806.8 Storm Water Pollution Prevention Plan (SWPPP)

Forms and Figures

Fig. 806.8.1 MoDOT/Contractor Responsibility

Form 806.8.2, Project-Specific SWPPP Information

Example of completed Form 806.8.2

Fig. 806.8.3, Examples of Erosion/Sediment Control Site Plans

Fig. 806.8.9 Example Erosion/Sediment Control Site Plans

Form 806.8.10 MoDOT Land Disturbance Inspection Record

Fig. 806.8.14 Example MDNR SWPPP Evaluation Form

Fig. 806.8.15 Imhoff Cone and Turbidity Tube Testing Procedures

Optional Pre-activity Meeting Form

Additional Information

Land Disturbance Training 2014, a summarized refresher presentation

806.8.1 Introduction to the Storm Water Permit and Storm Water Pollution Prevention Plan (SWPPP)

Provisions of the federal Clean Water Act and related state rules and regulations require stormwater permits where construction activities disturb one acre or more over the life of a project as part of a common plan or sale. MoDOT has a general State Operating Permit, obtained from the Missouri Department of Natural Resources (DNR), that authorizes stormwater discharges from land disturbance activities associated with highway, bridge and compensatory mitigation construction as well as maintenance activities related to the upkeep of these features. The permit stipulates that MoDOT will develop a project stormwater pollution prevention plan (SWPPP) describing erosion and sediment control guidelines and install temporary and permanent erosion and sediment control measures.

Locally sponsored federal aid projects involving an acre or more of land disturbance will need to obtain their own permits and develop effective SWPPPs. In some instances cities, counties and other government entities may already possess their own State Operating Permit and, in that case, must comply with their own SWPPP.

There are instances where contractors may have to obtain their own permits for work involving borrow and excess (waste) disposal areas, and in some instances when portable plants are used. (See Fig. 806.8.1 MoDOT/Contractor Responsibility for details about the permitting

requirements of these scenarios.) Also, in a few rare cases, MoDOT may require contractors to obtain their own individual State Operating Permit for land disturbance activities even though the project is being constructed on MoDOT right of way. These unique situations will normally be design/build projects that are funded by MoDOT, but totally managed by the contractor.

The purpose of the SWPPP is to ensure the design, implementation, management and maintenance of Best Management Practices (BMPs) in order to reduce the amount of sediment and other pollutants in storm water discharges associated with the land disturbance activities; comply with the Missouri Water Quality Standards, and ensure compliance with the terms and conditions of the general permit.

The following documents were used in the preparation of this SWPPP:

- **Best Management Practices for Erosion and Sediment Control**, (Report No. FHWA-FLP-94-005) published by the United States Department of Transportation (1995)
- **Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices**, (Document number EPA 832-R-92-005) published by the United States Environmental Protection Agency (1992)
- **Protecting Water Quality: A field guide to erosion, sediment and storm water best management practices for development sites in Missouri**
- **Missouri Standard Specifications for Highway Construction**
- **Missouri Department of Transportation Engineering Policy Guide**
- **Menu of BMPs – United States Environmental Protection Agency**.

A typical MoDOT project involves the implementation of many documents, processes, and standard operating procedures. These various processes and procedures are of such detail that it is impossible to include in this brief summary of BMPs. Pollution from storm water can be reduced by the implementation of the BMPs, construction techniques and site management measures in this article. However, pollution from storm water will also be reduced by the issuance of change orders, letters/memos of notification, Order Records, and Contractor Performance Reports. Changes that occur as a result of directives to contractors will usually be documented by Document Records and other various products and reports produced by the computer program, SiteManager or AASHTOWare. Lastly, a Semi-Final Inspection Report can serve to identify post-construction measures that will ensure permit compliance and water quality protection.

In addition to these contract management tools, MoDOT maintains training videos for storm water compliance as well as mandatory recertification requirements once every 4 years. All inspectors who will be engaged in storm water inspections, as well as all resident engineers and contractor's water pollution control managers must be certified through the training video program.

806.8.2 Site Description and Project-Specific Information

Example Project-Specific SWPPP Information Form, outlines project-specific information that is required to be completed for all MoDOT projects involving land disturbance of one acre or more or projects less than one acre that will be considered part of a common plan with offsite support activities, controlled by the contractor, that total one acre or more combined. Also required, and denoted at the bottom of Form 806.8.2, is the development of a project overview map, or maps, depicting the project location/alignment with enough detail to show waters of the United States within 1 mile of the project. These named waters of the U.S. are typically illustrated on U.S.G.S. topographic maps, and some county or city maps, as blue line streams or named impoundments, such as lakes and reservoirs, as well as tributaries to these bodies of water. Along with this information, MoDOT develops project-specific erosion and sediment control plan sheets (site maps) based on first-hand knowledge of site conditions and guidance described within this narrative SWPPP. Development of project-specific erosion and sediment control plans is described in EPG 806.8.3 Developing/Amending Project-Specific Project Plans.

806.8.3 Developing/Amending Project-Specific Project Plans

EPG 237.1 Plan Details describes the information that is to be included in all plans used by contractors to construct MoDOT projects. All projects are constructed from a set of project-specific design plans that are generated by MoDOT designers or consultants. The plans show all existing topographic features, buildings, roadways and drainages, as well as right of way limits. Within a project's design plans are erosion and sediment control plans which serve as the site maps for projects involving one acre or more of land disturbance and some projects less than an acre when considered a common plan with contractor off-site support activities such as borrow and/or excess (waste) sites. These site maps are to be used in combination with this narrative SWPPP to manage erosion and sediment control on MoDOT projects. These plans contain sufficient information to be of practical use to contractors and site construction workers to guide the installation of BMPs in the beginning, interim and final stages of construction. Up-to-date site maps are to be on location at active MoDOT job sites when work is being performed at the site. In lieu of paper copies, site maps can be maintained in digital format and accessed by electronic devices.

Though erosion and sediment control plans are developed by MoDOT designers and/or consultants, it is highly recommended that design and construction personnel work collaboratively to develop a strategy to control erosion, sediment and stormwater for applicable projects. There should generally be two sets of erosion and sediment control plans developed for projects with one acre or more of land disturbance. One set should be developed to depict existing site topography with outfall and perimeter protection BMPs, such as sediment basins, sediment traps, Type C berms, silt fence, etc., that will need to be installed prior to starting land disturbance of the site. The second set will generally show final project grade and BMPs that are envisioned during project construction and upon completion of final grading. The location of designed BMPs will be illustrated on the plan sheets; however, the exact location of BMPs will be determined in the field by the engineer or inspector.

Contract plans shall include erosion and sediment control measures that are sufficient to protect rivers, streams, lakes, ponds, wetlands and private land adjacent to MoDOT right of way.

MoDOT site maps (erosion and sediment control plans) are to include:

- An outline of the permitted site boundary (*all areas within the project termini on MoDOT R/W and all easements shown on the plans*);
- Location of public notification sign(s) (*if road is closed, place 2 or more signs - one at each entry point of the project accessible to the public*);
- Direction of stormwater flows;
- Areas of soil disturbance and areas that will not be disturbed;
- Location of permanent and temporary structural and non-structural BMPS;
- Locations where stabilization practices are expected to occur;
- Locations of borrow or waste sites within the permitted site;
- Location of all waters of the state (including wetlands)
- Locations were stormwater discharges to a water body, including discharge points at the perimeter of the permitted site;
- Locations were stormwater discharge to another regulated MS4;
- Areas where final stabilization has been accomplished and no further construction permit requirements apply.

Due to project phasing, all erosion and sediment control BMPs shown on project plans will not be installed until needed based on site conditions. Therefore, erosion and sediment control sheets will state that "all devices will be installed as necessary based on the discretion of project personnel." Inspectors may create a clean set of plans, with no BMPs depicted, as a working copy for SWPPP purposes and add/remove only installed devices as long as the original erosion and sediment control plan sheets are included in the project specific SWPPP for reference. A legend will be incorporated to depict BMPs used in the site plan. BMPs should be highlighted and dated as they are installed or removed. It is important that site maps reflect BMPs that are actually on the ground at any given time, so plan sheets shall be properly updated each time BMP additions and/or removals take place on the project. Example erosion and sediment control site plans can be found in Fig. 806.8.3, Examples of Erosion/Sediment Control Site Plans.

The engineer shall require modifications to the erosion and sediment controls whenever the:

- Design of the construction project has changed in a fashion that could impact the quality of stormwater discharges;
- MoDOT inspections indicate deficiencies in individual BMPs;
- MDNR/EPA notifies MoDOT of erosion and sediment control deficiencies on site;
- Erosion and sediment controls are determined to be ineffective in significantly minimizing or controlling erosion and sedimentation;
- MDNR determines violations of Water Quality Standards have occurred.

The Project-Specific SWPPP Information Form, general map, and project specific erosion and sediment control plans together comprise what is considered the project specific SWPPP. The project specific SWPPP must be kept up to date and be on site whenever work is being performed. Contractors who are responsible for installation, operation, or maintenance of any BMPs also must have an up-to-date copy of the project specific SWPPP with them while they are on the project site.

806.8.3.1 Shoulder Addition Project Plan Development and Implementation

Shoulder addition projects involving land disturbance of an acre or more can be particularly challenging to design, bid and implement BMPs. Design and construction personnel should collaborate to establish typical, desired BMP layouts for outfall and perimeter protection. These layouts should then be illustrated on a "Typical" erosion and sediment control plan as detailed plan sheets are not usually developed for these projects (There are a few exceptions to this when right of way acquisition or extensive grading is required).

Like other land disturbance projects of an acre or more, shoulder addition projects are required by permit to have a site map depicting the location of all installed BMPs. If a full set of plan sheets is not developed, an acceptable alternative is to develop an aerial photography site map of the project corridor at a scale of 1" = 200', labeling named bodies of water, intersecting routes and county roads, and labeling log miles every 0.5 mile for the project (depicting tick marks every 0.1 mile is recommended for better accuracy). If full survey data was collected for the project, the log mile stationing may be set up precisely based on survey data. Full surveys are not typical for shoulder addition projects, so a "rough" log mile stationing may be set up. The aerial map shall identify approximate BMP locations to enhance communication, illustration and documentation for inspectors and contractors. The aerial sheets will not be included as part of the contract documents but will be provided as electronic deliverables.

In addition to the "typical" erosion control detail in the contract plans, designers shall provide an estimated quantity of BMPs necessary to construct the project. The estimated quantity and location of each type of BMP shall be expressed in a table on the quantity sheet included in the contract plans for contractors.

It is important to be aware that all designed BMP quantities may have to be adjusted depending on the contractor's selected method of shoulder construction. Any expected adjustment in BMP quantities or implementation should be expressed to the prime and subcontractor, if applicable, during the erosion and sediment control discussion at the project preconstruction conference.

806.8.4 Site Inspections and Reports

The resident engineer or inspector is responsible for environmental matters on MoDOT projects. As such, the engineer or inspector shall routinely inspect the installation, condition and functionality of erosion and sediment controls. Inspections will commence once land disturbance operations begin for all projects permitted by and required to comply with MoDOT's state operating permit for land disturbance. For projects not designed to exceed one acre or are part of a common plan, if operations cause the disturbed acres to exceed one acre or more, inspections

will begin once it is known the disturbance will equal one acre or more. If allowable due to right-of-way constraints, receiving streams shall be inspected for off-site sediment deposits for 50 ft. downstream of project outfalls. Inspections are only required to be conducted during the projects normal working hours. Routine inspections are to be conducted at a minimum frequency based on one of the following options:

1. At least once every seven (7) days and within 48 hours after any storm event equal to or greater than a 2-year, 24-hour storm has ceased during a normal work day and within 72 hours if the event ceases during a non-work day such as a weekend or a holiday; or

2. At least once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater or the occurrence of runoff from snowmelt.

   a. Inspections shall be conducted within 24 hours once a storm event has produced 0.25 inches within a 24-hour period, even if the storm event is still continuing; and

   b. If an event occurs over multiple days, each day the event produces 0.25 inches or more of rain, an inspection is required within 24 hours of the first day, within 24 hours of each day 0.25 inches of rain is produced, and within 24 hours after the end of the storm.

A 2-year, 24-hour storm event shall be determined for the project location using the National Oceanic and Atmospheric Administration's National Weather Service Atlas 14 which can be located at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html .

It is acceptable to switch between the two inspection options as long as it is documented in the project specific SWPPP prior to switching. It is not acceptable to mix weekly and post runoff requirements between the two options.

It is critical that post runoff inspections are conducted as required for the inspection frequency selected. When utilizing the 7-day weekly inspection frequency, any event that extends over multiple days without 24-hours of dry time may be considered one event. However, general observations should be made daily, especially with regard to outfall BMPs, to ensure BMPs are performing to the desired level. If rainfall or snow/ice melt does not meet the specific criteria for the inspection duration chosen, inspection reports do not need to be completed until the next required inspection interval.

Projects with areas that have undergone temporary stabilization at the same time active construction continues (example: bridge construction, overlay work, or any non-land disturbance operation) on other areas, may change their inspection frequency to once a month while stabilized. Once areas are re-disturbed, inspection frequencies shall return to either the 7-day or 14-day inspection frequency. All changes to inspection frequencies will be documented in the project specific SWPPP.

MoDOT's Stormwater Database will be used for all inspections. Forms included in this database have been developed as a guide to assist the inspector with permit compliance, while also requiring a general narrative description of current site conditions observed by the inspector at the time of inspection. The inspection reports shall be certified by the inspector and the engineer.

The Stormwater Database will serve as MoDOT's official log of inspections conducted for each project.

The engineer or inspector will ensure that rainfall measurements are made for the job site and routinely monitor weather forecasts to recognize when predicted weather may threaten the construction site and when runoff has occurred. If the weather forecasts indicate storms may impact the project site, project personnel should evaluate whether or not the site has adequate BMP protection and is prepared to receive runoff and sediment.

Once inspections are complete and certified, an automatic email will be transmitted from the Stormwater Database to the engineer. Once the engineer has reviewed the inspection and it is certified, an automatic email notification of the inspection is sent to the contractor's Water Pollution Control Manager. Any controls that are found to be improperly installed, in disrepair, or are not functioning at the desired level of effectiveness will be noted in the inspection as deficiencies. **Any deficiencies noted shall be corrected as soon as possible but no later than 7 calendar days from the inspection date;** however, the engineer and inspectors may require immediate attention and issue various directives by other means discussed in EPG 806.8.1 Introduction to the Stormwater Permit and SWPPP. Directives to the contractor shall be noted in project records, which shall be available for review by DNR upon request. **In instances where weather conditions make it impossible to correct deficiencies within 7 days, the engineer or inspector will document site conditions in the inspection reports. This documentation will include a written description and pictures illustrating the adverse conditions. As soon as weather and site conditions become favorable, corrections to deficient BMPs shall be made.**

MoDOT provides environmental compliance training for construction site inspectors, resident engineers, designers and other personnel, including contractors and consultants, to ensure that erosion and sediment control inspections are being conducted in a consistent fashion statewide. MoDOT's Design/Environmental Section is responsible for developing and updating the environmental compliance training. MoDOT's Construction and Materials Division is responsible for first tier oversight audits of construction projects. The Design/Environmental Section will perform statewide second tier oversight audits to ensure that SWPPPs are being followed and there is compliance with the permit.. In cases where deficiencies are identified, the resident engineer or inspector has the responsibility to see that the deficiencies are corrected.

As part of the project inspection and compliance management process, the project's current authorized and disturbed acreage totals shall be recorded in in the Stormwater Database before each weekly or post runoff inspection is documented. These acreage totals are used to fulfill MoDOT's permit requirement to provide a list of statewide active land disturbance sites, one acre or more, to MDNR on a quarterly basis, every January, April, July and October. Also included within each report is the project name, location, description, primary receiving water(s), number of acres disturbed, percent completion and projected date of completion.

Primary receiving waters are named rivers, streams, lakes, etc. (e.g., Black River, Skull Lick Creek, Flat Branch, Longview Lake). If the project doesn't drain directly to named bodies of water, the inspector should list "Unnamed Tributary". Some urban projects will discharge to city stormwater systems. In this case, if the body of water the storm drain discharges to is unknown,

simply list “Municipal Storm Sewers” and identify the entity if possible (e.g., MSD Municipal Storm Sewers).

(Note: There are scenarios associated with the use of borrow and excess (waste) disposal areas, as well as portable plants, when the contractor may be responsible for site inspections. Please refer to Fig. 806.8.1, MoDOT/Contractor Responsibility, for inspection responsibilities in these scenarios.)'

806.8.5 Drainage Areas and Housekeeping

In compliance with the Missouri Clean Water Law (Section 644.051), neither MoDOT nor MoDOT's contractors shall pollute any waters of the state, or place, cause, or permit to be placed any water contaminant in a location where it is reasonably certain to cause pollution of any waters of the state. To comply with this law, proper preventive measures and good housekeeping shall be maintained on job sites. Job site litter, construction debris and sanitary waste should be controlled. All litter shall be placed in appropriate containment receptacles. The use of portable toilets may be necessary to control sanitary waste in some situations. If used, these facilities shall be adequately placed and maintained so as not to cause a safety or environmental concern. If hazardous waste is generated or encountered on a job site, the MoDOT Environmental Section, (573) 526-4778, should be informed immediately to assure proper handling and compliance with environmental regulations. Also, neither MoDOT nor MoDOT's contractors shall discharge water contaminants into any waters of the state, which reduce the quality of these waters below the state's water quality standards. These water quality standards include the following (MO 10 CSR 20-7):

(a) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.

(b) Waters shall be free from oil, scum and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses.

(c) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.

(d) Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life.

(e) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.

(f) Waters shall be free from used tires, car bodies, appliances, demolition debris, used vehicles or equipment and solid waste as defined in Missouri’s Solid Waste Law, Section 260.200, RSMo, except as the use of such materials is specifically permitted pursuant to Section 260.200–260.247.

MoDOT personnel or contractors hired by MoDOT shall comply with these and any other federal, state, and local laws and regulations controlling pollution of the environment. To ensure that these general criteria are met, the following guidelines will be observed:

1) Machinery shall be kept out of the waterway as much as possible.

2) Fuel, lubricants, debris and other water contaminants shall not be stored in areas that are subject to contact with water (such as adjacent to stream banks) or where contaminated runoff from the storage areas can enter waters.

3) Refueling and maintenance (e.g., oil changing) of machinery shall not take place in, or directly alongside, any water body.

4) Clearing of vegetation/trees shall be kept to the minimum required to accomplish the activity.

5) Riparian areas and banks shall be restored to a stable condition through recontouring and revegetation of the area, as necessary, as soon as possible (normally within three working days of final contouring).

6) Work shall be conducted during low flow whenever possible.

7) Wetland areas shall be avoided to the extent practical.

8) Work shall conform to all conditions that are part of the USACOE Section 404 permit and the ancillary MDNR Section 401 Water Quality Certification.

EPG 127.19 Section 404 Clean Water Act for Bridge Demolitions provides a detailed explanation of the process that is followed whenever a stream or drainage channel may fall into USACOE jurisdiction.

806.8.6 Erosion and Sediment Control (MO Specifications Division 800)

Water pollution control measures shall be required of all contractors MoDOT hires. The contractor shall exercise best management practices throughout the project to control erosion and water pollution. Construction of permanent drainage facilities and other activities, which may contribute to the control of siltation, shall be accomplished at the earliest practicable time. This work shall also consist of furnishing, installing, maintaining, and removing temporary control measures as shown on the plans (see Standard Plan 806.10) or as directed by the engineer. The control of water pollution will be accomplished through the use of berms, slope drains, ditch checks, sediment basins, seeding and mulching, silt fences and other erosion and sediment control devices or methods. Pollutants such as chemicals, fuels, lubricants, bitumens, raw sewage or other harmful materials shall not be discharged from the project. No work shall be started until the erosion and sediment control timetable and methods of operation have been approved and an on-site pre-activity meeting is conducted with the contractor and the engineer or their representative.

Temporary erosion control measures shall be coordinated with permanent erosion control measures to assure economical, effective and continuous erosion and sediment control. Temporary erosion controls must be kept in place until final stabilization has been achieved.

Materials required for erosion and sediment control measures shall meet the standards of the *Missouri Standard Specifications for Highway Construction*.

806.8.6.1 Construction Requirements

The goal for MoDOT land disturbance operations is to deliver the planned final product (e.g., roadway, bridge, etc.) while ensuring effective erosion, sediment and stormwater management throughout the design, construction and maintenance process to minimize the discharge of pollutants.

Permanent erosion control measures (e.g., permanent vegetation) shall be implemented into the project at the earliest practicable time in order to control erosion, reduce sediment control maintenance and improve the overall appearance of the project. Temporary erosion and sediment control measures shall be used to correct conditions that develop during construction which were not foreseen during the design stage. Temporary controls shall also be used when needed prior to installation of permanent erosion control measures or to control erosion that develops during normal construction practices.

When practical, clearing and grubbing operations shall be scheduled and performed so that border, perimeter, or outfall BMPs to control runoff from disturbed areas will be installed or marked for preservation before general site clearing. A limited amount of clearing (enough to gain access to the area) may be permissible to enable the installation of outfall and perimeter controls. Stormwater discharges from disturbed areas, which leave the site, shall pass through an appropriate sediment impoundment such as a sediment basin, sediment trap, or silt fence prior to leaving the site. The surface area of erodible earth material exposed at one time by clearing and grubbing, by excavating, by fill, or by borrow, shall be minimized to limit vulnerability of erosion and potential sediment loss from the project. The engineer may limit the total acreage of erodible earth material to be exposed at one time as determined by an analysis of project conditions. In such cases the engineer will identify specific BMPs and controls that have been or will be installed in order to exceed the specified maximum disturbed acreage threshold.

The engineer will limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress commensurate with the contractor's ability to keep the finish grading, mulching, seeding, and other erosion control measures current. Should seasonal limitations make such coordination unrealistic, temporary erosion and sediment control measures shall be implemented by the contractor as directed by the engineer.

Construction operations in rivers, streams, wetlands, and impoundments are restricted to those areas which must be entered for the construction of temporary or permanent structures. Rivers, streams, wetlands, and impoundments shall be promptly cleared of all falsework, piling, debris or other obstructions placed therein or caused by the construction operations unless otherwise approved by the engineer.

Frequent fording of live streams or wetlands with construction equipment is not permitted. Temporary bridges or other structures shall be used wherever stream crossings are necessary. All temporary fills and structures placed in streams, wetlands, or impoundments will be removed and

the site returned to natural or intended contours prior to completion of construction. Unless otherwise approved, mechanized equipment shall not be operated in live streams except as may be required to construct channel changes and temporary or permanent structures. If a Section 404 permit is applicable for a project, its requirements and/or conditions shall be followed.

Site-specific BMPs above and beyond those identified within the contract plans or MoDOT standard specifications shall be discussed with the contractor at a preconstruction conference, if known, or as necessary to control erosion and minimize sediment loss throughout the life of the project. The use of alternate BMPs or methods may be acceptable, but approval of alternate practices will need to be approved by the engineer. Also, special conditions may be developed which can include limitations on the amount of surface area that can remain unprotected at one time or could include special water quality or stream protections requirements.

The location of all local material pits (other than commercially operated sources) and all excess material areas shall be subject to the approval of the engineer (material in this case refers to soil and rock). Construction operations shall be conducted and pollution control measures implemented so that erosion will not result in water pollution.

Portable concrete and asphalt plants located on MoDOT right of way can be covered under the MoDOT State Operating Permit. Any discharges from these operations must be managed by appropriate BMPs. The plant and BMPs must be depicted on the project site map within the permitted site and appropriately accounted for in the project SWPPP. Operators of portable plants that are located off of MoDOT right of way will be responsible for obtaining all appropriate permits directly from the DNR. The contractor is responsible for all costs associated with erosion and sediment control to protect plant locations, regardless if the plant is located on or off of MoDOT right of way or easements.

Borrow and excess (waste) disposal sites located on MoDOT right of way or owned by MoDOT can be covered by the MoDOT permit and SWPPP. For borrow and excess disposal activities not located on MoDOT right of way, the borrow or excess disposal operator will be responsible for obtaining all appropriate permits. (See Fig. 806.8.1 MoDOT/Contractor Responsibility for details about the permitting requirements.)

In the event of a conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations may apply.

806.8.6.2 Non-Structural Control Measures

Protection of existing vegetation is an important and sometimes overlooked component of erosion and sediment control. Preserving natural vegetation in certain areas during construction serves to slow the flow of water, protect against erosion and reduce sediment transport from sheet flow. Vegetated filter strips (i.e., buffers) located along the shoulder, within the median, in MoDOT ditches, or adjacent to a body of water or wetland, serve as excellent sediment capture devices. They can be particularly effective in areas where the density of grass and other herbaceous vegetation can filter the water. In most cases, vegetative buffers are used in concert

with other BMPs; however, there may be situations where vegetative filter strips can suffice as independent features. Depending on site characteristics, these areas of undisturbed right-of-way can potentially provide the same benefit to water quality as would many types of structural controls, such as silt fences, ditch checks, and sediment traps or basins. If natural or created vegetated filter strips are used, they must be located within MoDOT right of way or easement and inspected and maintained like other BMPs. Vegetation on an adjacent property cannot be used as a MoDOT BMP. During project design, site conditions and stormwater runoff analysis will determine the selection of appropriate BMPs, which may include non-structural BMPs and vegetated buffers. If during inspections, BMPs, including vegetated buffers, are determined to be ineffective or insufficient at controlling erosion or sediment transport, additional BMPs will need to be installed to effectively manage the stormwater runoff.

Preserving natural vegetative filter strips is especially important when working in proximity to surface waters, which may include, but are not limited to, rivers, streams, lakes, ponds and wetlands. When working along or adjacent to these features, MoDOT is required by its statewide land disturbance permit with MDNR to retain a minimum of a 25-foot buffer of undisturbed natural vegetation between land disturbance operations and the body of water, unless site conditions and/or limitations make the use of such a buffer infeasible. To comply with this permit requirement, when working adjacent to these waters, MoDOT should determine on a case by case basis whether preserving an existing buffer is feasible, or whether contractor or maintenance operations will require complete use of the area to facilitate work activities. Preserving natural vegetative buffers must be considered for all MoDOT projects working in proximity to surface waters; however, factors like limited right-of-way, contractor/maintenance access, and the nature of work activity (e.g., bridge and culvert installation, maintenance and repairs) are often going to make MoDOT’s use of this BMP infeasible. In these cases, contractor/maintenance activities would make use of most or all areas of right-of-way or easement, which could include work up to the edge of, or even within waters of the state. If a vegetative buffer can be preserved, it must be incorporated as a non-structural BMP and denoted on plan sheets to remain undisturbed. If use of a buffer is determined to be infeasible or not effective at managing stormwater runoff, as previously mentioned, MoDOT will install other appropriate alternative BMPs to minimize the discharge of pollutants. The choice of an alternative BMP, or combination of BMPs, will depend on site variables, but could include the use of Type C Berms, sediment basins, sediment traps, ditch checks, perimeter silt fence (including mulch berms) and the effective use of temporary or permanent seed and mulch or erosion control blankets, all described within this SWPPP, to limit erosion and any subsequent sediment transport. All BMPs, including any vegetated filter strip(s), will need to be identified, inspected and managed within the project SWPPP.

Like other BMPs, vegetated buffers should be inspected for effectiveness and maintained accordingly. Sediment deposits within vegetated buffers may be left in place or removed post construction depending on MoDOT's future plans for the area and consideration of whether there is a potential to affect water quality in adjacent surface waters. Inspectors should also consider whether it would be more destructive to the buffer to retrieve sediment deposits than to leave them. If leaving sediment deposits within vegetated buffers, it may sometimes be necessary to seed and mulch over the area, depending on the amount of sediment deposited.

Other Non-Structural BMPs such as seeding, mulching, stabilized construction entrances, flocculants and other chemical additives are discussed elsewhere in this document.

806.8.6.3 Erosion Control Measures

The emphasis on MoDOT projects should be on erosion control, focusing on covering up exposed soil, preferably with permanent vegetation, rock, pavement, etc., as soon as practical in order to protect the soil surface and keep soil particles from dislodging and entering stormwater. Focusing on controlling stormwater velocity and volume is a critical element of erosion control. Best management practices (BMPs) shall be used to control stormwater volume and velocity, control stormwater discharges at outfalls, and minimize sediment loss from MoDOT right of way onto adjacent land or into streams, lakes, ponds, wetlands, drainage channels, etc.

The following described practices are commonly used erosion control BMPs that may be used individually or in combination with other practices, such as the sediment control devices discussed in EPG 806.8.6.4 Sediment Control Measures, to assure effective erosion control and minimize off site delivery of pollutants. Other practices that are not listed here or have not been identified or invented at the time of the preparation of this SWPPP, may be used if their performance is equivalent or better than the practices listed below.

806.8.6.3.1 Soil Surface Roughening

Surface roughening is a temporary erosion control BMP that will reduce runoff velocity and erosion potential by increasing infiltration and sediment trapping. This practice is intended for areas which have been cleared and grubbed and are awaiting application of temporary or permanent seed, or installation of other structural controls such as ditch checks, sediment traps, or sediment basins. The practice is NOT intended to serve as a stand-alone best management practice and is only to be used as a short-term, sequential practice as the grading and seeding proceeds.

Where backslopes are unlikely to be mowed or maintained due to steepness and lack of access, surface roughening can be a permanent measure. In these situations, seed and mulch may be applied directly to the roughened seed bed. This will aid in the establishment of vegetative cover and will minimize destructive compaction by heavy equipment. There are three common methods of surface roughening (tracking, grooving, stair stepping) that can be employed depending on the soil type, slope and potential maintenance concerns for the project.

> **A. Tracking** involves the use of tracked construction equipment (dozer, high lift, etc.) vertically tracking up and down slopes in order to create horizontal depressions, perpendicular to the runoff path, on the soil surface. These depressions reduce stormwater velocity and the potential for concentrated runoff, which typically leads to rill formation. Tracking can lead to significant soil compaction, which does help lock soil particles in place; however, it is also undesirable for root production and grass growth. Due to this fact, care should be taken in deciding which slopes to track. Tracking is typically recommended for sandy soils, where risk of excessive compaction is reduced.

B. Grooving involves the creation of a series of ridges and depressions that run along the contour of a slope. The grooves can be created using a variety of implements such as a disks, harrows, chisel plows, loader teeth, etc. The grooves should be no more than 3 inches deep and no more than 15 in. apart.

C. Stair-stepping involves creating stair steps to reduce runoff velocity and encourage sedimentation on steeper slopes that will not be mowed. The stairs should be cut such that the vertical step does not exceed 1 foot. The horizontal step should be longer than the vertical step and sloped inward toward the vertical step face to promote sedimentation.

806.8.6.3.2 Mulching and Crimping

Application of mulch without seed may be used as a temporary best management practice if approved by the engineer. This temporary stabilization practice is most applicable in late fall or early winter when grass seed would have little or no opportunity to germinate. Straw mulch should be applied with a mulch blower, or by hand, and must be anchored (crimped or otherwise tackified) immediately after spreading to prevent windblow. Application rates will vary based on the percent slope. Bark mulch and/or wood chips do not require crimping. The engineer will determine whether or not the wood chip mulch may remain in place, be cultivated or be modified for permanent seeding.

806.8.6.3.3 Temporary Berms - Erosion Control

A temporary berm is a temporary ridge of compacted soil, with or without a shallow ditch, constructed at the top of slopes or transverse to centerline on fills. The purpose of these ridges is to divert storm runoff from small areas away from steep slopes and direct this water to temporary, stabilized outlets where the water can be discharged with minimum slope erosion. These ridges are used temporarily at the top of newly constructed slopes to prevent excessive erosion of the slopes until permanent controls are installed and/or the slopes are stabilized. They are also used transverse to grade to divert runoff to stabilized slope drains. Weekly (and post-runoff) inspections will be necessary to identify breeches in all temporary berms used as BMPs.

Type B Berms are constructed on the top of slopes and are intended to direct runoff water away from project slopes and toward stabilized drop down structures/pipes or stormwater detention areas, sediment capture devices, etc. These temporary diversion structures are specified when embankment operations are shut down over extended periods of time. Operation and maintenance concerns are limited to ensuring that the majority of runoff water is directed into the inlet of the slope drain. Removal of Type B Berms will normally occur when base rock is installed, prior to paving, but may be used longer if necessary.

806.8.6.3.4 Temporary Pipe Slope Drains

A temporary pipe slope drain (see Standard Plan 806.10) is used to carry water down slopes to reduce erosion and may consist of half-round pipe, metal pipe, plastic pipe, or flexible rubber pipe. These structures are installed after the slope has reached its intended elevation and final grade.

The inlet end will be properly constructed to channel water into the temporary drain. The outlet ends will usually have some means of dissipating the energy of the water to reduce erosion downstream and will have a sediment control BMP or a system of sediment control BMPs to capture sediment carried within the stormwater. Where scour at the outlet is of lesser concern due to the physical characteristics of the ditch, there shall still be sediment capture devices in the ditch or drainage outlet downgrade from the slope drain outlet. Unless otherwise specified, all temporary slope drains will be removed when no longer necessary due to the slopes being stabilized or the routing of runoff down permanent letdown structures. Upon removal of temporary slope drains, the site will be restored to match the surroundings.

806.8.6.3.5 Interception Ditches and Letdown Structures (Including Roadside & Median Ditches)

Interception ditches and letdown structures are typically permanent erosion control BMPs that capture stormwater run-on or runoff and transport it down slopes through stabilized channels. These constructed channels are meant to reduce the likelihood of gully formation and allow for the establishment of permanent vegetative cover on the face of the slope. Interception ditches and letdown structures are typically constructed in a “V”, “U”, or trapezoidal shape to concentrate water flow down the center of the structure in order to minimize the risk of break over points and flanking. They are typically lined with stone (riprap), erosion control blankets, turf reinforcement mats, or other product which is self-adjusting and capable of withstanding concentrated, erosive flows. In some instances, these ditches and letdowns may be constructed as concrete or asphalt gutters; however, these types of rigid channel liners do not allow for water infiltration and often do not have built-in energy dissipation, which can exacerbate erosion at their outlets. In addition, due to their rigid nature, concrete and asphalt-lined drainage courses often undermine and experience section loss, which leads to system failure. There are alternative BMP technologies available (e.g. ShoreMax™, ScourStop™, Flexamat™, etc.) that give a degree of rigidity, if desired, to help armor the channel, or a portion of the channel more susceptible to erosion, while still allowing permeability for vegetative growth and water infiltration, as well as self-adjustment to prevent system failure.

Refer to EPG 806.8.6.2 Non-Structural Control Measures for the benefits of existing or reestablished vegetation within ditches, swales and other areas of right of way.

806.8.6.3.6 Temporary Pipes and Temporary Construction Crossings

A temporary pipe is a conduit used temporarily to carry water under a haul road, silt fence, etc. As additional erosion protection, temporary pipes can also be used to collect site run-on and covey it across disturbed areas on the job. Care should be taken to ensure the outlet of the temporary pipe is stabilized and adequate energy dissipation is available so as to not cause erosion of the receiving area.

Temporary pipes can also be used to convey normal and expected high flows at temporary stream crossings, preventing the contractor's equipment from coming into direct contact with the water when crossing active streams as discussed in EPG 806.8.6.1 Construction Requirements. Any temporary structures used to facilitate construction (e.g. temporary crossings, temporary

work pads) will be constructed of clean rock fill that is of sufficient size to be non-erodible under normal stream flow and also easily recoverable upon project completion. Temporary stream crossings will be sufficiently piped to allow for continuous and relatively unimpounded stream flow. The pipes will be placed to match the existing stream grade, which will allow for unimpeded aquatic life passage through the project area. Upon project completion, any temporary structure(s), including pipes and other materials, shall be completely removed and the area will be restored and stabilized.

806.8.6.3.7 Energy Dissipaters

An energy dissipater is a physical structure that is intended to reduce the erosive energy that is typically encountered down grade from a pipe or culvert. As such, these BMPs are normally permanent. Erosive energy from intense flows may also be encountered in median ditches or road ditches. Energy dissipation may be accomplished by the installation of large boulders, wood pilings, engineered concrete structures or other means approved by the engineer, following construction of the ultimate drainage channel or device. Unlike ditch checks and sediment traps, energy dissipaters are NOT intended to impound water and sediment. Energy dissipaters must be constructed in a fashion such that the water that flows through, over or around the structure is equally distributed in the discharge channel and does not exacerbate or cause a resultant erosion problem.

806.8.6.3.8 Seeding and Mulching

806.8.6.3.8.1 Temporary Seeding and Mulching (MO Specifications Sec 802 and Sec 805)

Temporary seeding and mulching will be used to produce a quick ground cover of annual grasses to reduce erosion in disturbed areas that are expected to be either re-disturbed or permanently seeded at a later date. It should be used as necessary to prevent erosion and decrease reliance on costly maintenance of sediment control BMPs. For project planning purposes, it is important to understand that temporary vegetative cover will begin to lose its effectiveness within 6 to 12 months depending on site conditions.

Disturbed areas shall be seeded and mulched when and where necessary to eliminate erosion. In designated areas seeding and/or mulching shall begin no later than 7 days after earthwork operations have ceased and shall be completed within 14 days (7 days on slopes steeper than 3:1 or greater than 3% and longer than 150 Ft. in length), weather permitting. Most disturbed areas, with the exception of the road grade itself, shall be temporary stabilized during the fall to prevent erosion. If final grade has been achieved, this operation should consist of establishing permanent vegetation, not temporary.

806.8.6.3.8.2 Permanent Seeding and Mulching (MO Specifications Sec 805)

Permanent seeding and mulching following the temporary seeding will be performed. It is important to remember that temporary seeding and mulching can be used to cover up bare soil during times that are not conducive to applying permanent seeding. Then, when conditions are more suitable for permanent seeding, it can be applied over/through the temporary seeding

stubble. In some cases, it may be necessary to mow the temporary seeding stubble and then apply permanent seeding.

Any revisions or deviations from contract seed mixtures and applications must be approved by the Roadside Section of MoDOT's Maintenance Division.

806.8.6.3.9 Fiber Reinforced Matrix (FRM)

Fiber Reinforced Matrix (FRM) is a hydraulically applied (spray-on) erosion control product that bonds to, and blankets bare soil. It is typically applied with a truck or trailer mounted sprayer or by walking the affected areas with a hose sprayer. According to manufacturers, FRMs lock in moisture and nutrients to promote seed germination. Since these products are applied through spray-on application, they can conform to the contours of a slope and therefore can be applied to rough seedbeds. These products can be applied to most soil types on a wide range of slope configurations and can be used in place of any of the erosion control blankets (ECBs) discussed in EPG 806.8.6.3.10 Erosion Control Blankets and Turf Reinforcement Mats, below. However, considerations must be given to soil type, slope and weight of the material when considering using an FRM. These products are only to be used as slope protection, and are not designed to withstand concentrated flows within ditches, drainages or streams.

806.8.6.3.10 Erosion Control Blankets and Turf Reinforcement Mats

Erosion control blankets (ECBs) and turf reinforcement mats (TRMs) are designed to protect and reinforce vegetation from erosive forces until it can become established, or in the case of TRMs, in perpetuity. ECBs and TRMs are typically manufactured with straw, wood fiber (excelsior), jute, coconut coir fiber and synthetic materials or combinations of these materials.

ECBs are typically used to prevent sheet, rill, or gully erosion on slopes and some lower flow channels. TRMs may be used on steep slopes or slope areas with concentrated flow but are typically used in channels. Since ECBs have a limited life expectancy (longevity) they are considered to be "temporary" erosion control measures; however, most TRMs are composed of interwoven layers of geosynthetic materials such as polypropylene, nylon and PVC netting, which protects from both bio and photodegradation and allows for permanent vegetative reinforcement. At culvert outlets, overflow structures or transition areas, it may be necessary to use a transition mat (e.g., ScourStop™, ShoreMax™, etc.) directly over the TRM in order to add additional scour protection in these highly erosive areas.

806.8.6.4 Sediment Control Measures

As previously stated, the emphasis on MoDOT projects should be erosion control, focusing on covering up exposed soil, preferably with permanent vegetation, rock, pavement, etc., as soon as practicable in order to protect the soil surface and keep soil particles from dislodging and entering stormwater. While erosion control should be the primary focus, it is important to back up erosion control efforts with appropriate and effective sediment control. Sediment control is most effective when incorporating a system of structural BMPs (treatment train) and focusing efforts on combatting sediment as close to its source as possible.

Understanding soil types is important when designing and implementing sediment control BMPs. Sand and silt consist of larger particle sizes that will fall out of suspension in stormwater more readily than clays. Clay particles are very fine and tend to stay in suspension for significant periods of time. Traditional sediment control BMPs, such as silt fence and ditch checks, are most effective at removing sand and silt from suspension. Larger impounding BMPs, such as sediment basins and sediment traps, are also effective at removing sand and silt, but can be effective at removing clay, due to prolonged impoundment. Even these impoundments may not successfully remove clay particles from suspension. In these situations, it may be necessary to include flocculants within a BMP system to remove excessive clay from stormwater prior to discharge from the project site. Flocculants are discussed in more detail in EPG 806.8.13 Turbidity Reduction and Advanced Treatment Systems.

The following sediment control measures should be used in combination with erosion control practices to control sediment movement and prevent or minimize the discharge of pollutants from MoDOT projects.

806.8.6.4.1 Sediment Basin

A sediment basin is a large sediment capturing device that can be constructed through excavation, or by constructing a dam across a low drainage swale to trap and store water and sediment that may not be caught by upgrade erosion and sediment control measures. Sediment basins can be temporary or permanent. Both permanent and temporary basins should be constructed with defined side slopes and rock riprap placed in inlet and outlet areas. (Refer to Standard Plan 806.10.)

The location of sediment basins will be shown on the plans. Sediment basins should be designed to a sufficient size to contain a volume of at least a local 2-year, 24-hour storm. Where the use of a sediment basin of sufficient size as described above is impractical similarly effective BMPs or BMP systems will be incorporated, such as sediment traps, ditch checks, type C berms, etc., and the use of appropriate erosion control items to cover up exposed soil. An explanation for selecting these similarly effective BMPs instead of a basin will be documented in the project SWPPP.

Maintenance (sediment removal) will be conducted before the basin is 50 percent full. Accumulated sediment removed from sediment basins shall be disposed of in locations where it will not erode into construction areas or waters of the state.

806.8.6.4.2 Sediment Trap

A sediment trap is a temporary sediment collection structure that is used for sediment control purposes. If properly maintained, the life expectancy of these structures can be approximately 2 years. (See Standard Plan 806.10.)

The location of sediment traps will be shown on the site plans. Accumulated sediment shall be removed from the trap when sediment has accumulated to 1/2 the height of the structure, or if an excavated pit, 1/2 of the original depth. Accumulated sediment removed from the sediment traps

shall be disposed of in locations where sediment will not erode into construction areas or waters of the state. Discharges from the sediment trap shall not cause scouring of the receiving area or banks or bottom of the receiving stream.

806.8.6.4.3 Ditch Checks

Ditch checks are also considered as erosion control measures.

MoDOT has two categories of ditch checks: rock and alternate ditch checks. Ditch checks should be installed as soon as practical to minimize erosion and control sedimentation. Initial placement of ditch checks, prior to final ditch grade, should focus on stormwater runoff control and drainage structure protection. Once ditch grading operations have achieved final grade, controls shall be installed as directed by the engineer.

Rock Ditch Checks are the predominant ditch check to be used on MoDOT projects. Rock ditch checks can be specified in most drainage areas where ditch slopes are 10 percent or less, and where expected ditch flow volumes and velocities are high. For scenarios that exceed the criteria established above, a combination of rock ditch checks and erosion control blankets (ECBs) or turf reinforcement mats (TRMs) should be used. *(Note: ECBs or TRMs may be designed into and used in any ditch or drainage regardless of the criteria outlined in this article.)*

Rock ditch checks will typically be constructed of rock with a predominant size between 4 in. and 12 in., but this size may be adjusted to incorporate larger sizes if site conditions warrant. They will have a minimum effective height of 18 in. as measured in the field (see Standard Plan 806.10). In areas of clay soils, where additional filtration may be needed, the upgrade face of the check can be capped with smaller stone, filter fabric or another approved filtering media. In some cases, it may also be necessary to place a section of ECB or geotextile beneath the rock ditch check and extending downgrade of the structure to prevent the rock from settling into the soil beneath and/or protect from downstream scour within the ditch line.

Alternate Ditch Checks should be considered as an alternate to rock ditch checks in areas where there are safety concerns for the traveling public or other constraints where there would be concern with installing rock. These devices can typically be used in smaller drainage areas (generally 3 acres or less), with ditch slopes of 4 percent or less, and where expected ditch flow volumes and velocities are small (see Standard Plan 806.10). These thresholds may be exceeded at the approval of the engineer.

Alternate ditch checks should have an effective height of at least 9 in. as measured in the field and should be installed in accordance with the manufacturer's recommendations or as outlined in this SWPPP.

Alternate Ditch Checks can include the following or other engineer approved devices:

- Triangular Silt Dike®
- EnviroBerm® Porous Sediment Control System (In combo with ECB or TRM)

GeoRidge/GeoRidge Biodegradable (Nilex) (In combo with ECB or TRM)

Compost Filter Berms (1'(H) x 2'(W)) (Covered with biodegradable ECB/TRM)

Sand Bags

Fiber Rolls, Sediment Logs, Compost Filter Socks – staked and > 9" effective height and must be used in combination with ECBs or TRMs as a channel liner beneath, unless used in a ditch with sufficient existing vegetative cover to prevent erosion.

(Important: Straw wattles, straw bales and geotextile silt fence are not acceptable as a ditch check BMP.)

Each type of ditch check (particularly the tubular/cylindrical/triangular products) will have specific directions for installation. In all cases care shall be exercised to install the device according to manufacturer specifications. Effectiveness may be compromised if not installed correctly.

Ditch checks shall be placed and constructed according to Standard Plan 806.10 which shows the spacing for ditch checks. The estimate of the required number of ditch checks is based on an effective height of 9 in. or 18 inches. In some cases, local conditions may dictate some deviation from the dimensions and shape that are shown in the Standard Plans; however, deviations from Standard Plans must still ensure that sediment capture and erosion control is occurring.

Ditch checks shall remain in place until the engineer directs that they be removed once adequate stabilization (vegetative cover, rock, concrete, etc.) upgrade of the structures has been achieved in accordance with the permit. Upon removal, the contractor shall remove and dispose of any excess silt accumulations, grade and dress the area to the satisfaction of the engineer, and establish stabilization on all bare areas.

Maintenance (sediment removal) will be conducted on a ditch check before the check is 50 percent full.

806.8.6.4.4 Silt Fence (MO Specifications Sec 624 and 1011)

Use of a silt fence consists of furnishing, installing, maintaining, and removing a geotextile barrier fence designed to remove suspended particles from water passing through the fence. Silt fence is a temporary sediment control measure to control sheet flow along the edge of the right of way where runoff attempts to leave the project onto an adjacent property or into an adjacent body of water or wetland. Silt fence must never be used in concentrated flow to cross a ditch, stream or drainage channel, and in no case installed downgrade from a pipe or culvert.

As a general rule, geotextile silt fence, especially non-wire reinforced geotextile silt fence, should not be used as inlet protection, particularly around culvert and drop inlets where high volume, concentrated flows are expected, except in the instance described in EPG 806.8.6.4.6 Inlet Controls.

Post spacing shall not exceed 5 ft. for geotextile silt fence installations. Posts shall be driven a minimum of 24 in. into the ground. Where rock is encountered, posts shall be installed in a

manner approved by the engineer, or an alternative BMP may be selected. Closer spacing, greater embedment depth and/or wider posts shall be used as necessary in low areas and soft or swampy ground to ensure adequate resistance to applied loads. In low swales, where concentrated flows may form, consider using a ditch check or sediment trap in lieu of silt fence. If heavy sediment or runoff loading is expected against the silt fence, the use of metal "T" posts should be considered in lieu of wooden post stakes.

When silt fence is used as a perimeter sediment control device it will generally be installed at the time of clearing and grubbing, and must be maintained for as long as necessary to contain sediment from runoff.

Sediment deposits shall be removed and disposed of when the deposit approaches 1/2 the height of the fence or sooner. If required by heavy sediment loading, a second silt fence shall be installed as directed by the engineer.

The silt fence shall remain in place until areas that drain to the fencing are stabilized in accordance with the permit and the engineer directs that it be removed. Upon removal, the contractor shall remove and dispose of any excess silt accumulations, grade and dress the area to the satisfaction of the engineer, and establish vegetation on all bare areas. Biodegradable silt fence (such as some of the example products listed below) need not be removed unless directed by the engineer.

At the discretion of the engineer the following product examples or other approved BMPs, such as mulch berms, may be substituted for perimeter geotextile silt fence. These devices should be installed in accordance with manufacturer recommendations. In the case of the wattles, socks and log devices, if practical and possible, a cradle trench should be created to lay the product in to ensure proper contact with the ground surface. This may not be appropriate if installing these devices in areas with existing grass cover, such as yards, or in areas with shallow utilities or bedrock beneath. Even so, care should be taken to ensure flush contact with the ground surface. Thought should also be put into product choice based on expected longevity, as some devices listed below will decompose or break down more quickly than others, and may require replacement or multiple replacements during the life of a job. In general, perimeter silt fence installations should have a minimum 9" in effective height, as measured in the field, unless site conditions warrant a higher or lower effective height.

Example Products:

Sediment STOP

Terra-Tubes

Sediment Logs, Wattles

Compost Filter Socks/Berms

Triangular Silt Dike

806.8.6.4.5 Rock/Mesh Sediment Control Fence and Inlet Protection Device

In situations when higher velocity stormwater flows are expected around the perimeter of a construction site, a rock/mesh sediment control fence should be installed in lieu of geotextile or other silt fence applications. This device is constructed using a 4 ft. wire mesh (hardware cloth – 24 gauge, ¼ in. openings) folded in half to form a 90° angle. This mesh is then wired to, and supported by 5 ft. metal "T" posts spaced 3 ft. apart and driven approximately 2 ft. into the ground. Lastly, a layer of grade 4 or grade 5 aggregate for drainage (Sec 1009) is placed against the mesh, with a minimum height of 12 in., but preferably 18 inches. (Refer to Standard Plan 806.10.)

This same device can be modified for use around drop inlets, creating a closed ring or box around the inlet opening using the same installation guidelines outlined above.

The rock/mesh sediment control fence shall remain in place until areas that drain to the fencing are stabilized and the engineer directs that it be removed. Upon removal, the contractor shall remove and dispose of any excess sediment accumulations, grade and dress the area to the satisfaction of the engineer, and establish vegetation on all bare areas.

806.8.6.4.6 Inlet Controls

Storm drain (culvert, drop or curb) inlet protection measures prevent soil and debris from entering storm drain inlets. Temporary inlet protection is implemented at existing inlets prior to land disturbance, and new inlets are to be protected as they are put into service. Effective storm drain inlet protection must be provided throughout the project for all inlets susceptible to receiving sediment until all sources with potential for discharging to an inlet have been stabilized. At that time inlet controls can be removed.

The following types of items are generally considered for use as inlet protection:

Curb Inlet Protection:

- Sand Bags/Rock Socks
- Wattles/Compost Filter Socks/Fiber Rolls/Sediment Logs, etc.
- Various Filter Devices and Inserts (e.g., but not limited to, FLEXSTORM Inlet Filters, Silt Saver Inlet Filter, Big Red Curb Inlet Protector and Dandy Products)
- Wood, Steel or Other Barricades

Drop or Pipe/Box Inlet Protection (Shall have a minimum 9 in. effective height):

- Rock/Mesh Inlet Check (NEW – see EPG 806.8.6.4.5 Rock/Mesh Sediment Control Fence and Inlet Protection Device)
- Rock Ditch Checks
- Triangular Silt Dike®
- Sand Bags

- Various Filter Devices (e.g., but not limited to, Silt Saver Inlet Filter, Big Red Area Inlet Protector and Dandy Products)
- Wood (CBST, as discussed in EPG 806.8.6.4.2 Sediment Trap), Steel or Other Barricades

  (Note: Item selection may vary depending on the type and design of inlet to be protected and careful consideration should be made with inlet protection to ensure any impounded water will not flood streets, buildings, homes, etc..)

As a general rule, geotextile silt fence, especially non-reinforced geotextile silt fence, should not be used as inlet protection, particularly around culvert and drop inlets where high volume, concentrated flows are expected. An exception to this is if a constructed wood or steel frame is erected around the inlet and this frame is then wrapped with geotextile material. In this application, it is recommended for additional support and protection that wire reinforcement be wrapped around the frame and then the geotextile applied over the wire.

Each type of inlet control device (particularly the tubular/cylindrical/triangular products) will have specific directions for installation. In all cases care shall be exercised so as to install the device according to Standard Plan 806.10 or the manufacturer's specifications. Effectiveness may be compromised if not installed correctly.

During construction, elevated curb inlets and median inlets, as well as excavations around inlets, may serve as "riser pipes" as long as they are sufficiently higher (approximately 9 in. or more) than the existing grade. Sediment that accumulates at the base of the riser pipe following stormwater events shall be removed when it reaches 1/2 of the original height of the riser pipe. Once the desired grade has been achieved and the inlet becomes flush to that grade, subsequent inlet protection is required.

806.8.6.4.7 Temporary Berms — Sediment Control

Type C berms are specified at the toes of spill slopes around bridge construction operations and will usually be constructed to the specified dimension (see Standard Plan 806.10). However, dimensions may deviate from those shown on the standard drawings based on site limitations. A straw layer, erosion control blanket, or geotextile is typically required on the upgrade side of the Type C berm to improve stormwater filtration. This additional filtration layer may be removed if the character of the rock material is sufficient to minimize sediment loss from the project. In certain construction operations, Type C berms may be used as perimeter protection where significant stormwater flows and/or sediment loading is expected, which would overwhelm silt fence applications. Installation will generally precede land disturbance activities, unless some clearing is necessary in order to gain access to the site. Type C berms are typically temporary, but may be permanent depending on the ultimate desired use of the right of way beneath the bridge. If the Type C Berm is removed, material may be used for bank stabilization, or other construction use. Bank stabilization will be in accordance with the Section 404 permit.

806.8.6.4.8 Compost Filter Devices

Two categories of compost filter devices are used as erosion and sediment control BMPs on MoDOT projects: compost filter socks/ logs and compost filter berms. *(Note: Compost can also be used as a soil amendment and sometimes as a mulch to enhance vegetative establishment.)*

Compost Filter Socks consist of compost filter media (compost, or non-treated wood) encased within a three-dimensional fabric tube for purposes of erosion, sediment and pollution control. Compost filter socks are typically used for perimeter protection and are an acceptable alternative to geotextile and other silt fence applications described in EPG 806.8.6.4.4 Silt Fence. Compost filter socks are also acceptable alternate ditch checks as described in EPG 806.8.6.4.3 Ditch Checks. Specified effective height, as measured in the field, shall apply for both silt fence and ditch check applications. Compost filter socks shall be installed according to the manufacturer's specifications or Standard Plan 806.10, including ground preparation and staking requirements. Though compost filter socks are commonly used for perimeter protection and alternate ditch checks, other uses may include: curb and drain inlet protection; slope interruption; protection along the toe of stream and channel banks; on compacted and frozen soils, or pavement where trenching is difficult or impossible; and around sensitive resources where trenching may disturb the resource.

Sediment shall be removed once it has accumulated to one-half the original height of the sock. Compost filter sock shall be replaced whenever it has deteriorated to such an extent that the effectiveness of sock is reduced. Compost filter socks shall remain in place until disturbed areas draining to the devices have been permanently stabilized in accordance with the permit. Upon removal of compost filter socks, the wooden stakes should be pulled and the biodegradable netting cut to encourage more rapid degradation. If the netting is non-biodegradable, the netting shall be cut and removed along with the stakes, but the compost filling may be left to further decompose and act as a soil amendment.

Compost or non-treated wood used for compost filter sock filter media (filler material) shall be weed, disease, and pathogen free and derived from a clean source of woody organic matter. Compost shall be produced using an aerobic composting process meeting CFR 503 regulations including time and temperature data. The filler material shall be free of any refuse, contaminants or other materials toxic to plant growth. Test methods for the items below should follow U.S. Composting Council Test Methods for the Examination of Composting and Compost guidelines for laboratory procedures:

- pH – 5.0-8.0 in accordance with TMECC 04.11-A, "Electrometric pH Determinations for Compost"
- Particle size – 99% passing a 2 in. (50mm) sieve and a maximum of 40% passing a 3/8 in. (9.5mm) sieve, in accordance with TMECC 02.02-B, "Sample Sieving for Aggregate Size Classification". *(Note- In the field, product commonly is between ½ in. [12.5mm] and 2 in. [50mm] particle size.)*
- Moisture content of less than 60% in accordance with standardized test methods for moisture determination.
- Bulk density shall be a minimum of 14 lbs/cu ft (dry weight)
- Material shall be relatively free (<1% by dry weight) of inert or foreign man-made materials.

- The engineer may request a sample for approval prior to being used and must comply with all local, state and federal regulations.

Compost Filter Sock Fabric Specifications				
Material Type	**5 mil HDPE**	**5 mil HDPE**	**Multi-Filament Polypropylene (MFPP)**	**Heavy Duty Multi-Filament Polypropylene (HDMFPP)**
Material Characteristics	Photo-degradable	Bio-degradable	Photo-degradable	Photo-degradable
Sock Diameters	8”	8”	8”	8”
	12”	12”	12”	12”
	18”	18”	18”	18”
	24”	24”	24”	24”
	32”	32”	32”	32”
Mesh Opening	1/8” - 3/8”	1/8” - 3/8”	1/8” - 3/8”	1/8” - 3/8”
Tensile Strength	26 psi	26 psi	44 psi	202 psi
Ultraviolet Stability % Original Strength (ASTM G-155)	23% at 1000 hr.	-	100% at 1000 hr.	100% at 1000 hr.
Minimum Functional Longevity	9 months	6 months	1 year	2 years
Note: All materials must be knitted. Extruded materials not permitted.				

Compost Filter Berms are temporary barriers of compost placed along the perimeter of a site, or at intervals along a slope, to control erosion and capture sediment from sheet flow. A filter berm can also be used as a check dam in small drainage ditches as described in EPG 806.8.6.4.3 Ditch Checks. Loose applied compost berms (i.e., mounded compost) should be anchored in place (covered) with ECB for stability. To anchor the compost effectively, place the ECB first and then install the compost along and atop the downgrade edge of the ECB and wrap the ECB over the compost in the direction of flow and anchor with staples or an equivalent.

Composts used in filter berms are made from a variety of feedstocks, including municipal yard trimmings, food residuals, separated municipal solid waste, biosolids, wood chips and manure.

Compost filter berms can be used in place of traditional sediment and erosion control tools such as geotextile silt fence. As such these berms can be installed at the time of clearing and grubbing, or as needed throughout the construction process, and will remain in place until the site is stabilized. Sediment shall be removed once it has accumulated to one-half the original height of the berm.

Post-construction removal is not required because the compost and ECB are biodegradable. However, unvegetated berms are often broken down once construction is complete and the compost is sometimes spread around the site as a soil amendment or mulch.

806.8.6.4.9 Mulch Berms

The use of shredded or chipped mulch for berms or temporary groundcover is an acceptable reuse of cleared trees and brush from MoDOT projects. Mulch berms are used for perimeter protection and are an acceptable alternative to geotextile and other silt fence applications described in EPG 806.8.6.4.4 Silt Fence. As such, these devices are used to filter sheet flow and are not appropriate in ditches, drainage channels or other areas of concentrated flow.

Mulch berms are most effective when piled to a height of at least two feet, preferably installed in existing vegetation, outside of, or at the edge of project clearing limits, so that a buffer of undisturbed soil and vegetation remains on both sides of the berm. Mulch berms will generally be installed at the time of clearing and grubbing, and must be maintained for as long as necessary to contain sediment from runoff. Mulch berms should be installed on the contour when possible to prevent overtopping or overloading at single points.

Where deficiencies are identified as a result of stormwater inspections, additional mulch, or another appropriate BMP shall be installed as approved or directed by the engineer.

Sediment deposits shall be removed and disposed of when the deposit approaches 1/2 the height of the berm or sooner. A mulch berm shall remain in place until areas that drain to the structure are stabilized in accordance with the permit and the engineer directs that it be removed. Upon removal, the contractor shall remove and dispose of any excess silt accumulations, grade and dress the area to the satisfaction of the engineer, and establish vegetation on all bare areas.

Mulch is biodegradable and need not be removed, unless directed by the engineer. Though not required to be removed, piled mulch should be knocked down and dispersed into a thin layer of ground cover, which will aide in the breakdown of the material.

806.8.6.4.10 Brush Pile Checks/Barriers

Brush pile checks or barriers are considered be temporary BMPs that can be effective during clearing and grubbing operations. Piled and compressed tree tops, limbs, stumps and other vegetation, when placed in a **non-jurisdictional** drainage swale or around the perimeter of a land disturbance site, can effectively impound gravel, soil and other eroded materials. Brush pile checks are not appropriate for use in jurisdictional (Section 404 of the Clean Water Act) bodies of water.

To be effective, brush piles should be compressed tight to the ground by clearing equipment at the time of installation so there is no void beneath. Brush checks and barriers are only intended to operate as stand-alone BMPs for a very short time period during initial clearing and grubbing, and should be bolstered by the installation of additional supportive measures upgrade or downgrade of the structures, such as sediment basins, sediment traps, ditch checks, etc., as soon as practicable. When these other devices are installed, the brush check/barrier may be left in place as additional filtration, if permissible, or removed.

806.8.6.4.11 Straw Bales (MO Specifications Sec 802)

Bales of straw are no longer acceptable sediment control BMPs on MoDOT projects and will not be used as such. Straw is acceptable as mulch when applying temporary ground cover or establishing permanent vegetative cover. Straw used as ground cover is required to be embedded or tackified per Section 802 of the Missouri Standard Specification for Highway Construction.

Straw bales are an acceptable practice used to control concrete diamond grinding residue that is discharged onto MoDOT right of way due solely to the short duration of the discharge as described in EPG 806.8.11 Diamond Grinding and Other Surface Treatments. During concrete diamond grinding operations, the straw bales are typically used in concert with other BMPs, including non-structural BMPs such as existing vegetation.

In these situations, bales of straw can be installed as ditch checks and used as a temporary means of controlling pollution by obstructing the flow of the slurry and allowing deposition of the fine cement particles. The bales should be properly staked and extend far enough up the inslope and backslope to sufficiently impound the discharge slurry. The integrity of straw bales must be maintained for as long as they are necessary to contain the slurry. When no longer necessary to control pollution, the bales and other temporary BMPs associated with diamond grinding operations should be removed.

806.8.7 Disturbed Areas

Project plans that are discussed in EPG 806.8.2 Site Description and EPG 806.8.3 Developing/Amending Project-Specific Project Plans will identify those areas that will be cleared and graded as part of the highway development project. The plans will also identify areas that are not to be disturbed. Both disturbance and do not disturb areas are generally staked in the field.

On areas of the site where soil disturbing activities will cease and are not planned to resume for a period exceeding 14 calendar days, interim stabilization must be initiated no later than 7 calendar days upon knowing of the 14-day cessation, and must be completed within 14 calendar days of the ceased operation. On portions of the project where slopes are greater than 3:1 (1V:3H), or greater than 3% and longer than 150 ft., all interim stabilization must be completed within 7 days of ceasing operations. Interim stabilization may include, but is not limited to the installation of sediment basins, sediment traps, ditch checks, sediment fences, and mulch; however, the preferred method of stabilization is seed and mulch.

All disturbed areas should be seeded and mulched or otherwise stabilized when and where necessary to eliminate erosion. Seeding and/or mulching shall be done as soon as possible after completion of the earthwork and preparation of the seedbed, weather permitting.

Whenever clearing, grading, excavating or other earth disturbing activities have permanently ceased on a portion of the site, final stabilization must be initiated no later than 7 calendar days after ceasing operations and must be completed within 14 calendar days of the ceased grading of the site or portion of the site. Final stabilization can be achieved by covering disturbed areas with pavement, buildings or other structures, perennial vegetation or non-erodible materials such as adequately sized rock placed in its final configuration. With respect to areas that have been

seeded, vegetation cover must be at least 70% perennial plant density with uniform coverage over 100% of the disturbed area.

For the purposes of this section, allowances to the 14-day completion period for temporary and permanent stabilization may be made due to inclement weather or adverse site conditions. If used, these allowances must be properly documented in the project SWPPP and shall include pictures.

The following types of activities will constitute initiation of stabilization (this list is not exhaustive):

- Prepping the soil for vegetative or non-vegetative stabilization
- Applying mulch or other non-vegetative product to the exposed area
- Seeding or planting the exposed area
- Starting any of the above activities on a portion of the area to be stabilized, but not on the entire area
- Finalizing arrangements to have stabilization product fully installed in compliance with the applicable deadline for completing stabilization

806.8.8 Installation and Removal

The contractor shall be required to incorporate all permanent erosion control measures into the project at the earliest practicable time. As stated in EPG 806.8.6.1 Construction Requirements, when practical, border, perimeter or outfall BMPs to control runoff from disturbed areas shall be installed or marked for preservation before general site clearing. A limited amount of clearing may be permissible to enable the installation of outfall and perimeter controls. Stormwater discharges from disturbed areas, which leave the site, shall pass through an appropriate impediment prior to leaving the site. It may be necessary to install additional control measures during construction which were not foreseen during the design stage. Temporary controls shall also be used when needed prior to installation of permanent erosion control measures to control erosion that develops during normal construction practices.

Temporary BMPs should be removed from the project when areas they are protecting have achieved final stabilization in accordance with the permit. Oftentimes engineers and/or contractors may desire to leave all temporary BMPs in place until project completion and then have one mass removal. Though this practice is not ideal due to increased vulnerability, it is acceptable if the BMPs are continuously inspected and maintained in accordance with the permit until their removal. Also, if the engineer determines that some BMPs shall remain in place for a period of time after the job is closed out; arrangements will be made to remove BMPs with MoDOT forces once they are no longer necessary.

806.8.9 Dewatering

Dewatering of ponds, lakes, coffer dams, pits or excavations associated with construction shall be discussed at the preconstruction conference, and articulated in a written plan, which will outline a method for properly treating the water before it can re-enter a river, stream, pond, lake, wetland, etc. This plan may be amended at any time if changes are necessary.

Sec 107.10.2 requires a dike or appropriate barrier to be placed between the excavation and the stream to prevent sediment from reaching the watercourse. The structural BMPs that are identified in EPG 806.8.6.4 Sediment Control Measures are usually sufficient to remove sediment and similar pollutants prior to discharge of return water. Land application of the discharge water is a viable option when percolation into the subsurface results; however, caution shall be used to ensure that water discharge does not cause the formation of gullies in cases where pumping exceeds percolation.

Discharges from dewatering activities shall be managed by appropriate controls suitable for treating water pumped from trenches and excavations. These appropriate controls shall be detailed in the SWPPP, including specific BMPs that will be used to treat the discharge. In no case shall water be pumped off site without being treated by the specified BMP unless approved by the engineer.

Untreated discharges must be specified as an allowable option through a project specific individual permit, typically on projects where structural foundations in large rivers, such as the Missouri or Mississippi, will be constructed

806.8.10 Roadways

In order to ensure that sediment is not transported into a situation where it can be delivered off-site, stabilized construction entrances should be used when construction equipment is frequently crossing or entering paved roadways. Stabilized construction entrances are typically built with rock of sufficient size to cause mud and dirt to fall off of the tires of the construction equipment. Geotextile fabric may be necessary for placement below the stabilized entrance in some soil conditions to prevent the rock from subsiding into the soil. In muddy situations, the voids between the rocks will always fill up with soil particles and as such, additional stone will need to be applied periodically and when repair is required.

The purpose of the stabilized entrance is to reduce the amount of sediment that will be transported onto the driving surface. However, the driving surface at the point of the active crossing cannot remain clean without additional measures such as sweeping or grading.

Because it is impossible to eliminate all trackout of sediment, inspections should ensure that sediment control measures downgrade from the area of trackout are in good operating condition, especially inlet controls.

On projects where there is one primary construction entrance/exit and a large volume of equipment is expected to pass through this point, a more structural BMP may be appropriate to handle the volume of sediment. If this is the case, rumble strips, cattle guards, or wheel wash stations may be employed to effectively remove sediment. In these situations, routine

maintenance will be needed to remove accumulated sediment from beneath and/or around these structures. If a wheel wash system is used, wash water should be channeled to a constructed sediment trap for treatment, unless the system has the capability to recycle the wash water. Just as with other sediment traps, once installed, the location of the trap will be shown on the inspector's site plans. Accumulated sediment shall be removed from the trap when the accumulation reaches 1/2 the height of the structure, or if an excavated pit is used, 1/2 of the original depth.

When accumulated sediment is removed from these BMPs, the material shall be disposed of in locations where sediment will not erode into the construction areas or waters of the state.

806.8.11 Diamond Grinding and Other Surface Treatments

Although diamond grinding, grooving, and other pavement surface and bridge deck treatments are not land disturbance activities, the fine material that is removed from the driving surface will become suspended in discharge water and has the potential to contaminate nearby streams if not sufficiently managed. The following shall be considered the minimum requirements for performing this work within the project limits in addition to Sec 622 and EPG 622.2.1 Construction Inspection for Diamond Grinding of Existing Portland Cement Concrete Pavement.

The contractor shall submit to the engineer for approval in writing prior to the pre-construction conference, the best management practices (BMPs) to be used to protect the environment, including the method of disposal whether on right of way or off-site. Dispersal of diamond grinding residue on the right of way, where allowed, is the contractor's choice versus tanking and disposal. Therefore, all BMPs necessary for protection of drainage outlets will be incidental to the diamond grinding operation. See EPG 806.8.6.4.11 Straw Bales for more information about using straw bales as BMPs.

When concrete slurry is dispersed on the right of way, BMPs shall be installed to keep slurry residue from entering drainage structures, waters of the state, and from leaving the right of way. At no time should asphalt diamond grinding slurry be discharged directly onto MoDOT right of way. Asphalt grinding residue must be tanked and disposed of properly.

Prior to starting work, concrete slurry or residue “no discharge zones” will be identified by the engineer with respect to the contractor’s approved BMP and residue disposal plan. Special provisions and restrictions will apply when operating in proximity to streams, wetlands, sensitive species habitat and in karst (landscapes with caves) and groundwater recharge areas.

The engineer may suspend operations during periods of rainfall or during freezing temperatures.

806.8.12 Concrete Washout

Concrete washout BMPs are to be established in designated areas for all projects where concrete production or delivery is occurring. These washouts are used to contain residual concrete, concrete associated liquids and the wash water from cleaning trucks, hoppers and chutes, which typically have a high pH, heavy metals, and could contain other chemical additives. Washout

BMPs can be non-leaking plastic or clay/bentonite lined pits, a straw bale enclosure lined with plastic, a storage tank or prefabricated BMP or other structure approved by the engineer. In karst regions of the state, such as the Ozarks, extra care should be taken to ensure proper lining of earthen pits, as cracks and fissures within the bedrock could allow for direct pollution of ground water. Designated washout areas should be located at least 50 feet away from storm drains, ditches, streams or other water bodies. Washouts should be cleaned out when they reach 75% of their design capacity. Care should be taken to ensure these structures do not overflow during storm events.

Washout liquids can be allowed to evaporate or be pumped out and properly disposed of. They cannot be discharged into storm drains, ditches, streams or other bodies of water. Dried concrete can be broken up and used as clean fill on the project, recycled or properly disposed of by other means.

806.8.13 Turbidity Reduction and Advanced Treatment Systems

Water clarification and the removal of turbidity will usually require the addition of flocculants, polymers, polyacrylamides (PAM), chitosan and other chemicals that cause soil particles to bind together, become heavy and settle to the bottom of a sediment trap or sediment basin.

Since settling of flocculated soil particles requires very slow moving (still) water, natual and chemical additives should never be introduced into an outfall BMP where water leaves MODOT right of way. In all cases where flocculants are used to reduce turbidity it is essential to include a sediment basin or sediment trap and a ditch liner or ditch check apron that prohibits additional erosion on the downgrade side of the ditch check.

The following Advanced Treatment Systems are options for use in MODOT projects where turbidity removal is required:

- Flocculant logs and flocculant flats that are installed directly in a ditch, pipe or culvert upgrade from a sediment basin or sediment trap.
- Flocculant treated ditch checks (i.e. fiber rolls, or compost socks/logs) that have been installed upgrade from a sediment basin or sediment trap.
- Flocculant treated rock ditch checks installed upgrade from a sediment basin or sediment trap.
- Geo ridge ditch checks with attached flocculant bags, installed upgrade from a sediment basin or sediment trap.
- Addition of granular flocculants directly into a ditch, upgrade from a sediment basin or sediment trap.
- Erosion control blankets and turf reinforcement mats that have been inoculated with flocculants, and installed upgrade from a sediment basin or sediment trap.

Chemical Stabilizers

Chemical stabilizers, also known as soil binders or soil palliatives, provide temporary soil stabilization. Various products are sprayed onto the surface of exposed soils to hold the soil in place and minimize erosion from runoff and wind. These materials are easily applied to the surface of the soil, can stabilize areas where vegetation cannot be established, and provide immediate protection.

Use chemical stabilizers alone in areas where other methods of stabilization are not effective because of environmental constraints, or use them in combination with vegetative or perimeter practices to enhance erosion and sediment control.

Closely follow the manufacturer's recommended application procedures to prevent the products from pooling and creating impervious areas where stormwater cannot infiltrate.