must be met.

- Construction at the site is complete
- All construction materials and debris shall be properly removed from the site

- All earthen surfaces must be permanently stabilized with vegetation to within at least 70% of the naturally occurring vegetative cover in the area
- Permanent control measures are in place and functional including a long term operation and maintenance plan. (Permanent Controls will be reviewed by the City during the initial stormwater quality plan review)
- After the site is properly stabilized, then the temporary erosion controls must be removed from the site (Except those temporary controls that will become permanent controls i.e. Detention Pond)

It is considered a violation of the permit to remove temporary control measures before the first three of the above criteria are met. Once the temporary erosion controls are removed and all four of the criteria above are met, the permit is automatically terminated. If new construction is required at the site after the permit was terminated, a new permit will be required before new work begins.

1.2 Stormwater Quality Plan Requirements

The City's stormwater permit application requires the submission of a Stormwater Quality Plan (SWQP) in order for the permit application to be reviewed by the City. The SWQP must be prepared by a Certified Professional in Erosion and Sediment Control (CPESC) or a P.E. The City will accept SWP3s developed in accordance to the TCEQ construction general permit in place of a separate SWQP. The City does not intend to require any elements that are not already required by the TCEQ permit. The City's criteria for review of Stormwater Quality Plans are included in Section 6.0 of the document. It is recommended that construction site operators review the TCEQ permits and have a qualified person(s) develop the plan. The following sections are required by the City in order for the SWP3 to be considered for City permit approval.

Contents of the Stormwater Quality Plan

A. Site or Project Description

The site or projection description section of the SWQP or SWP3 must include the following elements.

1. The location of the site or project: The address, subdivision name and lot number or other detailed description that will allow City inspectors to locate and inspect the project. *Examples: Lot 2 of Subdivision A, 110 West Drive or at the intersection of West Drive and Ave H.*
2. A brief description of the nature of the construction activity: What will be constructed or accomplished as a result of the construction activity. *Examples: A house, subdivision streets and utilities, commercial strip center, clearing and grading of 2 acres of wooded land or others.*
3. A list of potential pollutants and their sources: The pollutants that will be potentially discharged into the storm sewer system and the sources of those pollutants. *Examples: Pollutant: Sediment Source: Clearing and grading activities, Pollutant: Construction Debris Source: Scrap Materials from Construction.*
4. The total number of acres of the entire property and the total number of acres where construction activities will occur: Example: *Total Acres: 27 Land Disturbance Acres: 7.4.*
5. A general location map and a detailed site map: The maps must conform to the specification required by the TCEQ in the TPDES Construction General Permit TXR150000. *Examples are included with the example SWP3 in section 7.0 of this guidance.*
6. Other sections as required by the TCEQ Construction General Permit TXR150000 Part III Section F.

B. Sediment and Erosion Controls

The sediment and erosion controls section of the SWQP must address the following requirements.

1. The plan must describe temporary and permanent erosion control and stabilization practices for the site. *Examples: temporary or permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of existing trees and vegetation, slope texturing temporary velocity dissipation devices, flow diversion mechanisms, and other similar measures.*
2. Procedures for the initialization of stabilization measures by the 14th day after construction activity temporarily or permanently ceased. *Examples: Temporary stabilization will be achieved by hand broadcasting grass seeds, Permanent Stabilization will be accomplished by installing sod strips and landscaping.*
3. A description of sediment control practices used to remove eroded soils from stormwater runoff. *Examples: Sedimentation Basins, Sediment Traps, Rock Filter Dams, Silt Fences, Vegetative Buffer Strips or equivalent sediment controls.*

C. Permanent Controls (Post-Construction Runoff Controls Measures)

The permanent controls section of the SWQP must include a description of any measures that will be installed during the construction process to control pollutants in stormwater discharges that may occur after construction operations are complete. *Examples: On-site detention pond, Vegetated Swales, Vegetated Buffer Areas, Drainage to Regional Detention Ponds, Drainage to Low Velocity Drainage Channels and other permanent controls.*

D. Tracking Controls

The tracking controls section of the SWQP must contain a description of control measures designed to minimize offsite tracking of sediment, mud and other construction related pollutants. The plan must also include controls to minimize the general of dust. *Examples: Stabilized Construction Site Entrances and Exits, Wheel Washing Stations, Daily Street Sweeping or watering of haul roads to prevent dust generation.*

E. Construction and Waste Materials Controls

The plan must include a description of how construction waste products, debris and other wastes and pollutants will be retained or stored on-site. *Examples: Temporary Roll-off dumpsters will used to store scrap construction materials and site debris, Contractor maintained portable restrooms will be provided for sanitary waste.*

F. Velocity Dissipation Controls

The plan must include a description of velocity dissipation devices at discharge locations and along the length of any outfall channel to provide a non-erosive flow velocity from the structure to a water course, so that the natural, physical and biological characteristics and functions are maintained and

protected. *Examples: Level Spreaders, Concrete Aprons where outfalls enter drainage channels, Rock Stabilized Outlets, Engineered Dissipation Structures, Low Velocity Swales or Sheet Flow Discharges.*

G. Site Dewatering Controls

The plan must include control measures that minimize the offsite transport of sediment when it is necessary to pump or channel standing water from the site. *Examples include pumping into sediment traps, silt fence controlled areas or engineered products or channeling water through rock filters or sediment traps prior to water entering the City storm sewer system.*

H. Maintenance and Inspection of Controls

The plan must describe inspection and maintenance procedures for the controls included in the stormwater quality plan. The inspections must be summarized in an inspection report and maintained with the SWQP. Maintenance of controls measures must be conducted according to the manufacturer's specifications and/or the specifications included in Sections 3, 4 and 5 of this guidance document.

I. Any other information required to comply with the current TCEQ Construction General Permit.

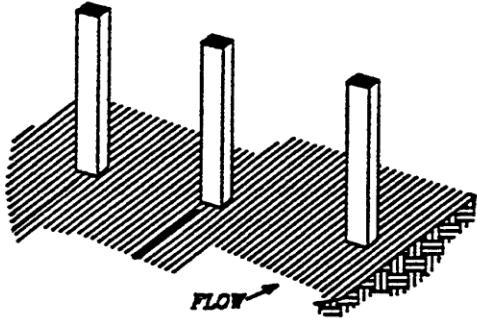
The SWQP must comply with the requirements as established by the TCEQ Construction General Permit TXR150000. It is the responsibility of the construction site operator to ensure that the requirements of the TCEQ are met during construction. Conformance to the City's construction guidance document does not relieve a construction site operator or owner from any state or federal regulations.

2.0 Sediment Controls

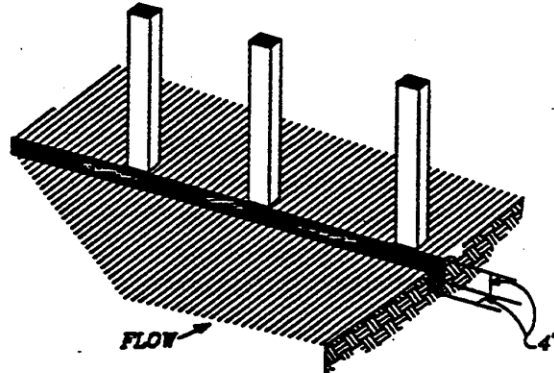
Construction activities near drainage channels, streams, rivers, and lakes have the potential to cause water pollution and stream degradation if erosion and sediment controls are not properly installed and maintained. In order to effectively reduce erosion and sedimentation impacts, Best Management Practices (BMP's) must be designed, installed, and maintained during land disturbing activities. This section is designed to provide information to planners, developers, engineers, and contractors on the proper selection, installation, and maintenance of BMP's. This guidance is intended for use during the design and construction of projects that require erosion and sediment controls to protect waters of the state.

FILTER FABRIC FENCE

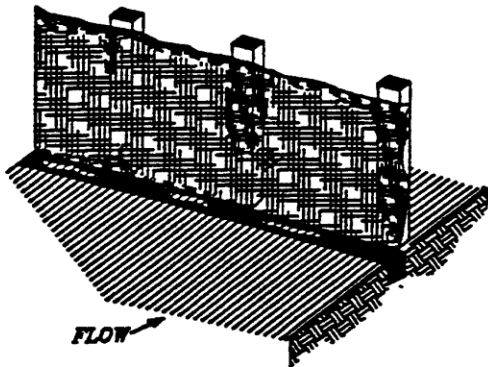
1. SET POSTS AT REQUIRED SPACING (2" x 2" wooden posts)



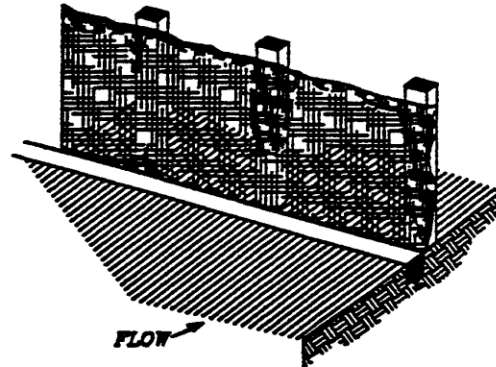
2. EXCAVATE A 4"x4" TRENCH UPSLOPE ALONG THE LINE OF STAKES.



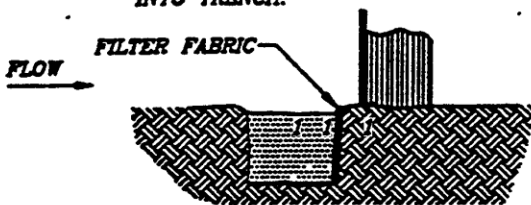
3. STAKE FILTER MATERIAL TO STAKES AND EXTEND IT INTO THE TRENCH.



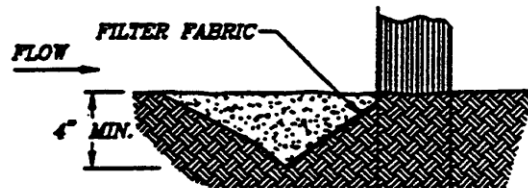
4. BACKFILL AND COMPACT THE EXCAVATED SOIL.



EXTENSION OF FABRIC INTO TRENCH.



ALTERNATE V-TRENCH EXTENSION OF FABRIC INTO TRENCH.



GENERAL NOTES:

1. POSTS TO BE SET AT 8-FOOT MAXIMUM SPACING. IF FACTORY PREASSEMBLED FENCE WITH SUPPORT NETTING IS USED, SPACING OF POST MAY BE INCREASED TO 10 FEET MAXIMUM.
2. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHOULD BE OVERLAPPED 6 INCHES AT THE POSTS, AND FOLDED.

2.1.1 Filter Fabric (Silt) Fences

A. Purposes

1. To intercept and detain small amounts of sediment from disturbed areas during construction operations, preventing sediment from leaving the site.
2. To decrease the velocity of sheet flows.

B. Conditions Where Practice Applies

1. Down slope of disturbed areas where erosion is likely to occur in the form of sheet or rill erosion.
2. Around or down slope of soil piles.
3. Where the maximum size of the drainage area is 0.50 acres per 100 feet of fence length; the maximum length of slope behind the fence is 200 feet; and the maximum gradient behind the fence is 50% (2:1). The maximum slope length is as follows:

Slope, %	Maximum Slope Length
< 0.2%	200
0.2 to 0.5	175
0.5 to 1.0	140
1.0 to 2.0	100
2.0 to 5.0	75
5.0 to 10.0	50
10.0 to 20.0	25
> 20.0	15

4. Under no circumstances may filter fabric fences be used in streams, swales, ditches, or below ordinary high-water marks along streams.

C. Placement

1. Filter fabric fences shall be placed on the contour to the extent practicable. The ends of the fence should be turned up slope 1 to 2 feet in elevation to prevent flanking.
2. The full height of the filter fabric fence shall be supported by 2-inch x 2-inch wooden posts or equivalent. The posts shall be driven at least 8 inches into the ground. The filter fabric shall be stapled using at least 0.5-inch staples to the up slope side of the posts.

3. The filter fabric shall be anchored by spreading at least 8 inches of the fabric in a 4-inch x 4-inch trench or in a 4-inch deep V-trench on the up slope side of the fence. The trench shall be backfilled and compacted.

D. Fabric Specifications

1. **Grab Strength** – 100 lb. minimum in any principal direction
2. **Mullen Burst** – Minimum 200 psi
3. **Equivalent opening size** – Between 50 and 140 for soils with more than 15% by weight passing a No. 200 sieve. Between 20 and 50 for soils with less than 15% by weight passing a No. 200 sieve.

E. Maintenance

1. Under normal conditions, filter fabric fences require removal of trapped sediment. Once sediment has accumulated to 50% of the height of the filter fabric fence, the sediment should be removed. Filter fabric fences should be inspected at least once a week and daily during periods of prolonged rainfall.
2. Filter fabrics degrade due to ultraviolet light. Consult the manufacturer's specifications for usual life.
3. Filter fabric fences should be removed once final stabilization of the disturbed area is completed.

2.1.2 Hay Bales

A. Purposes

1. Used to intercept small drainage areas of disturbed soils to reduce offsite transport of sediment.
2. To decrease the velocity of sheet flows.

B. Conditions Where Practice Applies

1. Down slope of disturbed areas where erosion is likely to occur in the form of sheet or rill erosion
2. Around or down slope of soil piles.

3. Straw bales deteriorate with time. They should be utilized for short-term use where pollutant control is needed for less than 3 months.
4. Under no circumstances may straw bale fences be used in streams, swales, ditches, or below ordinary high-water marks along streams.

C. Placement

1. Stake firmly in place with two 2" x 2" wooden stakes or 1" metal stakes in the center of each bale.
2. Ramp 6 inches of compacted fill to toe in the disturbed soil side of the bales to prevent flow bypasses.

D. Maintenance

1. Straw bales shall be inspected at least once a week and daily during periods of prolonged rainfall.
2. Sediment deposits should be removed before deposits reach one-third the height of the bale.

2.1.3 Inlet Protection

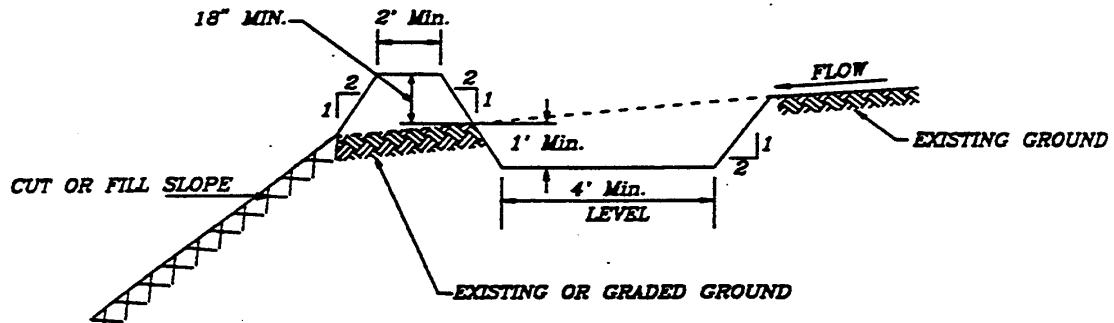
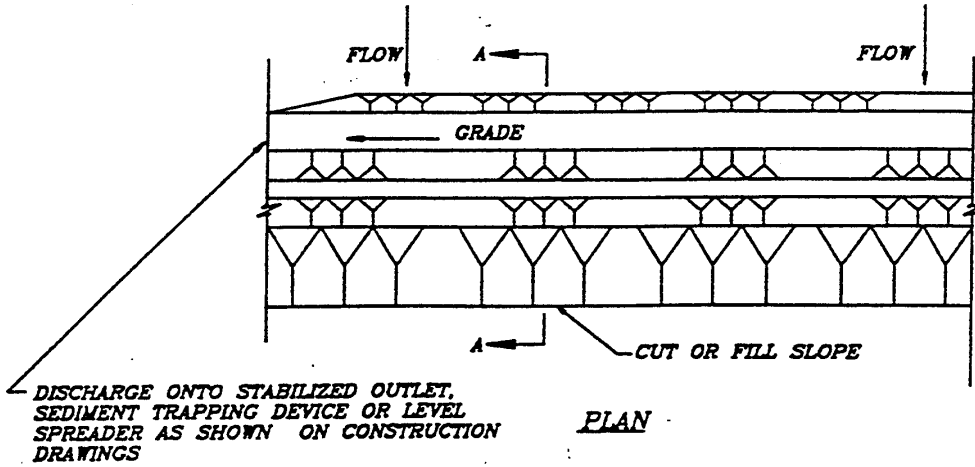
A. Inlet Protection – Filter fabric material used in silt fence staked around stormwater inlet structures or many other materials used in the same manner.

1. Use 2" x 2" wooden stakes at each corner of the inlet. Minimum 36" long, drove 12 to 18 inches deep. (Stakes no greater than 1 meter apart)
2. Toe filter fabric material around base of inlet 8 to 10 inches deep.
3. Wire mesh re-enforcement is recommended.

B. Inlet Socks – The sock, usually constructed of polypropylene, is place in a drop inlet to remove sediment and debris.

1. The fabric may be attached to a frame or the grate of the inlet may hold the sock.
2. Inlet socks should be inspected at least once a week and after each rainfall of 0.5 inches or more.
3. Check manufacturer's specifications for inlet sock capacity.

DIVERSION DIKE WITH SWALE



GENERAL NOTES:

1. DIKE MATERIAL - MACHINE COMPACTED SOIL.
2. DIKE HEIGHT - 18 INCHES MINIMUM, MEASURED FROM THE EXISTING OR GRADED GROUND AT THE UPSLOPE TOE, TO THE TOP OF THE DIKE.
3. SIDE SLOPES OF THE DIKE WITH SWALE-2:1 OR FLATTER.
4. GRADE - AS SHOWN ON THE CONSTRUCTION DRAWINGS, IF NOT SHOWN, PROVIDE POSITIVE DRAINAGE TO POINT OF DISCHARGE.

2.2 Dikes and Swales

A. Purpose

Diversion dikes and swales divert runoff around disturbed areas to a stabilized outlet where the water can be discharged without adversely impacting the receiving area or channel. Diversion dikes and swales can be used along the perimeter of the site or disturbed area to carry sediment laden runoff to a sediment trapping facility. Interceptor dikes and swales are used to shorten the length of exposed slopes by intercepting runoff and diverting it to a stabilized outlet.

B. Conditions Where Practice Applies

1. Up slope of disturbed areas where erosion is likely to occur.
2. Up slope of soil piles.
3. To direct runoff from an area to a stabilized outlet sediment trap or sediment basin.

C. Placement

The slope behind the dike or swale also is an important consideration. The dike or swale must have a positive grade to assure drainage, but if the slope is too steep, precautions must be taken to prevent erosion due to high flow velocity.

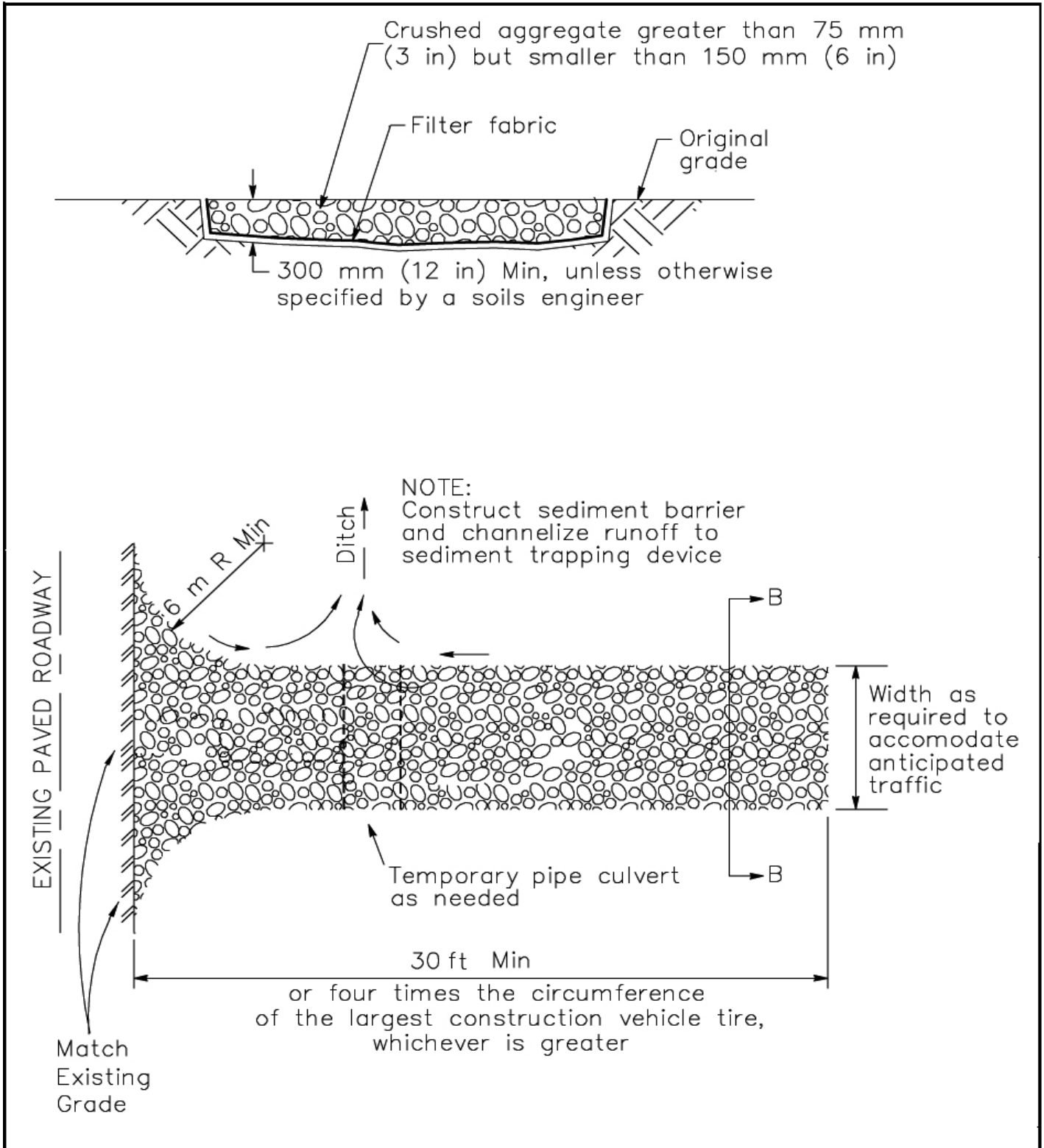
D. Capacity

The capacity of a permanent dike or swale should be designed in accordance with existing TCEQ or EPA design criteria. The capacity of a temporary dike or swale shall be designed to carry the peak runoff from at least a 3-year 24-hour frequency storm with a freeboard not less than 0.3 feet. The drainage area of a temporary dike or swale shall not exceed 5 acres.

E. Maintenance

1. Dikes and Swales should be inspect weekly and on a daily basis during periods of prolonged rainfall until the vegetative cover is stabilized. Thereafter, dikes and swales should be inspected at least every two weeks.
2. The life expectancy of temporary diversion dikes and swales is 18 months.

Stabilized Entrance/Exit



2.3 Stabilized Entrance/Exit

A. Purpose

To reduce the tracking of mud/dirt (sediment) onto public roadways by construction vehicles. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

B. Conditions Where Practice Applies

1. Where traffic will be entering or leaving the construction site.
2. Adjacent to water bodies.
3. When an existing permanent entrance/exit is not available.

C. Placement

1. Entrances/exits should be constructed on level ground only and used in conjunction with street sweeping.
2. Entrance/exit should be underlain with filter cloth before placing aggregate down.
3. Select 3” to 6” diameter stones and have a minimum length of 50 feet.

D. Maintenance

1. Inspect local roads adjacent to site daily. Sweep/remove any visible accumulated sediment.
2. Replace aggregate when surface voids are visible.
3. Remove aggregate and filter fabric at completion of construction.

2.4.1 Vegetative Buffer

A. Purpose

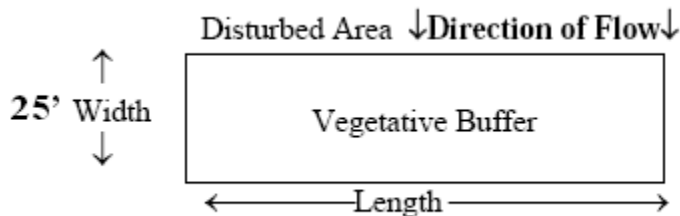
A vegetative buffer is an area of dense vegetation intended to slow runoff and trap sediment. Vegetative buffers are commonly referred to as filter or buffer strips. The purpose of this practice is to remove sediment in sheet flow by velocity reduction.

B. Conditions Where Practice Applies

This practice applies to areas where sediment delivery is in the form of sheet and rill erosion from disturbed areas.

C. Placement

1. The vegetative buffer shall be located on the contour of the disturbed area. The buffer shall be located along the entire length of the down slope edge of the entire disturbed area for which the practice is being applied.
2. The width of the vegetative buffer shall have slopes less than 5%.
3. The vegetative buffer shall have a minimum width of 25 feet.



D. Maintenance

1. A stand of dense vegetation shall be maintained to a height of 3-12 inches. To minimize compaction and destruction of the vegetative cover, designate the vegetative buffer as an area of no disturbance. Construction equipment shall be excluded from the designated area. Vegetative buffers shall be clearly shown on plans and marked in the field.
2. If the vegetative buffer becomes silt covered, contains rills, or is otherwise rendered ineffective, other perimeter sediment control measures shall be installed.
3. Vegetative buffer shall be inspected every 14 days or after each 0.5 inch storm event. TCEQ also allows inspection every 7 days as an alternative frequency.

2.4.2 Grassy Swales

A. Purpose

A grassy swale is a long, narrow grassy depression used to collect and convey stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground or flows through the facility.

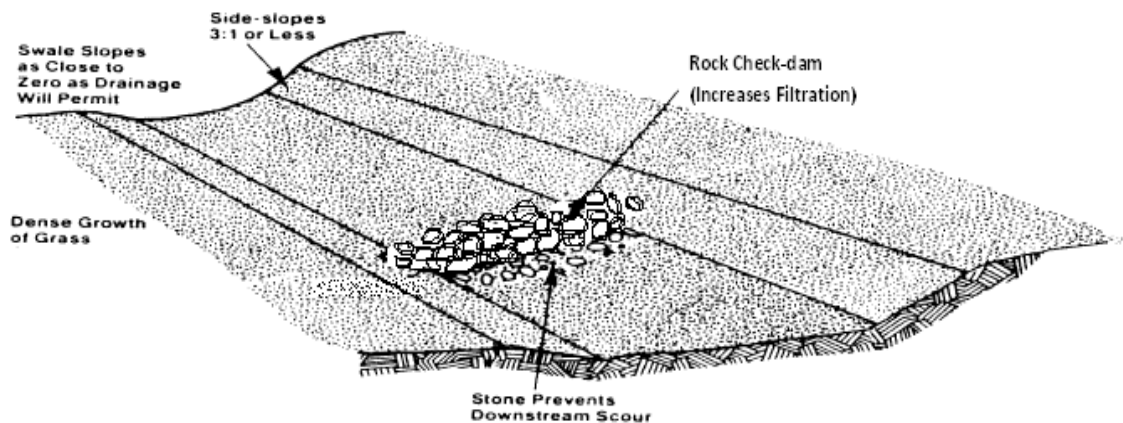
B. Conditions Where Practice Applies

Small projects (less than 15,000 square feet of impervious surface) can be managed using grassy swales. Swales are best used in combination with other treatment BMPs.

C. Placement

1. Swales should be designed to be as flat as possible and still allow efficient drainage.
2. Maximum flow rates to the swale should not exceed 1.5 feet per second to prevent erosion.
3. Swales should be designed for a maximum residence time of 24 hours.
4. Vegetation that can survive periodic inundation should be used in the swale bed.

Schematic Design of an Enhanced Grass Swale



D. Maintenance

Swales require routine maintenance, including mowing, watering, fertilizing, and removal of sediment (especially behind check dams). Swales should be inspected every 14 days or after each 0.5 inch storm event. TCEQ also allows inspection every 7 days as an alternative frequency.

2.5.1 Rock Filter Dam

A. Purpose

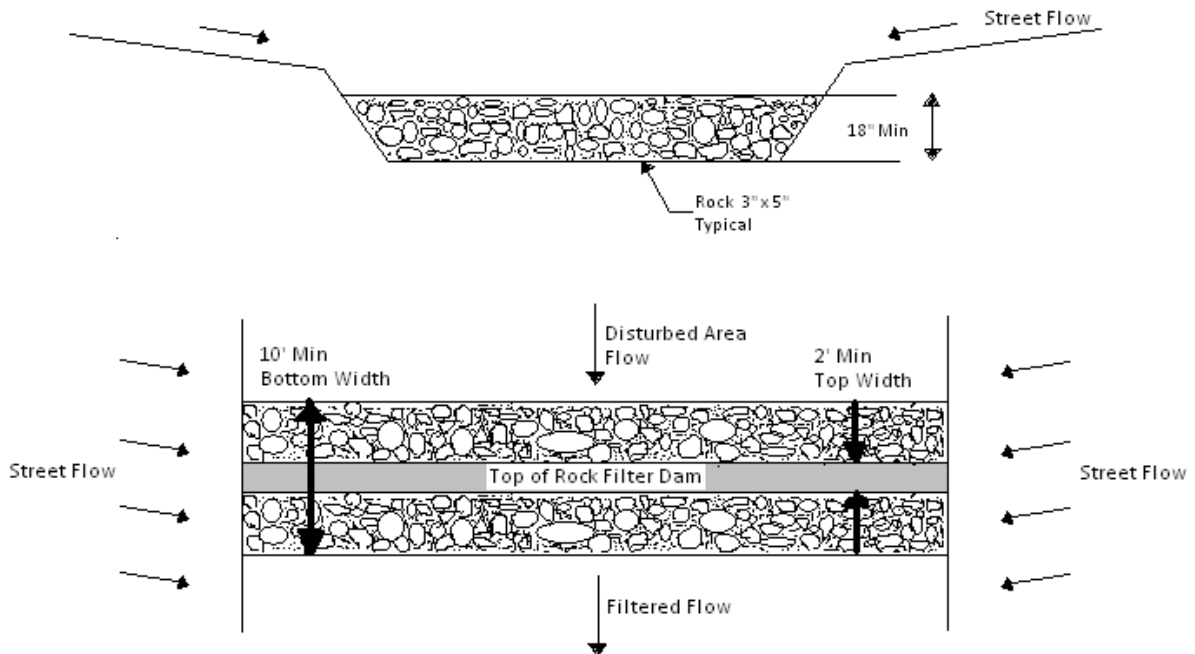
The purpose of a rock filter dam is to intercept channelized drainage from small to medium drainage areas in order to trap sediment and dissipate channel velocity.

B. Conditions Where Practice Applies

This practice can be used as an alternative to a standard sediment basin for locations with a drainage area of 5 acres or less.

C. Placement

1. Rock filter dams should be located in accessible areas for periodic sediment removal and that will not interfere with construction activity.
2. Typically constructed of 3" to 6" rock or larger (same material can be used as stabilized construction site entrance/exit).
3. Minimum 18" in height, 10 feet at the base, 2 feet at the top, and the width should be equal to the channel width.



D. Maintenance

1. Rock filter dams should be inspected every 14 days or after each 0.5 inch storm event. TCEQ also allows inspection every 7 days as an alternative frequency.
2. Remove sediment when sediment is 50% of the height of rock dam. (Example: If rock dam has height of 18", sediment should be removed when it reaches 9" in depth)

2.5.2 Rock Gabions

A. Purpose

A rock gabion is a woven wire basket filled with rock, to form an erosion resistant structure. The gabions provide a degree of grade stability and reduce flow velocities long enough to trap coarse sediments.

B. Conditions Where Practice Applies

Rock gabions are intended for areas with a mild gradient. They should not be used in areas with high velocity flows greater than 3ft/sec.

C. Placement

1. Proper gabion design and installation are crucial to the success of these structures. The rock gabions must be properly placed, keyed in, and anchored to stay in place during runoff events.
2. Downslope energy dissipaters are recommended in conjunction with rock gabions to reduce the risk of the gabions being undercut.
3. Rock gabions are typically constructed using 3" x 6" rock.
4. Gabions should be a minimum of 18" in height and should be equal width to the channel they are placed in.

D. Maintenance

1. Rock gabions should be inspected every 14 days or after each 0.5 inch storm event. TCEQ also allows inspection every 7 days as an alternative frequency.
2. Remove sediment when sediment is 50% of the height of rock gabion. (Example: If rock gabion has a height of 18", sediment should be removed when it reaches 9" in depth)

3.0 Erosion and Stabilization Practices

The BMPs discussed in this section are erosion prevention controls that should be used when temporary or permanent stabilization is needed. The proper use of these best management practices can be effective in preventing erosion and controlling sediment on construction sites. A construction site shall be stabilized during suspension of construction activity for periods of fourteen (14) or more days and permanently stabilized by the time of completion of construction activities.

3.1.1 Hydromulch Seeding

A. Purposes

Hydromulch seeding is temporary or permanent planting of grasses used to stabilize disturbed areas, minimize erosion, and to reduce overland flow velocities.

B. Conditions Where Practice Applies

On exposed soils.

C. Placement

1. The effectiveness of seeding in controlling erosion is increased if drainage from up slope areas is diverted around the exposed areas.
2. Seeding should be used in conjunction with other best management practices such as filter fabric fences or straw bale fences.
3. Seeding shall not be considered as acceptable vegetative cover until the grasses are established. (See Section 3.2)
4. Seeds shall conform to requirements of U.S. Department of Agriculture Rules and Regulations as set forth in Federal Seed Act and Texas Seed Law. These standards can be viewed at www.agr.state.tx.us. Use seed which has been treated with an approved fungicide. Container labels are to show purity and germination, and name and type of seed. Planting date, type, and rate of application as follows:

<u><i>Type A</i></u>	<u><i>Rate of Application in pounds per acre</i></u>	<u><i>Planting Date</i></u>
Hulled Bermuda Grass (98/88)	40	January 1 to April 15
Unhulled Bermuda Grass (98/88)	40	“ “
Annual Rye Grass (Gulf)	50	“ “

<u><i>Type B</i></u>	<u><i>Rate of Application in pounds per acre</i></u>	<u><i>Planting Date</i></u>
Hulled Bermuda Grass	40	April 16 to October 1

<u><i>Type C</i></u>	<u><i>Rate of Application in pounds per acre</i></u>	<u><i>Planting Date</i></u>
Hulled Bermuda Grass (98/88)	40	October 2 to January 1
Unhulled Bermuda Grass (98/88)	40	“ “
Rye Grass (Gulf)	30	“ “

D. Maintenance

The hydro-mulch seeding areas should be adequately watered until well established (See Section 3.2). Any areas damaged by erosion or areas that do not have an acceptable turving should be reseeded.

3.1.2 Sodding

A. Purposes

Sodding is the application of sod rolls or mats to rapidly establish a permanent grass cover and stabilize disturbed areas by decreasing the velocity of sheet flow.

B. Conditions Where Practice Applies

1. Sodding may be used where initial flow velocity is low to moderate.
2. Sodding can be applied to unstabilized swales, ditches, or diversions where flow velocities are less than 5 feet per second. Sodding is also applicable to any disturbed area with overland flow runoff.

C. Maintenance

1. Water sod as needed to maintain adequate moisture in the root zone and to prevent dormancy of the sod. Mow only after the sod is firmly rooted, usually in about 2 to 3 weeks. Do not remove more than 1/3 of the shoot during mowing.
2. Until sod is firmly root and well established, it should be inspected every 14 days or after each 0.5 inch storm event. TCEQ also allows inspection every 7 days as an alternative frequency. Damaged sod should be repaired or replaced immediately.

3.2 Initialization of Stabilization

- A. Erosion control and stabilization measures must be initiated as soon as practicable in portions of the site where construction activities have temporarily ceased. Stabilization measures that provide a protective cover must be initiated as soon as practicable in portions of the site where construction activities have permanently ceased. Except as provided in (1) through (4) below, these measures must be initiated no more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased:
1. Where the initiation of stabilization measures by the 14th day after construction activity temporarily or permanently ceased is precluded by snow cover or frozen ground conditions, stabilization measures must be initiated as soon as possible.
 2. Where construction activity on a portion of the site has temporarily ceased, and earth disturbing activities will be resumed within 21 days, temporary erosion control and stabilization measures are not required on that portion of site.
 3. In arid areas, semiarid areas, and areas experiencing droughts where the initiation of stabilization measures by the 14th day after construction activity has temporarily or permanently ceased or is precluded by arid conditions, erosion control and stabilization measures must be initiated as soon as practicable. Where vegetative controls are not feasible due to arid conditions, the operator shall install non-vegetative erosion controls. If non-vegetative controls are not feasible, the operator shall install temporary sediment controls as required in Paragraph (4) below.
 4. In areas where temporary stabilization measures are infeasible, the operator may alternatively utilize temporary perimeter controls (silt fence). The operator must document in the SWP3 the reason why stabilization measures are not feasible, and must demonstrate that the perimeter controls will retain sediment on site to the extent practicable. The operator must continue to inspect the BMPs at the frequency of Section III.F.7.(a) of the TPDES General Permit TXR150000 for unstabilized sites.

B. What is Final Stabilization?

- Construction at the site is complete
- All construction materials and debris is properly removed from the site
- All earthen surfaces must be permanently stabilized with vegetation to within at least 70% of the naturally occurring vegetative cover in the area
- Permanent control measures are in place and functional including a long term operation and maintenance plan. (Permanent Controls will be reviewed by the City during the initial stormwater quality plan review)
- After the site is properly stabilized, then the temporary erosion controls must be removed from the site (Except those temporary controls that will become permanent controls i.e. Detention Pond)

4.0 Structural Controls

4.1 Temporary Sediment Ponds (Drainage Areas > 10 acres)

A. Purpose

Temporary sediment ponds are intended to slow the velocity of concentrated flows of stormwater before leaving the site. The reduction in velocity allows sediment to be deposited and trapped in the pond. The ponds serve to control sediment transport from larger disturbed areas (> 10 acres) draining to a common outfall or discharge point.

B. Conditions Where Practice Applies

1. Down slope of drainage areas greater than 10 acres.
2. Temporary sediment ponds may not be practicable in all situations. Some of the following factors may be considered when deciding if sediment basins are practicable for a specific site.
 - Site Soils
 - Depth to groundwater
 - Slope
 - Site geometry
 - Other Factors
3. If temporary sediment ponds are not feasible for large drainage areas exceeding 10 acres, then a combination of smaller sediment traps and/or at a minimum appropriate perimeter controls must be implemented.

C. Placement

Sediment ponds should be placed where channelized flows of stormwater can be collected in the pond before being discharged off-site and down slope of large drainage areas greater than 10 acres.

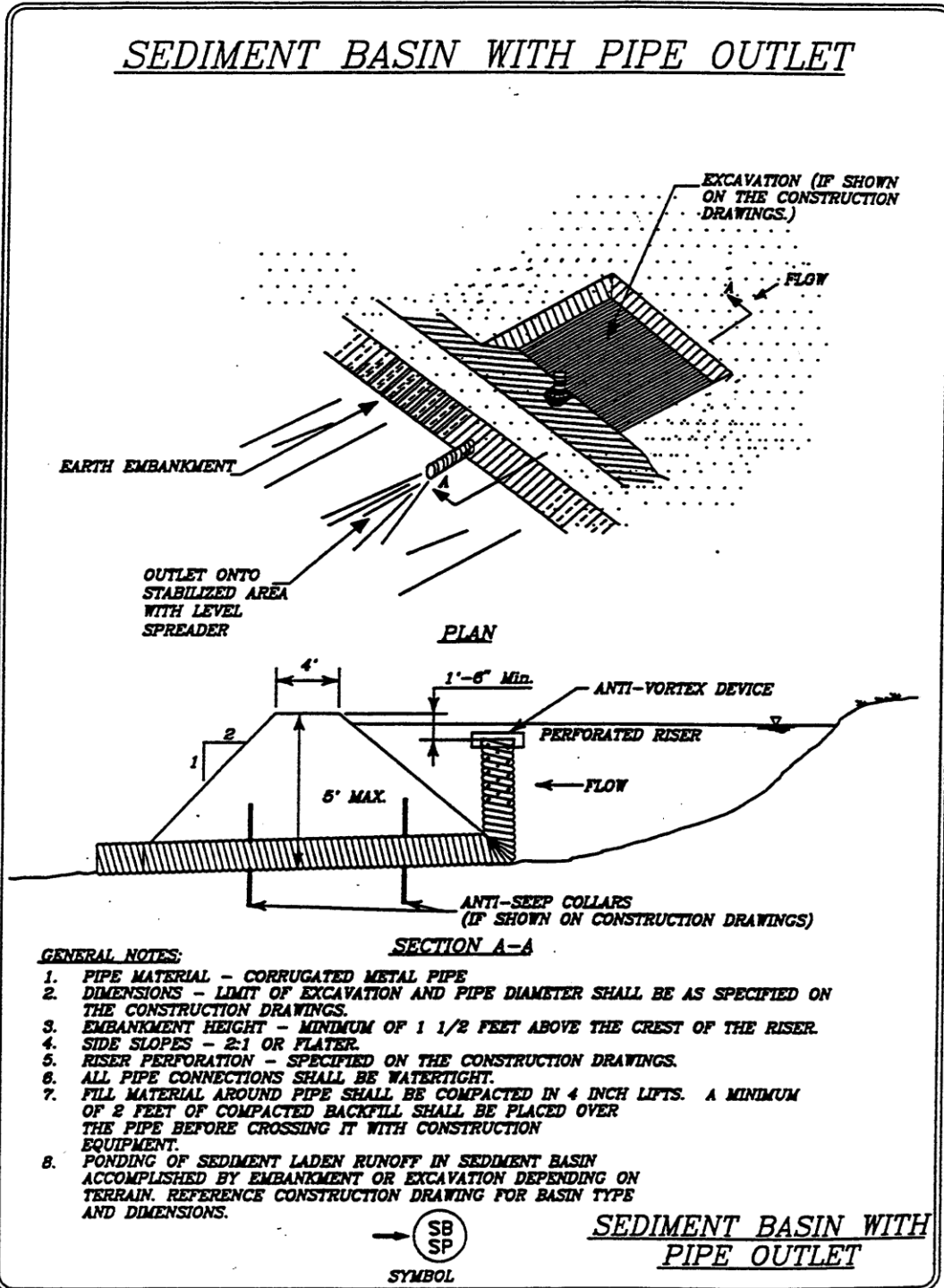
D. Capacity

The capacity of a sediment pond must contain the runoff of the drainage area that would result from a 2 year 24-hour frequency storm. Where data required for calculating the volume of the pond based on a 2 year 24 hour storm is not available, the pond must have a capacity of at least 3600 cubic feet per acre in the drainage area served by the pond.

E. Maintenance

1. Sediment ponds should be inspected weekly and on a daily basis during periods of prolonged rainfall until the vegetative cover is stabilized. Thereafter, sediment ponds should be inspected at least every two weeks.
2. Sediment from sediment ponds must be removed when 50% of the ponds capacity is diminished due to sediment deposits.

SEDIMENT BASIN WITH PIPE OUTLET



4.2 Temporary Sediment Traps

A. Purpose

The purpose of a sediment trap is to intercept sediment-laden runoff and trap the sediment to protect drainage ways, properties, and right-of-way below the sediment trap from sedimentation.

B. Conditions Where Practice Applies

A sediment trap usually is installed at points of discharge from disturbed areas. The drainage area should not exceed five acres.

C. Placement

Sediment traps should be placed to intercept concentrated flows of sediment-laden stormwater runoff down stream of disturbed areas not exceeding 5 acres.

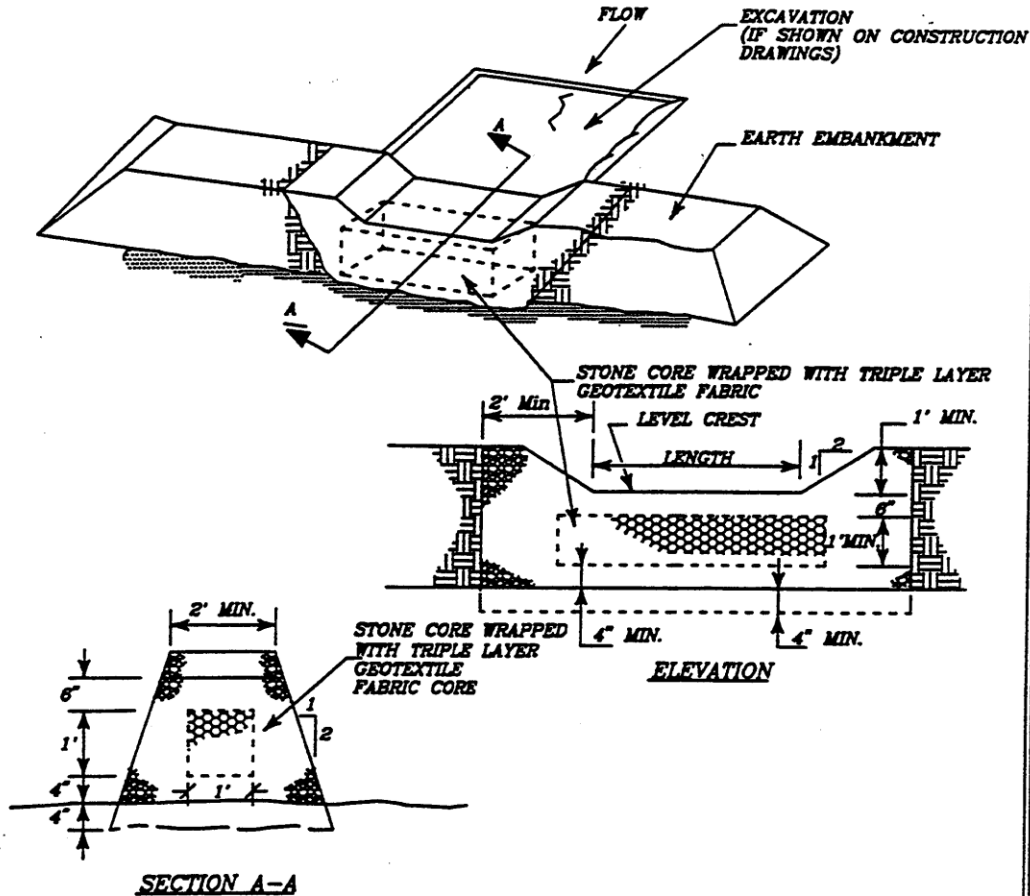
D. Capacity

It is recommended that the volume of a sediment trap as measured at the elevation of the crest of the outlet be at least 1,800 cubic feet per acre of drainage area. The trap must be large enough to allow sediment to settle and must have a capacity to store the collected sediment until it is removed. The volume of the trap shall be calculated using standard mathematical procedures.

E. Maintenance

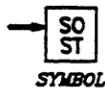
1. Sediment traps should be inspected weekly during routine site inspections.
2. Sediment from sediment traps must be removed when 50% of the ponds capacity is diminished due to sediment deposits.

STONE OUTLET SEDIMENT TRAP



GENERAL NOTES:

1. ROCK AND GEOTEXTILE FABRIC SHALL BE AS INDICATED BY THIS SPECIFICATION
2. DIMENSION - LIMIT OF EXCAVATION AND OUTLET LENGTH AND HEIGHT SHALL BE AS INDICATED ON THE CONSTRUCTION DRAWING.
3. SIDE SLOPE SHALL BE 2:1 OR FLATTER.
4. MAINTAIN A MINIMUM OF 6 INCHES BETWEEN TOP OF CORE MATERIAL AND TOP OF STONE OUTLET, A MINIMUM OF 4 INCHES BETWEEN BOTTOM OF CORE MATERIAL AND EXISTING GROUND AND A MINIMUM OF 1 FOOT BETWEEN TOP OF STONE OUTLET AND TOP OF EMBANKMENT.
5. ROCK SHALL BE EMBEDDED A MINIMUM OF 4 INCHES INTO EXISTING GROUND.
6. CORE SHALL BE A MINIMUM OF 1 FOOT IN HEIGHT AND IN WIDTH AND SHALL BE WRAPPED IN GEOTEXTILE FABRIC.
7. PONDING ON SEDIMENT LADEN RUNOFF IN SEDIMENT TRAP ACCOMPLISHED BY EMBANKMENT OR EXCAVATION DEPENDING ON TERRAIN. REFERENCE CONSTRUCTION DRAWINGS FOR TRAP TYPE AND DIMENSIONS.
8. OUTLET ONTO STABILIZED AREA.



STONE OUTLET
SEDIMENT TRAP

5.0 Permanent Controls

Permanent control measures or post-construction control measures are features installed during construction that are left in place in order to serve as permanent stormwater quality features at the site after construction is complete. Each large construction site (resulting in at least one acre of new impervious surface area) must incorporate at least one permanent control measure option. Each large construction application will be reviewed to determine if additional permanent controls are required to ensure long term stormwater quality in order to maintain the pre-development peak-flow rate or to address other flood control considerations. When completing the stormwater permit application, at least one of the post-construction control measures must be selected in order for the application to be considered complete. Residential home construction projects will not generally result in a full acre of new impervious surface area and therefore do not need to consider including permanent controls. It is the project engineer's responsibility to provide appropriate details and specifications for the construction of permanent control measures in plans submitted for approval. The following is a partial list of acceptable permanent control measures; other control measure options may be submitted and reviewed for approval.

- On-Site Detention Ponds (Dry or Wet)
- Vegetated Swales (Grass lined ditches or swales)
- Low Impact Development (Innovative methods of reducing impervious surface area or peak runoff flow rates) Examples: Permeable pavers, vegetated swales, rain barrels, reduction of impervious surface area, etc.
- Low Velocity Drainage Channels served by Pump Stations (Drainage channels receiving the discharge from the site is low velocity and is served by a fixed rate pump station and trash rack system.)
- Regional Detention (The site drains to a watershed served by a regional detention facility)

6.0 Other Controls

6.1 Containment of Waste Products (Dumpsters, Potable Restrooms)

The stormwater permit requires that discarded building materials, chemicals, trash, sanitary waste and other potential pollutants are retained at the site in proper containers or portable restrooms. Trash or other wastes that leave the site during stormwater runoff events will result in a violation of the permit.

6.2 Concrete Truck Washout Controls

Concrete trucks must not wash out into the storm sewer system. Concrete truck may washout in designated locations where appropriate controls measures will retain concrete on site for proper disposal. A small area upstream of silt fence or other control measures will be accepted.

6.3 Site Dewatering Controls

If site dewatering is required at a construction site remove impoundments of water, the water must be directed through appropriate sediment traps or control devices to reduce off-site transport of sediment.

6.4 Non-stormwater controls

Significant sources of non-stormwater from construction sites including springs or other constant discharges must be directed through appropriate controls in order reduce the off-site transport of sediment.

7.0 Inspection of Controls

Control measures installed at construction sites must be inspected according to manufacturer's recommendations and at least once every two weeks which ever is more frequent. The construction site operator must document these inspections and maintain inspection records with the stormwater quality plan. Prompt maintenance of controls is required if controls are found to require sediment removal or have been damaged.