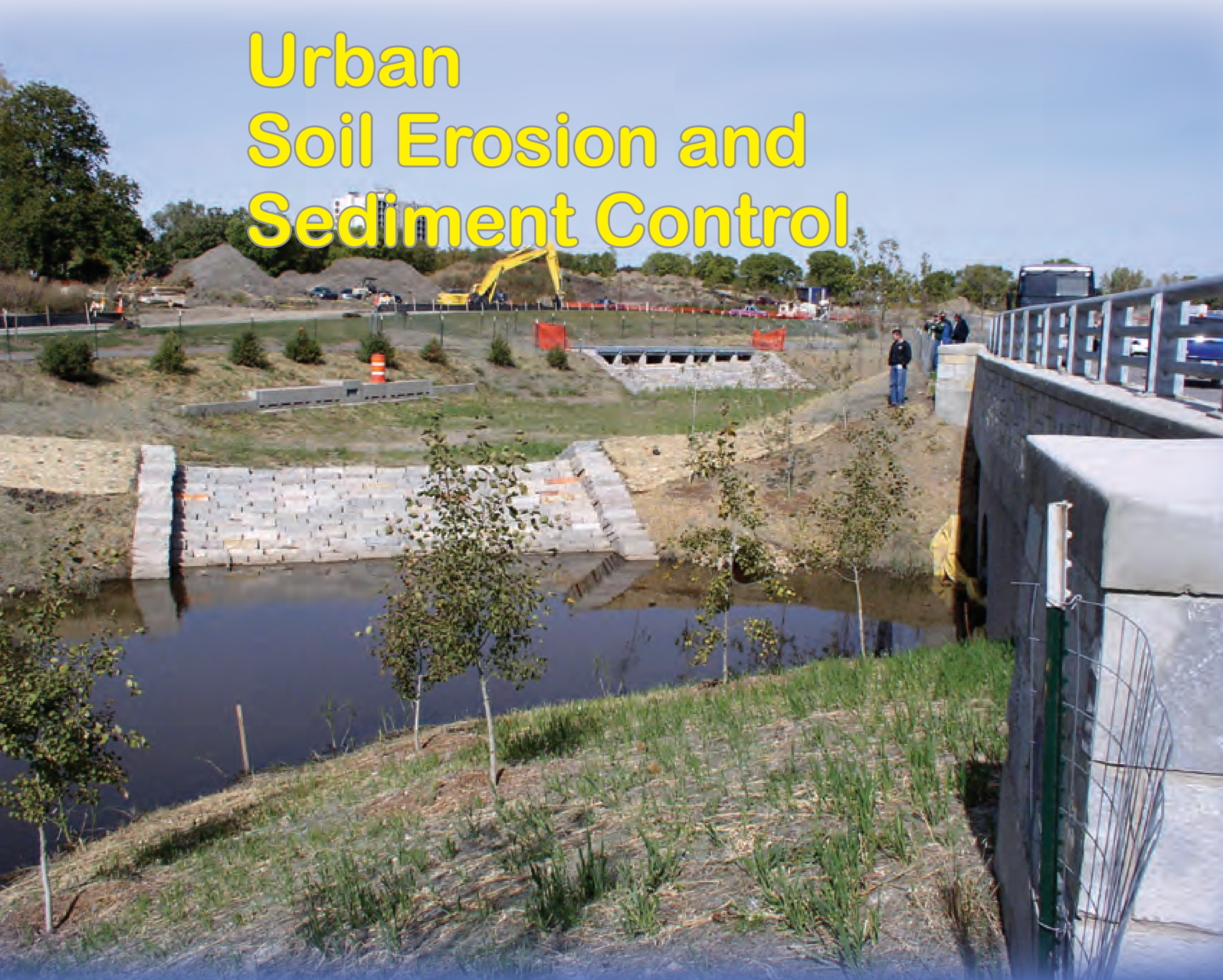
United States Department of Agriculture
Natural Resources Conservation Service

Association of Illinois Soil and Water Conservation Districts

Urban Soil Erosion and Sediment Control



Conservation Practices for Protecting and Enhancing Soil and Water Resources in Growing and Changing Communities

March 2008

Urban Soil Erosion and Sediment Control

Conservation Practices for Protecting and Enhancing Soil and Water Resources

Introduction

Land use change is a fact of life for many communities in Illinois. From cities to suburbs to rural villages, farmland is being developed to accommodate a population that wants larger homes, larger lots and more shopping, recreation, schools and roads.

These land use changes are intensifying pressure on the natural environment. When land is under construction, soil erosion can be significant – often many times greater than on land used for agriculture. The resulting sediment damages surface water resources (including community water supplies), obstructs roads and degrades wildlife habitat.

Once developed, the land has more roofs, roads, parking lots, and compacted turf. Impervious surfaces like these send more runoff across landscapes, and consequently, the risk of flooding is increased. Urban runoff impairs water quality in streams, lakes and wetlands by delivering sediment, nutrients, hydrocarbons and other pollutants. Ground water recharge is also reduced by impervious surfaces.

This brochure provides information about specific strategies for addressing soil erosion and sediment control on construction sites and on land that is already developed. It will help local decision-makers meet the changing land use needs of communities without compromising the need for clean and abundant water, protection from flooding, recreation amenities, and preserving wildlife habitat.

Developers, planners, engineers, local units of government, and interested citizens will find this brochure helpful for understanding:

- Soil erosion and sedimentation processes and issues,
- Illinois water quality laws and regulations related to erosion and sedimentation,
- Specific practices that protect local natural resources by controlling soil erosion and sedimentation.

For each practice, this guide will:

- Provide a description,
- List design techniques for implementation,
- Indicate challenges or limitations that may limit effectiveness,
- Illustrate with photos.

(This list of practices is not all inclusive and may not work for every situation. Evaluation of each situation must be made before deciding on a specific practice.)

What's inside

*PAM = polyacrylamide (water-soluble anionic)

Aerial photo with contour lines showing lakes and wetlands that will need protection if adjacent upland areas are disturbed for future development.

For more information on practice selection, design, implementation and maintenance, refer to the most current edition of the Illinois Environmental Protection Agency's "Illinois Urban Manual: A Technical Manual Designed for Urban Ecosystem Protection and Enhancement."

Why be concerned?

Urban runoff and construction site erosion have been identified as significant sources of pollution for surface water quality.

Sediment deposits destroy fish spawning areas, resulting in the loss of sensitive or threatened fish species; adversely impact aquatic insects which are at the base of the food chain; reduce channel capacity; and decrease the overall quality of lakes, streams and wetlands.

Sedimentation can cause flooding; require additional water treatment; pose safety and nuisance issues on roadways; and increase cost of construction and maintenance. Chemicals (such as some pesticides, phosphorus, as well as toxicants and trace metals) can be transported with sediment to receiving waters where they cause additional damage to aquatic ecosystems.

And lastly, it is a Federal, state and sometimes local law to place good soil erosion and sediment control practices on construction sites.

Nonpoint Pollutants

Most common pollutants from construction sites:

- Sediment
- Oil & Greases
- Concrete Truck Washout
- Construction Debris
- Construction Chemicals

Nonpoint Pollutants

Most common pollutants from Urban Land after Construction is completed:

- Nutrients
- Hydrocarbons
- Pathogens
- Sediment & Road Grit
- Organic Matter (e.g. lawn clippings, leaves)
- Litter
- Thermal Pollution (heated runoff from impervious surfaces)

Water Quality Regulations

(What the Law Requires)

You should be aware that the US Army Corps of Engineers (Corps) and the US Environmental Protection Agency (US-EPA) are the two federal agencies that regulate water quality. Both agencies have authority under Section 404 of the Clean Water Act (CWA), but only the Corps has the authority under Section 10 of the Rivers and Harbors Act. A review by other federal and state agencies, as well as public notification, is provided prior to the issuance or denial of permit.

Section 10 – Rivers and Harbors Act of 1899 (RHA)

Under the RHA, the Corps regulates "all work or structures" placed in or affecting the navigational waters of the U.S. You are required to get a permit from the Corps for marinas, bulkheads, bank stabilization, shoreline protection, piers, pipelines, dredging, discharging or other work in navigational waters of the U.S.

Clean Water Act of 1977 (CWA)

Formerly known as the Federal Water Pollution Control Act, this statute was enacted to address the problem of water quality by reducing the discharge of pollutants into lakes, rivers, streams and wetlands. The CWA established a system of water quality standards, discharge limitations and permits.

In Illinois, US-EPA has delegated responsibility for Section 401 and 402 to the Illinois EPA. Prior to the issuance of either a Section 402 or 404 permit, you must obtain a Section 401 certification. This states that any discharge complies with all applicable effluent limitations and water quality standards in Illinois. See the following for each Section explanation.

Section 401-Water Quality Certification

You must receive the Section 401 certification before applying for a federal permit for any work, which may result in a discharge to waters of the U.S., to ensure that actions would not violate Illinois' water quality standards.

Section 402 – National Pollutant Discharge Elimination System (NPDES)

NPDES requires that a Storm Water Pollution Prevention Plan (SWPPP), including a soil erosion and sediment control plan, be developed for all construction activity projects that require a permit.

Current regulations require a permit for ALL construction activities in Illinois (ILR10 permit) that disturb one (1) acre or more, or smaller projects that are part of a larger common plan of development or sale.

In addition, in designated urbanized areas, there are regulations requiring permit applications for storm water discharges for industrial sources and municipal separate storm sewer systems (MS4's). Communities with greater than 10,000 population (ILR40 permit) are required to implement six minimum control measures to improve the quality of storm water runoff. The control measures include the following:

- Storm water runoff control from construction sites.
- Post-construction storm water management for developments.
- Detection and elimination of illicit discharges to storm sewer systems.
- Public education and outreach regarding storm water runoff impacts.
- Public involvement in storm water runoff related issues.
- Good housekeeping procedures and practices.

Section 404-Dredge or Fill Permitting

Establishes a permit program to regulate the discharge of dredged or fill material into waters of the U.S., including some wetlands. This section of the CWA is administered by the Corps.

Ordinances in Illinois

Check to see if your county or municipality has implemented ordinances or other enforcement mechanisms that require water quality and quantity issues be addressed during the land development process. Ordinances often require the implementation of both temporary and permanent "Practices". The development of a soil erosion and sediment control plan prior to the onset of construction is also often a requirement of these ordinances.

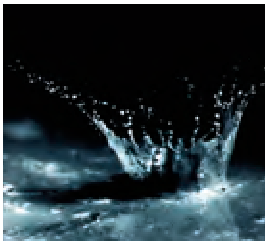
What is Soil Erosion?

Erosion is a three-step process involving the detachment, transport and deposition of soil particles. There are many kinds of erosion. Sheet and rill erosion, gully erosion, streambank/bed erosion and wind erosion are the primary concerns. Each of these types of erosion involves the detachment and transport of soil and downstream/downwind deposition of sediment.

What is Sediment?

Sediment is the result of erosion. Once soil particles have detached from the surface, are transported from their site of origin and have come to rest on other ground surfaces or in lakes, ponds, watercourses, or wetlands, they are referred to as sediment. The process of soil particles being transported and deposited is known as sedimentation.

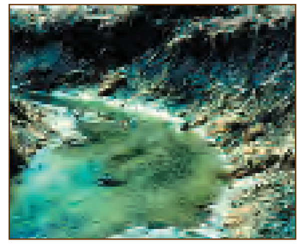
Types of Erosion



Mechanism for Erosion: When rain impacts exposed soil particles, the particles dislodge and splash into the air. The dislodged particles can become suspended in the water and can easily be transported great distances by surface water runoff.

Sheet & Rill Erosion: Sheet erosion is the uniform movement of a thin layer of soil from sloping, bare, unprotected land. Falling raindrops detach soil particles which go into solution as runoff occurs. Detached particles are transported down slope/grade to a point of deposition. Rills form with longer, harder rains when runoff volumes accelerate. Erosion increases as slope/grade becomes steeper and with longer slope length.

Gully Erosion: Rill erosion evolves into gully erosion as runoff increases, from one heavy rain or a series of storms over time. A gully is generally defined as a scoured out area that is not crossable with tillage or grading equipment.



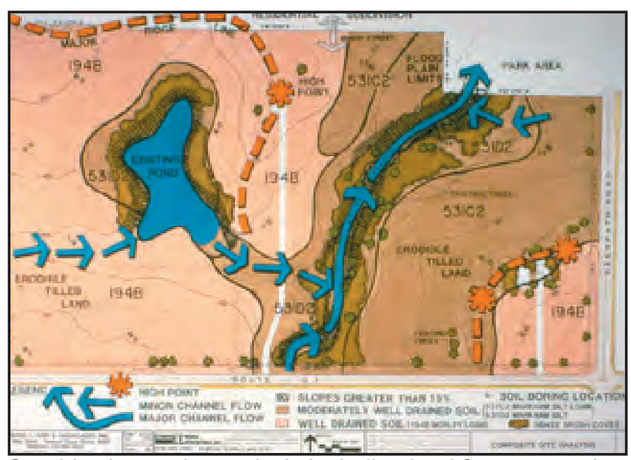
Streambank and Streambed Erosion: This type of erosion is the scouring away of stream banks. Degrading or downcutting streambeds and/or repeated high flows for extended duration causes bank erosion. Streambank and streambed erosion is a significant contributor of sediment loads to surface water resources.

Wind Erosion: Wind erosion is similar to sheet erosion in that detachment, transport, and deposition of soil particles occur, except that wind is the transportation mechanism rather than water.

What are the Issues?

All sites being developed will vary in their suitability for different types of development. Knowing the soil type, topography, natural landscape features, drainage area, on and off-site hydrology, flooding potential, and other pertinent data help identify both beneficial features and potential problems of a site and adjacent areas. Generally, the location of the site has already been determined. What is needed then are the best procedures for identifying and addressing potential or existing problems, or for addressing established restrictions, ordinances, or regulations to develop a site in a quality manner.

Proper site planning can identify areas particularly susceptible to erosion. These areas should be avoided if possible. If not, planning and timely implementation of practices will be needed to minimize negative on and off-site impacts.



Graphic shows site analysis including land features such as rivers, lakes, wetlands, plant life, wells, structures, etc.

Planning Process

The process outlined in the Illinois Urban Manual is a standard process used by the Natural Resources Conservation Service (NRCS) and others. It is a nine-step process that is fully explained in NRCS's National Planning Procedures Handbook. The nine steps are:

1. Identify problems
2. Determine objectives
3. Inventory resources
4. Analyze resource data
5. Formulate alternatives
6. Evaluate alternatives
7. Make decisions
8. Implement plan
9. Evaluate plan

How to Control Erosion?

Understanding how erosion occurs is essential to the design and implementation of effective erosion control plans. Two main keys to erosion control are preventing the detachment of soil particles and reducing the volume of runoff. Erosion control may also be achieved by establishing protective cover such as temporary or permanent seeding, mulching, applying a compost blanket, or installing rolled erosion control products (mats or blankets).

Erosion control should be emphasized as the primary design goal before sediment control in a soil erosion and sediment control plan. Once erosion control is implemented, sediment control should be utilized. Controlling erosion is easier and less expensive than sediment control. By preventing soil particles from being detached, less sediment will need to be controlled.

Grading strategies, such as minimizing the area exposed at any given time, is the most effective way of reducing the potential for erosion to occur.

Erosion Control Practices

Erosion control practices discussed and examined in this section:

- Grading Strategies [1]
- Dust Control[2]
- Temporary/Permanent Vegetation [3]
- Mulching[4]
- Rolled Erosion Control Products (R.E.C.P.)[5]
- Compost Blanket [6]
- PAM (polyacrylamide) Application for Erosion Control [7]
- Outlet Protection [8]

Grading Strategies

. . . designing developments to fit the existing landscape minimizes the amount of required grading. Minimizing grading reduces the amount of land exposed to erosion and saves money. Coordinate essential grading to minimize the potential for erosion.

Design Techniques

- Phased grading maintains strategic vegetative cover and minimizes the amount of disturbed land at any given time to reduce erosion.
- Phasing divides essential grading into distinct portions. Grading of each phase is started, completed and stabilized in sequence.
- Generally, it is best to start grading activities at the top of a site first and then move down the gradient. Maintain vegetative cover (buffer strips) as the site work progresses.
- Deep tillage should be done as the final step of grading activity at each phase to reduce soil compaction. This increases infiltration, decreases runoff, and improves rooting depth.
- Use temporary or permanent stabilization techniques as soon as site grading is completed.
- Protect areas of existing trees and other natural vegetation that will be preserved.

Challenges/Limitations

- Each grading phase needs to be planned carefully to assure time and cost efficiencies are realized.
- Marginal or steep sites may require extensive grading to allow for building sites and road construction.
- Mass grading is a standard practice in some areas due to costs and contractor specialization.

Dust Control

. . . a temporary control of dust blowing and movement from exposed soil surfaces on construction sites and roads. Typical methods of dust control include mulch, vegetative barriers, binding agents and irrigation.

Design Techniques

- Mulches - Chemical or wood cellulose fiber binders should be used instead of emulsified asphalt to bind mulch material due to environmental considerations.
- Existing trees or large shrubs may afford valuable protection if left in place.
- Spray-on binding agents, such as PAM (polyacrylamide), may be used on mineral soils . They should not be used on organic soils. Keep traffic off these areas after application.
- Roughen the surface and bring clods to the surface. This is an emergency measure that should be used before soil blowing starts.
- Irrigation is commonly used and affords fast protection for haul roads and other heavy traffic roads. The site is sprinkled with water until the surface is moist. Repeat as needed.
- Barriers such as solid board fences, snow fences, burlap fences, crate walls, bales of hay and similar material can be used to control air currents and blowing soil.
- Calcium chloride can be applied at a rate that will keep the surface moist. Application rates should be strictly in accordance with the manufacturer's specified rates.
- Crushed stone or coarse gravel may be used to control dust on roads or other areas during construction.
- Paved areas that have soil on them from construction sites should be cleaned daily, or as needed, utilizing a street sweeper or bucket-type end-loader or scraper.

Challenges/Limitations

- When temporary dust control measures are used, repetitive treatment may need to be applied as needed to accomplish control.

Temporary and Permanent Vegetation

. . . temporary seeding helps reduce runoff and erosion during construction. Permanent seeding stabilizes disturbed or exposed areas in a manner that adapts to site conditions and allows selection of the most appropriate plant materials for long-term erosion control.

Temporary Seeding

Design Techniques (Temporary)

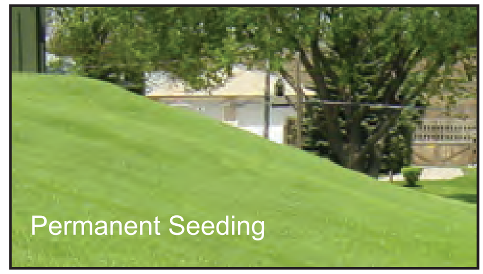
- Temporary seeding applies to all cleared, unvegetated, or sparsely vegetated soil surfaces where vegetative cover is needed for less than one year.
- Prior to seeding, install other necessary erosion control and sediment control practices if possible to avoid disturbing the area being planted.
- Seed should be evenly applied with a cyclone seeder, drill, cultipacker seeder or hydroseeder.
- Seeding made during optimum spring and late summer seeding dates, with favorable soil and site conditions, will not require mulch.
- Reseed areas as soon as possible where seedling emergence is poor or where erosion occurs.

Challenges/Limitations

- Temporary seeding provides protection for no more than one year, during which time permanent stabilization should be initiated.

Design Techniques (Permanent)

- Prior to seeding or planting, the seedbed should be relatively free of all weeds, stones, roots, sticks, rivulets, gullies, crusting and caking, or debris which may interfere with seeding or planting operations or plant establishment.
- All legumes should be inoculated with the proper inoculant prior to seeding.
- Seeding may be done by any of the following methods:
    - Conventional Drill
    - Broadcast Seeding
    - Hydroseeding
    - Dormant Seeding
    - No-till



Permanent Seeding

- All permanent seeding should be mulched upon completion of seed application or planting.
- Native species are recommended due to their deep root structure and increased infiltration and filtering abilities.
- Follow seeding rate recommendations.

Challenges/Limitations

- The site should not be worked when frozen or saturated.
- The grading plan should utilize techniques and equipment that minimize soil compaction.
- Some plants cannot be grown readily from seed and should be planted using rootstock, transplant, or other planting methods.

Mulching

. . . is applying vegetative residue, tackifier or other material to ensure the residue remains in place to protect the soil surface from the impact of raindrops or the erosive forces of wind until vegetative cover is established. Mulching conserves moisture for seedlings and protects them from temperature extremes. Mulching limits soil erosion and lessens the need to contain sediment. Mulches most often used include straw, fiber or wood chips.

Design Techniques

- Mulching is one of the best ways to provide instant erosion control on a bare site to protect it until vegetation can be established.
- Straw mulches do not bond to the soil. They must be crimped in by disking to prevent them from blowing away. They can also be held in place by spraying on a tackifier (glue) or fiber mulch to hold the straw in place.
- Straw mulch is usually applied at a rate of 1-2 tons per acre.
- Fiber mulches are chopped up paper or wood fiber and are typically sprayed on as a slurry along with seed.

Challenges/Limitations

- Mulches are limited by severe slopes. On steeper slopes, rolled erosion control products should be used.
- Mulch is not effective at stabilizing channels or other areas of concentrated flows. A rolled erosion control product is recommended for areas of concentrated flow.
- Too much mulch or uneven distribution of mulch can smother new grass seedlings.

Rolled Erosion Control Products (RECPs) . . . apply Turf Reinforcement Mats (TRM) or Erosion Control Blankets (ECB) of organic or synthetic materials to the soil surface to protect disturbed areas from erosion until vegetative cover is established. Rolled erosion control products are especially effective at controlling erosion on severe slopes or areas of concentrated flows.

Design Techniques

- Choose TRMs or ECBs depending on application and site conditions. Proper selection and installation of RECPs is critical to successful use of these products.
- Trenching, overlapping, and stapling must be completed according to manufacturer's recommendations.
- Seedbed preparation and seeding are done prior to blanket installation (some blankets have seed embedded).
- RECPs are highly recommended with other velocity minimization practices for protecting areas of concentrated flows.

Challenges/Limitations

- Labor intensive.
- Cannot use on frozen ground, roughened ground, or established vegetation.
- More expensive than mulching.
- Careful consideration to grading and shaping is required.

Challenges/Limitations continued

- ECBs are temporary products with typical life spans ranging from 3 to 36 months. They are used in situations where natural vegetation alone will provide sufficient permanent erosion control protection.
- TRMs are permanent products that provide reinforcement to natural vegetation during and after maturation. They are typically used in high flow ditches and channels, steep slopes, streambanks, and shorelines where erosive forces exceed what natural vegetation can sustain or in areas where only limited vegetation establishment can be expected.

Shown here are different types of RECPs and coir fiber roll being used to stabilize the shoreline.

Compost Blanket . . . provides a soil amendment consisting of decomposed organic waste with a consistency similar to high quality topsoil but with a much higher organic matter content. The high organic matter content of compost absorbs the impact of raindrops, which prevents detachment of soil particles. Organic matter also retains water on site to reduce runoff and potential transportation of sediment or other pollutants.

Design Techniques

- Compost can be applied to a depth specified for site conditions using manure spreaders, bulldozers, end loaders, or pneumatic blower trucks. Generally, a two-inch minimum blanket depth is recommended.
- Compost blankets are effective as temporary site stabilization while vegetation is established.
- Seeding is completed after the compost blanket has been installed or as the blanket is being installed with a blower truck.
- Compost amended soils contribute to rapid establishment of vegetative cover and water retention.
- Before applying the compost blanket, construction surface should first be scarified or tilled.

Challenges/Limitations

- Compost blankets should not be used in areas of concentrated water flow or slopes steeper than 3(H) to 1(V).
- Access to composting facilities and adequate supplies of compost may limit use of compost blankets in some locations.

PAM Application for Erosion Control . . . a land application of products containing water-soluble anionic polyacrylamide (PAM) as temporary soil binding agents to reduce erosion. The purpose of this practice is to reduce erosion from wind and water on construction sites and agricultural lands.

Design Techniques

- PAM is intended for direct soil surface application to sites where the timely establishment of vegetation may not be feasible. Such areas may include construction sites where land disturbing activities or winter shutdown prevent establishment or maintenance of a temporary or permanent seeding.
- Only the anionic form of PAM should be used. Cationic PAM is toxic.
- Soils on-site should be tested for the appropriate PAM to ensure successful applications and results.
- Application rates and methods should follow manufacturer's recommendations but should not exceed limits established in Material Data Safety (MDS) sheets.
- PAM may be applied either in solution or in granular form. The method chosen should ensure a uniform coverage of active polymer over the area to be stabilized.
- Additional practices such as seeding and mulching enhance PAM effectiveness and duration.

Challenges/Limitations

- PAM for erosion control should only be used in areas of sheet flow. PAM is not designed for use in areas of concentrated flows.
- PAM should not be applied on frozen soils or when ice is present at the surface.
- Additional practices will be required when PAM is applied to slopes steeper than 3(H) to 1(V).
- PAM for erosion control is a temporary practice, with effectiveness limited to a maximum of four months.
- PAM use should be limited to finely textured silts, clays and colloidal particles.
- PAM must be reapplied to areas disturbed after initial application.
- Overuse of PAM application can lead to clogging of soil pores, resulting in reduced infiltration and increase runoff and erosion.
- Consider the cost of PAM compared to other forms of treatment such as mulching or RECPs. Depending on the application where it is used, PAM may be a more cost effective alternative.
- Inhaling granular polymer may cause choking or difficulty breathing. Persons handling and mixing polymer should use personal protective equipment of a type recommended by the manufacturer.
- Polymer mixtures combined with water are very slippery and can pose a safety hazard.

Outlet Protection . . . a section of rock protection placed at the outlet end of culverts, conduits or channels. Rock outlet protection prevents scour erosion, protects the outlet structure and minimizes the potential for downstream erosion by reducing the velocity and energy of concentrated flows.

Design Techniques

- A riprap-lined apron is the most commonly used practice for this purpose because of its relatively low cost and ease of installation.
- Apron length and width should be determined based on appropriate tail water condition, discharge velocity and shape of outlet area.
- Stone for riprap should consist of field stone or rough quarry stone.
- Recycled concrete equivalent may be used provided it has a density of at least 150 pounds per cubic foot, does not have any exposed steel or reinforcing bars, and provided the longest dimension (length, width, thickness) of each piece is not more than 3 times its smallest dimension.
- In all cases, filter fabric shall be placed between the riprap and the underlying soil to protect soil movement into and through the riprap.
- The riprap should be extended downstream until stable conditions are reached even though this may exceed the length calculated for velocity control.

Challenges/Limitations

- Inspect riprap outlet structures after heavy rains to see if any erosion around or below the riprap has taken place or if stones have been dislodged and take steps to repair.
- Stilling basins or plunge pools may be required where overfalls exist or where excessive apron length is required.
- Discharge velocities greater than 10 feet per second will require special design for energy dissipation.
- This practice applies to the immediate area or reach below the pipe or channel and does not apply to continuous rock linings of channels or streams.
- Pipe outlets at the top of cuts or on slopes steeper than 10 percent cannot be protected by rock aprons or riprap sections due to reconcentration of flows and high velocities encountered after the flow leaves the apron.

What is Sediment Control?

Sediment control, which is often confused with erosion control, is trapping detached soil particles that are already moving in the erosion process. Slowing the velocity of runoff and providing vegetative filtering helps trap sediment on-site, but typically, sediment control is achieved by temporarily impounding flows to allow sediment to settle out. It is critical that effective sediment control practices be installed and maintained when soil is exposed to the erosive force of rain and wind. Sediment control should be a secondary design goal in a soil erosion and sediment control plan, after erosion control is addressed to the extent practical.

Sediment Control Practices

Sediment control practices discussed and examined in this section:

- Silt Fence Barriers/Filters[1]
- Stabilized Construction Entrance[2]
- Inlet Protection Devices[3]
- Sediment Basins/Trap[4]
- PAM Application for Sediment Control[5]
- Filter Strips[6]

Silt Fence Barriers/Filters

Silt Fence Barriers/Filters . . . temporary barrier of geotextile fabric anchored in the ground and supported by posts on the downstream side of the fabric. Some fabrics are designed to allow water to pass through and filter out the sediment. Other materials act as a barrier, not allowing water to flow, but redirecting water runoff to a suitable outlet.

Design Techniques

- Silt fences can be sliced or trenched into the ground. Slicing normally creates a more secure system as the ground can be compacted more fully to prevent undercutting of the fence.
- Install silt fences on the contour with the ends extending upslope.
- Maximum allowable slope length contributing to a silt fence is dependent on slope steepness. The steeper the slope, the shorter the allowable contributing slope length (shorter the distance).
- The maximum drainage area for overland sheet flow to a silt fence should not exceed 1/2 acre per 100 feet of fence.
- Wire backing may be used to increase post spacing and strength of the fence.
- Choose geotextile fabric based on maximum post spacing, grab strength, permitivity, apparent opening size and ultraviolet stability. Some fabrics will allow opening sizes to be specified, allowing targeted particle sizes to be trapped.
- When silt fence is used for perimeter sediment control, it should be installed and functioning prior to upslope land disturbance.
- Ensure a water tight seal is formed when joining two sections of silt fence.

Challenges/Limitations

- Silt fences should not be placed in areas of concentrated flows.
- Sediment deposits should be removed after each rainfall, and must be removed after reaching one-half the height of the silt fence.
- Compacted subsoil material may prevent wooden supporting posts being driven in to the depth required to adequately support the geotextile fabric. The use of metal posts may alleviate this problem.
- Other practices may also need to be considered.
- Silt fences are a high maintenance practices.
- The use of wire backing may interfere with easy removal and disposal once the contributing drainage area has been stabilized.

Stabilized Construction Entrance

Stabilized Construction Entrance . . . stabilized pad of aggregate underlain with filter fabric, located at any point where vehicular traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk, or parking area. Stabilized construction entrances prevent the tracking of sediment off-site.

Design Techniques

- A stabilized construction entrance should be used at all points of construction ingress and egress.
- The graveled access should be installed before or as soon as practical after the start of site disturbance.
- The entrance should remain in place and be maintained until the disturbed area is stabilized by permanent practices.
- Filter fabric should be used under the aggregate to minimize the migration of stone into the underlying soil by heavy vehicle loads.
- All surface water flowing or diverted toward construction entrances should be piped across the entrance. If piping is impractical, a mountable berm with 5(H) to 1(V) side slopes should be used to prevent sediment laden water from leaving the construction site.
- If conditions on the site are such that the majority of the mud is not removed, the vehicles traveling over the gravel must wash the tires before entering a public road. A wash rack may be used to make washing more convenient and effective.
- The washing station should be located to provide for maximum utility by all construction vehicles.
- All sediment from tire wash and pad should be prevented from entering storm drains, ditches, watercourses, or surface waters, including wetlands.

Challenges/Limitations

- Maintenance may require periodic top dressing with additional aggregate to prevent tracking sediment off-site.
- All sediment spilled, dropped, or washed onto public right-of-way must be removed immediately.
- Periodic inspection and needed maintenance should be provided after each rain.

Inlet Protection

Inlet Protection . . . traps and filters sediment before runoff enters storm sewer inlets or culverts. Inlet protection serves as a last line of defense for keeping sediment on-site. Construction sites will always generate some sediment-laden runoff, making inlet protection an important practice. A variety of products and techniques are available to provide inlet protection.

Design Techniques

- Inlet protection devices can include surrounding or covering inlets with silt fences, compost socks or rock filter dams around the inlet.
- Traditional flood control detention basins can be retrofitted with an inlet protection system to provide water quality benefits while maintaining flood control functions.
- All culvert inlet protection should be constructed in such a manner that any resultant ponding of storm water will not cause inconvenience, safety issue, or damage to adjacent areas or structures.
- The maximum area draining to a stone culvert inlet protection should be no more than 3 acres.
- For drainage areas larger than 3 acres, install a sediment basin/trap.

Challenges/Limitations

- Since inlet protection devices impede direct flow into the storm drain, streets may become temporarily flooded or covered with deposited sediment. This may pose a safety issue.
- Designers should provide a plan for dealing with impounded water. Deposited sediment should be cleaned promptly. Sediment can also clog the filtering medium, requiring regular maintenance to prevent extended ponding of runoff water.
- Inlet protection devices must be designed to withstand the expected velocity of water under the expected sediment load.
- Inlet protection devices should not be subjected to large sediment loads. Inlet protection should provide a final filtering of runoff, after other components of a storm water pollution prevention plan have done their job.

Sediment Basin or Trap

Sediment Basin or Trap . . . an impoundment for storm water to retain sediment by slowly releasing runoff. Sediment settles out of standing water, so maximizing the time water is impounded increases the amount of sediment retained on site. Basin outlets can be wrapped in geotextile or bedded in gravel to enhance trap efficiency.

Design Techniques

- Sediment traps are used where drainage areas are between 1-5 acres in size and have a stone weir outlet structure. Sediment basins are used where drainage areas are greater than 5 acres in size and utilize an engineered pipe outlet principal spillway with an auxiliary spillway.
- Traps can be placed strategically throughout the construction site and be temporary in nature. For instance, a trap can be installed as part of a phased grading plan and removed as the phase is completed.
- Often, a large basin is installed as a perimeter protection practice. Large volumes of water can be captured and retained with this approach.
- Perimeter basins can be removed and the site landscaped after grading is completed and the site is stabilized.

- In many cases, sediment basins can be multi-functional. They can serve as sediment basins during construction and as wet detention ponds that help manage storm water after development is completed.
- Basins and traps should be designed to include sediment storage, as well as wet (permanent) and dry (temporary) storage.
- Bed outlets in gravel or wrap them with geotextile to help trap fine particles. Coagulating agents (polymers) are also available, which cause fine particles to clump together and fall out of suspension.

Challenges/Limitations

- Trapped sediment should be cleaned out regularly to maintain storage capacity and maximize time of impoundment.
- Sediment basins and traps are not efficient for trapping very fine silt and clay soil particles that stay in suspension for extended periods.

PAM Application for Sediment Control . . . use of products containing water-soluble anionic polyacrylamide (PAM) as temporary soil binding agents to reduce off-site sedimentation into water bodies. The purpose of this practice is to remove sediment from turbid discharged water.

Design Techniques

- Only anionic polymers should be used. Cationic forms are toxic.
- The selection of polymer type is site specific. Soil samples should be used to determine the right polymer to use.
- The key factor to the performance of polymer is to make sure it is thoroughly dissolved and mixed with the turbid water before the floc is able to form.
- Application rates and methods of application should follow manufacturer's recommendations but should not exceed Material Data Safety (MDS) sheets.
- All the floc formed from the mixture process must be trapped before water is discharged from the site.
- Placement of semi-hydrated block should be as close to the source of particles as possible.
- When using products in impoundments immediately adjacent to, or within waters of the state, consider using products for which the manufacturer's recommended application rate is considerably lower than the use restriction.

- Select the form of polymer to be used (emulsion, granulated, or gel block) based on location where turbid water will be treated. *(Examples include pipe inlet or discharges, channelized or concentrated flows, and bypass channels.)*
- Polymer mixtures should be applied in conjunction with other erosion control practices and under an erosion and sediment control or storm water management plan.
- Use PAM treated jute yarn or a floc pit to trap the floc from sediment-laden water.
- PAM application frequency is dependent on the volume of water being treated. Follow manufacturer's recommendations to determine when floc logs or granules need to be replaced.

Challenges/Limitations

- Inhaling granular polymer may cause choking or difficulty breathing. Persons handling and mixing polymer should use personal protective equipment of a type recommended by the manufacturer.
- Polymer mixtures combined with water are very slippery and can pose a safety hazard.

Filter Strips. . . permanent herbaceous vegetation situated between developed land and environmentally sensitive areas to trap sediment, particulate organic matter and/or dissolved contaminants.

Design Techniques

- Filter strips should be located along the down-slope edge of a disturbed area on the approximate contour.
- Filter strips should be permanently designated plantings to treat runoff.
- Permanent herbaceous vegetation should consist of grasses or a mixture of grasses, legumes and/or other forbs adapted to the soil and climate.
- Native species are preferred due to their deep root structure and increased infiltration and filtering abilities.
- Filter strips should be maintained to function properly.
- Filter strips should be strategically located to intercept contaminants and reduce runoff by increasing infiltration and ground water recharge, thereby protecting water quality.
- The length and width of the filter strip is sized according to the area draining to the filter strip.

- Filter strips should be used where surface water runoff occurs as overland sheet flow.
- Land grading, the creation of level spreaders, or other measures are often required to ensure maximum effectiveness of the filter strip.

Challenges/Limitations

- Filter strips cannot be installed on unstable, eroding channel banks due to undercutting of the bank toe.
- Inspect and repair filter strips after storm events to fill in gullies, remove flow disturbing sediment accumulation, re-seed disturbed areas, and take other measures to prevent concentrated flow.
- The maximum area draining to a filter strip is 5 acres, the maximum slope of a filter strip is 15 percent. Filter strips perform best on slopes of 5 percent or less.

Where to go for help

Soil and Water Conservation Districts
http://www.ilconservation.com/soilandwater/htdocs/MEMBERS/ILSWCDs.html

USDA-Illinois Natural Resources Conservation Service (USDA-NRCS)
http://www.il.nrcs.usda.gov/technical/
http://www.il.nrcs.usda.gov/contact/directory/ilcntys.html

Illinois Environmental Protection Agency - Bureau of Water
http://www.epa.state.il.us/water/

Credits

Photography by Illinois Soil and Water Conservation Districts and USDA-NRCS.

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Additional information

Procedures and Standards for Urban Soil Erosion and Sedimentation Control in Illinois; 1988 (Green Book)

Illinois Field Manual for Implementation and Inspection of Erosion and Sediment Control Plans; 1990 (Brown Book)

US Environmental Protection Agency - Menu of Practices
http://cfpub.epa.gov/npdes/storm water/menuofbmps/index.cfm?action=min_measure&min_measure_id=4
http://cfpub.epa.gov/npdes/storm water/menuofbmps/index.cfm?action=min_measure&min_measure_id=5

Illinois Urban Manual
http://www.il.nrcs.usda.gov/technical/engineer/urban/index.html

USDA-Natural Resources Conservation Service (NRCS): Electronic Field Office Technical Guide (eFOTG)
http://www.nrcs.usda.gov/technical/efotg/