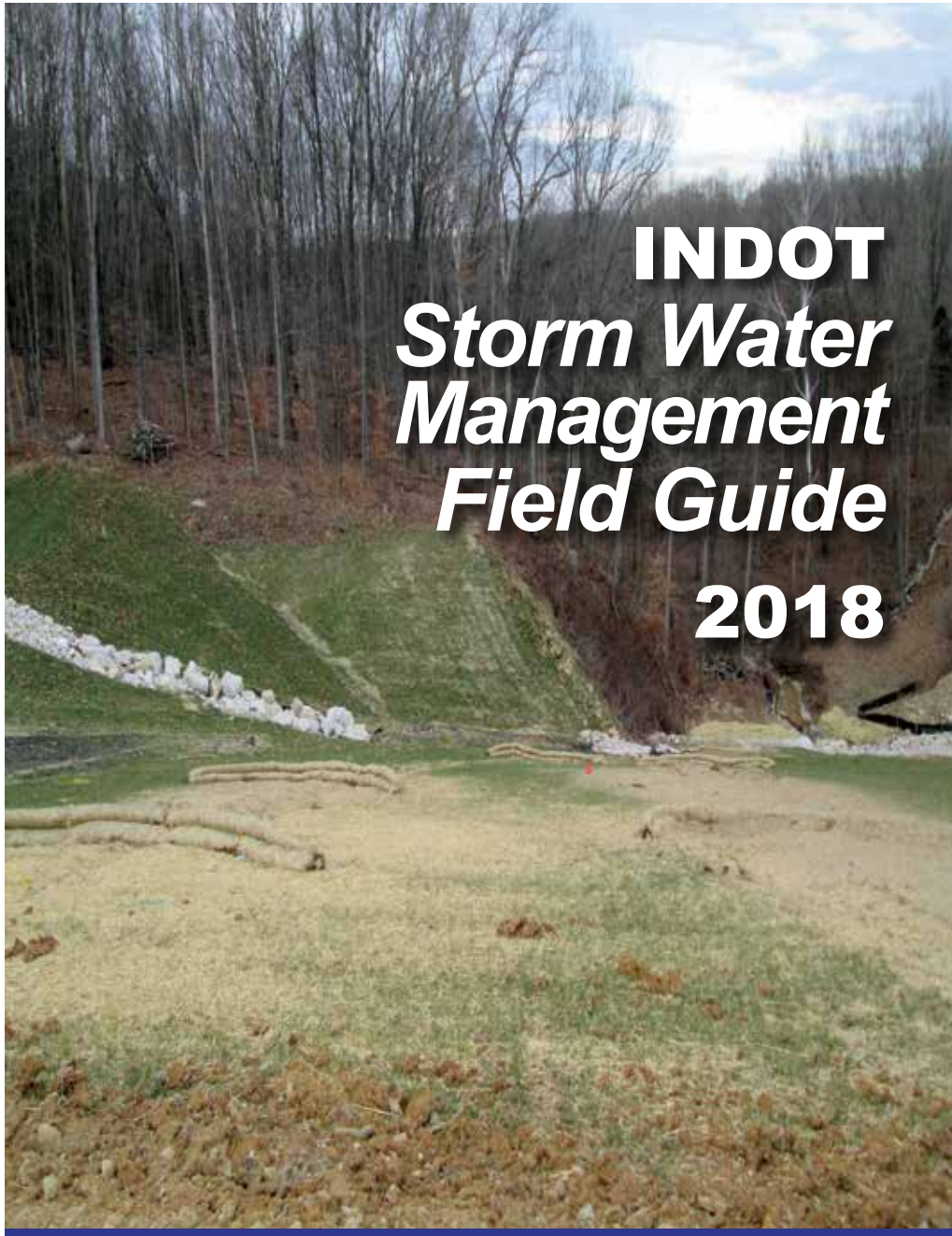

INDOT
Storm Water Management Field Guide
2018

www.in.gov/indot

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Introduction

The development of the Indiana Department of Transportation (INDOT) Storm Water Field Guide has been a collaborative effort between INDOT's Office of Environmental Services, Construction Management, and District Support. The guide concept developed as a result of the Joint Transportation Research Program, Project No. C-36-68-DD, File No. 4-7-30, Indiana SPR-3312. This project also included updates to the INDOT Standard Specifications, Standard Drawings, and Design Standards.

This guide was created to provide guidance on the critical factors of management, understanding, setup, inspection, maintenance, and removal of storm water control features that may be required for INDOT contracts.

The Field Guide is not intended to act as a contract document or design standard but as a visual and conceptual reference for INDOT projects requiring storm water management. INDOT Standard Specifications and Standard Drawings are referenced throughout this guide and should be used for additional information. The Indiana Department of Environmental Management (IDEM) Storm Water Quality Manual was used as a reference in the creation of this field guide. This guide is not intended to replace IDEM's manual but rather to enhance it and provide additional information such as photographs of Best Management Practices (BMPs) used in highway construction settings.

The guide is organized with the intent of ease and efficiency of storm water management and follows a logical decision-making process. The Storm Water Field Guide begins with topics on improving communications with team members and progresses to the development of a work management plan. The logical process continues with sections describing the methods used for storm water management, erosion control, sediment control, and other pollution prevention.

The Storm Water Field Guide concludes with a section on successful strategies. This section provides tips and suggestions on managing environmental hot spots, and includes clear methodology on achieving Notice of Termination at the end of a contract. A glossary of terms and a Decision Matrix to help determine the best control measure to use for a particular problem are also included. The back page includes internet links to help further the understanding of storm water management on department contracts.

How to Use this Field Guide

This guide has been organized to provide an effective process for the use of Best Management Practices (BMPs) for effective storm water management. The process should be followed as an overall strategy leading to successful storm water management for the contract.

1. COMMUNICATION – Communicate with all members of the team. Develop a working communication plan.
2. WORK MANAGEMENT – Develop plans for effective phasing and scheduling with all team members to minimize water pollution.
3. STORM WATER MANAGEMENT – Be aware of how water moves through the job site and plan for measures to help minimize the erosive effects of water as it flows through the construction site.
4. EROSION CONTROL – Plan to keep soil in place as much as possible. Erosion control measures are relatively inexpensive and more effective than sediment control.
5. SEDIMENT CONTROL – Once soil becomes mobile, plan for BMP's to filter and minimize the potential for sediment to leave the job site. Sediment control measures are relatively expensive to use and less effective than erosion control.

This process is one of the most efficient and cost-effective ways to manage a construction site for pollution prevention. Each chapter includes storm water features to help keep soil in place and sediment and other pollutants from leaving the job site.

The Successful Strategies section contains topics on managing hot spots, achieving Notice of Termination, a list of definitions, and a decision matrix to help the user select appropriate storm water measures to best solve a particular issue. This matrix contains a page index to guide you to the storm water feature.

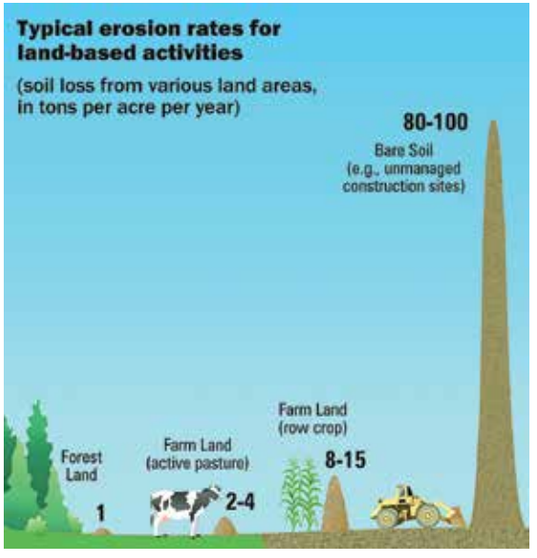
Purpose

Rain and snow melt create storm water runoff. When precipitation falls too fast for the ground to absorb, it flows over the ground as storm water runoff. The storm water runoff picks up pollutants such as sediment and eventually flows to a stream, wetland or other water body.

Regulatory agencies do not allow sediment and other pollutants to enter water bodies or storm drains. INDOT, by law, must follow the stipulations set out by these regulatory agencies.

Stream sediment is one of the most important water quality concerns in Indiana. Muddy water kills aquatic organisms, increases the potential for flooding, and ruins wildlife habitat. Sediment laden water also carries pollutants such as heavy metals to waterways. Construction sites that are mismanaged contribute significantly more sediment pollution per acre than any other land use including agriculture. Effective storm water management on construction sites can significantly reduce storm water pollution. With numerous active construction sites throughout the state, INDOT can significantly effect Indiana's water quality.

Important environmental resource adjacent to INDOT roadway.



Mismanagement of construction sites contributes significantly more sediment pollution per acre than agricultural activities. Source: 2007 USEPA Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites.

Sediment from construction site filling in a stream. This is a violation of many environmental permits.

Processes and Requirements

Storm Water Quality Control Plan (SWQCP)

As stated within the contract documents, a minimum of 14 days prior to commencing earth disturbing activities, the Contractor shall provide a Storm Water Quality Control Plan to the Project Engineer/Project Supervisor (PE/PS)
Technical assistance can be found using:

- INDOT District Erosion Control Specialist.
- INDOT Office of Environmental Services (INDOT-ES).

The SWQCP shall be in accordance with the Rule 5, the Contract Documents, and shall include:

- Areas not included in the Department submittal such as:
    a. Staging areas
    b. Stockpiles
    c. Haul Roads
- Changes initiated by the contractor.
- Name of SWQM and proof of training.
- Soil stockpile locations, storage areas, fueling locations, construction trailers, batch plants, and designated concrete truck washout areas.
- Concrete Waste Water Plan.
- Construction phasing of storm water control measures.
- Construction entrance locations.
- Material handling and spill prevention plan.
- Monitoring and maintenance plan.

Off-site areas (borrow/disposal sites, etc.) may require a separate Rule 5 obtained by the Contractor.

Storm Water Quality Manager (SWQM)

The SWQM shall be trained appropriately for the identified contract. The required level of training is identified in the Contract Information Book. Training requirements for SWQM's are as indicated within RSP 205-R-636.

Responsibilities of the SWQM include:

- Ensuring the contractor's SWQCP has been submitted for review prior to beginning any earth disturbing activity.
- Being in responsible charge of storm water site inspections.
- Being in responsible charge of implementing the SWQCP.
- Being in responsible charge of BMP installation, maintenance, and removal.
- Attending the pre-construction conference.
- Attending at least one contract scheduling meeting per calendar month.
- Accompanying personnel from IDEM or other governmental agencies, as required, during their site visits.

Standard References

Standard Specification Reference: RSP 205-R-636

Effective storm water management can be achieved with thorough planning and proper field implementation.

Other Environmental Considerations

Jurisdictional wetlands and waterways cannot be dredged, cleared, filled, re-routed or otherwise altered without one or more permits from the US Army Corps of Engineers, IDEM and the Indiana Department of Natural Resources (IDNR) Division of Water. This includes the installation of temporary measures such as riprap, cofferdams and temporary crossings.

Non-permitted wetland impacts. Equipment tracks have altered the wetland.

Keep vegetation on the banks and near jurisdictional waterways as long as possible. After work in a jurisdictional waterway is complete, the banks must be stable prior to allowing water to flow through (re-energizing) the newly constructed channel.

Environmental permit review

- Locate project specific permits on the posted contract documents website.
- Link all permitted impacts to plans and contact INDOT-ES with questions.
- Know your permit conditions and the stream/wetland/habitat impacts.
- Do not exceed your permitted impacts without consultation with INDOT-ES.
- Be familiar with all the environmental commitments for the contract.
    a. Potential bat tree clearing restrictions (no clearing April 1 - September 30).
    b. Potential fish spawning restrictions (no in-stream work April 1 - June 30).
    c. Potential Swallow nest protection (no disturbance May 7- Sept 7).

Contractor Permit modifications and waivers

- The contractor reviews permits for any modifications or waivers.
- Temporary impact permits may be required for:
    a. Stream crossings
    b. Causeways
    c. Pump-arounds
- Waivers (when applicable) may be requested for:
    a. Fish spawning (no in-stream work April 1 – June 30).
    b. Bat tree clearing (no clearing April 1 – Sept 30).
    c. Nesting Swallows (no disturbance May 7- Sept 7).
- Additional impacts outside of construction limits.
- Communicate needs to INDOT-ES.
- Allow time for processing (several weeks or longer).
- Borrow/disposal areas may need separate IDEM Storm Water Construction permit.

Storm Water Management Inspections

Description

Construction sites are exposed to the weather and are continuously changing. Therefore, a proactive SWQCP and thorough site inspections are needed to minimize or eliminate the potential for storm water pollution. The inspections are a requirement to keep job sites in compliance with Rule 5. No construction site is perfect. Deficiencies are expected on these reports. The deficiencies and the measures taken to correct the problems should be documented. These reports can be used to indicate the actions taken to provide and maintain the overall quality of the storm water management plan for the site.

Standard References

Standard References: RSP 205-R-636.
Storm Water, Erosion, and
Sediment Control Inspection form.

Storm Water Quality Managers shall use the INDOT ITAP Inspection Application for all Storm Water Inspection Reports.

Expectations of the Site Inspections

- All site inspections are to be under the responsible charge of the properly trained SWQM.
- Completed weekly and within 24 hours of ½” or more rain event.
- Reports will be reviewed and signed by PE/PS within 24 hours of the inspection.
- Reports must be readily available.
- Reports should note required maintenance, additional BMP’s needed and progress made.
- Deficiencies noted shall be addressed within 48 hours.
- Inspections should be proactive. Is there a potential for storm water pollution?
- Photographs are the best method to document progress and prove efforts toward compliance.
- Inspections must continue until the Rule 5 permit is closed out with the Notice of Termination (NOT) process.

Communication

Good communication is essential to effective storm water management. No one communication plan will work for every situation and every team. Below are a few successful strategies that can be used to help prevent storm water pollution.

Successful Strategies to Save Time and Money

Communicate Early – Preconstruction Meeting

- Prior to bid, the contractor should communicate with subcontractors and suppliers about storm water quality management.
- One of the best tools for saving money and using time effectively on environmental compliance is to thoroughly discuss storm water management at the Preconstruction Meeting.
- The contractor, subcontractors, and INDOT should all be communicating storm water management issues and project phasing beginning at the Preconstruction Meeting.

Education

- Prior to installing any BMP, the SWQM should communicate with the operators and laborers on proper installation. It is more cost effective to install them correctly the first time and avoid having to repair them.

Contract Progress Meetings

- SWQMs are required to attend at least one contract scheduling meeting a month and be on the agenda each time. They shall take an active role and keep storm water management and pollution prevention as an item on the schedule.

Feedback Loop

- Avoid repeat issues by ensuring there is communication with the entire team about problems and successes.

Qualified Professional

- All SWQMs shall have attended and passed INDOT's Storm Water Quality Management Training. For level 2 projects, the SWQM shall also have a national certification in addition to INDOT training in accordance with the Specifications.
- The contractor's SWQM should be qualified to assess the situation and provide a resolution on storm water management issues.
- The SWQM should supervise the installation of pump arounds and dewatering systems as well as be on site for major concrete pours

Team

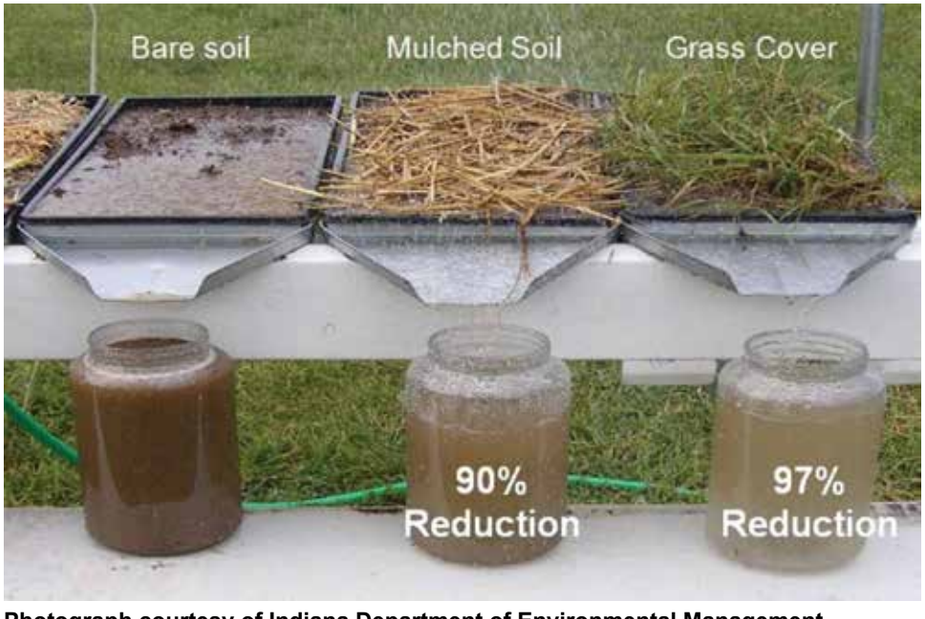
- Communication should flow in all directions. Each team member (contractors, subcontractors, INDOT field staff, District Storm Water Specialists, etc.) should keep each other informed.

Work Management

Successful Strategies to Save Time and Money

Minimize Disturbance

- Managing construction operations to minimize disturbance or leave existing vegetated areas intact as long as possible is one of the most effective ways to prevent erosion.
- Existing vegetation is approximately 97 percent effective in preventing erosion, costs nothing to install, and needs no maintenance.



Photograph courtesy of Indiana Department of Environmental Management

Save Topsoil

- When removing topsoil, save it to use on slopes and ditches that will be seeded and sodded. Protect the soil stockpile with temporary seed and mulch.

Assembly Line Grading

- Plan grading operations like an assembly line, grade ditch, followed by roughening, followed by seeding and mulching.

Have a Plan "B"

- If a seeding subcontractor is not available, have an alternate plan to accomplish the work.

Timing is Everything

- Time grading operations so that any remaining permanent seeding operations can be completed in early September.
- Use weather forecasts for better pro-active storm water management.
- Schedule work to ensure site is stable prior to rain events.
- Seed and mulch exposed soil within seven days after earthwork operations to prevent erosion and allow as much time as possible for vegetation growth.

Install Perimeter Protection First

- Prior to any earth disturbing activities, including tree clearing, install silt fence, filter sock, sediment traps, filter berms, construction entrances and other BMPs to prevent off-site sedimentation.

Phasing

- Have a plan for each phase of construction and amend the SWQCP as needed in response to changing site conditions.

Prioritization of erosion and sediment controls for construction sites

Practice	Cost	Effectiveness
Limiting disturbed areas through **phasing**	$	
Protecting disturbed areas through **mulching and revegetation**	$ $	
Installing diversion around disturbed areas.	$ $ $	
Sediment removal through **detention** of all site drainage	$ $ $ $	
Other **structural controls** to treat sediment-laden flow	$ $ $ $ $	

Generally the least expensive storm water measures are the most effective. For example, limiting the amount of bare soil by phasing your project and preserving existing vegetation is less expensive and works better than installing large storm water sediment basins or ponds. Source: 2009 edition KY Erosion Prevention and Sediment Control Field Guide.

Storm Water Management

Storm water flowing through disturbed areas causes erosion. Minimizing the amount of water flowing through the disturbed areas will decrease erosion.

Successful Strategies to Save Time and Money

Divert Off-Site Water

- Divert off-site storm water around disturbed areas through a stabilized channel so it does not have to be filtered. Off-site water that becomes dirty as it moves through a construction site must be filtered.
- Sediment control measures will not need to treat as much water and will require less maintenance.

Keep Water Off Slopes

- Divert storm water to slope drains or rock chutes to protect slopes while grass is getting established.
- Use slope drain to extend underdrains and median drains down to the ditch line while slopes are being stabilized.

BMPs in a Series

- Rather than relying on one giant sediment control BMP at the end of the project to collect sediment, install a series of BMPs to keep water velocity low, erosion to a minimum and reduce BMP maintenance needs.
- When used in series, sediment control devices are more efficient than when used alone.

Identify the Hot Spots

- Wetlands and Streams
- Karst features (Caves, sinkholes, underground streams)
- Endangered species habitat
- Ponds, open water
- Fish, wildlife or plant resources
- Long and steep slopes
- Public roads
- Sediment and erosion beyond project limits

Often times, hot spots are low areas or areas where storm water leaves the job site. Manage the storm water to protect them from pollution.

Multiple Storm Water BMPs working together to protect slopes and waterway.

Silt fence and mulch protecting a wetland (hot spot).

Slope Drain

Standard References

Standard Specification Reference (205-R-636): 205.05(f) Slope Drains
205.07 Maintenance

Standard Drawing Reference: 205-TECS-02, 03, 04

Description

Slope drains are intended to serve as an aid to reduce the erosion and sediment transfer on constructed slopes. When properly constructed, the drains will collect the runoff storm water at the surface of the slope and direct the flow through an inlet end section into a pipe to a discharge outflow area at the toe of the slope. Using a slope drain can successfully transport storm water, temporarily, from underdrains and median drains to the ditch while the slopes are being stabilized. This reduces the potential for rills and gullies on freshly graded slopes. The outflow area should be stabilized as per the Standard Drawings to further reduce sediment transferred through the construction site.

Installation

- Construct a temporary diversion channel (see Diversion Interceptor on page 40) to divert runoff towards the inlet.
- Lay the pipe down the slope face, connect an inlet section to the pipe at the top of the slope, and anchor it in place.
- Extend the pipe beyond the toe of the slope to a stable grade with the end of the pipe on a riprap pad to protect the outlet from erosion.
- Construct a ridge over the inlet section of pipe by placing fill over the pipe in six-inch lifts. **Do not** compact with heavy equipment.
- Following installation, stabilize all areas down slope of the diversion.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Inspect the installation for inlet/outlet erosion problems and pipe anchoring and leakage issues. Correct as necessary.
- Inspect for gullies and other potential areas where slope drains should be installed.

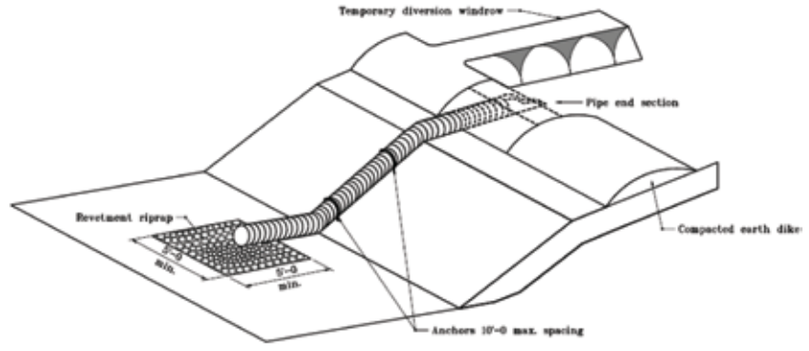
Maintenance

- Check the inlet for sediment or trash accumulation; clear and restore to proper entrance condition.
- Check the fill over the pipe for settlement, cracking, or piping holes; repair promptly.
- Check pipe for evidence of leaks or inadequate anchoring; repair promptly.
- Check the outlet for erosion or sedimentation; clean and repair, or extend if necessary.
- Once slopes have been stabilized, remove temporary diversions and slope drains, and stabilize all disturbed areas.

Example Installations

A slope drain would have prevented erosion from the underdrain.

Slope drains properly constructed with a stable outlet.



Typical Installation from Standard Drawing

Good example of slope drain diversion channel and inlet.

A slope drain would have prevented this erosion caused by water running off bridge super elevation.

Cofferdam

Standard References

Standard Specification Reference (205-R-636): 206.09 Cofferdams and Temporary Construction Dikes

Standard Drawing Reference: Drawings shall be supplied by the Contractor for the specific use or are shown on the plans.

Description

Cofferdams are temporary enclosures usually constructed within a body of water that, once built, are dewatered. Once dewatered, the cofferdam is either filled to produce a working platform or, left empty and used to construct a structural foundation within the water body limits. There are times when cofferdams can be utilized to protect an adjacent body of water closest to an active work area. The purpose for the use of cofferdams is to either isolate a jurisdictional stream or to provide a dryer area to work within and to help prevent sediment generated from the excavation/construction site from entering into the water body. Cofferdams must be constructed with materials that are impermeable and non-erodible. Cofferdams made of earth are never permitted.

Installation

- Ensure the proper permits, including 401/404 permits, are obtained for use of temporary cofferdams.
- Working drawings for a cofferdam installation shall be submitted by the contractor and will provide the method of construction for details not fully shown in the plans.
- Dewatering with sediment filtering shall be used (see Dewatering on page 36).
- If concrete is being poured inside a dewatered excavation, any water that mixes with the uncured concrete shall be pumped into an approved concrete waste water containment and disposed of properly in accordance with 206.09, 702.20 (e), and RSP 205-R-636.
- Ensure all banks are stable prior to removal of cofferdams.
- Remove carefully with as little disturbance as possible.

Inspection

- Review all plans and working drawings for errors or omissions. Understand what is being built.
- Inspect the cofferdam installation to ensure the methods and location is correct.
- Inspect daily for leakage or bowing of the cofferdam sides. Report any deficiencies immediately. Ensure cofferdams are not tilted or shifted.
- If excessive water is entering work area, inspect for leaking areas such as joints.
- Review the location of the cofferdam. Report any movement immediately.

Maintenance

- Remediate any movement or bowing of the cofferdam body prior to re-entry. If cofferdams have tilted or shifted, straighten as necessary and brace to prevent future movement.
- Repair any leaks to the cofferdam body in order to provide a buffer to any sediment leaving the area.
- Regrade and reseed work areas adjacent to the water bank as soon as practical prior to removal of the cofferdam.

Example Installations

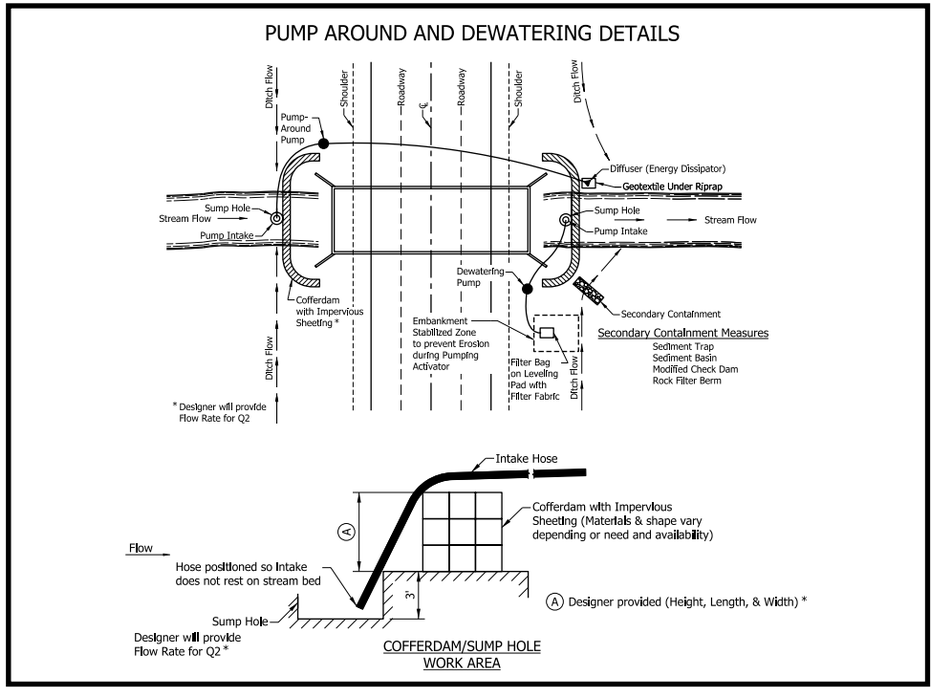
One Ton sand bags and plastic sheeting together makes an effective cofferdam to isolate the waterway during the bridge replacement.

Steel sheet piling used for a working platform within the waterway.

Bare earth is highly erodible and not a suitable barrier to be used for cofferdams. Water infiltration is evident.

Ineffective sheet piling cofferdam. Sediment off-site in waterway.

Pump Around



Standard References

Standard Specification Reference: 206.09 Cofferdams and Temporary Construction Dikes

Standard Drawing Reference: Details shown on plans and in environmental permits.

Description

A pump around should be utilized as a method of diversion for existing stream water. The purpose of the pump around is to isolate the jurisdictional water from the work area. This method of water control is usually designed specifically for a contract and will be detailed within the plans. This method may be used by a contractor in lieu of stream diversion to isolate the work area from the jurisdictional waterway. Earthen dikes are never permitted on INDOT projects.

Installation

- Place water tight cofferdams (see Cofferdam page 28) in the waterway both upstream and downstream of the work area.
- Pump water from the upstream side, around the work area, and outlet on a stable outlet (usually riprap) on the banks of the waterway downstream of downstream cofferdam.
- Pump should be sized to ensure upstream water does not overtop the cofferdam and allow water into the work area.
- Stream water should not be allowed to flow through work area until the area is completely stable, which includes the final shaping of the disturbed stream banks and stabilization of those banks with riprap, erosion control blankets, etc.
- Pump around stream water is not to be filtered through a filter bag.

Inspection

- Inspect daily during pump around operations.
- Inspect stable outlet and ensure stream bank is not eroding.
- Monitor the creek water level upstream to ensure pump is adequately sized and water does not flow over cofferdam.
- Monitor the weather forecast and anticipate increases in stream water levels.

Maintenance

- Adjust outlet stabilization if bank erosion is noticed.
- Adjust pump capacity as needed to handle stream water volume.
- Fix leaks or otherwise stabilize cofferdams if water is back flowing into work area.

Example Installations

Water tight cofferdam on upstream side with adequately sized pump.

Stable outlet shall not be placed in the stream channel. This is unpermitted fill and a violation of 401/404 permits.

Pump around was removed prior to channel bank stabilization.

This pump around set up is wrong. Clean water discharging directly into a stream without an energy dissipater is causing erosion.

Dewatering

Standard References

Standard Specification Reference: 206 Structure Excavation

Standard Drawing Reference: Details shown on plans and in environmental permits.

Description

Dewatering may be used in a variety of construction operations such as to remove water from the bridge foundation footing excavations, drainage structure installations, or from fill areas prior to placement of the borrow materials. Proper outflow of the dewatering activity should be reviewed and planned for in the design of the system. The components of the dewatering process should include the use of water filtering and stabilized outlets. The filtering operation helps to greatly reduce the sediment transportation which is associated with the dewatering operation.

Installation

- Locate the desired outflow location for the dewatering system and coordinate the filter and stabilization method to be used with the installer.
- Discuss the pump capacity and piping components to be used with the installer. Review the layout of the system prior to placement and have any deficiencies corrected prior to operation activation.
- Construct a secondary containment BMP such as a rock filter berm or sediment trap near the waterway.
- Place filter bag on a flat stable surface outside of the waterway behind the secondary containment.
- Place filter bag in a location that they can be removed efficiently without causing damage or losing sediment.

Inspection

- Inspect daily during dewatering operations.
- Inspect the filter location and condition for necessary repair.
- Review the piping system for leakage, kinks and conditions for needed repair.
- Inspect the filter bag for tears and sediment and water capacity.
- Look for erosion between the filter bag and waterway.

Maintenance

- Repair any pumps damaged or not operating properly.
- Repair or replace filters that exhibit leakage or failure.
- Filters may need to be replaced when they become laden with sediment.
- Repair or replace leaking or damaged piping.
- Repair eroded areas and stabilize.

Example Installations

Filter bag has been placed outside construction limits and in a jurisdictional wetland. This would be considered a permit violation and cause for work stoppage and possible fines.

Good placement of cofferdam, pump around discharge and filter bag.

Filter bags should not be placed in waterways. Bags often break or become dislodged sending sediment downstream.

Filter bag placed on flat surface away from sensitive environments.

Diversion Interceptors

Standard References

Standard Specification Reference (205-R-636):

205.05(c) Diversion Interceptors
205.07 Maintenance

Standard Drawing Reference: 205-TECS-01, 205-TECS-02, 205-TEC-03, 205-TECS-04

Description

A **temporary interceptor ditch** is a storm water control measure consisting of a temporary ridge, excavated channel, or combination of a channel and supporting ridge construction on a predetermined grade across a slope to collect storm water runoff and divert it to a treatment device or stable outlet. It is most commonly used with slope drains.

Slope diversion interceptors are constructed storm water control measures, consisting of a dike or dike and channel, construction along the up-slope perimeter of a disturbed slope to control storm water runoff from undisturbed areas and divert it around the construction zone.

Water bars are a series of small ridges or ridges and channels used to intercept and divert storm water runoff from long, narrow corridors and discharge it into a stabilized area or sediment treatment device.

Installation

- Construct the diversion to dimensions and grades shown in the construction plans or to general dimensions listed below.
  a. Side slopes – ratio of 2:1 or flatter (3:1 or flatter if mowed).
  b. Grade – positive towards outlet, but not exceeding one percent.
  c. Stabilize for flow.
- Construct the diversion ridge in compacted lifts. Leave enough area along the diversion to permit cleanout and re-grading.
- Stabilize interceptor ditches and slope diversions within seven days.
- Stabilize diversion interceptors and outlets within seven days. The diverted storm water flow must pass through an appropriate sediment control measure prior to leaving the construction site.

Table 1. Water Bar Spacing

Slope		Spacing
< 5%	< 20:1	125 feet
5% to 10%	20:1 to 10:1	100 feet
10% to 20%	10:1 to 5:1	75 feet
20% to 33%	5:1 to 3:1	50 feet
>33%	> 3:1	25 feet

Note: Diversion interceptors are also used in conjunction with temporary slope drains (Temporary Slope Drain page 24).

Inspection

- Inspect weekly and within 24 hours of a ½" or more rain event.
- Inspect daily if impacted by grading operations.
- Inspect ridge height and valley depth.
- Check outlets for needed repair.

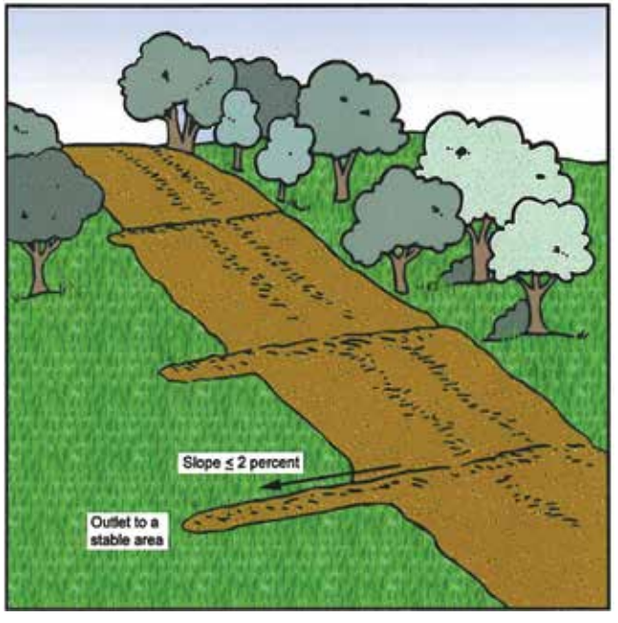
Maintenance

- Remove sediment from channel to maintain positive grade.
- Adjust ridge height to prevent overtopping.
- Make necessary repairs immediately to outlets.
- Stabilize areas that are eroding.
- Reform diversion interceptors as needed if disturbed by grading operations.

Example Installations

Diversion interceptor directing water to a filter berm.

Stable diversion interceptor around a box culver installation. Diverted stream water should flow freely. Riprap should not be placed in channel.



Schematic of diversion interceptor concept. IDEM Indiana Storm Water Quality Manual.

Example of permanent diversion interceptor installation.

Rock Chute

Standard References

Standard Specification Reference: 616.01-08 Riprap, 616.10-11 Geotextiles

Standard Drawing Reference: Rock Chute details shown in plans

Description

A rock lined chute is a water conveyance consisting of a lined channel used to move water down a slope in a non-erosive manner. Its main purpose is to reduce channel flow velocity, increase energy dissipation, and provide a stable grade at the outlet to prevent erosion. Riprap is used to stabilize a channel but should not be used to collect sediment.

Installation

- Excavate and compact the channel prior to placement of geotextile. Construct the channel excavation with a swale depression through the length of the channel for flow direction. Riprap is recommended to be placed at a depth of twice the stone diameter or 12 inches, whichever is greater.
- Place geotextiles on the compacted, relatively smooth surface. Overlap geotextile sheets 18” with the upstream sheet over the downstream sheet. Blend the lining material into the surrounding grade.
- Chute must be cut to final cross section/grade in a concave shape. Water shall be directed to flow down the middle of the rock chute and not along the sides causing erosion.

Inspection

- Inspect weekly and within 24 hours of a ½” or more rain event.
- Inspect channel geotextiles and lining materials for gaps, breaks, or washouts for necessary repairs.
- Inspect for any undermining of the channel and repair as needed.
- Look for any rills that may begin to form due to washouts or undermining and repair promptly.
- Inspect for sediment collecting in the riprap.

Maintenance

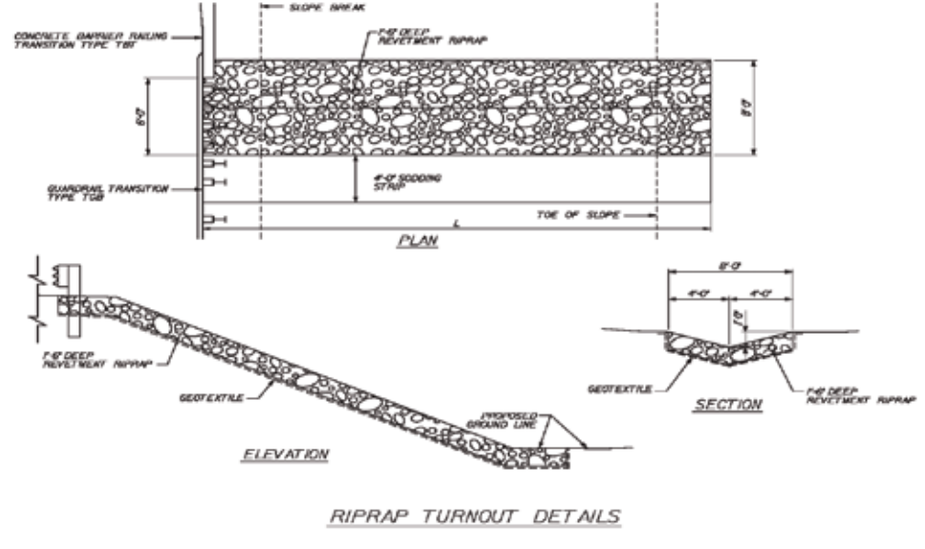
- If scour is found along the sides of the chute, reshape chute as needed for water to flow through the riprap.
- Promptly repair and reseed/mulch any small rills that form.
- Repair or replace any breaks, gaps, washouts or damage in the geotextile or the channel lining material.
- If sediment is found in the riprap, stabilize slopes and areas upstream of channel. Clean out or replace riprap.
- If scour is found downstream of the chute, additional riprap may be needed. Consult with designer and/or Environmental Services to ensure no permits or permit modifications are needed.

Example Installations

Good example of placement of a rock chute to help with runoff from an adjacent farm field.

Water is bypassing rock chute.

Rock chute installed without proper swale depression causing erosion rills.



Riprap turnout details can be found in the plans with the miscellaneous details.

Erosion Control

Erosion control involves maintaining the soil on the ground, within the construction area, and minimizing its movement. Preventing erosion is more efficient and cost effective than managing sediment after it begins to be transported by storm water. Keeping soil in its place with well managed erosion control, minimizes the need for sediment control BMPs, reduces maintenance on those BMPs, and lowers costs of regrading.

Successful Strategies to Save Time and Money

Minimize Disturbance

- Preserve as much existing vegetation for as long as possible.
- Work that exposes bare soil and is scheduled to be inactive for more than seven days, shall have mulch and seed applied to the area.
- Limit disturbance through thoughtful phasing/sequencing of construction activities.

Protect the Soil

- Permanent seed as soon as possible
- Seeding and mulching are the least expensive and most effective erosion control measures.
- Erosion control blankets can also be used for temporary stabilization for bare or exposed areas. Blankets are very effective on long steep slopes.

Vegetative Buffers

Standard References

Standard Specification Reference (205-R-636):

205.05(g) Vegetative Filter Strips
205.07 Maintenance

Standard Drawing Reference: N/A

Description

Grass, shrubs, trees and other vegetation located above or below excavated areas should be preserved if possible. A vegetative buffer located above a construction site reduces water runoff velocity. Vegetative buffers located below construction site activity helps trap and filter sediment before it can move into ditches, channels and streams. All vegetated areas help to promote infiltration of storm water, which is a key objective in preventing erosion and controlling sediment movement off the construction site. Flat areas with sheet flow are a more effective buffer than steep areas or areas of concentrated flow.

Installation

- Evaluate existing vegetation and determine if it will serve as a filter strip (weeds are not an acceptable vegetative filter). Look for areas where vegetation is at least four inches high and cover 80 percent or more of the soil surface.
- If existing vegetation is not adequate, and if site conditions and seeding conditions are favorable, overseed the area or fertilize the existing vegetation to enhance growth and density. Allow time for sufficient vegetative growth before discharging sediment-laden storm water runoff into the filter strip.
- Never use wetlands as a vegetative filter. Water should be filtered prior to entering wetlands.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Inspect for the beginning of erosion rills or channel erosion.
- Inspect for accumulated areas of sediment.

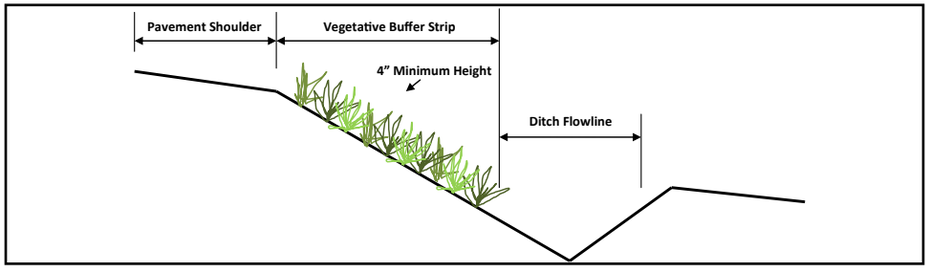
Maintenance

- Promptly repair any small rills that form.
- Add fertilizer and soil amendments as needed to maintain healthy vegetation.
- Mow as needed but not shorter than four inches.
- Where the filter strip has actively trapped sediment during construction, remove the accumulated sediment, regrade the area and reseed it when conditions are favorable for vegetative establishment.

Example Installations

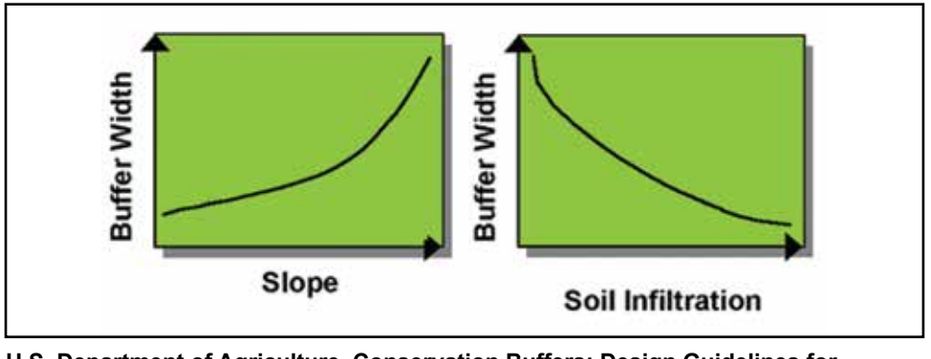
Narrow strip of vegetation on the bank is only partially protecting the stream. Note the sediment entering the waterway.

Existing vegetative buffer along and within the ditch.



Vegetative buffer helps trap and filter sediment before it enters ditch flowline.

Good example of vegetative filter strip (and silt fence) protecting the waterway from sediment.



U.S. Department of Agriculture. Conservation Buffers: Design Guidelines for Buffers, Corridors, and Greenways. General Technical Reports SRS-109 September 2008.

Roughening

Standard References

Standard Specification Reference: 203.09 General Requirements
205.07 Maintenance

Standard Drawing Reference: N/A

Description

Surface roughening (or tracking), is the creation of ridges and depressions parallel to the contour of the slope to reduce runoff velocity and increase infiltration. A bulldozer track mark creates small ridges and valleys which help trap sediment and aid in establishment of vegetation. The track marks help to reduce the eroding effect of rain water as that water hits and travels down the slope. Without these track marks, and their roughening effect on the bare soil, the slope's resistance to erosion is greatly reduced.

Installation

- All slopes shall be roughened until permanent erosion control measures are placed. Roughening shall take place each day after work is performed on the slopes, or as directed to re-establish the roughening.
- Slopes shall be roughened to create a series of ridges and depressions **parallel to the contour** making grooves at least 1" deep and not more than 15" apart.
- Discuss the operation of roughening with the Storm Water Management Team to ensure understanding of the operation.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Ensure that the ridges and depressions created by the track marks are in a horizontal direction and parallel to the contour of the slope.
- Check for rills and gullies.

Maintenance

- Promptly repair any small rills that form and re-roughen the repaired area when directed or required.
- As soon as possible, reinforce the slope roughening with an appropriate erosion control measure such as seeding and mulching.

Example Installations

Vertical track marks will contribute to rill erosion.

Operate bulldozer or other tracked vehicle up and down slopes before seeding to create tread-track depressions for catching and holding seed.

Horizontal track marks create small ridges and valleys to trap seed and mulch and help stabilize a slope.

Vertical track marks make erosion worse and creates a series of rills to quickly move water and sediment to the ditch bottom.

Temporary Seed

Standard References

Standard Specification Reference: 205.04(a) Seed
205.07 Maintenance

Standard Drawing Reference: N/A

Description

Temporary seed is used to stabilize bare soil surfaces, including temporary soil stockpiles, until the areas are ready for permanent seeding. Temporary seeding can also be used to reduce problems associated with mud or dust on areas of disturbed bare soil during construction. Temporary seeding is one of the least expensive and most effective methods of erosion control and can reduce the potential for sediment-laden storm runoff. The intent of temporary seed is to stabilize areas for a short duration of several months. Temporary seeding may be required to be used several times for an area throughout the development of the project. Permanent seeding (page 94) should be placed as soon as practical to stabilize areas for the long term.

Installation

- Temporary seed and mulch shall be placed on disturbed areas that are expected to be inactive for more than seven days.
- Prepare slopes by roughening the soil surface prior to temporary seeding. (See Roughening page 54.) If soil is compacted, loosen soil to a depth of 2-3” prior to temporary seeding.
- Apply temporary seed mix uniformly over the disturbed, bare soil areas expected to be inactive for more than seven days, or as directed.
- Install the seed by drilling, hydroseeding, hand broadcasting, or other approved method that provides a uniform distribution.
- Do not cover the seed with more than one-half inch of soil.
- Mulching should take place within 24 hours after the seeding operation. (See Temporary Mulch page 62.)
- When directed, fertilizer may be applied at the temporary application rate, in accordance with 205.04, during the active growing season from March through November.
- Temporary seed application rates:
  Spring Mix: January 1 to June 15 (oats at 150 lbs/acre)
  Fall Mix: September 1 to December 31 (winter wheat at 150 lbs/acre)

Inspection

- Inspect weekly and within 24 hours after a ½” or more rain event.
- Look for eroded areas, rills and gullies
- Adequate temporary stabilization is approximately 80 percent vegetation density

Maintenance

- Repair eroded areas by reworking the area and reseeding promptly.
- Apply Mulch to reseeded areas within 24 hours.
- Fertilize if needed during the active growing season (March through November).

Example Installations

Weeds indicate slope has been unprotected for an extended amount of time. Temporary seed and mulch should have been applied within seven days of inactivity.

Temporary vegetation and slope drains providing slope stability.

Early stages of temporary vegetation providing slope stability.

Temporary seeding on long steep slope requires maintenance. Notice the beginning of rills.

Temporary Mulch

Standard References

Standard Specification Reference: 205.04(b) Mulch
205.07 Maintenance

Standard Drawing Reference: N/A

Description

Install temporary mulch to prevent erosion by protecting the soil from wind and water impact. Mulch helps to stabilize slopes, prevents soil from crusting, conserves soil moisture, moderates soil temperature, and promotes seed germination and growth.

Installation

- Mulch can be straw, wood chips or other products in accordance with 914.05.
- Install temporary straw mulch uniformly and at a rate of 2.5 tons per acre.
- Install within 24 hours of seeding.
- Mulch shall be secured with acceptable netting, punching in with notched disks, cleating with dozer tracks, commercially produced water borne mulch binder, or other approved method to hold it in place.
- Punching or cleating of mulch should be performed in the same slope direction as roughening (page 54).
- Mulch is not effective in ditch bottoms or other concentrated flow areas
- Avoid mulching across waterways or wetlands.

Inspection

- Inspect the day of application to ensure uniform coverage.
- Inspect weekly and within 24 hours after a ½" or more rain event.
- Check for mulch movement and eroded areas.
- Continue to inspect mulch coverage until vegetation is established.

Maintenance

- Correct eroded areas, reseed and reapply mulch as needed.
- If erosion is severe, reoccurring or in channelized flow, consider using erosion control blanket (page 78) and slope drains (page 24).

Example Installations

Temporary mulch applied too thin. Slope lacks erosion protection. Mulch and seed application rate should be per Specification.

Mulch applied adequately and uniformly.

Wood chips from tree clearing used as erosion control for sheet flow area.

Stockpiled soil protected with mulch.

Dust Control

Standard References

Standard Specification Reference: 107.08 (b) Dust and Air Pollution

Standard Drawing Reference: N/A

Description

Dust control, especially during hot and dry conditions, helps reduce wind erosion. Methods can include watering, resin/polymer application (in accordance with local, state, and federal regulations), mulching, street sweeping, and temporary vegetative covers. A pro-active approach should be used for effective dust control.

Installation

- The contractor and INDOT's PE/PS should discuss the location of haul roads at the pre-construction meeting to determine the best method to utilize for dust control. If possible, locate haul roads away from residential, commercial or other public areas.
- Apply water at a rate to keep soil wet/moist, but not saturated or muddy.
- If sweeping is a chosen method, wet the area with water prior to the sweeping operation to aid in dust suppression.

Inspection

- Be aware of the potential for dust as the season progresses and keep discussions on the issue open between the SWQM and INDOT's PE/PS.
- Inspect as needed, daily during hot and dry seasons. Be proactive. Stay ahead of the issue.

Maintenance

- Apply additional water or mulch as needed to control dust. Repetition is required for effective control.
- Keep construction equipment speeds appropriate for the conditions.
- Stabilize disturbed areas with vegetation and mulch as much as possible.

Example Installations

Dust contributes to air pollution, can interfere with drainage and can create traffic hazards.

Sweeping paved surfaces reduces dust from vehicles.

Covering exposed soil with mulch is an effective dust control practice.

Temporary seed or permanent seed as early as possible to reduce dust on a construction site.

Rock Check Dam

Standard References

Standard Specification Reference: 205.05(a) Check Dam
205.07(g) Maintenance

Standard Drawing Reference: E 205-TECD-01

Description

A rock check dam consists of geotextile fabric and aggregate, placed across drainage channels to slow storm water runoff. This measure is primarily to prevent channel erosion in roadside ditches but may also provide limited sediment control. Rock check dams should not be used as a substitute for other erosion control BMPs (seed and mulch) and sediment control BMPs (sediment traps).

IDEM requires that one-quarter of the total check dams on INDOT projects be Modified Check Dams. Modified check dams have filter stone all the way up the face of the dam. These modified check dams should be placed closest to a sediment control BMP or stream/wetland.

Installation

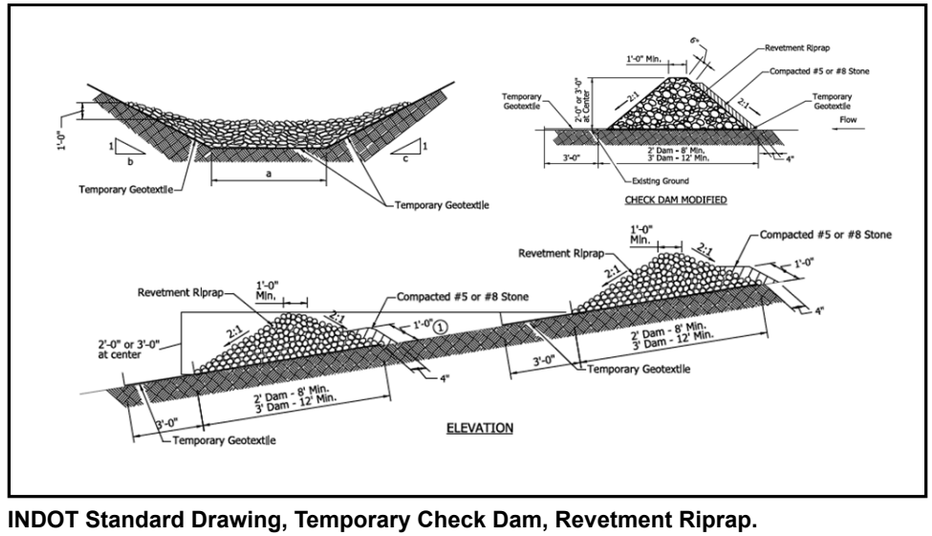
- Discuss with team members and identify the areas for rock check dam installation.
- Install check dams so that 25 percent are modified check dams.
- Place revetment riprap on geotextile fabric that extends downstream of check dam.
- Include #5 or #8 filter stone on upstream side.
- The weir (lowest part of the dam) should be in the middle with the sides tied into the slopes. (Like a smile ☺)
- Space check dams so that the bottom of the upstream dam should align with the weir of the downstream dam.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Check to make sure center of the dam is low and the sides are tied into the slopes so water flows across center of dam. Check dam should resemble a smile.
- Check for #5 or #8 filter stone on front face of dam.
- Geotextile under dam should extend 3 feet down the slope.
- Inspect for channel erosion. If channel erosion is found, space check dams closer so that the bottom of the upstream dam is aligned with the weir of the downstream dam.

Maintenance

- Remove sediment once it reaches one-half the height of the check dam.
- Repair or replace if the check dam is damaged or ineffective.



INDOT Standard Drawing, Temporary Check Dam, Revetment Riprap.

Example Installations

Check dam is much bigger than necessary. Wasted material, wasted money, can cause flooding, and will be much more difficult to remove.

Check dam not shaped correctly causing water to bypass dam and erode slopes.

Check dam shaped correctly with low weir in the middle and tied into the slopes.

Rock check dam not built to specification. Not shaped correctly, no filter stone, no geotextile. The check dam should be rebuilt.

Traversable Check Dam

Standard References

Standard Specification Reference: 205.05(b) Check Dam, Traversable
205.07(g) Maintenance

Standard Drawing Reference: E 205-TECD-02

Description

Traversable dams should not be utilized as a first choice when selecting a channel erosion control measure. This option should only be used in clear zones with active traffic and when watersheds and velocities are small. A traversable check dam consists of geotextile fabric and soft material such as straw or filter socks, placed across drainage channels to slow storm water runoff. This measure is primarily to prevent channel erosion but may also provide limited sediment control. Straw bale temporary check dams decompose rapidly and require frequent replacement.

Installation

- Place only in clear zone areas with active traffic and low storm water velocity.
- Place straw bales or filter socks on geotextile fabric that extends downstream of check dam.
- Trench the bottom of the check dam into the ground 4 inches.
- The weir should be in the middle of the dam with the sides tied into the slopes. (Like a smile ☺)
- Space check dams so that the bottom of the upstream dam should align with the weir of the downstream dam.
- Straw bales should be two rows wide. Filter socks should be placed three in a pyramid shape.
- Stake into the soil to securely anchor dams.

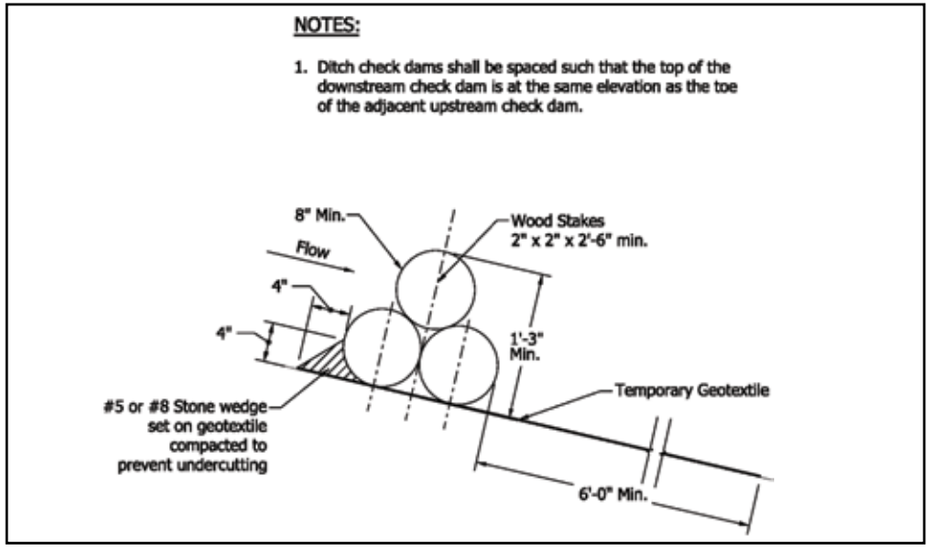
Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Check to make sure center of dam is low and the sides are tied into the slopes so water flows across center of dam. Shaped like a smile.
- Check for #5 or #8 filter stone on front face of dam. (when using filter socks).
- Geotextile under dam should extend 6 feet down slope.

Maintenance

- Remove sediment once it reaches ½ the height of the check dam.
- Repair or replace if the check dam is damaged or ineffective.

Example Installations



INDOT Standard Drawing of filter socks used as an alternative to straw bales. Installation should include three filter socks in a pyramid with geotextile underneath.

The water volume and velocity in this area are too much for traversable check dams. There should be more focus on erosion control with seed, mulch and erosion control blanket.

Straw bale check dams undermined due to high velocities, no geotextile and no trenching.

Straw bales should be two wide along the ground, not two high.

Erosion Control Blanket

Standard References

Standard Specification Reference (205-R-630):
205.04 (c) Temporary Surface Stabilization

Standard Specification Reference: N/A

Description

Erosion control blankets are a manufactured surface protection product. They act as a specialized mulching material and are normally used on long or steep slopes and in concentrated flow channels. The advantages that erosion control blankets provide include preventing erosion by protecting the soil from rainfall impact, overland water flow, concentrated runoff, or wind. The blankets are also anchored to help in the most critical areas. Blankets tend to conserve moisture and increase seed germination and seedling growth.

Installation

- Select the appropriate type of blanket needed specifically for the designated area and anticipated water velocity.
- The area shall be relatively free of all rocks or clods over 1½" in diameter
- Lay erosion control blankets on the seeded area so that they are parallel to the primary direction of water flow, in continuous contact with the soil, and with each upstream blanket overlapping the downstream blanket.
- Tuck the uppermost edge of the upper blankets into a check slot, backfill with soil and tamp down.
- Anchor the blankets in place by driving staples, pins, or stakes through the blanket and into the underlying soil.

Inspection

- Check for erosion or displacement of the blanket weekly and within 24 hours of a ½" or more rain.
- Blanket needs to be anchored and overlapped properly according to specification to ensure proper function.

Maintenance

- If any area shows erosion, pull back that portion of the blanket covering the eroded area, add soil and tamp, reseed the area, replace and staple the blanket.

Example Installations

Ditches without blankets will wash the mulch away, disabling grass from growing and leading to erosion.

Erosion Control Blanket being used for permanent vegetation establishment and slope protection.

Erosion control blankets will not work if proper soil grading is not completed first. Blankets not installed parallel to direction of water flow.

Blankets can be used as temporary or permanent erosion control around hot spots such as creek banks.

Permanent Inlet Protection

Standard References

Standard Specification Reference: 616.05 Riprap
616.11 Geotextile under riprap

Standard Drawing Reference: N/A – Contract Specific Design

Description

The inlet protection is described as the permanent protection of the upstream side of culverts and pipes. Channel flow upon approaching a structure, pipe or culvert will constrict and increase velocity having to enter a smaller cross-sectional area. This increased velocity can cause erosion around the structure inlet. Typically, riprap is used on the upstream part of the structure to armor the areas affected by the increased velocity of the water flow.

Installation

- Geotextile must be laid out according to the plans and details. Geotextiles should cover the bottom of the channel and at least halfway up the side slopes of the channel.
- Geotextile must be placed under all the intended areas for riprap. The geotextiles shall be placed on a relatively smooth grade free of obstructions, depressions, and debris.
- Place riprap on geotextile at the depth shown on the plan and matching the plan location and grade.

Inspection

- Inspect weekly and within 24 hours of a ½" or more rain event.
- Ensure that the geotextile has been handled and placed according to specification.
- All riprap shall be placed on top of installed geotextile.
- Inspect for scour around the inlet and beyond the limits of the riprap.

Maintenance

- Promptly repair any erosion that forms.
- Replace geotextile if it has been damaged.
- Clean out or replace any riprap showing excessive sediment build-up.

Example Installations

The lack of permanent protection has caused scouring around pipe inlet.

Pipe does not need riprap for permanent inlet protection because permanent vegetation was established for stabilization and velocity is low.

Permanent inlet protection without geotextile fabric and haphazard placement.

Permanent inlet protection includes wing walls and riprap protection.

Permanent Outlet Protection

Standard References

Standard Specification Reference: 616.05 Riprap
616.11 Geotextile under riprap

Standard Drawing Reference: N/A – Contract Specific Design

Description

The outlet protection is described as the permanent protection of the downstream side of culverts and pipes. Channel flow velocity leaving a structure, pipe or culvert may increase. This increased velocity can cause erosion downstream of the structure. Typically, riprap is used on the downstream part of the structure to armor the areas affected by the increased velocity of the water flow.

Permanent Outlet Protection

Installation

- Geotextile must be laid out according to the plans and details. Geotextiles should cover the bottom of the channel and continue at least halfway up the side slopes of the channel.
- Geotextile must be placed at all the intended areas for riprap. The geotextiles shall be placed on a relatively smooth grade free of obstructions, depressions, and debris.
- Place riprap on geotextile at the depth shown on the plans and matching the plan location and grade.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Ensure that the geotextile has been handled and placed according to the specifications.
- All riprap must be placed on top of installed geotextile.

Maintenance

- Promptly repair any erosion that forms.
- Replace geotextile if it has been damaged.
- Clean out or replace any riprap with excessive sediment build-up.

Example Installations

Too much riprap has been placed within the channel. Riprap should be sumped to allow the waterway and box culvert to naturally fill with sediment over time and form a new channel above the riprap. Refer to and follow the IDEM 401 and USACE 404 permit conditions.

Ditch is properly sumped to create a natural flow line to eliminate erosion.

Outlet protection not shaped correctly. Water should flow down the middle of the riprap.

Outlet protection slows the velocity of water exiting the pipe to help prevent erosion.

Riprap Ditch

Standard References

Standard Specification Reference: 616.01-08 Riprap, 616.10-11 Geotextiles

Standard Drawing Reference: N/A – Contract Specific Design

Description

Riprap is used as a means to slow the velocity and dissipate the energy of water in concentrated or channel flow to prevent channel erosion. Stone should be extended far enough up the slope to prevent scouring at the edge of the riprap. A riprap ditch is often placed where water volume or velocity is too high to establish adequate permanent vegetation. Riprap is used to stabilize and armor a channel but should not be used to collect sediment. Geotextile should always be placed under the riprap.

Installation

- Ditch must be cut to final cross section/grade.
- Place geotextile on a relatively even surface. Overlap geotextile sheets 18 inches with the upstream sheet over the downstream sheet.
- Riprap must be placed at the specified thickness shown on the plans.
- Top of riprap must match the cross section grade. The finished surface shall vary no more than 9 inches from a true plane.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Verify riprap is was placed in the correct location and quantity shown in the plans and standard specifications.
- Inspect for scour along the sides of and downstream of riprap channel.
- Inspect for sediment collecting in the riprap channel.

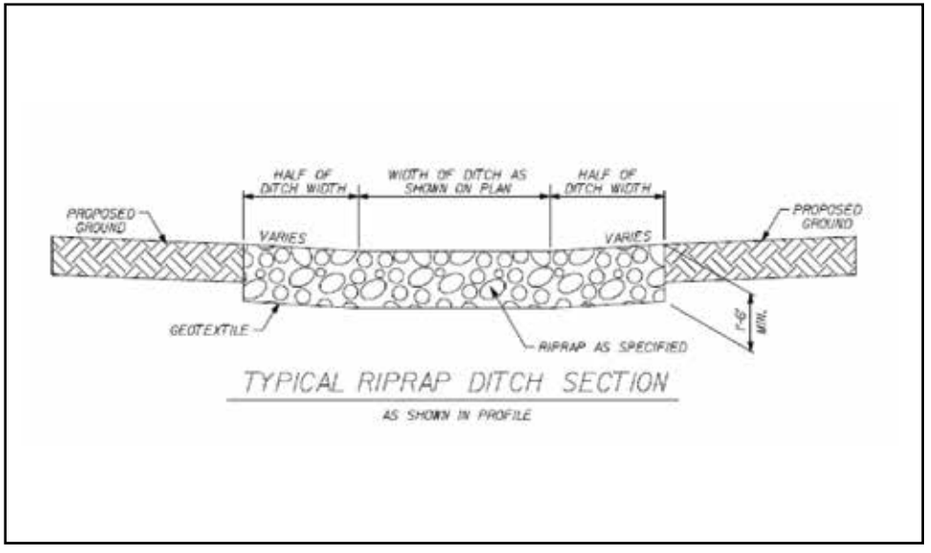
Maintenance

- If sediment is found in the riprap, stabilize slopes and areas upstream of channel. Clean out or replace riprap.
- If scour is found along the sides of the channel, reshape channel as needed for water to flow through the riprap.
- If scour is found downstream of the channel, additional riprap may be needed. Consult with designer and/or Environmental Services to ensure no permits or permit modifications are needed. Repair any damaged geotextiles.

Example Installations

Permanent riprap should be installed in steep ditches to prevent gully erosion.

Permanent riprap ditch with correct shape and placement.



Typical riprap ditch section can be found in the plans.

Riprap is not extended far enough up the slope and not shaped correctly, causing scour.

Permanent Seed

Standard References

Standard Specification Reference: 621 Seeding and Sodding
RSP 629-R-630 Plant Growth Layer
914 Roadside Development Materials

Standard Drawing Reference: N/A

Description

Permanent seeding is one method to provide vegetation to manage erosion. Thick permanent vegetation stabilizes slopes and minimizes maintenance years after the project is complete. Permanent vegetation also helps filter pollutants such as oils and nutrients. Timing of seeding is critical. September is the best time to plant seed due to the temperature and moisture. Seeding is allowed throughout the year per specification 621.12 but may require a warranty bond and/or watering.

Installation

- Topsoil should be capable of supporting normal vegetation, free of noxious weeds and shall be in accordance with the final cross section and grade.
- Topsoil shall be free of rocks over 1 inch in diameter.
- Topsoil shall have a pH value within acceptable range. A soil test is recommended to determine if amendments are needed.
- Loosen topsoil to a minimum of 3 inches.
- Fertilizer shall be uniformly applied at the appropriate rate.
- Seed may be drilled or mixed with water and sprayed over area. Seed shall not be covered more than one-half inch.
- Permanent mulch shall be applied uniformly at 2 tons per acre within 24 hours after seeding.
- Alternatively, erosion control blanket can be used to protect seed and slope. Erosion Control Blankets are required on slopes 2:1 or steeper. They are strongly recommended on slopes 3:1 or greater for higher vegetation establishment success.
- Punch mulch into soil with a mulch tiller.
- Unless seed was applied by a hydroseeder, water thoroughly.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Areas should be monitored to ensure that mulch cover stays in place.
- With appropriate temperature and moisture, seed should germinate in approximately 2-3 weeks.
- Any areas void of seed germination shall be subject to soil test for proper correction measures before reseeding. Change order for soil test might be warranted.

Maintenance

- Promptly repair any small rills that form and reapply seed and mulch as needed.
- If consistent rills or gullies are forming, consider installing slope drains or fiber rolls at the top of the slope until vegetation is established.
- If vegetation appears yellow or wilted, fertilizer and/or watering may be needed.

Example Installations

Mulch is not an appropriate protection for seed in concentrated flow areas.

Picture represents a higher than 70 percent uniform density permanent vegetation.

Erosion control blanket and filter sock together are assisting with the permanent seed establishment on this slope.

Poor soil conditions can hinder the vegetative growth.

Permanent Sod

Standard References

Standard Specification Reference: 621 Seeding and Sodding
RSP 629-R-630 Plant Growth Layer
914 Roadside Development Materials

Standard Drawing Reference: Sod typical drawing within plan details

Description

Installing permanent sod is one method to provide permanent vegetation to manage erosion. Thick permanent vegetation stabilizes slopes and channels and minimizes maintenance needed years after the project is complete. Permanent vegetation also helps filter pollutants such as oils and nutrients. Sod edges should be tightly butted together to help keep moisture in the soil and prevent air from drying out the grass roots.

Installation

- Topsoil should be capable of supporting normal vegetation and free of noxious weeds and have a pH value within acceptable range.
- Loosen topsoil to a minimum of 3 inches. Soil shall be smooth, uniform and free of clods, lumps, boulders and waste material.
- Fertilizer shall be applied at the appropriate rate and raked into 1-2” deep loose topsoil prior to laying sod.
- Notch the sod into the soil so that after installation, the surface is in accordance with the final cross section and grade.
- Lay sod in the direction of water flow. Tightly butt together to avoid open joints.
- Water immediately after laying the sod enough to saturate the sod and the top few inches of soil.
- After watering, tamp or roll to ensure contact with the soil. Surface shall be smooth and free from lumps and depressions.
- Secure sod in place with wood pegs or wire pins driven flush with top of the sod when required.

Inspection

- Inspect weekly and within 24 hours after a ½” or more rain event.
- Repair or replace sod that is no longer in contact with the soil or has moved.
- Monitor after the required minimum watering time frame and water as necessary during dry and/or hot weather conditions.

Maintenance

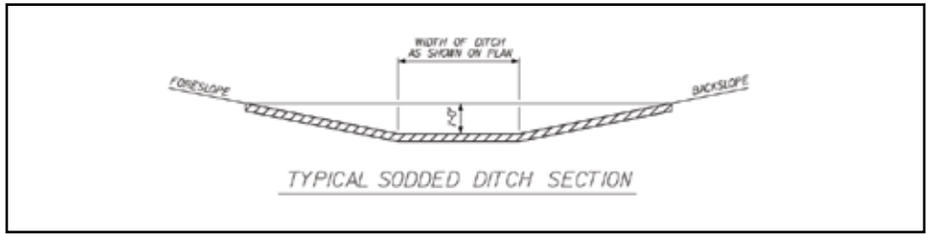
- Water sod every day of the first week, once every second day of the second week, once every third day of the third week and once a week thereafter for a minimum of four weeks.
- During ample rainfall, watering may be modified to simulate the above schedule.

Example Installations

Area upstream of sodded ditch is not stable and causing sedimentation on permanent sod.

Permanent sod installed in concentrated flow area in median.

Sod failed because it was installed on a thick bed of straw mulch. An adequate growing surface is needed for the sod to take root.



When placing sod in a ditch, extend the sod up the slope to prevent scour on the edge of the sod. Notch sod into the soil so that there is a smooth surface transition in accordance with the final cross section and grade.

Sod was not adequately watered or otherwise maintained.

Sediment Control

If previous storm water management efforts have been exhausted, sediment control BMPs will be needed to minimize sediment and other pollution from leaving the site. Sediment control measures are designed to slow water down long enough for sediment particles to settle out of flowing water. Smaller particles (such as clay) need more time to settle out than larger particles (such as sand). Because of this, sediment control features are not very effective in areas with clay soils. This is why the focus should be on other management tools (Communication, Work Management, Storm Water Management and Erosion Control). Once soil is on the move, it's hard and expensive to manage. Generally, sediment control measures are the most expensive, require the most maintenance, and are the least effective storm water management tools.

Successful Strategies to Save Time and Money

Last Line of Defense

- Use all other Best Management Practices (Communication, Work Management, Storm Water Management and Erosion Control) so that sediment control measures do not need as much maintenance.
- Sediment control measures are like the safety position in football. An effective team uses all defensive players with the safety as the last line of defense.

Plan for Maintenance

- When sediment control measures are placed, install them in a location where they can easily be maintained. If the last measure cannot easily be maintained, consider additional measures that minimize maintenance needs.

Consider the Watershed

- Sediment control measures should be designed to handle the sediment load and storm water velocity of the entire watershed.
- If the watershed size is not known, existing features such as ditch size, pipe size, etc. will provide an indication of an appropriate sediment trap or basin size.

Construction Entrance

Standard References

Standard Specification Reference (RSP 205-R-636):

205.03 General Requirements
205.07 Maintenance

Standard Drawing Reference: E 205-TECP-01

Description

A construction entrance is a stone pad made of geotextile fabric placed under #2 stone. The construction entrance provides ingress and egress to a construction site and minimizes tracking of mud and sediment onto public roadways. Sediment on public roadways is a safety hazard due to slippery conditions, loose rocks, and decreased visibility from dust. Sediment on roadways is a common complaint from citizens to regulatory agencies such as IDEM. The minimum length of the entrance is established to allow the tires on large construction vehicles to make one full rotation on the stone prior to entering the roadway.

Installation

- Place geotextile fabric under #2 stone
- Construction entrances should be a minimum of 12’ wide by 50’ long. Ideally, if space allows, the entrance should be 150’ long.
- Avoid placing on steep slopes or curves onto public roads.
- Do not block ditches. Install an appropriately sized culvert if traversing a ditch.
- Verify that the entrances are where they are most effective. Is the location safe? Are the trucks entering and exiting in that location?
- Ensure the entrance will not interfere with existing drainage patterns.

Inspection

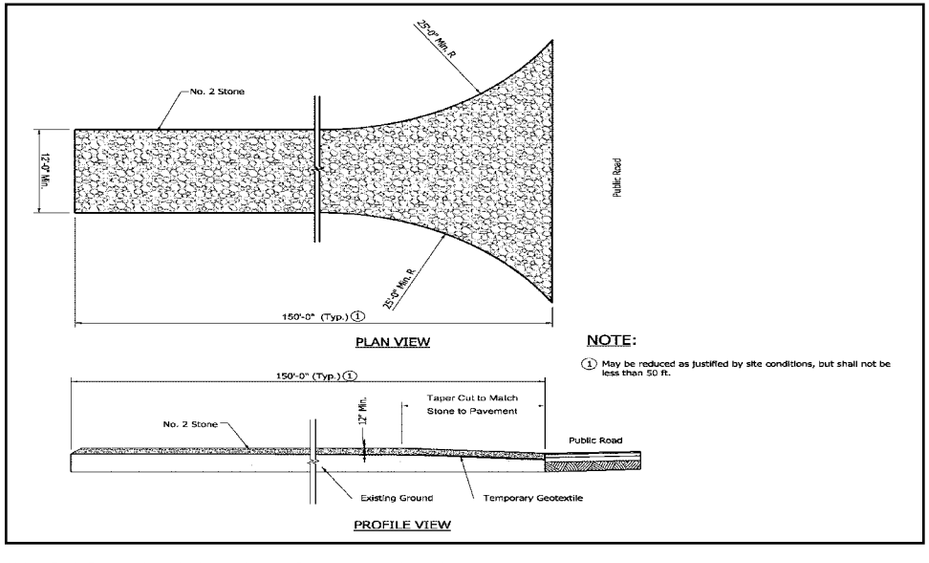
- Inspect the entrance each day it is being used.
- Monitor tracking onto public roads and observe the sediment being collected in the stone. Redress or remove stone and sediment and replace with clean stone as necessary.

Maintenance

- Redress the #2 stone as necessary to provide clean stone with voids capable of trapping additional sediment.
- Remove stone and sediment and replace with clean #2 stone on construction entrances near sensitive areas (wetlands, streams, etc.) or where redressing could cause a safety (example: sight lines) or drainage problems.
- Sweep or otherwise remove sediment from public roads as necessary.
- Reshape, resize or relocate ineffective construction entrances.

Example Installations

Construction entrance not the minimum 50’ long. Tracking onto the roadway will become a safety hazard.



INDOT Standard drawing, Construction Entrance.

Insufficient #2 stone on construction entrance. Note tracking onto public roadway. Mud tracked onto paved roads becomes a safety issue.

Construction entrance installed correctly, steep slope could not be avoided.

Silt Fence

Standard References

Standard Specification Reference (RSP 205-R-636): 205.06 (a) Silt Fence
205.07 (a) Maintenance

Standard Drawing Reference: E 205-TECP-02

Description

Silt fences are used primarily as perimeter protection in sheet flow areas. Install silt fence to trap sediment from small, disturbed areas by reducing the velocity of sheet flow. Silt fence captures sediment by ponding water to allow deposition, not by filtration. Silt fence should not be used as a diversion and should not be installed across a stream, channel, ditch, swale, or anywhere that concentrated flow is anticipated.

Installation

- The contractor's SWQM and the INDOT PE/PS should discuss silt fence locations prior to installation.
- Install prior to earthwork or clearing operations.
- Do not place silt fence in concentrated flow areas.
- Do not install silt fence perpendicular to slopes.
- Do not install silt fence in floodways.
- Trench in the bottom of silt fence and install joints per the INDOT standard drawing.
- Place silt fence along a contour and "J" hook the ends to tie into the slope.
- Allow access for maintenance if possible. If maintenance access is impossible or difficult, plan additional erosion control measures to reduce the need for silt fence maintenance.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Check for torn, decomposed or ineffective fence.
- Ensure fence is trenched in and placed along a contour.
- Check for sediment accumulations and areas where fence has fallen.
- Check for "J" hooks at the end of silt fence runs.

Maintenance

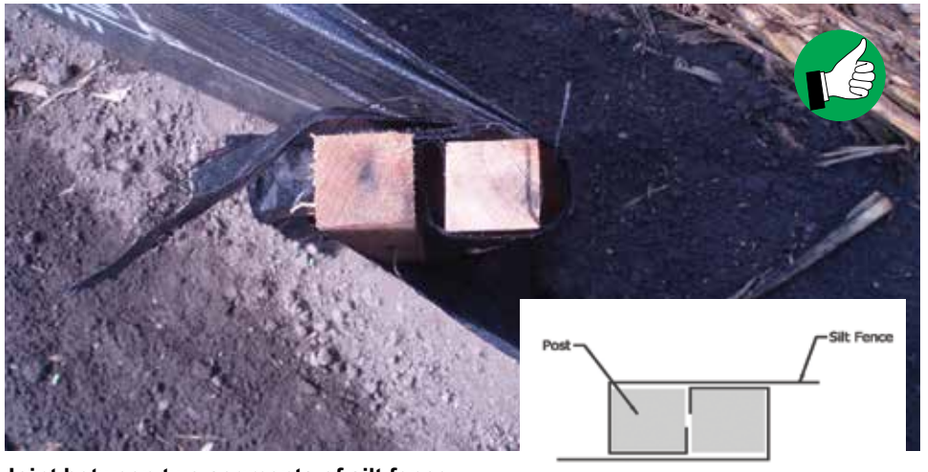
- Repair or replace silt fence if torn, starting to decompose, damaged by construction equipment, or is ineffective. Correct any "J" hook problems at the end of runs.
- Remove sediment once it reaches one-half the height of the fence.

Example Installations

Silt fence is overwhelmed with sediment and requires maintenance.

“J” hook the end of the silt fence uphill to prevent water from bypassing fence.

Silt fence is not an appropriate BMP for concentrated flows, nor can it be used across jurisdictional waterways.



Joint between two segments of silt fence properly installed.

Sediment Trap

Standard References

Standard Specification Reference (RSP 205-R-636): 205.05 (d) Sediment Trap
205.07 (e) Maintenance

Standard Drawing Reference: E 205-TECD-03

Description

A sediment trap is placed to contain and minimize sediment release from construction areas by pooling storm water runoff and allowing time for settling of suspended soil particles. Sediment traps should be placed in ditches at the downstream end of the construction area or immediately before a ditch flows into a jurisdictional waterway. Sediment traps are designed to treat runoff up to five acres. If the watershed is more than five acres, a sediment basin (page 116) should be constructed instead. Classified as a sediment control measure, sediment traps are less efficient and more expensive to maintain than storm water management or erosion control measures. Sediment traps should be the last measure in a series for better Storm Water management.

Installation

- Sediment traps are a form of perimeter protection and are to be installed before soil disturbance.
- Install in concentrated flow areas where water leaves the construction site.
- Traps should be sized for the watershed including on-site and off-site, disturbed, and stable areas.
- Use geotextile fabric, revetment riprap and #5 or #8 stone.
- Make sure outlet is stabilized with stone, vegetation, geotextile or other material.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Water should drain within 72 hours of a rain event to regain the trap's storage volume.
- If the trap does not drain within 72 hours, check for clogged filter stone and sediment build up.
- Ensure trap is stable after a 2-year, 24-hour storm event (approximately 3 inches). If not, trap is undersized or a series of measures are needed.

Maintenance

- Remove sediment once the sediment trap is one-half full.
- Replace filter stone when water does not drain within 72 hours.

Example Installations

Sediment trap without filter stone allows sediment to travel through riprap and into waterway.

Sediment trap placed at the end of the ditch right before a waterway.

Trap placed too far away from waterway, should have a stable outlet to the creek and needs maintenance.

Sediment trap placed in an appropriate location close to stream with filter stone.

Sediment Basin

Standard References

Standard Specification Reference RSP 205-R-636: 205.05 (e) Sediment Basin
205.07 (b) Maintenance

Standard Drawing Reference: N/A. Contract specific design

Description

Sediment basins consist of an embankment constructed basin with a riprap and filter stone encased perforated stand pipe near the downslope side. The stand pipe outflows through a connected buried pipe within the downslope embankment wall. Sediment basins are placed in order to minimize sediment release from construction areas by pooling storm water runoff and allowing time for the suspended soil particles to settle out of the storm water. They are contract specific and designed to accommodate storm water runoff and sediment from large areas. Sediment basins are designed to treat runoff from approximately 5 to 30 acres and should be placed as close to the sediment source as possible.

Installation

- The INDOT PE/PS and the Contractor's SWQM should discuss the locations and sizes of the designed sediment basins prior to installation.
- Install sediment basins in concentrated flow areas where water leaves the construction site.
- Basins should be sized for watersheds that include on-site and off-site areas and should also account for both disturbed and stable areas. They should accommodate no more than 30 acres of watershed.
- Ensure the basin has stable slopes, stable outlet overflow, perforated stand pipe placed to the correct height (2' below the top of basin), and #5 or #8 filter stone surrounding the riprap core.
- Make sure the outlet is stabilized with stone, vegetation, geotextile or other suitable material.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Check to ensure that the basin drains within 72 hours of a rain event.
- Check for clogged filter stone and sediment build up.

Maintenance

- Remove sediment once design volume (check plans) is reached.
- Replace filter stone when water does not drain within 72 hours.

Example Installations

Sediment basin slopes are not stable and no filter stone is used on perforated stand pipe.

Sediment basin stabilized with vegetated banks, riser pipe and stable overflow.

Sediment basins must have stable banks and a stable outlet, this live outfall structure is buried in sediment along with the straw bales being used to protect the structure.

Sediment basin with stable slopes, stable outlets, filter stone and stand pipe.

Filter Berm

Standard References

Standard Specification Reference (RSP 205-R-636): 205.06 (b) Filter Berm
205.07 (c) Maintenance

Standard Drawing Reference: N/A

Description

Filter berms are used to trap sediment from long, linear disturbed areas by reducing the velocity and dissipating the energy of sheet flow. Filter berms capture sediment by filtering storm water runoff and by ponding smaller amounts of water at their base to allow settling and deposition. A filter berm can be constructed with rock, compost, or filter socks. Only rock filter berms can be used where more concentrated flows are anticipated.

Installation

- Discuss the locations, materials and timing of the construction of filter berms with the Contractor's SWQM.
- Install filter berms along the perimeter of the construction area close to locations where runoff would enter an adjacent waterway in primarily sheet flow areas. Only rock filter berms can be installed for concentrated flow areas.
- Rock filter berms should include geotextile fabric with riprap placed on top. #5 or #8 filter stone should be added to the upslope side of the riprap berm.
- Wood chips from tree clearing operations or filter socks can be used as filter berms, but only where water velocity is low.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Monitor for sediment accumulation.
- Look for areas that have been damaged by storm water or equipment.

Maintenance

- Remove sediment once it reaches one-quarter the height of the berm.
- Repair damaged areas as needed or directed.

Example Installations

Filter berm after a large rain event that needs maintenance.

Filter berm protecting creek with geotextile, revetment riprap and filter stone. Note existing vegetation left in place between filter berm and waterway.

Filter berm protecting creek from long fill slope. Note existing vegetation left in place along creek bank.

A rock filter berm would have been the correct BMP for this situation. Silt fence not sufficient and not functioning properly, sediment has moved into the stream from the unprotected slope and bank.

Filter Sock

Standard References

Standard Specification Reference (RSP 205-R-636): 205.06(b) Filter Berm
205.07 Maintenance

Standard Drawing Reference: E 205-TECD-02 as traversable check dam

Description

Filter Socks are versatile filter devices that can be used in a few different applications, such as a filter berm, perimeter protection or traversable check dam. Filter socks are mesh tubes usually filled with organic material, such as straw, that are staked into the ground. They are designed to slow runoff water velocity, filter sediment, and temporarily pond small amounts of water. If filter socks are used as traversable check dams, they should be used only in clear zones with adjacent active traffic lanes and low storm water velocities. Filter socks, or coir rolls, are a good choice for tree clearing areas where roots prevent trenching in of silt fence.

Installation

1. Traversable check dam

- Install three horizontal rows to form a pyramid and secure with stakes.
- Install geotextile fabric below the socks and extend the fabric downstream to prevent scour.
- Shape with a lower center and sides tied into the slopes (like a smile ☺) when used within a ditch line.
- Adding a filter stone wedge to face will increase efficiency in filter sock traversable check dams.

2. Filter berm

- Install in sheet flow areas with small watersheds and low velocities.
- Secure into soil with wooden stakes.
- Can be used at the top of slopes to reduce runoff velocity and help vegetation establishment.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Monitor sediment accumulation and remove once it reaches one-quarter of the height of the filter berm.
- Look for areas that have been damaged by storm water or equipment.

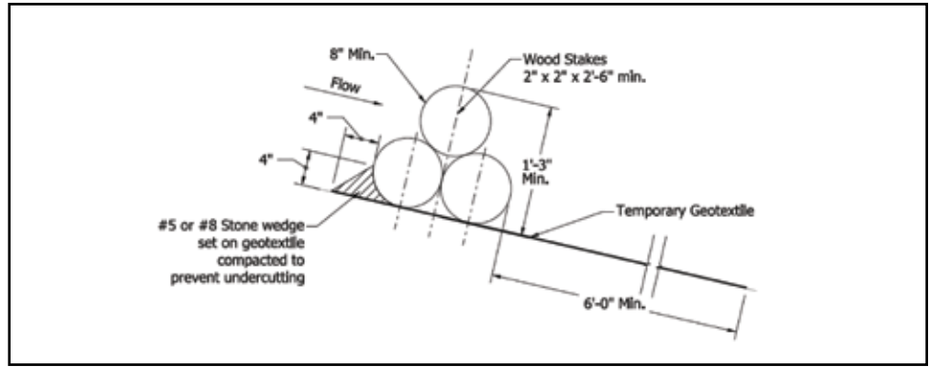
Maintenance

- Secure or replace damaged filter socks.
- Replace with a stronger measure, such as rock, if damage is severe or reoccurring.
- Remove accumulated sediment once it reaches one-quarter of the height of the filter berm.

Example Installations

Filter sock used as traversable check dam in the clear zone (good) but installed where water velocity is very high (bad). No geotextile was used and only one filter sock was used (verses three in a pyramid).

Filter socks can be placed horizontally across a slope to shorten a slope's length and prevent rill and gully erosion.



Standard Drawing showing filter socks used as traversable check dam.

Filter socks can be used on the edge of pavement to slow water before vegetation is established.

Filter socks used for channel stabilization.

Inlet Protection

Standard References

Standard Specification Reference (RSP 205-R-636): 205.05 (i) Inlet Protection
205.07 (d) Maintenance

Standard Drawing Reference: E 205-TECI-01 through E 205-TECI-06

Description

Inlets are designed to carry moderate and large flows of storm water. Inlets also have the potential to transport sediment to streams, rivers, wetlands and lakes if they are not properly protected. This sediment control measure can be the last chance to remove sediment before storm water leaves the job site. Inlet protection can take many forms and a review of the Standard Drawings listed above will better illustrate these methods. The choices within the Standard Drawings or plan details will allow for a “best fit” solution to specific construction situations. Inlet protection may need to be coordinated with a local MS4.

Installation

- Discuss the inlet protection methods with all personnel involved in the installation. Choose the best method for project conditions, urban street conditions are different from rural road conditions.
- Install the specified inlet protection so that storm water does not bypass the inlet.
- Install top cross bracing and trench in silt fence when using geotextile box.
- Use #8 filter stone and #2 coarse aggregate for gravel ring.
- Follow the standard drawing and/or manufacturers installation information (when using a commercially available product) when installing inlet bag type protection for inlets.
- Do not place this type of protection within any jurisdictional waterways.

Inspection

- Inspect weekly and after every rain event.
- Look for inlet protection materials that are damaged, clogged or have become ineffective.
- Make sure storm water is not bypassing or undercutting any type of inlet protection that has been installed.

Maintenance

- Remove sediment after each storm event.
- If measure is repeatedly damaged or clogged, consider additional erosion and sediment control measures upstream in a series.
- Cleaning by flushing with water will not be allowed
- Remember, only rain goes down the drain.

Example Installations

Geotextile placed under inlet is not an acceptable inlet protection measure. Geotextile will clog causing standing water, making measure impossible to maintain without getting muddy water into storm system. Ponding water could cause traffic hazards or muddy construction conditions.

Inlet bag protection can be used on curb inlets with active traffic. Maintain bags after each storm event. Bags can get heavy and hard to maintain when very full.

Filter sock inlet protection staked correctly.

No cross bracing used on inlet protection. Silt fence not trenched properly.

Culvert Inlet Protection

Standard References

Standard Specification Reference (RSP 205-R-636): 205.05 (i) Inlet Protection
205.07 (d) Maintenance

Standard Drawing Reference: N/A. Shown in plans

Description

Culverts are designed to carry moderate to large flows of storm water. Sediment from storm water runoff can be transported through unprotected or under-protected culverts into streams, rivers, wetlands and lakes. Culvert inlet protection can easily become the last measure to remove sediment from storm water before it leaves the job site. Culvert inlet protection should be constructed using methods similar to permanent culvert protection methods. The use of rock rings is also considered to be an acceptable culvert inlet protection measure.

Installation

- Review and discuss the installation process, the methods, and the locations for culvert inlet protection measures with the storm water management team.
- Install culvert inlet protection as indicated within the plans.
- Use #5 or #8 filter stone around the perimeter of the revetment riprap basin material.
- Do not place culvert inlet protection in jurisdictional waterways.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Look for clogged or ineffective materials.
- Make sure storm water is not bypassing or undercutting the installed method of culvert inlet protection.

Maintenance

- Remove sediment after each storm event. Replace filter material if it becomes overly choked with sediment.
- If the protection measure is repeatedly clogged or overburdened, consider additional erosion and sediment control measures placed further upstream in a series.

Example Installations

Silt fence should not be located in concentrated flow areas and is not appropriate as culvert inlet protection.

Inlet protected from sediment with filter stone surrounding riprap.

Although not an INDOT standard, straw bales and riprap functioning well for culvert inlet protection.

Culvert inlet protection not shaped correctly contributing to scour around inlet.

Other Pollution Prevention

Exposed soil and sediment are not the only pollutants exposed to storm water on construction sites. Other pollution prevention methods should be utilized to protect the environment when constructing and maintaining roads and bridges. Careful handling and storage of construction materials will help ensure our natural resources are protected.

Successful Strategies to Save Time and Money

Protect Natural Resources

- Locate stockpiles, temporary toilets, concrete waste water containment, fueling operations, etc. as far away from sensitive areas such as streams and wetlands as possible.
- Remove cofferdams, temporary crossings and other features within streams as carefully as possible. Do not over excavate or churn up muddy water unnecessarily.

Treat Chemicals with Care

- Ensure the concrete washout is adequately sized and completely contained. Chemicals in concrete washout raise pH levels and can result in high alkaline runoff which cause fish kills in streams, soil contamination and severe human health risks.
- Store chemicals such as fertilizers, petroleum products and sealants inside if possible. Always protect chemicals in sealed containers so there is no exposure to storm water.
- Use secondary containment for all fuel storage.

Maintain Equipment

- Ensure all equipment is maintained in good working order. Fix fuel, oil or other fluid leaks as soon as they are discovered.
- Remove contaminated soils or otherwise clean up the job site due to these leaks immediately.

Temporary Crossing

Standard References

Standard Specification Reference: 107.02 Permits, Licenses and Taxes
RSP 205-R-636: 205.07 Maintenance

Standard Drawing Reference: N/A. Designed for specific site conditions.

Description

A temporary crossing is intended to be installed in a stream or waterway for short-term use by construction vehicles or heavy equipment. Temporary stream crossings are individually designed and are specific to the stream and conditions encountered at the site. If the crossing has not been included as part of the plans, the contractor is responsible to develop and submit for approval the design for the crossing. The contractor is responsible for obtaining permits for temporary impacts such as crossings, cofferdams and demolition of structures if these issues are not covered under the IDEM 401, USACE 404, and IDNR Construction in a Floodway permits.

Installation

- Have discussions with all storm water team members involved in the installation to determine and clarify the construction methods and procedures, and to ensure proper permitting of the crossing prior to construction.
- Crossings should be placed to disturb as little of the existing stream bed and banks as possible and sized to carry a minimum of a two-year, 24-hour storm event. Construct the overflow for 10-year, 24-hour storm.
- Temporary crossings should be constructed with riprap large enough to not allow the stone to wash down stream.
- Re-grade, re-seed or otherwise stabilize areas of removed vegetation.

Inspection

- Inspect weekly and within 24 hours after a ½" or more rain event.
- Check for accumulation of debris and obstructions such as limbs, trash, rocks, etc. at culvert openings; remove promptly as needed.
- Inspect for erosion of stream banks and approach road and repair promptly as needed.
- Inspect for sediment accumulation in the stone and replace as needed.

Maintenance

- Remove debris or other obstructions and repair eroded areas promptly.
- Periodically remove built up sediment carefully to ensure 10-year, 24-hour overflow is maintained. Replace the sediment laden stone as needed.
- When no longer needed, remove the crossing with as little creek disturbance as possible.

Example Installations

Pipes under temporary crossing are undersized causing creek to widen upstream.

Temporary crossing with adequate pipe capacity. These temporary impacts must be permitted, usually by the contractor, prior to installation and should be removed as soon as practical.

#2 stone on temporary crossing needs to be redressed to reduce sediment entering creek during rain events.

The use of this temporary bridge along with rock and geotextile fabric helps protect this stream from repeated equipment crossing.

Material Storage/Staging

Standard References

Standard Specification Reference: 108.04 Prosecution of the Work
RSP 205-R-636: 205.07 Maintenance

Standard Drawing Reference: N/A

Description

Material storage and staging operations contain many pollutants harmful to humans and aquatic life. These pollutants need to remain isolated from storm water to prevent pollutants from entering water bodies, leaving the site or leaching into the soil. Place fuel and other hazardous materials as far away from sensitive areas as possible such as creeks, wetlands and inlets.

Installation

- Discuss spill prevention plan with storm water team members and all personnel using the material storage and staging areas.
- Be ready to handle spills of petroleum or other noxious substances by having a written plan within the SWQCP, spill kits, and containment materials on-site, especially near fueling or equipment service areas. Keep spill kits readily accessible and near where a spill may occur.
- Locate material storage, staging, fueling operations, equipment maintenance, and temporary toilet facilities away from hot spots such as waterways, wetlands and inlets.
- Hazardous materials (i.e. flammable paints, solvents), hazardous waste, and petroleum products should be stored in a trailer or other structure to avoid spills and runoff.
- Provide additional storm water control measures for material storage and staging areas.

Inspection

- Inspect daily.
- Check for soil stains indicated a fuel, oil or other leaks.
- Ensure materials are stored in proper containers, have secondary containment as required, and store indoors or under canopy.

Maintenance

- Call the IDEM Spill Hotline at (888) 233-7745 for all reportable environmental emergency spills.
- Remove contaminated soil caused from leaks immediately.
- Keep construction site free of debris and remove trash.

Example Installations

Locate fueling operations, temporary toilets and staging away from waterways and other hot spots.

Good housekeeping includes trash collection.

Material Storage/Staging

Keep construction debris contained in designated areas, away from hot spots and BMPs.

Prevent fuel or other toxic spills. Locate spill cleanup kits in accessible areas and clean up immediately.

Waste Water Containment

Standard References

Standard Specification Reference (RSP 205-R-636):

205.03 General Requirements
205.07(f) Maintenance
ITM 803-16P 15.6

Standard Drawing Reference: N/A

Description

Concrete waste water is generated from concrete truck washouts, pier construction and rehabilitations, and hydro demolition operations. Concrete washout areas are designated locations, either a prefabricated unit or built measure, designed to completely contain concrete slurry. Uncured concrete and associated liquids are highly alkaline, and if not contained, may leach into the soil and contaminate ground water or a water body, elevating the pH to harmful levels. Elevated pH levels in the soil may also prevent vegetation growth. Straw bale containment is prohibited on INDOT projects.

Installation

- Follow the approved concrete waste water plan as part of the SWQCP.
- Choose washout location near a road for easy truck access.
- Size the washout to ensure adequate capacity for the day's operations.
- Create a structure or excavate a hole in the ground large enough to completely contain concrete slurry. Straw bale containment is not allowed.
- Use one continuous sheet of plastic to line the washout. Do not overlap two or more sheets. Any overlap or tear in the plastic will allow the chemicals to be released.
- Secure plastic with stakes, stone or other acceptable methods.
- Place sign next to washout and ensure all drivers are aware of its location.
- Never washout into storm drains, bodies of water, wetlands, adjacent properties, vegetation, or soil.
- Contractor shall provide secondary emergency waste water containment on site.
- Beginning in 2019, containment must be roofed or canopied.

Inspection

- Make sure all concrete slurry can be contained within the washout provided. Construct additional washouts as needed.
- Inspect daily during concrete pour operations.
- Ensure washout is completely contained with one sheet of plastic free of tears.
- Dispose of cured concrete per specifications.
- Any spillage of concrete slurry water on the ground must be fully excavated and disposed of in accordance with 203.

Maintenance

- Repair or replace if leaks, spills or tears are found.
- Provide additional concrete washouts as needed to ensure adequate capacity.
- Maintain a minimum of 12 inches of free board. Dispose of washout waste water if it exceeds the free board in accordance with 202.

Example Installations

Straw bale containment not allowed on INDOT contracts.

Good Example of an effective plastic lined dumpster washout. However, this washout has reached its capacity.

Plastic liner is too thin. Dumpster leaking while driver was washing out. Soil around dumpster contaminated, must be excavated and disposed of as per Standard Specifications 203.

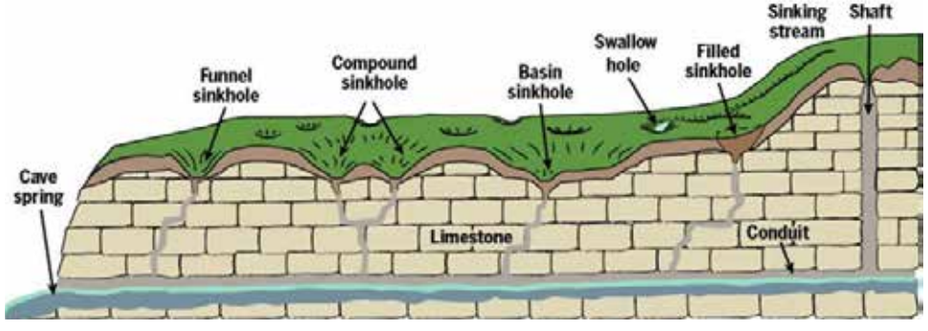
Concrete washout water held within an impermeable container with signage.

Successful Strategies
Managing HOT Spots

Karst Features:

Karst: noun, Geology.

1. An area of limestone terrane characterized by sinks, ravines, and underground streams.



Solution features characteristic of karst terrains Hasenmueller and Powell, 2005 as found on the Indiana Geological Survey website.

In certain parts of the state, karst systems are a part of the landscape. Identified karst regions exist in Crawfordsville, Seymour, and Vincennes districts. Often it is known that the project contains, or may contain, sink holes and other karst features. Sometimes a sink hole is discovered during the process of construction. INDOT currently holds a Memorandum of Understanding with IDEM, IDNR, and the U.S. Fish and Wildlife Service (USFWS) over the discovery and protection of karst features. If a sink hole is discovered on an INDOT project, call the INDOT Office of Environmental Services for direction on how to proceed. INDOT has procedures in place regarding proper capping of sink holes.

https://www.in.gov/indot/2522.htm (INDOT Ecology Manual: Karst Geological Resources and INDOT Construction).

Previously unknown sink hole discovered during construction.

A sink hole being protected during active construction.

Storm Drain Inlets:

"Only rain goes down the drain"

Storm drain inlet protection is important for both environmental compliance and public safety. Storm water entering storm drains, by state and federal regulations, must contain only rain water. There are many products available for inlet protection but the correct one must be used for roadway conditions and ensure public safety. Failing to maintain storm drain inlets can result in added costs related to cleaning storm sewer systems, removing sediment from receiving waters, or causing street flooding.

Inappropriate and ineffective inlet protection.

Long and Steep Slopes:

Long and steep slopes are areas of a project that require special and constant attention. Water flows faster when going down a long steep slope. It is often difficult and expensive to reestablish proper slope elevations after erosion has altered or damaged the slope. Waterways can also become polluted with run-away sediment from unprotected slopes.

Strategies for protecting slopes:

- INDOT Standard Specifications require that slopes are roughened, or tracked, daily to provide horizontal ridges created by equipment tracks to trap water, seed and mulch. Roughening can cut erosion significantly.
- Stabilize slopes that are not being actively worked within seven days. Stabilization can be seed and/or mulch, erosion control blankets, or temporary terracing of the slopes with filter berms made of rock, or filter sock.
- Geotextile fabric or tarps can temporarily be used to protect small areas before a rain event to prevent slope erosion.
- Temporarily diverting storm water away from un-stabilized slopes with slope drains, diversion interceptors and other methods will help a great deal in keeping soil in its place.
- Using slope drains to temporarily divert water from underdrain and median drain outfalls into a stabilized channel will help prevent slope erosion.
- Permanent measures, such as properly shaped rock chutes and vegetation will assist in keeping slopes stable.

Trash and liquids not stored properly.

Concrete washout not properly maintained.

Remember that the construction work environment is often in the public eye. Thousands of motorist may pass your project site daily. A job site that has trash blowing around, messy staging areas, leaking equipment, large areas of erosion, sediment in a waterway, unprotected stockpiles eroding, unmaintained construction entrances, and excessive dust are unacceptable situations that attract attention from the public. Often a visit from a regulatory agency is prompted by a complaint from the public.

One Step Removal Process:

The following is a list of requirements for the removal of silt and vegetation from "Waters of the U.S." under the one-step removal process that does not require a permit under Section 404 of the Clean Water Act.

- One-step removal requires that sediment and debris must be removed and immediately placed landward sufficiently enough to prevent the runoff water of the dredged material from re-entering the stream/wetland.
- No dredged or fill material shall be placed below the ordinary high water mark of the stream or wetland.
- Berms or other approved methods for controlling and containing sediment should be used when the dredged material is discharged within close proximity to any "Waters of the U.S."
- The removal of vegetation should be limited to the removal of snags, loose debris and live vegetation which obviously obstructs stream flow.
- All work, including the removal of vegetation, should be performed from one side of the channel, leaving one side undisturbed.

- The side casting of dredged material into wetlands adjacent to the stream is not allowed and would require authorization before the work is performed.
- Equipment, work areas, or access roads should not be staged within the wetland or waterway.
- Implement best management practices to ensure that the one-step removal activities being performed in “Waters of the U.S.” will not contribute to any significant degradation to the aquatic environment.

This is not acceptable under the “One Step Removal Process”.

Vegetation Establishment for NOT

- Save and protect existing top soil through all phases of the project.
- Protect slopes during vegetation establishment to minimize erosion.
- Attach slope drain pipe to newly installed underdrains and median drain outfalls to take storm water down to a stable ditch.
- Track or roughen slopes daily or before seeding and mulching.
- Mow or spray weeds, invasive plants, or other undesirable vegetation to aid in the establishment of permanent vegetation.
- Use the correct seed mix for field conditions.
- Test soil.
- Weed/invasive plant identification assistance (see links on back page).

Working in and around Waterways:

- Make sure all correct permits have been obtained. Possible permits, waivers and special provisions that may be required for work in and around waterways include:
  - Rule 5 (for soil disturbance of .90 acres or greater).
  - 401/404 Permits, dredge and/or fill of streams and wetlands.
  - Construction in a Floodway (CIF) for work within a floodway.
  - Fish Spawning restrictions/waivers.
  - Swallows Special Provision.
  - Bat tree clearing restrictions.

- Use appropriate and effective BMPs in and around streams and wetlands:
  - Silt fence is not an appropriate BMP for use along stream banks, or in areas prone to flooding. Fiber rolls or filter socks are better choices for perimeter control of sheet flow protection around a stream, wetland, or in a flood-prone area. If a disturbance is significant, a rock filter berm may also be needed to protect a stream or wetland.
  - The most commonly used type of Erosion Control Blanket contains a plastic grid that does not degrade in areas of shade, such as under a bridge. This product is extremely dangerous to small animals living in and around the streams. There are many erosion control blanket products on the market without the plastic grid core. All efforts should be made to select the correct product for the field conditions.
  - Turbidity Curtains: This BMP can only be used safely and effectively in a narrow set of conditions. The intent of this BMP is to protect stream and lake banks from sediment loss into the waterway. This BMP is difficult to install and remove and there is an increased risk of downstream issues if the product is not installed correctly. In most cases a cofferdam system should be considered instead of a turbidity curtain.
  - If a pump around/dewatering system is needed for work in a stream, the designer must provide details in the plans on the set up of the system and location of key elements.
  - When blown mulch is being applied around waterways, do not allow the mulch to enter the jurisdictional waterway channel or wetland.

Silt fence does not hold its integrity in areas prone to flooding. INDOT-ES strongly recommends not using silt fence near stream banks. A filter sock is a more appropriate BMP around stream banks.

Blown mulch covering and clogging a jurisdictional waterway.

Filter sock and erosion control blanket together providing adequate protection for this stream bank.

Notice of Termination (NOT)

Standard References

Standard Specification Reference: Construction Memorandum 17-01
IAC 327 15-5 (Rule 5)

Description

Projects that disturb one or more acres of ground require an IDEM Site Run-off General Permit. After the work has been completed and the site becomes stable, an NOT request must be accepted by IDEM in order to close the original Site Run-off General Permit.

INDOT Environmental Services will complete, sign, and submit the NOT request to IDEM based on INDOT-ES acceptance of the field staff's evaluation of the site including submitted photographs and documentation in accordance with the Construction Memo referenced above.

Note: For LPA contracts, the LPA owner (city or county) will fulfill the roll of INDOT Environmental Services for completing, signing and submitting the NOT request to IDEM.

Site Inspection and Evaluation

In order to reduce the potential for erosion problems after the contract is closed, the vegetation must be healthy and green. Weekly and post rain event inspections are required until the NOT has been accepted and notification received from INDOT-ES or the LPA owner.

Completing permanent stabilization such as seeding and placing erosion control blankets as early as possible will give the vegetation time to germinate and establish prior to the end of the contract. Simply having the site seeded and covered in mulch is not enough to satisfy the stabilization requirement for the NOT. The NOT will not be issued until all requirements listed above have been met.

Before INDOT-ES can issue an NOT for the IDEM Rule 5 Permit, both the INDOT PE/PS and the contractor must certify that:

1. No active erosion is evident on the project, all bare areas have been dressed, and vegetation re-established.
2. All temporary storm water control features have been removed.
3. The entire site has been stabilized (70% uniform density of permanent vegetation).
4. No further earth disturbing activities are planned for the project.
5. All post construction BMPs have been installed and functioning.

Successful Strategies

Successful Strategies for getting a timely NOT include:

- Save the existing topsoil for reuse within seed and sod areas.
- Be aware of the sand, silt, and clay components of the topsoil. Good composition makes for good results.
- Test the soil to determine what amendments are necessary for best seed germination.
- Sow seed into the topsoil with adequate organic matter and fertilizers.
- Time the permanent seeding operations for late April or early September.
- Use erosion control blankets or other methods to break up long steep slopes to help establish vegetation.
- Use slope drains for pipes outletting onto slopes to help prevent erosion.
- Water, mow and maintain the permanent vegetation as required.

Examples

All temporary erosion and sediment control measures must be removed prior to issuing the NOT. Although the site is stable and more than 70 percent uniform density of vegetation, silt fence was left along the creek.

Good example of 70 percent uniform density vegetation.

This example does not meet 70 percent uniform density vegetation.

The site does not yet meet 70 percent uniform density but likely will with time. Final grade and seed as early as possible to allow more time for thick vegetation growth.

NOT Process

The NOT process is outlined within Construction Memo 17-01. The steps to follow for NOT application, along with photographs depicting variations in vegetative density, are described in this section. The photos depicting vegetative density should be used to help determine whether an area is ready for an NOT request submittal.

There are three basic contract types for NOT submission:

1. **Single Signature Contracts –** The majority of INDOT contracts are of this type.

   a) PE/PS will notify Environmental Services, or the District Storm Water Specialist (DSWS) of substantial completion. A site visit to review the site may be needed.

   b) The Contractor and PE/PS will evaluate the site for 70% uniform permanent vegetative density.

      1. The PE/PS will document that the all five points listed within the Site Inspection and Evaluation heading (page 161) have been accomplished.

      2. The PE/PS will document actual site conditions by taking photographs of turf areas. Four (4) photographs should be taken from the least vegetated areas. All photos should be taken perpendicular to the ground, taken from a standing position, and taken using a digital camera.

   c) The PE/PS notifies Environmental Services of the NOT request by:

      1. Email request to the Storm Water Team Leader and copy appropriate persons involved (Area Engineer (AE), Project Manager (PM), DSWS, etc.).

      2. Attach documentation described in part b) above.

2. **Co-signature Contracts –** Design/Build contracts or contracts containing a Design/Build item for storm water management.

   a) Same as step a) for Single Signature Contracts.

   b) Same as step b) for Single Signature Contracts except that the PE/PS and the Contractor will jointly perform the documentation requirements.

   c) The Contractor notifies Environmental Services of NOT request by:

      1. Email request to the Storm Water Team Leader and copy appropriate persons involved (PE/PS, AE, DSWS, etc.).

      2. Attach documentation as described in part b) of Single Signature Contracts.

3. Local Public Agency (LPA) Contracts – These contracts will follow one of the processes listed above based on the type of contract. The LPA's designee will fulfill the role of Environmental Services.

NOT Compliance

- When Environmental Services accepts the submitted documentation for NOT compliance for Single Signature Contracts, Environmental Services will sign the NOT and notify the PE/PS and appropriate persons involved in the contract (AE, PM, DSWS, IDEM, etc.).

- When Environmental Services accepts the submitted documentation for NOT compliance for Co-Signature Contracts, Environmental Services will notify the Contractor. The Contractor shall then:

  1. Prepare and sign the NOT form.

  2. Deliver the signed form to Environmental Services for signature.

  3. Deliver the signed form to IDEM for a date stamp.

  4. Provide a hard copy of the IDEM date stamped document to Environmental Services and the PE/PS.

- If the documentation fails to achieve compliance for any type contract:

  1. A field review with INDOT Environmental Services, the PE/PS, and the Contractor may be scheduled to discuss the contract and work on options to consider.

  2. When the required work has been completed, resubmit a new NOT request including updated documentation.

Vegetation Analysis Photographs

The following series of photos should be used to help determine the percentage of permanent vegetative establishment for NOT application.

The series of pictures have been taken and analyzed using the INDOT Vegetation Analyzer. The pictures were taken with a Sony DSC-F505 camera.

Percentage of Green: 46.88%

Percentage of Green: 48.89%

Percentage of Green: 53.66%

Percentage of Green: 59.13%

Percentage of Green: 66.87%

Percentage of Green: 68.60%

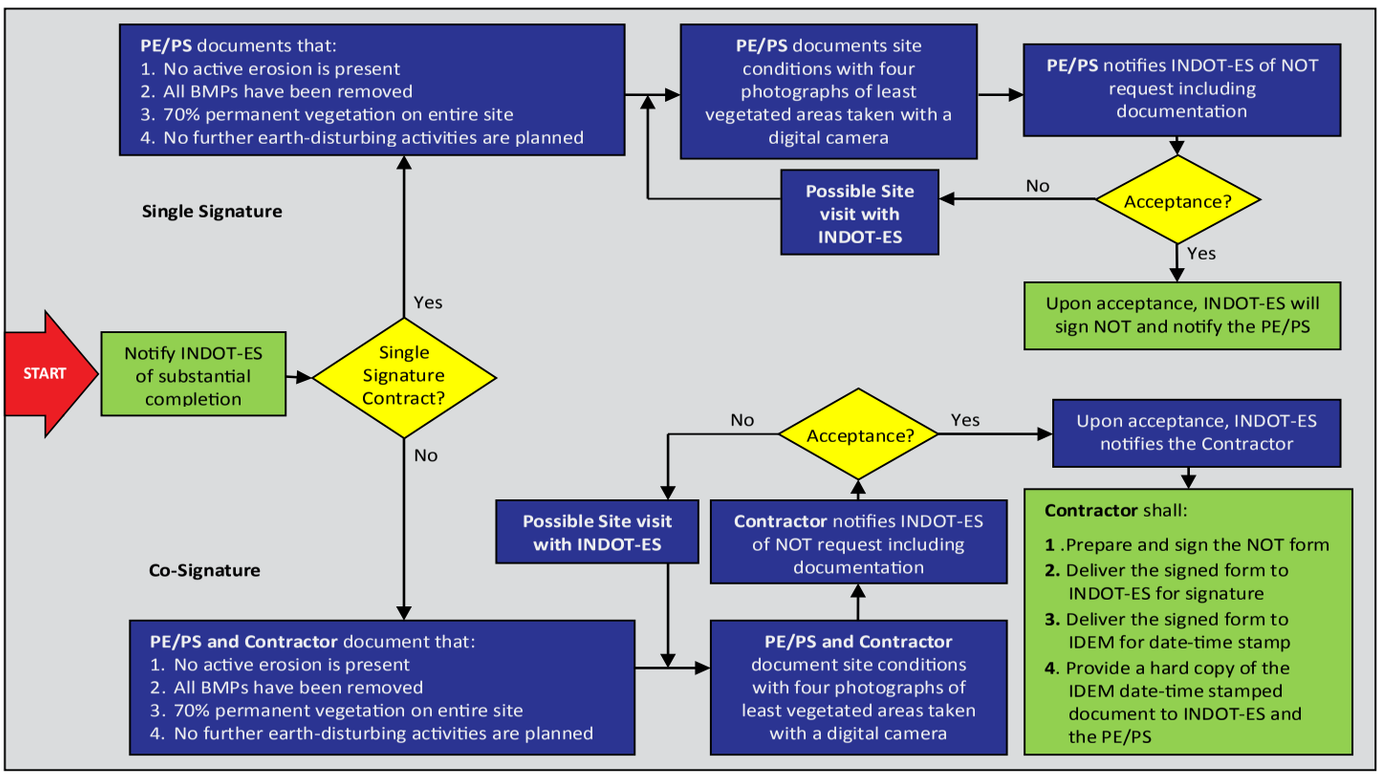
Percentage of Green: 76.22%

Percentage of Green: 77.17%

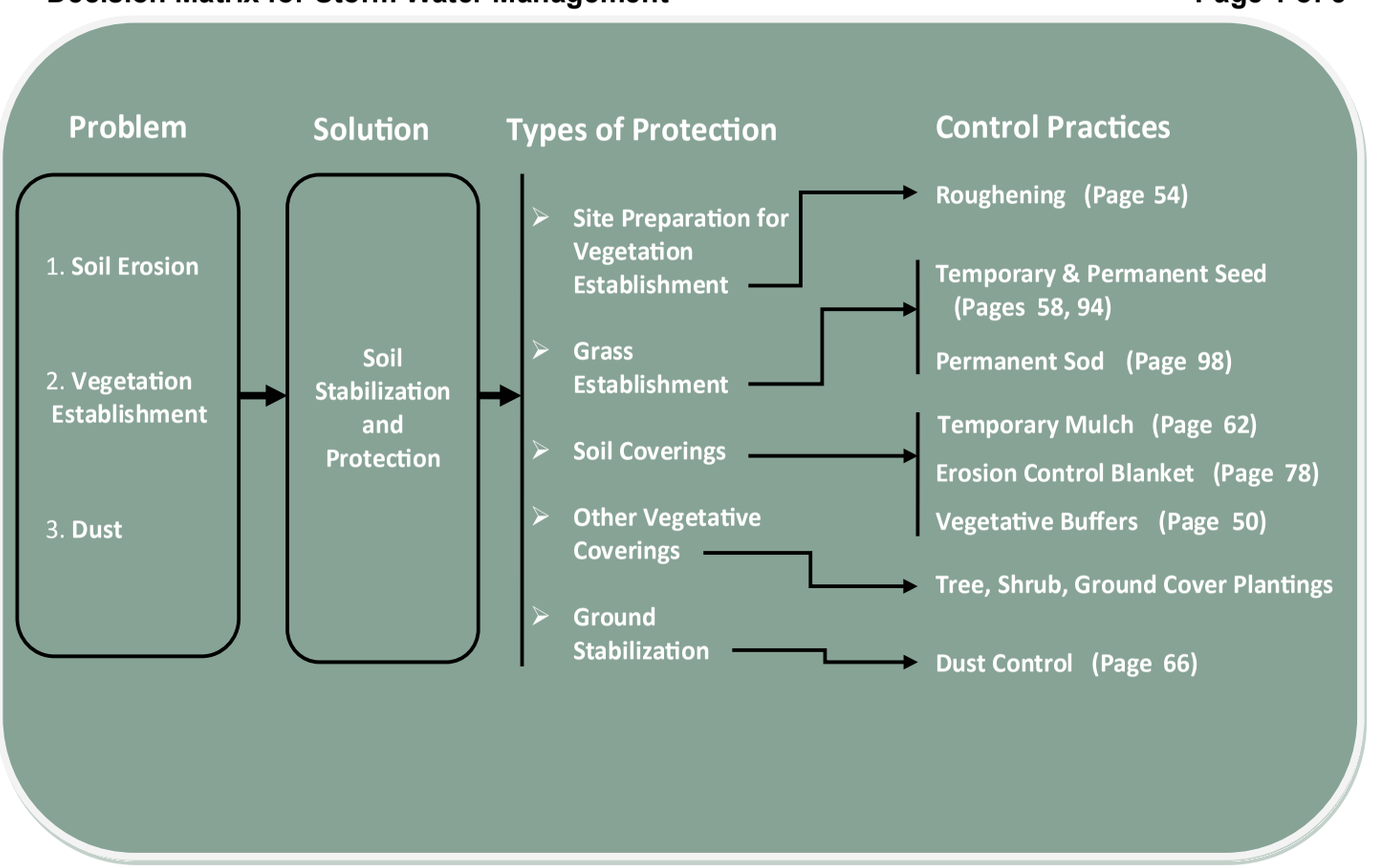
Percentage of Green: 85.79%

Percentage of Green: 86.37%

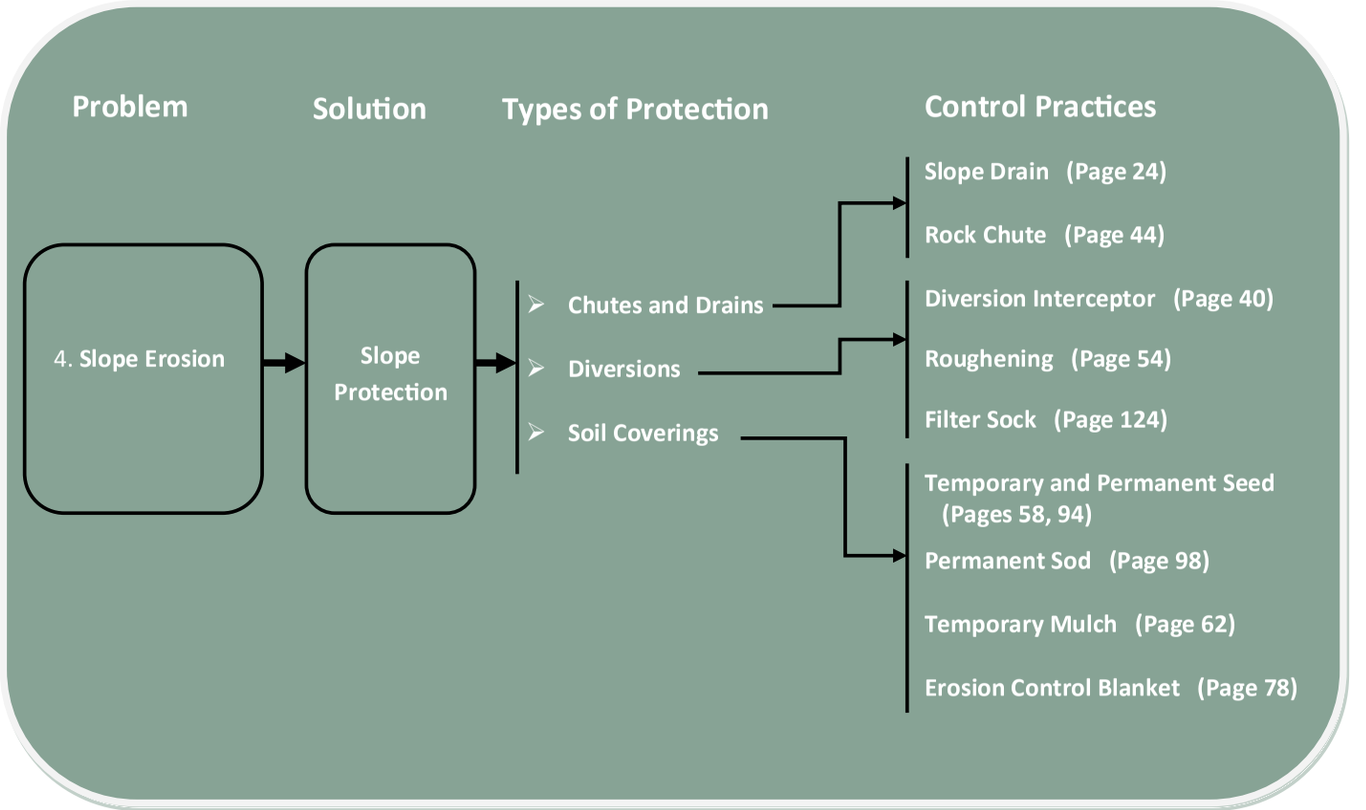
Notice of Termination Process Flow Chart



Decision Matrix for Storm Water Management

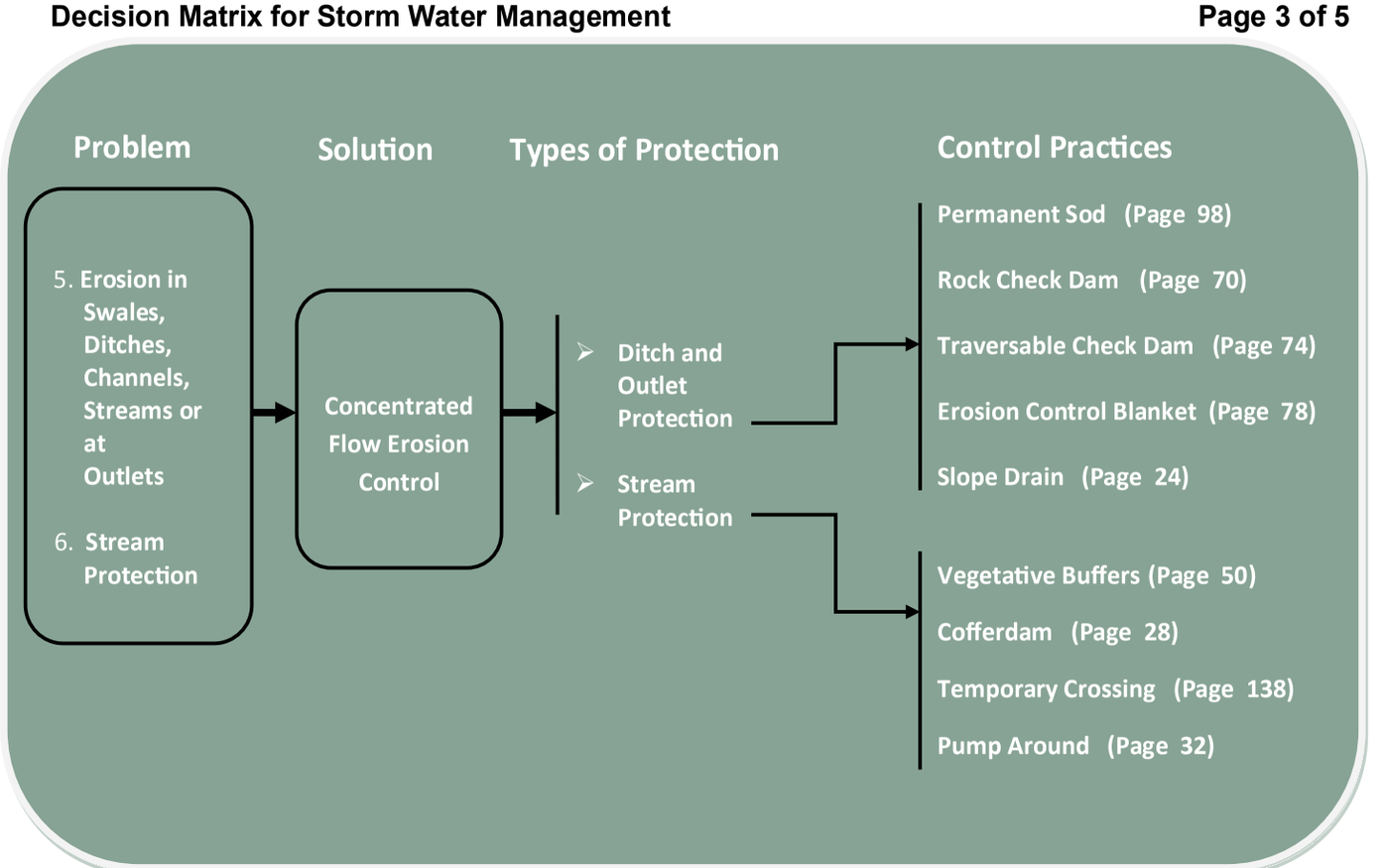


Decision Matrix for Storm Water Management

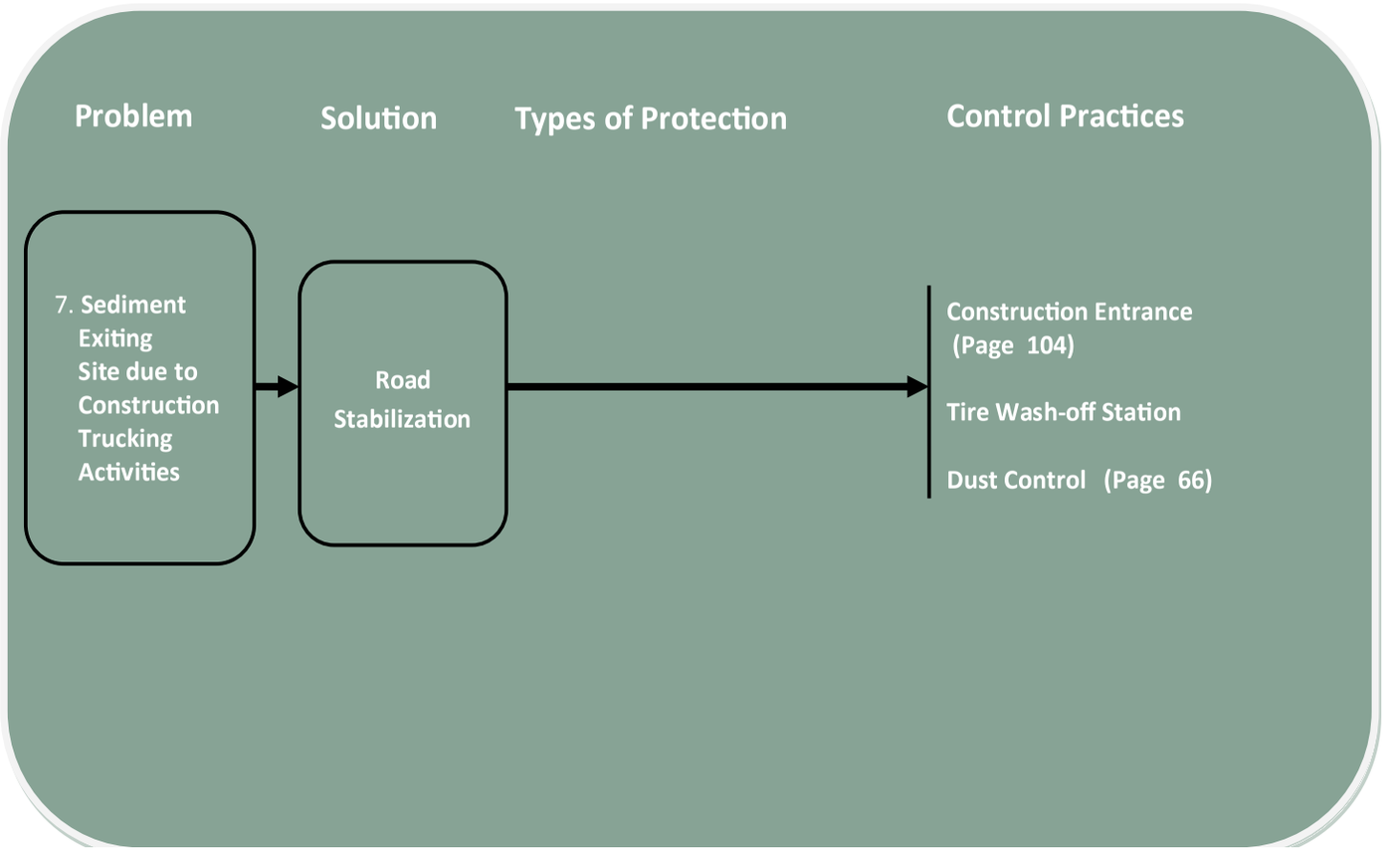


INDOT Storm Water Management Field Guide

Decision Matrix for Storm Water Management

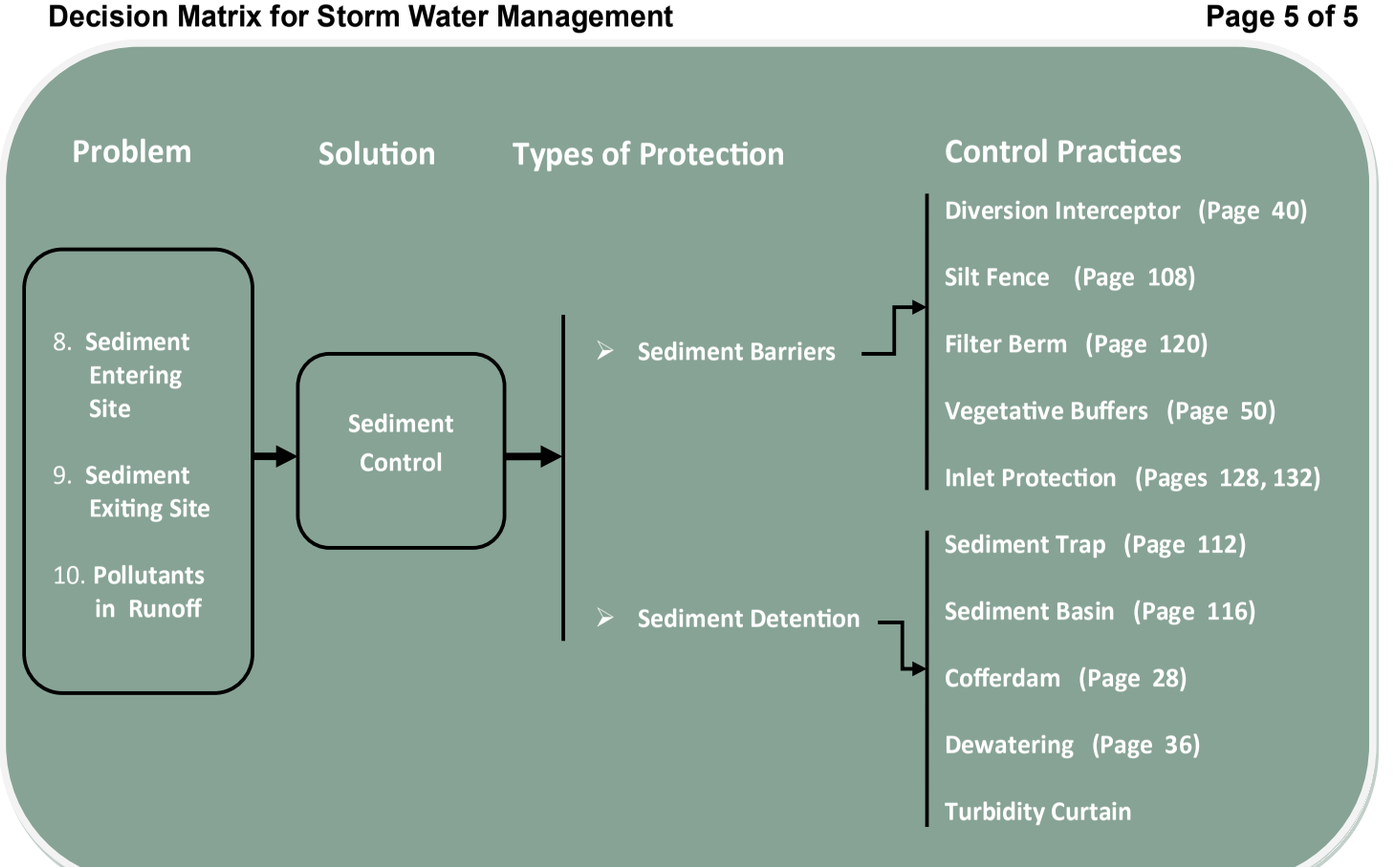


Decision Matrix for Storm Water Management



INDOT Storm Water Management Field Guide

Decision Matrix for Storm Water Management



Definitions

BMP – Best Management Practice. A general term used to refer to a storm water feature utilized effectively for storm water management.

Clean Water Act – Established in 1972 in order to regulate discharges of pollutants into waters of the United States and provide quality standards for the surface waters.

Contour Line – A line connecting a set of points of the same elevation on a plan view.

DSWS – District Storm Water Specialist working for INDOT.

Gravity Dewatering – Removal of water from an area using a change in grade rather than a pump.

Gully – Larger erosion channel formed as rills combine.

IDEM – Indiana Department of Environmental Management.

IDEM 401 Water Quality Certification – IDEM issued water quality permit for any person or company planning to discharge fill materials to Indiana wetlands or other water bodies by filling, excavating, open-trench cutting, or mechanical clearing.

INDOT – Indiana Department of Transportation.

INDOT-ES – Indiana Department of Transportation Environmental Services.

Jurisdictional Waterway – Also known as a “Waters of the U.S.” Generally, these are wetlands, lakes, streams, rivers, etc. that are not to be dredged, filled or otherwise altered without a permit.

Karst – Landscape features such as sinkholes, caves and underground streams formed from continually running water which dissolves limestone-like rock.

MS4 – Municipal Separate Storm Sewer Systems.

NEPA – National Environmental Policy Act. Requires federal agencies to assess environmental effects of their proposed actions prior to making decisions. Signed into law in 1970.

NOI – Notice of Intent (Rule 5). A document submitted to IDEM that includes specific project information and confirms the intent to comply with Rule 5 laws. This document should be posted at the job site.

NOS – Notice of Sufficiency (Rule 5). A letter from IDEM confirming the receipt of all NOI submittal requirements. This letter contains the permit number and expiration date and should be posted at the job site.

NOT – Notice of Termination (Rule 5). A document submitted to IDEM confirming the completion of the project, including achieving 70% permanent vegetative density, and termination of the permit.

Ordinary High Water Mark – A line on the shore indicating the fluctuations of the water level and identified by physical characteristics such as lack of vegetation, shelving, or the presence of debris.

pH – A scale from 0 to14 indicating the acidity or alkalinity of a solution. Low numbers indicate acidic substances, high numbers indicate alkaline substances. An indication of 7 is considered neutral.

Rill – Small erosion channel only a few inches in depth.

Rule 5 – Indiana state law requiring storm water management for construction activities. (327 IAC 15-5) In 2019, Rule 5 will be replaced with “Construction Site Storm Water General Permit”.

SWPPP – Storm Water Pollution Prevention Plan. The Department’s plan for storm water management for the contract.

SWQCP – Storm Water Quality Control Plan. The Contractor’s submitted plan for storm water management for the contract. The SWQCP works in conjunction with the SWPPP site conditions, and all contract documents to develop a fully functional storm water management plan for a contract.

SWQM – Storm Water Quality Manager. The individual identified by the Contractor to oversee the installation, inspection, and maintenance of all storm water management features for a contract.

Types of Water Flow:

- **Sheet** – Overland water moving in a continuous sheet over relatively even ground.
- **Concentrated** – Sheet flow will eventually collect and transition to shallow concentrated flow.
- **Channel** – Concentrated flow in a defined path such as a ditch bottom.

USACE – United States Army Corps of Engineers.

USACE Section 404 – Permit required for any discharge of dredged or fill material into Waters of the United States. Part of the Clean Water Act.

Velocity – The distance an object moves over a period of time.

Waters of the United States – Defined in the code of federal regulations 40 CFR 230.3

Watershed – A region or area drained by a common body of water such as a stream or river.

Weir – The lowest point on a structure where water is designed to flow across.

Wetlands – An area that has been saturated with water which contains soil and plant material specific to that environment.

Links

IDEM Emergency Response # 1-888-233-7745
http://www.in.gov/idem/files/er_quickref.pdf

Indiana Storm Water Quality Manual
http://www.in.gov/idem/stormwater/2363.htm

IDEM Construction/Land Disturbance Permitting
http://www.in.gov/idem/stormwater/2331.htm

Weed and Invasive Plant Identification
https://www.entm.purdue.edu/IISC/invasiveplants.php *and*
http://www.inpaws.org

INDOT Links

Project Specific Documents
http://www.in.gov/dot/div/contracts/letting/index.html

INDOT Recurring Special Provisions
http://www.in.gov/dot/div/contracts/standards/rsp/index.html

INDOT Request for Approval of Borrow or Disposal Site (IC 203 R4 10/16)
http://www.in.gov/dot/div/contracts/standards/forms/IC-203%20170101.pdf

INDOT Standard Drawings
http://www.in.gov/dot/div/contracts/standards/drawings/index.html

INDOT Standard Specifications
http://www.in.gov/dot/div/contracts/standards/book/index.html

General Instructions to Field Employees (GIFE)
http://www.in.gov/dot/div/contracts/standards/GIFE/GIFEindex.html

INDOT Environmental Services Ecology and Waterway Permitting
http://www.in.gov/indot/2522.htm

INDOT Environmental Services Storm Water Link
http://www.in.gov/indot/2892.htm

INDOT Construction Memorandums
http://www.in.gov/dot/div/contracts/conmemo/con_memo.htm

INDOT Design Memorandums
http://www.in.gov/dot/div/contracts/standards/memos/memos.html

www.in.gov/indot