Chapter 2: Selecting Stormwater Control Measures (SCMs)

2.1 - Temporary versus Permanent Stormwater Control Measures

The same level of care should be taken to select both temporary SCMs and permanent SCMs. The same level of care should also be taken to install and maintain temporary SCMs: the only difference is in the intended lifespan of the SCM. It is good to remember that, in the world of construction and industry, a temporary solution may be in place for years due to oversight, neglect, good performance, etc. In general, temporary SCMs are intended to address construction activities; while permanent SCMs address long-term stormwater management objectives.

Temporary SCMs may include a variety of "good housekeeping" measures and short-term erosion and sediment control activities. An appropriate professional such as construction site operator and/or licensed professional civil engineer should utilize temporary SCMs. A licensed professional engineer must design some of the more complicated or sensitive SCMs. The temporary management practices must be designed and submitted for review with the Montgomery County Stormwater Program. The contractor is responsible for properly constructing, implementing and maintaining the temporary practices and/or seeking guidance when the measures do not appear to be meeting the stormwater management objectives (namely that sediment and other pollutants do not leave the construction site).

Permanent SCMs, which are designed to control long-term stormwater pollution, are the final improvements to and configuration of the project. Permanent SCMs are selected by licensed professional civil engineers, incorporated into the plans and specifications for the project, and have long-term maintenance responsibilities identified. The contractor is responsible for properly constructing the permanent controls. Permanent SCMs are normally selected in the planning phase in conjunction with the approval of the tentative map designed during the design phase of a project and completed to the satisfaction of the Montgomery County Stormwater Program.

Occasionally, unforeseen natural or manmade factors may require revisions to or additions of permanent SCMs during the construction phase. These revisions or additions must be also be approved by the Montgomery County Stormwater Program.

2.2 - Identifying Stormwater Control Measure Objectives

The objectives in pollution prevention for each property can vary widely. Therefore, a specific understanding of pollution risks for each activity is essential for selecting and implementing SCMs. Defining these risks requires review of the characteristics of the site and the nature of the construction process or industrial activity. This information should be carefully assembled and reviewed early in the design process. Once these pollution risks are defined, then SCM objectives are developed and specific SCMs can be selected. The SCM objectives for a typical construction project include, but are not limited to:

- Practice Good Housekeeping: Perform activities in a manner, which keeps potential pollutants from either draining or being transported offsite by managing pollutant sources

and modifying construction activities. Dispose of waste materials in designated areas and in designated containers away from rainfall and stormwater runoff.

- Minimize Disturbed Areas: Only clear land that will be actively under construction in the near term (within the next 30 to 60 days). Minimize new land disturbance, and do not clear or disturb sensitive areas (e.g., steep slopes, buffers and natural watercourses).

- Stabilize Disturbed Areas: Provide temporary stabilization of disturbed soils whenever active construction is not occurring on that portion of the site. Provide permanent stabilization during the final grading process and carefully landscape the site.

- Protect Slopes and Channels: Avoid disturbing steep or unstable slopes. Safely convey runoff from the top of the slope and stabilize disturbed slopes as quickly as possible.

- Avoid disturbing natural channels. Stabilize temporary and permanent channel crossings as quickly as possible and ensure that increases in runoff velocity caused by the project do not erode the channel.

- Control Site Perimeter: Upstream runoff should be diverted around or safely conveyed through the construction project, and must not cause downstream property damage. Runoff from project site should be free of excessive sediment and other constituents.

- Control Internal Erosion and Drainage: Detain sediment-laden waters from actively disturbed areas within the site to minimize the risk that sediment will have the opportunity to leave the site.

- Reduce Pollutant Discharge from the Development after Construction (Post-Construction Water Quality): Long-term SCM selection must be based upon the ability to meet Montgomery County's requirement of an 80% Total Suspended Solids (TSS) reduction of an average annual urban pollutant load. Select permanent treatment practices based upon the TSS reduction provided, the proposed land use, and the level of maintenance required.

- Protect Natural Features: Identify natural features such as wetlands, streams, sinkholes, and springs. Install SCMs to protect these features. Consider leaving natural features within areas that are not to be disturbed.

SCM objectives for an industrial or commercial facility already in operation will basically have all of the same objectives, but there will be a different amount of emphasis placed on good housekeeping, institutional controls and procedures, good training methods and regular refresher classes, and using the best available technology. SCM objectives in this chapter are generally discussed from a construction point of view, but are applicable to all types of land uses

Site characteristics and proposed contractor activities will affect the potential for site erosion and contamination by other constituents used on the construction site. It is important to plan the

project to fit the topography and drainage patterns of the site. Before defining SCM objectives, these factors should be carefully considered:

1. Site conditions that affect erosion and sedimentation, which include:

    a. Soil type, including underlying soil strata that are likely to be exposed

    b. Natural terrain and slope

    c. Final slopes and grades

    d. Location of concentrated flows, storm drains, and streams

    e. Existing vegetation and ground cover

2. Climatic factors, which include:

    a. Seasonal rainfall patterns

    b. Appropriate design storm (quantity, intensity, duration)

3. Type of construction activity.

4. Construction schedules, construction sequencing, and phasing of construction.

5. Size of construction project and area to be graded.

6. Location of the construction activity relative to adjacent uses and public improvements.

7. Cost-effectiveness considerations.

8. Types of construction materials and potential pollutants present or that will be brought on-site.

9. Floodplain, floodway, and buffer zone requirements.

2.2 – Stormwater Control Measure Selection Considerations

Once the SCM objectives are defined, it is necessary to identify the SCMs that are best suited to meet each objective. To determine where to place SCMs, a map of the project site can be prepared with sufficient topographic detail to show existing and proposed drainage patterns and existing and proposed permanent stormwater control structures. The project site map should identify the following:

- Locations where stormwater enters and exits the site. Include both sheet and channel flow for the existing and final grading contours.

- Identify locations subject to high rates of erosion such as steep slopes and unlined channels. Long, steep slopes over 100 feet in length are considered as areas of moderate to high erosion potential.

- Categorize slopes as: low erosion potential (0 to 5 percent slope), moderate erosion potential (5 to 10 percent slope), or high erosion potential (slope greater than 10 percent).

- Identify wetlands, springs, sinkholes, floodplains, floodways, sensitive areas, or buffers, which must not be disturbed, as well as other areas where site improvements will not be constructed. Establish clearing limits around these areas to prevent disturbance by the construction activity.

- Identify the boundaries of tributary areas for each outfall location. Then calculate the approximate area of each tributary area. Define areas where various contractor activities have a likely risk of causing a runoff or pollutant discharge.

Using this map, categories of SCMs can be selected and located. Detailed planning before construction begins and phasing construction activities achieve erosion and pollution prevention most cost-effectively. **Remember, it is more cost-effective to prevent erosion and pollution than it is to remove sediment and pollutants.** See figure 2.1 for a comparison of SCM options.

Figure 2.1: SCM Treatment Option Example

Closer to Source	→		Farther from Source
Most Cost Efficient	→		Least Cost Efficient
Tier 1 SCM	Tier 2 SCM	Tier 3 SCM	Tier 4 SCM
Prevent Pollution Generation	Reduce Runoff and Stormwater Contact	Capture Pollution before Leaving Vicinity	Treatment and Attenuation at Site Boundary
Examples of SCMs			
Employee Training Public Awareness Minimize Paved Areas Material Storage Spill prevention	Waste Handling Permanent Seeding Protection of Trees Grassed Swales RipRap	Inlet Protection Silt Fence Sediment Trap Check Dams Tire Washing	Dry Detention Basin Wet Detention Basin Oil/Water Separator Constructed Wetlands

SCMs that can achieve multiple objectives should be utilized to achieve cost-effective solutions. For instance, it is not always necessary to install extensive sediment trapping controls during initial grading. In fact, sediment trapping should be used only as a short-term measure for active construction areas and replaced by permanent stabilization measures as soon as possible. A permanent detention pond may be built first and used as temporary sediment control by placing a filter on the outlet. After construction is complete and the tributary area is stabilized, the permanent outlet configuration can be reestablished.

2.4 – Stormwater Control Measure Selection for Developments and other Large Projects

For developments, effective EPSC management first minimizes erosion by keeping the soil protected (e.g. minimize disturbed areas) as long as possible (Erosion Prevention), and second, directs runoff from disturbed areas to locations where suspended soil materials can be removed prior to discharge from the site (Sediment Controls). The use of SCMs to control erosion before its starts is the preferred method of long-term sediment control.

SCMs for erosion and sediment control are selected to meet the objectives based on specific site conditions, construction activities, and cost-effectiveness. Different SCMs may be needed at different times during construction since construction activities are constantly changing site conditions.

The following general items are provided to aid in preparing the project plans and choosing appropriate erosion and sediment control SCMs.

Minimize Disturbed Areas:

The first step for selecting SCMs is to compare the project layout and schedule with on-site management measures that can limit the exposure of the project site to erosion and sedimentation. Scheduling and planning considerations are the least expensive way to limit the need for EPSC controls. Consider the following SCMs:

- Do not disturb any portion of the site unless an improvement is to be constructed there.
- The staging and timing of construction can minimize the size of exposed areas and the length of time the areas are exposed and subject to erosion.
- The staging of grading operations should limit the amount of areas exposed to erosion at any one time. Only the areas that are actively involved in cut and fill operations or are otherwise being graded should be exposed. Exposed areas should be stabilized as soon as grading is complete in that area.
- Retain existing vegetation and ground cover where feasible, especially along watercourses and along the downstream perimeter of the site.
- Do not clear any portion of the site until active construction begins.
- Construct outfall detention or perimeter sedimentation control (with filter weirs/berms and temporary sedimentation control barriers first).
- Quickly complete construction on each portion of the site.

- Install landscaping and other improvements that permanently stabilize each part of the site immediately after the land has been graded to its final contour.

- Minimize the amount of denuded areas and any new grading activities during the wet months of December through May.

- Construct permanent stormwater control facilities (e.g., detention basins) early in the project and use for sediment trapping, slope stabilization, velocity reduction, etc. during the construction period.

Stabilize Disturbed Areas:

The purpose of site stabilization SCMs is to prevent erosion by covering disturbed soil. This covering may be vegetative, chemical, or physical. Any exposed soil is subject to erosion—either by rainfall striking the ground, runoff flowing over the soil, wind blowing across the soil, and vehicles driving on the soil. All exposed soils should be stabilized except where active construction is in progress. Locations on a construction site which are particularly subject to erosion and should be stabilized as soon as possible include:

1. Slopes
2. Highly erosive soils
3. Construction entrances
4. Stream channels
5. Soil stockpiles

Site Perimeter Controls:

Disturbed areas or slopes that drain toward adjacent properties, storm drain inlets or receiving waters, should be protected with temporary linear barriers (continuous berms, silt fences, sand bags, etc.) to reduce or prevent sediment discharge while construction in the area is active. In addition, the contractor should be prepared to stabilize those soils with erosion prevention measures prior to the onset of rain.

When grading has been completed, the areas should be protected with erosion prevention controls such as mulching, seeding, planting, or emulsifiers. The erosion prevention SCMs measures should remain in place until the area is permanently stabilized.

Significant offsite flows (especially concentrated flows) that drain onto disturbed areas or slopes should be controlled through use of continuous berms, earth dikes, drainage swales, and lined ditches that will allow for controlled passage or containment of flows.

Concentrated flows that are discharged off the site should be controlled through outlet protection and velocity dissipation devices in order to prevent erosion of downstream areas.

Perimeter controls should be placed everywhere runoff enters or leaves the site. They are usually installed just before clearing, grubbing and rough grading begin. Perimeter controls for all but

the smallest projects will become overloaded by both runoff and sediment. Additional controls within the interior of the construction site should supplement perimeter controls once rough grading is complete.

Internal Swales and Ditches:

Often, flows are directed toward internal swales, curbs, and ditches. Until the permanent facilities are constructed, temporary stormwater facilities will be subjected to erosion from concentrated flows.

- These facilities should be stabilized through temporary check dams, geotextile mats, and under extreme erosive conditions by lining with concrete.

- Long or steep slopes should be terraced at regular intervals (per local requirements).

- Terraces will slow down the runoff and provide a place for small amounts of sediment to settle out.

- Slope benches may be constructed with either ditches along them or back-sloped at a gentle angle toward the hill. These benches and ditches intercept runoff before it can reach an erosive velocity and divert it to a stable outlet.

- Overland flow velocities can be reduced by creating a rough surface for runoff to cross (e.g. tall grass or riprap).

Internal Erosion:

Once all other erosion and sediment control SCMs have been exhausted, excessive sediment should be removed from the stormwater both within and along the perimeter of the project site. The appropriate controls work on the same principle: the velocity of sediment-laden runoff is slowed by temporary barriers or traps which pond the stormwater to allow sediments to settle out. Appropriate strategies for implementing sedimentation controls include:

- Direct sediment-laden stormwater to temporary sediment traps.

- Locate sediment basins and traps at low points below disturbed areas.

- Protect all existing or newly-installed storm drainage structures from sediment clogging by providing inlet protection for area drains and curb inlets.

- Construct temporary sediment traps or ponds at the stormwater outfall(s) for the site.

- Excavate permanent stormwater detention ponds early in the project, use them as sedimentation ponds during construction, remove accumulated sediment, and landscape the ponds when the upstream drainage area is stabilized.

- Temporary sediment barriers such as:
    - Continuous Berms
    - Silt Fences or Erosion Eels
    - Sand or Small Gravel Bag Barriers
    - Brush or Rock Filter
        - These barriers should only be used in areas where sheet flow runoff occurs. They are less effective or ineffective if the runoff is concentrated into rill or gully flow.

Stormwater Inlets and Outfalls:

- Stormwater inlets, including drop inlets, and pipe inlets, should be protected from sediment intrusion if the area draining to the inlet has been disturbed.

- Stormwater inlet protection can utilize sand bags, sediment traps, or other similar devices.

- Internal outfalls must also be protected to reduce scour from high velocity flows leaving pipes or other drainage facilities.

Selection of Permanent Treatment Practices

Most permanent SCMs will be proposed by the developer early in the planning stage of a project. For most projects, there will be no single SCM which addresses all the long-term stormwater quality problems. Instead, a multi-level strategy will be worked out with the Montgomery County Stormwater Coordinator, which incorporates source controls, a series of on-site treatment controls, and community-wide treatment controls. At a minimum, long term water quality planning should be based on reducing the Total Suspended Solids (TSS) load to 80% or less of an average urban pollutant load.

In most cases permanent SCMs can be implemented most effectively when they can be integrated into other aspects of the project design. This requires that conceptual planning consider stormwater controls rather than as an afterthought to site design. The following should be considered early in the design process.

- Planned open space which will be relatively flat (e.g., final grade slopes less than 5 percent) may be merged with stormwater quality/quantity facilities. Such integrated, multi-use areas may achieve several objectives at a modest cost.

- Infiltration SCMs may serve as groundwater recharge facilities, detention/retention areas may be created in landscaped areas of the project, and vegetated swales/filters may be used as roadside/median or parking lot median vegetated areas.

2.5 – Stormwater Control Measure Factors for Construction Sites

Certain contractor activities may cause pollution if not properly managed. Not all SCMs will apply to every construction site; however, all SCMs should be evaluated for usefulness. Considerations for selecting SCMs for contractor activities include the following:

- SCMs may be different on rainy days versus dry days, winter versus summer, etc. For instance, a material storage area may be covered with a tarp during the rainy season, but not in the summer. However, it should be noted that plans should be made for some amount of rain even if a flood event is not expected.

- Less-intensive SCM implementation may be necessary if a relatively small amount of pollutant containing material is used. It is important to remember that some materials may be more dangerous or have the potential to cause widespread pollution, even if only a small quantity of the material is on hand.

- The more water used and waste-water generated, the more likely that pollutants will be transported offsite.

- SCMs selected will differ depending on whether the activity is conducted on a slope or flat ground, near a stormwater structure or watercourse, etc. Anticipating problems and conducting activities away from environmentally sensitive areas will reduce the cost and inconvenience of performing certain SCMs.

As a rule of thumb, it is best to establish controls for common (daily or weekly) activities and be prepared to respond quickly to accidents. This is especially true for contractors handling unusual materials that are not usually at the project site. Industrial and commercial facilities are expected to have contingency plans and spill measures for every material that is used regularly.

It is important to keep in mind that the SCMs for contractor and development activities are suggested practices, which may or may not apply in every case. Construction personnel should be instructed to develop additional or alternative SCMs, which are the most cost-effective and efficient for a particular project. The best SCM is a construction work force aware of the pollution potential of their activities and committed to a clean worksite.

2.6 - Stormwater Treatment Goals

Various SCMs will have different rates of effectiveness. For most SCMs, the goal is to discharge clear stormwater with no visible pollutants and no known sources of man-made pollution (such as toxic substances, chemicals or fertilizers). The objective of this section is to establish a baseline for pollution removal goals to evaluate the stormwater treatment SCMs, especially manufactured SCM systems, oil/water separators, or other methods of treating stormwater runoff.

There is a three-step approach to achieving higher water quality. The first step is large-scale prevention of pollution from entering or even contacting any stormwater runoff. The second step is removal of the visible components of stormwater runoff pollution, such as coarse sediment, oil and grease, bulk materials, and floating debris. The third step is the treatment and removal of the less obvious pollutants in stormwater runoff, such as fine sediment, nutrients, and heavy metals from automotive emissions.