ARTICLE 4: EROSION AND SEDIMENT CONTROL

Introduction

Controlling **erosion** and **sedimentation** during construction activities is critical in preventing negative impacts to water quality and local drainage systems. **Development** activities involving earth work, such as clearing, grubbing, grading, filling, and installing utilities, remove existing protective vegetative cover and expose soils to excessive **erosion**. The rate of **erosion** dramatically and unnaturally increases when soils are left unprotected during **development** or construction activities. Unprotected **sites** can erode at a rate in excess of one hundred times the natural rate of **erosion**. As shown in Figure 4.1, **sediment** can be carried from the project **site** in **stormwater runoff**, which results in the accumulation of **sediment** in **storm sewers**, **waterways**, **detention facilities** and other drainage features.

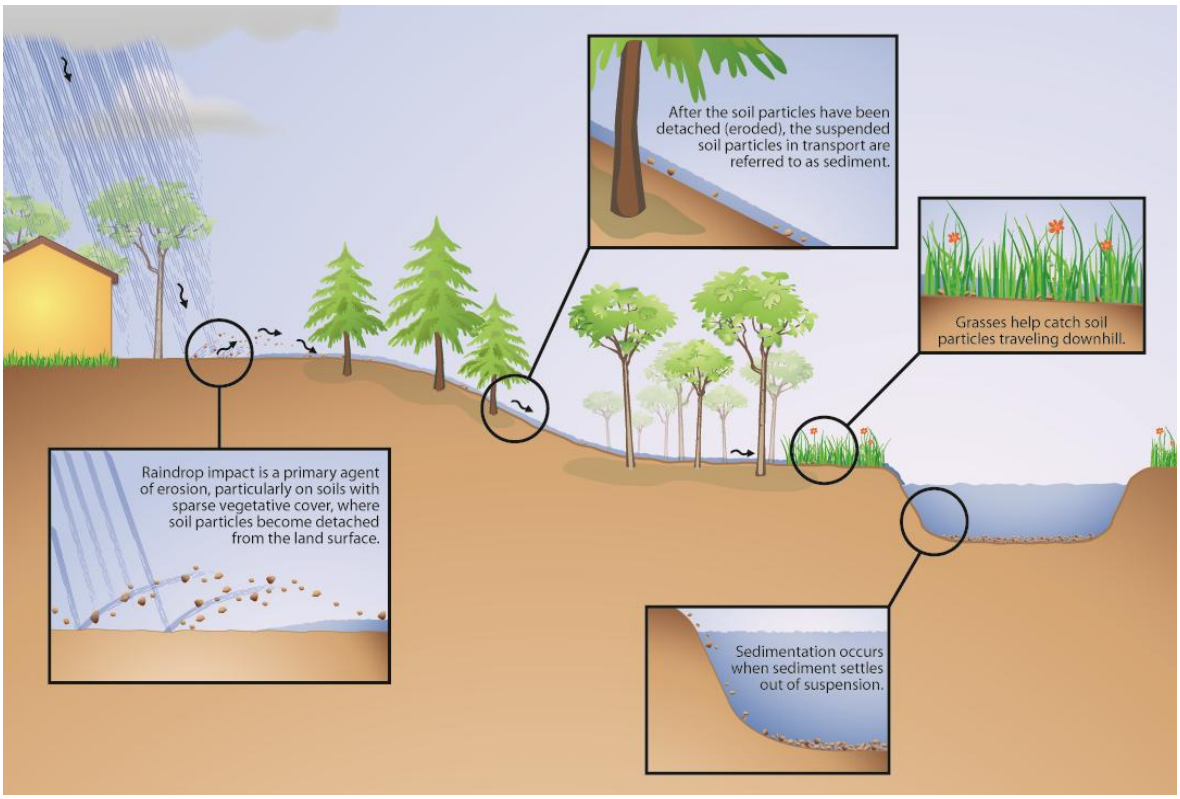

Figure 4.1 Erosion, Sediment, and Sedimentation

The accumulation of **sediment** reduces **stormwater** conveyance and the storage functions of streams, **wetlands**, **storm sewers, detention basins**, highway drainage ditches, **floodplains**, and navigable water channels. These impacts can result in more frequent and/or severe **flooding**. **Sedimentation** can also impact the storage capacity of municipal and industrial water supply reservoirs and increase costs due to the need to filter muddy water in preparation for domestic

Note: All bold terms contained in this document are defined terms in the WMO. Refer to Appendix A of the WMO or the TGM for the definition of each bold term.

or industrial use. It is also expensive to remove **sediment** from **storm sewers**, **detention facilities**, and other drainage systems. Excessive **sediment** in water bodies can be detrimental to aquatic life since it interferes with respiration, growth, reproduction, oxygen exchange and photosynthesis in plants.

Due to the many adverse environmental and economic impacts that result from **sedimentation**, the **Watershed Management Ordinance** (WMO) requires soil **erosion and sediment control practices** for all **development**. The purpose of these practices is to minimize and prevent pollution impacts during the construction phase of **development**. These practices are often referred to as Best Management Practices (BMPs). BMPs are measures that can be done on a small scale (individual **development sites**) that, in the aggregate, are designed to address the large scale objective of improving water quality throughout the **watershed**.

WMO Erosion and Sediment Control Requirements

The WMO requires all **developments**, regardless of size, to install and maintain soil **erosion** and **sediment** control measures during construction to prevent and/or reduce the **sediment** in **stormwater runoff** leaving the **site**. The **erosion** and **sediment** control requirements in the WMO are generally based on the general **National Pollutant Discharge Elimination System** (**NPDES**) Permit for **Stormwater** Discharges from Construction **Site** Activities (General **NPDES** Permit ILR-10). All **developments** that are equal to or greater than one acre in size must comply with the **Illinois Environmental Protection Agency** (**IEPA**) **NPDES** requirements for construction activities. For those **developments** located in a **combined sewer area**, if all **site stormwater** discharges, including construction dewatering, drain to a **combined sewer system**, ILR-10 permit coverage is <u>not</u> required.

The WMO requires **erosion and sediment control practices** on all **development sites**, regardless of the acreage of land disturbance or if it is located in a **combined** or **separate sewer area**. The WMO requires an **Erosion** and **Sediment** Control Plan to be prepared and submitted on all **development** projects requiring a **Watershed Management Permit** (§301.7). With every **Watershed Management Permit** application, a completed Schedule P form must be included with the submittal.

Although **erosion and sediment control practices** are required for every **development** regulated under the WMO, Schedule P is not required for certain types of **development**, including:

- Utility trenches not in **flood protection areas**;
- Projects undertaken solely by the **District**; and
- **Development** activities listed in WMO §201.1 that are undertaken solely by state or federal agencies (**IDOT**, Illinois Tollway Authority, **Corps**, etc.).

The WMO provides requirements for:

1. Temporary **erosion** control (§401);
2. Temporary **sediment** control (§402);
3. Construction **site** management (§403); and
4. Permanent **stabilization** (§404).

The **erosion and sediment control practices**, design criteria, and specifications in the WMO are generally based on the ***Illinois Urban Manual***. The ***Illinois Urban Manual***, which was originally developed by the US Department of Agriculture (USDA) – **Natural Resources Conservation Service** (**NRCS**), is considered to be the foremost resource for the selection and design of soil **erosion** and **sediment** control measures. When criteria and specifications are not provided in the ***Illinois Urban Manual***, the design criteria and specifications provided in the **TGM** shall be used (§400.6). In circumstances where other **erosion and sediment control practices** that are equally effective as those in the ***Illinois Urban Manual*** or those included in the **TGM** are to be used, prior written approval must be obtained from the **District** (§400.7).

A copy of the ***Illinois Urban Manual*** is available on-line through the Association of Illinois Soil and Water Conservation **District**s (AISWCD) website at: http://www.aiswcd.org/IUM/.

All standard drawings from the ***Illinois Urban Manual*** are available for download in pdf, dxf, dwf, and dwg file formats at: http://aiswcd.org/IUM/listdraw.html.

In addition, standard **erosion** and **sediment** control notes are available on-line through the **US Army Corps of Engineers** (**Corps**) website at:
http://www.lrc.usace.army.mil/Portals/36/docs/regulatory/pdf/SESCrec.pdf

The WMO requires that for all **developments** discharging directly to **Jurisdictional Waters of the US**, the hydraulic and hydrologic design of the **erosion** and **sediment** control plan shall be designed for a **storm event** equal to or greater than a 25-year, 24-hour **storm event** (§400.4).

It should be understood that **development sites** have unique **stormwater runoff** situations and that the application of **erosion and sediment control practices** vary from **site** to **site**. Each type of **erosion and sediment control practice** has certain limitations based on the **drainage area** served, available land space, cost, and pollutant removal efficiency in addition to a variety of **site**-specific factors such as soil types, slopes, and depth of **groundwater** table. Careful consideration of these factors is necessary in order to select the appropriate **erosion and sediment control practice**. As stated in §400.3, all **developments** must address **erosion** and **sediment** control and the following:

1. Incorporate **erosion and sediment control practices** into the initial **site** plan;

2. Place a primary emphasis on **erosion control practices** that minimize **erosion**; and

3. Place a secondary emphasis on **sediment control practices** that contain eroded soil after it is in transport.

DEVELOPMENT OF AN EROSION AND SEDIMENT CONTROL PLAN

As part of the WMO submittal requirements, applicants need to develop an **erosion** and **sediment** control plan (§302.2). The ***Illinois Urban Manual***, Section 3, outlines a nine-step planning process recommended for the **development** of an **erosion** and **sediment** control plan and provides a list of pre-planning activities. At a minimum, **site erosion** and **sediment** controls and overall **site** management should conform to the following:

1. Control **stormwater** volume within the **site** to minimize soil **erosion**;

2. Control **stormwater** discharges, including both peak flowrates and total **stormwater** volume, to minimize **erosion** at outlets and to minimize downstream channel and stream bank **erosion**;

3. Minimize the amount of soil exposed during construction activity;

4. Minimize the disturbance of steep slopes;

5. Minimize **sediment** discharges from the **site**;

6. Address factors such as the amount, frequency, intensity, and duration of precipitation, the nature of resulting **stormwater runoff**, and soil characteristics, including the range of soil particle sizes expected to be present onsite;

7. Provide and maintain natural buffers around surface waters, direct **stormwater** to vegetated areas to increase **sediment** removal and maximize **stormwater** infiltration (unless infeasible); and

8. Minimize soil compaction and unless infeasible, preserve topsoil

For purposes of the WMO, an **erosion** and **sediment** control plan must describe all measures appropriate for the **development** such that all the requirements of Article 4 are met. In addition, the **erosion** and **sediment** control plan should put emphasis on avoiding sensitive areas and minimizing the amount and duration of soil exposed to **erosion** by wind, rain, **runoff** and vehicle tracking. Effective planning includes the **development** of a schedule for implementing appropriate **erosion control practices**, **sediment control practices**, and construction **site** management practices that control pollution generated from construction activities.

The plan sheet(s) require the associated details and staging construction plans, where

applicable. Some **sites** may require unique details to describe **site**-specific **erosion control practices** and **sediment control practices** and applications. Typically, a **site** grading plan will be utilized as the base for the **erosion** and **sediment** control plan sheet(s) as it is necessary to locate limits of **disturbed areas** and discharge points when designing the **erosion** and **sediment** control plan sheet(s).

The **erosion** and **sediment** control plan sheet(s) apply to all areas that are directly related to the project's construction activity, including but not limited to staging areas, storage yards, material borrow areas, storage areas, and access roads. The **erosion** and **sediment** control plan must provide controls for existing, interim, and proposed conditions. Also, the **erosion** and **sediment** control plan sheet(s) must ultimately reflect the contractor's phasing and/or construction staging, and must address the entire scope of the contract work.

Components of Erosion and Sediment Control Plan

As described in §302.2, the **erosion** and **sediment** control plan shall include the following:

1. "A narrative description of the existing land cover, hydrologic conditions of the proposed **development**, upstream **tributary area** and areas adjacent to the **development** including a description of any **Flood Protection Areas**, **site** discharge location(s), points of discharge to **Jurisdictional Waters of the U.S.**, and soil survey data." (§302.2A)

   This paragraph(s) narrative should include a discussion of the existing conditions of both the **development** and the areas adjacent to the **development** that can be impacted by **erosion** or **sedimentation**. Soil data for the county can be obtained on-line through the **NRCS** at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

   It is recognized that soil data may not be available for some areas of **Cook County**. If data is not available, then it should be noted in the narrative.

2. "The **NPDES** ILR-10 permit number issued by **Illinois Environmental Protection Agency** (**IEPA**) to the applicant upon submittal of the ILR-10 Notice of Intent permit application or permit." (§302.2B)

   After the application has been submitted and reviewed by **IEPA** for completeness, an identifying ILR-10 number is assigned to the permit application and the Notice of Intent (NOI) will be published to the NOI page(s) of **IEPA's** website. The NOI and identifying ILR-10 permit number should be noted on the Schedule P form.

3. "A narrative description of the proposed temporary **erosion and sediment control practices**, including a narrative describing how **Flood Protection Areas** will be protected from **erosion** and **sedimentation**." (§302.2C)

   This narrative should include a description of the temporary **erosion control practices**, the temporary **sediment control practices** selected for the **development**, and how

these practices will be used to protect **Flood Protection Areas**.

4. "A schedule of construction activities including, but not limited to, clearing and grading, installation of **stabilized** construction entrances, **erosion and sediment control practice** implementation, disposal of construction waste, stockpiling, and inspection and **maintenance** of all **erosion and sediment control practices**." (§302.2D)

   The schedule should allow adjustments in implementation of **erosion and sediment control practices** based on factors such as potential weather and the pace of work progress. The schedule should provide for the monitoring of weather forecasts for rainfall and adjust installation of **erosion and sediment control practices** prior to predicted rainfall events or dry-spells. The schedule should incorporate staged seeding and re-vegetation of graded slopes as work progresses.

   Apply permanent **erosion** control to areas deemed substantially complete during the project's defined seeding window. The schedule should include a monitoring program consisting of regular inspection of **erosion and sediment control practices** to ensure proper installation, **maintenance**, and performance of implemented **structures** and procedures. Objectives and **maintenance** schedules should be adjusted based on the results of monitoring and changes in construction plans.

5. "Data and calculations used to size, locate, design, and maintain all **erosion and sediment control practices**, and the design of temporary stream crossings." (§302.2F)

   All calculations, data, and assumptions used for the sizing and placement of **erosion and sediment control practices** should be included in the plan. This information should demonstrate how the proposed **erosion and sediment control practices** have been designed in compliance with the regulations in the WMO and/or **NPDES** ILR-10 permit.

6. "A mechanism for ensuring that the **erosion** and **sediment** control installation and **maintenance** requirements for both temporary and permanent measures will be met, including the list of **maintenance** tasks and performance schedules that have been identified and/or required in the plan sheet(s) and specifications." (§302.2G)

   In accordance with ILR-10, onsite inspections must be completed regularly and also after **storm events** that result in 0.5 inches or more rainfall. An assessment should be made on whether the onsite soil **erosion and sediment control practices** are performing properly, as compared to the specifications contained in the plans and/or ***Illinois Urban Manual***. Any **maintenance** that is required should also be identified as part of this process. Additional guidance on **maintenance** of soil **erosion** and **sediment** controls is provided in Article 9 of the **TGM**.

General NPDES Permit ILR-10 Requirements

The goal of General **NPDES** Permit ILR-10 is to protect the quality and beneficial uses of the State's surface water resources from polluted **stormwater runoff** and from non-**stormwater**

discharges associated with construction activities. To achieve this goal, the ILR-10 requires **permittees** to plan and implement appropriate pollution prevention and control practices for **stormwater runoff** and non-**stormwater** discharges throughout construction. These BMPs are aimed at reducing **erosion**, controlling **sediment** transport, implementing good housekeeping practices, and minimizing pollutant discharges. As stated previously in this article, for those **developments** located in a **combined sewer area**, if all **site stormwater** discharges, including construction dewatering, drain to a **combined sewer system**, ILR-10 permit coverage is not required.

A copy of General **NPDES** Permit ILR-10 is Available at:
http://www.epa.state.il.us/water/permits/storm-water/construction.html

Notice of Intent

To receive authorization under the ILR-10 Permit, a discharge must either be covered by a valid Illinois General **NPDES** Construction **Site** Permit, or a completed Notice of Intent (NOI) in accordance with Part II (NOI Requirements) and Part VI.G (Signatory Requirements) of the ILR-10 Permit. The NOI must be submitted in sufficient time to allow a 30 day review period after receipt of the NOI by **IEPA** and the **start of construction**. Dischargers who fail to notify the **IEPA** of their intent to be covered, and discharge **stormwater** associated with construction **site** activity to Waters of the State without an **NPDES** permit, are in violation of the Environmental Protection Act and the Clean Water Act.

Construction activities that are operating under approved local **sediment** and **erosion** control plans, land disturbance permits, grading plans, or **stormwater** management plans, shall also submit signed copies of the NOI to the local agency approving such plans in accordance with the deadlines set forth in Part II.A of the ILR-10 permit. A copy of the NOI shall be sent to the entity holding an active General **NPDES** Permit No. ILR-40 if the project is located in an area covered by an active ILR-40 permit.

Additional NOI guidance is available on-line through the **IEPA** at:
http://www.epa.state.il.us/water/permits/storm-water/construction.html

Storm Water Pollution Prevention Plan (SWPPP)

A SWPPP is required for **developments** that will result in the disturbance of one or more acres of total land area, or for a **development** less than one acre of total land that is part of a larger common plan of **development** or sale, if the larger common plan will ultimately disturb one or more acres of total land area. The SWPPP is an integral part of the **IEPA**'s ILR-10 permit program, and plays a crucial role in minimizing the pollution of **stormwater runoff** from construction **sites**. A properly prepared and implemented SWPPP assists permitees with meeting **stormwater** pollution prevention goals. The **erosion** and **sediment** control plan alone should not be considered a SWPPP, rather one component of the **site** specific SWPPP.

The US Environmental Protection Agency (EPA) has published a guide to developing SWPPPs for

construction **sites**. The guide is available on-line at:
http://www.epa.gov/npdes/pubs/sw_swppp_guide.pdf

An example SWPPP for a small (5-acre) construction **site** is available in pdf form on-line at: http://www.epa.gov/npdes/pubs/exampleswppp_smallcommercial.pdf.

An example SWPPP for a medium-sized (20-acre) construction **site** is available in pdf form on-line at: http://www.epa.gov/npdes/pubs/exampleswppp_residential.pdf.

Inspections

In accordance with the WMO (§1000.4), inspections must be performed to verify that the **development** is in compliance with the soil **erosion** and **sediment** control requirements of the WMO. An initial inspection of soil **erosion** and **sediment** control measures should occur after mobilization and installation of initial **erosion and sediment control practices**, prior to any soil disturbance (§1000.4A).

In accordance with ILR-10 regulations, inspections must be conducted at least once every seven calendar days and within 24 hours of the end of a storm, or by the end of the following business or work day, that is 0.5 inches or greater.

Inspections may be reduced to once per month when construction activities have ceased due to frozen conditions. Inspections must commence when construction activities are conducted, if there is a 0.5 inches or greater rain event, or if discharge due to snowmelt occurs.

An assessment should be made and documented in a report on whether the soil **erosion and sediment control practices** are performing properly, as compared to the specifications contained in the plans and/or ***Illinois Urban Manual***. All remedial actions taken to repair or install soil **erosion** and **sediment** controls should be completed within 7 days of their discovery, unless the repair or installation is resulting in a pollutant discharge, in which the remedial action must occur immediately. For additional guidance on inspections, refer to Article 10 of the **TGM**.

TEMPORARY EROSION AND SEDIMENT CONTROL (§401 - §402)

Overview

Erosion and sediment control practices are techniques, measures or structural controls used for a given set of **site** conditions to manage the rate, quantity, and quality of **stormwater runoff** in a cost-effective manner. No single practice can address all pollutants associated with construction activities. Independently these practices serve different purposes. **Erosion** controls are preventative strategies that utilize techniques to stabilize the soil, thus minimizing the occurrence of **erosion**. **Sediment** controls are back up strategies that incorporate structural measures to contain **sediment** on **site** in the event that **erosion** does occur. While functionally different, these two forms of pollution control should be selected and implemented in a

complimentary manner in order to maximize pollution prevention effectiveness.

The selection process for temporary **erosion and sediment control practices** is an iterative process that first identifies potential pollutant sources and then identifies the measures necessary to reduce or eliminate pollutant discharges from the **site**. The nature and extent of the **erosion and sediment control practices** should be appropriate to address the specific conditions of the **site** and be properly maintained to ensure continued effective operation. For each aspect of construction, the placement of the necessary measures should be timed to optimize their effectiveness.

Temporary **erosion and sediment control practices** should reflect the features and limitations of the **development site** and adjacent properties. The following must be considered:

1. Seasonal, topographic, and **maintenance** limitations;
2. The susceptibility of soils to **erosion**;
3. Amount of tributary **drainage area**; and
4. Proximity to **Flood Protection Areas**.

Examples of seasonal, topographic, and **maintenance** limitations may include seeding windows, steep slopes, and accessibility. Available soil survey information and **site** investigation should be used to understand the potential susceptibility of **site erosion** of unprotected soils. Soil investigation should also include an understanding of infiltration capability, soil textural classes (percent sand, silt, and clay), as well as an understanding of the depth to seasonally high water table, bedrock, or other limiting layer. A description of these **site** soil features are required in the **development** of the volume control plan (§303), and can also facilitate the **development** of the temporary **erosion and sediment control practices**.

Avoiding Disturbance to Sensitive Areas

Construction schedules and planning should include all practicable measures to avoid disturbances to environmentally and culturally sensitive and regulated areas. Sensitive areas may include, but are not limited to, steep slopes, highly erodible soils, streams, stream buffers, specimen trees, and natural vegetation. Other sensitive areas include **Flood Protection Areas** (i.e., **floodplains**, **wetlands**, and **riparian environments**), threatened and endangered species habitat, historic preservation **sites**, and EPA 303(d) listed receiving waters. These areas provide numerous water quality and **flood** protection benefits and therefore require special management and protection in order to preserve their functions.

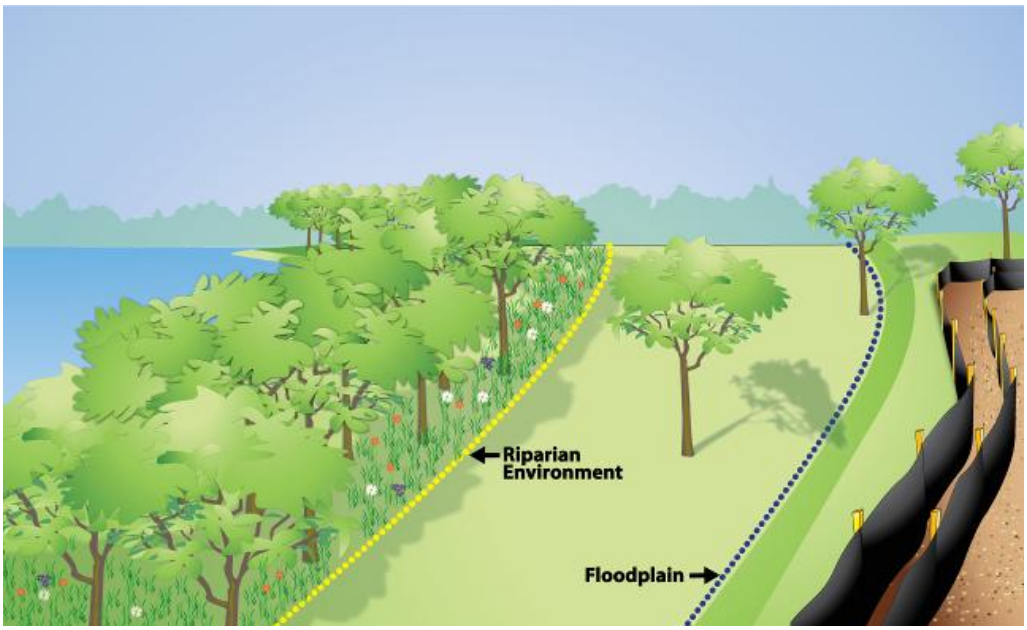

Figure 4.2 Example of a Double Row Silt Fence Protecting a Flood Protection Area

Flood Protection Areas

The WMO requires that soil stockpiles or other construction materials are not located within **Flood Protection Areas** (**FPAs**), and that they be protected by a minimum of a double-row **silt fence** or equivalent measure, as shown in Figure 4.2. Additional **erosion and sediment control practices** should be employed as necessary to protect **FPAs** from negative impacts associated with **development**. Stockpiles should never be placed within **FPAs** in order to prevent **sediment**-loading, impairment of ecological functions, and restriction of conveyance during **storm events**. The implementation of preventative measures prior to construction, such as the preservation of vegetated buffers, use of fencing and signage, and avoiding disturbances near **FPAs**, are some of the most effective means of protection.

Floodplains

Floodplains safely convey floodwaters and dissipate flows and velocities, subsequently reducing streambank **erosion** and protecting **structures** and people from the effects of **flooding**. Protection of **floodplain** corridors also promotes connectivity of habitat, which encourages the spread of native plants and wildlife.

Wetlands

Wetlands and **wetland buffers** are important **stormwater** management assets, where biogeochemical interactions cleanse surface and subsurface water of pollutants. Decreased flow velocities in **wetlands** allow **sediment** to settle out of suspension, and **wetland** vegetation provides the surface area and energy sources necessary for microorganisms to break down and immobilize pollutants. **Wetlands** also provide **stormwater** attenuation and volume reduction benefits by detaining surface waters, which alleviates **flooding**, promotes evapotranspiration, and allows recharge of **groundwater** aquifers. **Wetlands** can also offer protection from

erosion, sequester atmospheric carbon dioxide into organic soils, and provide plant and wildlife habitat.

Riparian Environments

Riparian environments provide ecosystem services in the form of streambank **stabilization**, interception and immobilization of **sediment**, sequestration of nutrients, metals, organic compounds, and other pollutants, and also enhancement of biodiversity in this transitional zone. **Riparian environments** also provide **stormwater** management benefits, since the vegetated and wooded areas adjacent to streams can reduce **flood** velocities and flowrates. These areas can also provide volume reduction benefits through infiltration in the vegetated areas.

TEMPORARY EROSION CONTROL REQUIREMENTS (§401)

Erosion control practices involve the **stabilization** of soil in order to alleviate raindrop impact, prevent sheet and rill **erosion**, prevent suspension of solids in **stormwater runoff**, and prevent dust due to wind **erosion**.

Temporary **erosion control practices** are **stabilization** measures including, but not limited to:

- Protection of existing vegetation;
- Establishment of new vegetation;
- Soil **stabilization** measures;
- Wind and dust control measures;
- **Stormwater** conveyance channels; and
- Velocity dissipation measures.

When selecting **erosion control practices**, it is important to consider both onsite and offsite conditions. All potential sources of **erosion** should be evaluated and optimal methods should be chosen based upon the combination of soil characteristics, topography, climate, existing resources, proposed construction activities, and proximity to **FPAs**. Preservation of existing vegetation should always be considered as a primary method of soil **stabilization**, due to present and future value for **erosion** protection, **sediment** control, wildlife habitat, landscape aesthetics, and economic value. Implementing preventative measures early in the project timeline can save cost and time during later phases by reducing the need for supplemental **stabilization** and **sediment** containment practices.

Erosion control practices should be removed as soon as practicable, but no longer than seven days after construction activities have temporarily or permanently ceased. As stated in the ILR-10 permit, this requirement may be waived if construction activity is scheduled to resume

within 14 days from when activities ceased.

A listing of ***Illinois Urban Manual*** drawings for recommended temporary **erosion** control measures is provided in Table 4-1.

Protection of Existing Vegetation and Site Soil Disturbance Activities

Vegetation can be an effective and economic method of soil **stabilization**. Vegetative cover protects soils from raindrop impacts, rill and sheet **erosion**, and wind **erosion**. Vegetation also provides a reduction in velocity, valuable filtration and adsorption of pollutants, and can reduce **runoff** volumes by enhancing infiltration. The WMO states that existing vegetation shall be preserved where practicable to minimize the area of soil disturbance (§401.1). The purpose of retaining existing vegetation is to temporarily preserve areas that have value for **erosion** control during the construction process.

Preservation of existing vegetation is also a simple way of maintaining **stabilized** soils in areas of the **site** where no construction activity is planned or will occur at a later stage, phase, or date.

In addition to preservation of existing vegetation, the following general guidelines relating to soil disturbing activities should also be followed:

1. Minimize the area of soil exposed to **erosion** at one time;

2. Schedule major grading operations for the non-rainy season when practicable and limiting soil disturbing activities during the rainy season; and

3. Sequence trenching activities so that most open portions are closed before new trenching begins. Also any trenches, holes, or other excavations required for utility installation should be protected at the end of each workday.

Establishment of New Vegetation

As stated above, vegetation can be an effective and economic method of soil **stabilization**. Similar to preservation of existing vegetation, establishing temporary or permanent vegetative cover on disturbed or exposed areas reduces **erosion** and creates a landscape that enhances soil permeability and the filtering of **runoff** pollutants.

Soil Stabilization

Soil **stabilization** measures are manufactured products that protect against raindrop impact and enhance vegetative establishment by retaining soil moisture, providing an insulating layer, preventing seed washout, controlling weedy species, and protecting seeds from wildlife consumption. These products include mulches, soil binders, **erosion** control blankets, and turf reinforcement mats, which provide effective and immediate **stabilization** of slopes and channels before, during, and after the establishment of vegetation.

Wind and Dust Control

The purpose of this practice is to prevent blowing and movement of dust from exposed soil surfaces, to reduce on and offsite damage, to minimize health hazards, and to improve traffic safety. This practice is applicable to areas subject to dust blowing and movement where on and offsite damage is likely without treatment.

Stormwater Conveyance Channels

Stormwater conveyance channels prevent **erosion** by redirecting potentially erosive flows or convey clean or **sediment** laden water from upstream **tributary areas** along a **stabilized** path and away from areas that have not yet been **stabilized**. These include diversion dikes, drainage swales, lined ditches, and slope drains. **Stormwater** conveyance channels are not suitable as **sediment**-trapping devices, and should be **stabilized** prior to use to prevent **erosion** of exposed soils.

Velocity Dissipation Measures

Velocity dissipation measures prevent **erosion** by slowing the velocity of concentrated flows at the **stormwater outfall**. These measures are to be employed wherever concentrated flows are conveyed at erosive velocities, such as in steep swales or at pipe outlets. These consist of an area or apron of rock, concrete rubble, or gabions placed at the outlet of a drainage system. Appropriate applications include, outlets carrying a continuous flow of water, outlets subject to short, intense flows, outlets to **sediment basins**, and points where lined channels discharge to unlined channels or natural **waterways**.

Erosion and Sediment Control for Construction Shutdown or Phased Projects

The WMO requires that temporary **erosion control practices** be maintained on a year-round basis during construction (§401.5). Temporary **erosion control practice** are required for any periods of construction shutdown until permanent **stabilization** is achieved (§401.5).

All open areas that are to remain idle throughout winter should be **stabilized** with temporary or permanent vegetation prior to the end of the fall growing season. Seeding should be performed during the appropriate season in order to ensure rapid establishment of vegetation. In the event that temporary or permanent re-vegetation cannot be established prior to winter shutdown, a backup **stabilization** and containment plan should be in place in order to implement additional **erosion** control measures, such as the installation of mulch or **erosion** control blankets on all exposed soil. **Sediment control practices**, such as perimeter **silt fence** and **storm sewer** inlet protection devices, should also be installed and maintained throughout the winter shutdown period.

Table 4-1. *Illinois Urban Manual* Drawings for Temporary Erosion Control Strategies

Temporary Erosion Control Strategy	*Illinois Urban Manual* Code
Protection of Existing Vegetation	
Tree and Forest Ecosystem Preservation	984
Establishment of New Vegetation	
Temporary Seeding	965
Permanent Vegetation	880
Sodding	925
Erosion Control Blanket	830
Mulching	875
Wind and Dust Control Measures	
Dust Control	825
Stormwater Conveyance Channels	
Diversion Dike	820
Temporary Diversion	955
Temporary Slope Drain	970
Temporary Swale	980
Temporary Pipe Diversion	676-PD
Velocity Dissipation Measures	
Rock Outlet Protection	910

For projects involving phased construction, within the portions of the **site** where construction activities will be temporarily ceased, **stabilization** practices must be completed within seven days unless construction activity is resumed on that portion of the **site** within 14 days (§401.6). The WMO allows for the instances where snow cover precludes the completion of the **stabilization** practices. In such cases, the **erosion control practices** must be completed as soon as practicable.

TEMPORARY SEDIMENT CONTROL REQUIREMENTS (§402)

Sediment-laden waters generated onsite should be routed through at least one **sediment control practice** prior to discharge (§402.3). These practices are designed to contain or filter **sediment**-laden **runoff** (eroded material) before it leaves the **site**. Most **sediment control practices** function by reducing flow velocity and turbulence of **sediment**-laden water, subsequently allowing **sediment** to settle out of suspension. In some instances, multiple **sediment control practices** will be necessary to protect against the discharge of suspended **sediment**. All **sediment control practices** should be installed in conjunction with **erosion control practices**, and therefore should not be utilized as stand-alone measures. A listing of

Illinois Urban Manual drawings for recommended temporary **sediment** control measures is provided in Table 4-2.

Sediment control practices must intercept all **runoff** from **disturbed areas** before **runoff** leaves the **site** (§402.5). When the **disturbed area** or areas constitute an area draining less than one acre, then the **disturbed area** must be protected by a minimum of a **silt fence** or equivalent. For a **silt fence** equivalent, refer to the following section, Perimeter Controls. Equivalent measures should be used only when approved by the **District**.

When the **disturbed area** or areas constitute an area draining more than one acre, then the **disturbed area** must be protected by a **silt fence** (or equivalent) and a **sediment basin** or equivalent. The **sediment basin** must be sized to intercept the 2-year, 24-hour **runoff** volume from the **tributary area**.

In all cases, it is important to consider measures that capture and contain **sediment** close to its source. **Sediment control practices** should always be integrated with **erosion control practices**, and should never be used as stand-alone methods of water quality protection.

Sediment control can be accomplished using the following general control mechanisms:

- Perimeter Controls: Vegetated buffers, **silt fences**, rolled barriers;
- Inlet Controls: Inlet filter bags, above grade inlet filters;
- Entrance/Exit Controls: **Stabilized** construction entrance/exit, tire wash stations;
- **Sedimentation** Controls: **Sediment** traps, **sediment basins**, flocculents;
- Instream **Sediment** Controls: Turbidity curtains, cofferdams; and/or
- Dewatering Operation Controls: Rim ditching, sock pipe/horizontal wells, well point systems, tank systems, and filtration.

Perimeter Controls

Perimeter controls are methods of containing **sediment** within the boundaries of the project **site**, or preventing offsite sources of **sediment** to enter the **site**. These practices prevent the discharge of **sediment** by filtering and dissipating the energy of **sediment** laden sheet flow **runoff**. All **site** characteristics should be considered when selecting appropriate perimeter control practices. Perimeter controls must be installed and functioning prior to soil disturbance (§402.3).

Inlet Controls

Inlet controls prevent the movement of **sediment** and other pollutants into the **storm sewer** network. All **site** and **storm sewer** characteristics should be considered when selecting an appropriate inlet control. Sheet flow draining to drop inlets may require different methods of

treatment than shallow concentrated flow draining to culvert inlets, so it is important to select an inlet control best suited to accommodate the expected velocity, shear stress, and **sediment** load of **site runoff**.

Entrance/Exit Controls

Entrance/Exit controls prevent offsite tracking of **sediment** at all points of construction ingress/egress where **sediment** can be tracked onto public roads. Any soil reaching a public or private roadway shall be removed immediately and transported to a controlled **sediment** disposal area.

Sedimentation Controls

Sedimentation controls utilize excavated or impounded areas to temporarily detain **sediment**-laden water to promote settling of suspended particles prior to discharge. The outlets of **sedimentation** controls should be **stabilized** (see Velocity Dissipation Measures) such that treated water does not become re-contaminated. Designs should allow for adequate retention time to ensure maximal **sedimentation** for the anticipated **sediment** loads. Pumping **sediment**-laden water into any **stormwater facility** that is not designated to be a **sediment** control measure, **sediment** trap, or **sediment basin** either directly or indirectly without filtration is prohibited.

Sediment traps should only be used for small disturbed soil areas draining less than one acre, and for treating coarse textured soils consisting of medium to large sized **sediment** particles (sands and coarse silts). If the contributing **drainage area** is greater than one acre, or **site** consists of finer textured soils, such as silts and clays, a **sediment basin** should be used. Basins are appropriate for large disturbed soil areas draining between one and ten acres, but are not appropriate for **drainage areas** greater than 75 acres.

Design of **sediment** traps and basins should provide enough storage to accommodate the settling process (live storage) in addition to the accumulated **sediment** (dead storage). Live storage volume should, at a minimum, accommodate the 2-year, 24-hour **runoff** volume for the **tributary area** to each **sediment** trap or basin. Dead storage should be sized to store the estimated **sediment** load generated from the **site** over the duration of the construction period and be below the permeable fill. The **sediment** load can be estimated by using the Revised Universal Soil Loss Equation (RUSLE). Total storage may consist of only live detention storage; however, a more frequent schedule for **sediment** removal will be required. The following example demonstrates how to calculate the 2-year, 24-hour **runoff** volume for an example **site**.

Example 4.1: Sediment Basin Sizing

This example demonstrates how to size a **sediment basin** for a 10-acre **site**. The WMO requires that the **sediment basin** be sized based on the 2-year, 24-hour **runoff** volume from the tributary **drainage area**. In this example, it is assumed that the entire project **site** (10 acres) is tributary to the **sediment basin**.

To calculate the **runoff** volume, the **NRCS runoff** equation is used, which is:

$$R = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

where,

R = **runoff** depth (in)
P = 2-year, 24-hour rainfall depth of 3.04 in (**Bulletin 70** Northeast Section)
S = potential maximum retention after **runoff** begins (in), and is calculated by:

$$S = \frac{1000}{CN} - 10$$

where,

CN = **runoff** curve number for the **tributary area**. A CN of 91 is used, assuming newly graded (bare soil) and C soils.

$$S = \frac{1000}{CN} - 10 = \frac{1000}{91} - 10 = 0.99 \text{ in}$$

Substituting the known values for P and S,

$$R = \frac{(3.04 - 0.2*0.99)^2}{(3.04 + 0.8*0.99)} = 2.11 \text{ in}$$

The volume of **runoff** (acre-feet), V, from the **tributary area**, A, can then be calculated by:

$$V = \frac{R}{12} \times \text{Area} = \frac{2.11 \text{ in}}{12 \text{ in/ft}} \text{ X } 10 \text{ ac} = 1.76 \text{ ac-ft}$$

Therefore, the required **sediment basin** volume is 1.76 acre-feet.

Instream Sediment Controls

These are methods of **sediment** containment when work must occur in or near **waterways**. Instream **sediment** controls are implemented to contain and prevent **sediment** loading of surface waters and subsequently protect **watershed** quality. All necessary permits (USACE, **FEMA**, **IEPA**, Section 401 and Section 404 permits, etc.) must be granted before installation can begin. Examples of instream **sediment** controls include turbidity curtains and cofferdams.

Dewatering Operation Controls

Dewatering operations remove and treat **groundwater** from an excavation area. These controls ensure safe working conditions, proper removal of contaminants, and appropriate discharge of **groundwater**. Dewatering operations include Filtration Systems, Pipe Socks,

Horizontal Wells, Well Point Systems, and Dewatering Tanks. Construction dewatering operations shall be designed and operated so that water discharged from a **site** will meet State of Illinois water quality standards, as set forth in Title 35, Subtitle C, Chapter I, Part 302, Subpart B, Illinois Administrative Code.

Table 4-2. *Illinois Urban Manual* Drawings for Temporary Sediment Control Strategies

Temporary Sediment Control Measure	*Illinois Urban Manual* Code
Perimeter Controls	
Silt Fence	920
Filter Strip	835
Permanent Vegetation	880
Sodding	925
Temporary Seeding	965
Tree and Forest Ecosystem Preservation	984
Inlet Controls	
Culvert Inlet Protection	808
Inlet Protection - Fabric Drop	860
Inlet Protection - Excavated Drain Plan	555
Inlet Protection - Paved Areas Curb Protection	561C
Inlet Protection - Paved Areas Drop-In Protection	561D
Inlet Protection - Fabric Drop Plan	560
Inlet Protection - Sod Filter Plan	562
Sedimentation Controls	
Rock Check Dam - Riprap	605R
Rock Check Dam	905
Temporary Sediment Trap	660
Sediment Basin Dewatering Device	615
Polyacrylamide for Temporary Soil Stabilization	893
Polyacrylamide for Turbidity Reduction and Sediment Control	894
Sedimentation Controls	
Ditch Check (Manufactured)	514PC,514RC,514SC,514UF, 514VC
Instream Controls	
Floating Silt Curtain Cofferdam	617A, 617B, 917 803
Dewatering Operation Controls	
Dewatering	813
Portable Sediment Tank	895
Sump Pit	950

CONSTRUCTION SITE MANAGEMENT REQUIREMENTS (§403)

Construction **site** management practices are considered "good housekeeping" measures that are to be carried out throughout the duration of the project. These practices aim to reduce or eliminate the spread of pollutants by placing structural and/or procedural controls on activities that have the potential to pollute **stormwater runoff**. Emphasis is placed on preventing contact of **stormwater** with sources of pollutants. **Stabilized** construction entrances, proper management of soil stockpiles, and the proper installation of temporary stream crossings are all examples of construction **site** management controls. Good housekeeping can be accomplished using the following general control mechanisms:

- Material Handling and Waste Management: proper delivery, storage, and removal of construction materials and wastes;
- Spill Prevention and Control: **development** of a spill prevention and control plan;
- Equipment and Vehicle Use: designated fueling, cleaning, and **maintenance** areas;
- Street Sweeping and Vacuuming: timely removal of **sediment** tracked onto roadways;
- Allowable Non-**Stormwater** Discharge Management: prevention of contamination of these discharges from **stormwater**; and
- Stockpile Management: BMP implementation and proper location of piles.

One of the most useful tools for efficient construction **site** management is adequate signage. Legible signs should be placed throughout the construction **site** to identify vehicle wash and **maintenance** stations; designate solid, liquid, and hazardous waste storage locations; and convey any important notices concerning construction **site** management practices.

Temporary Stream Crossings

A temporary stream crossing is a culvert, ford, or bridge placed across a **waterway**, when frequent crossing cannot be avoided. Crossings are designed for short-term use (one year or less), allowing construction vehicles and heavy equipment to cross **waterways** while avoiding downstream **sedimentation** or damage to the channel morphology and ecosystem. All necessary permits (**Corps**, **FEMA**, **IEPA**, Section 401 and Section 404 permits, etc.) must be granted before installation can begin.

Temporary stream crossings should not cause **erosion** or damage due to increases in water surface profiles to adjacent properties. Disturbance or removal of vegetation should be limited to that which is necessary to complete construction, and when necessary, vegetation should be cut off no lower than ground level to promote re-growth. Riparian vegetation should be covered by a sufficient layer of clean river run cobble to prevent damage to underlying soil and root **structure**.

Temporary stream crossings used during construction should be designed to convey a two-year, 24-hour **flood** event without overtopping unless the **District** approves a more frequent design

event. In addition, the following conditions should be met:

- Temporary stream crossings should not reduce the carrying capacity of the channel;
- The entire crossing should be designed to withstand hydrodynamic, hydrostatic, and erosive forces up to the **base flood** event without washing out;
- Upon completion the temporary stream crossings should be entirely removed and the stream bed and banks restored to a stable non-erosive condition that incorporates native vegetation where appropriate; and
- **Erosion and sediment control practices** should be implemented and maintained during installation, **maintenance**, and removal of temporary stream crossings.

All **structures** should be inspected often, especially following **runoff**-producing rainfall, for any blockages in the channel and for **sediment** or debris buildup upstream or within the stream crossing **structure**.

A listing of ***Illinois Urban Manual*** Drawings for recommended construction **site** management controls is provided in Table 4-3.

Table 4-3. *Illinois Urban Manual* Drawings for Construction Site Management Strategies

Construction Site Management Strategy	*Illinois Urban Manual* Code
Stabilized Construction Entrance	930
Temporary Stream Crossing	975
Temporary Concrete Washout Facility	954

PERMANENT EROSION CONTROL REQUIREMENTS (§404)

Permanent **stabilization** means that all soil disturbing activities in an area of the **site** have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover has been established on all unpaved areas and areas not covered by permanent **structures**. Vegetative cover must have a density of 70 percent of the native background vegetative cover. A **disturbed area** may also be considered permanently **stabilized** if riprap, gabions, or other non-vegetative practices are installed.

In general, permanent **stabilization** using seeding often takes time (weeks or even months), especially during times of low rainfall or during the colder months of the year, so it is important to generate an appropriate timeline for permanent **stabilization** in order to prevent extended and costly **maintenance** of temporary **erosion and sediment control practices**.

Permanent **stabilization** must be initiated within seven days following the completion of soil disturbing activities. All temporary **erosion and sediment control practices** should be maintained until permanent **stabilization** is achieved and then removed within 30 days of **stabilization**.

By bringing areas of the **site** to permanent **stabilization**, the workload associated with maintaining and inspecting temporary **erosion and sediment control practices** will be reduced as routine inspections can be discontinued in that area. Table 4-4 provides the ***Illinois Urban Manual*** standard drawings for permanent vegetation.

Table 4-4. *Illinois Urban Manual* Drawings for Permanent Erosion Control Strategies

Permanent Erosion Control Strategy	*Illinois Urban Manual* Code
Permanent Vegetation	880, 880a, 880b, 880c, and 880d

TYPICAL EROSION AND SEDIMENT CONTROLS BY DEVELOPMENT TYPE

The acceptable **erosion and sediment control practices** will vary from project to project, however, certain types of projects will have many of the same practices in common. Examples of typical **erosion and sediment control practices** for different types of **development** are shown in Table 4-5 below.

Table 4-5. Typical Erosion and Sediment Control Practices by Development Type

Development Type	Typical Erosion and Sediment Control Practices
Commercial	• Stabilized Construction Entrance • Silt Fence • Seeding with Erosion Control Blanket • Sedimentation Basin • Concrete Washout Facility • Inlet Protection
Underground Utility Project (within FPA)	• Stabilized Construction Entrance • Double-row silt fence to protect FPA • Placement of soil stockpiles outside of FPA
Single-Family Development (within FPA)	• Stabilized Construction Entrance • Double-row silt fence to protect FPA • Inlet Protection • Sodding and/or Seeding with Erosion Control Blanket • Placement of soil stockpiles outside of FPA
Roadway/Alleyway Projects	• Stabilized Construction Entrance • Silt Fence • Concrete Washout Facility • Inlet Protection

It should be noted that the **erosion and sediment** controls shown in Table 4-5 are typical practices for those **development** types. These should be considered the minimum **erosion and sediment practices** that are required, and depending on the project, additional measures may be required to meet the requirements of Article 4 of the WMO.

SEDIMENT CONTROL PRACTICES FOR GREEN INFRASTRUCTURE

Because every **development** permitted under the WMO is required to incorporate **green infrastructure** into the **site** design, special **maintenance** practices should be developed (both during construction and post-construction) that ensure that the **green infrastructure** functions properly over time. Without proper **maintenance**, the void spaces in porous pavement and infiltration basins may become clogged with **sediment**, reducing their effectiveness.

During Construction

Green infrastructure is susceptible to failure during construction and therefore it is important that staging, construction practices, and **erosion and sediment control practices** all be considered during their installation. To protect the long-term functionality of volume control practices, the following measures should be addressed in the construction sequencing, general notes, and/or **soil erosion and sediment control** plan for a **development**:

- **Volume control practices** should be installed toward the end of the construction period.
- The contributing **drainage area** must be stabilized prior to the installation of the **volume control practice**.
- Soil compaction shall be minimized as much as possible during **site** grading. Appropriate measures (such as fencing) should be used to prevent heavy construction equipment traffic from accessing the area.
- **Volume control facilities** must be protected with a double-row of silt fence (or equivalent measure) during construction. The two layers of silt fence should be placed at least 5 feet apart and must follow the ***Illinois Urban Manual*** standards.
- In general, **volume control facilities** should not be used as temporary sediment traps during construction. For **sites** where this is not practicable, special construction notes and/or details are required to protect the functionality of the facility.

Post-Construction

To prevent clogging in the void space of pervious pavement (concrete, asphalt, pavers), it is recommended that adjacent landscaped areas be designed such that **stormwater runoff** from these areas onto the porous pavement is minimized. In addition, low pressure power washing and vacuuming of the surface is recommended on a yearly basis. This **maintenance** is especially critical during the fall. High pressure washing should be avoided for these types of surfaces, as it can cause damage to the pavement. Proper **maintenance** is especially difficult for pervious pavers, because extra care must be taken so that power washing and vacuuming does not dislodge the small chips that are used to fill in the paver gaps. In addition, small debris can collect in the paver gaps and lead to weed growth.

For infiltration trenches and basins, the use of a mulch layer above the infiltration practice will work like a filter for the **sediment** transported by **stormwater runoff**. The mulch layer will need to be replaced when it is filled, but will protect the void spaces in the soil and aggregate layers below from **sedimentation**. An alternative to using a mulch layer is the installation of a **sediment** trap upstream of the infiltration area. The **sediment** trap is a small depression that captures **stormwater** and allows the **sediment** to settle before it reaches the infiltration basin. For the **sediment** trap to be effective, the collected **sediment** must be removed regularly.

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