

Construction Field Manual

Construction Site Management and Erosion and Sediment Control



**South Dakota Department of Transportation
Water Quality Enhancement Program**

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ATTENTION

The purpose of this manual is to assist field personnel with establishing and maintaining construction site compliance with the 2004 South Dakota Standard Spec Book – Div. II and the General Permit for Storm Water Discharges Associated with Construction Activities.

It is assumed that most design decisions have been made prior to needing the information contained in this field manual. Therefore, this document contains information intended to assist in decisions involving maintenance, inspection, and record keeping. Refer to the SD DOT Erosion and Sediment Control Design Manual for issues on design, planning or training.

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1 Principles and Practices of Erosion and Sediment Control

1.1 Erosion and Sediment Control Types

The terms erosion and sediment control are often used interchangeably. However, erosion and sediment control are quite different in what they do and how they do it. **Sediment is a product of erosion.**

Erosion control is any practice that protects the soil surface and minimizes the amount of soil particles detached and transported by rainfall or wind. Erosion control is implemented as a source control. Soil is a natural resource that has a significant value, especially in the structural integrity of a highway system.

Sediment control is any practice that traps the soil particles after they have been detached and transported. Sediment control begins with erosion control by minimizing the potential sources of sediment. The emphasis should be placed on providing a protective cover on the soil surface, diverting runoff so that it does not flow across disturbed areas, and preserving existing vegetation to maximize soil infiltration and capture sediment.

1.2 Types of Erosion

Splash – Energy from the raindrop dislodges soil particles and initiates the erosion process.

Sheet – Uniform removal of saturated soil particles.

Rill – Long, narrow incisions in the soil caused by increased runoff velocities.

Gully – Deep, wide incisions caused by concentrated flow.

Streambank – Bank sloughing, toe cutting in a natural drainage pattern.

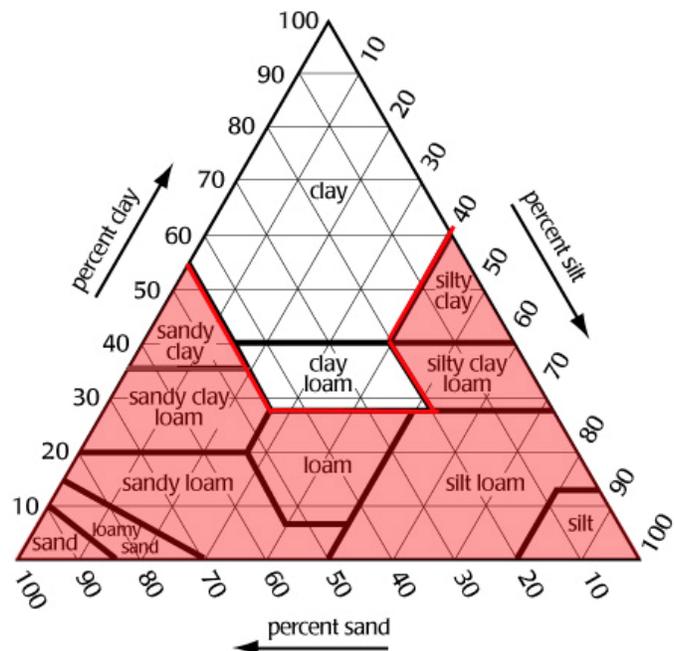
1.3 Factors Affecting Erosion

1.3.1 Soil Type

The primary soil property that affects erosiveness is the cohesiveness of the soil. While there are other factors, this is the most dominant factor when considering temporary erosion controls. The generalized soil triangle shows the break between soils that can be considered cohesive or non-cohesive soils. This rule of thumb has to be applied with good professional judgment.

1.3.2 Vegetation

Vegetation is the primary permanent erosion control for unpaved surfaces along the roadside. Anytime the existing vegetation is removed, there is immediate potential for wind and water erosion. Therefore, any un-



vegetated surface should be treated with an appropriate best management practice (BMP) to prevent surface erosion. The appropriate BMP depends on the other factors affecting erosion.

1.3.3 Climate

The key climatic factors affecting erosion are rainfall intensity, duration, and return frequency, which in turn determine soil particle detachment and transport in runoff. Other climatic properties, such as temperature and growing season, have more to do with reestablishing permanent erosion controls.

1.3.4 Topography

The slope and length of slope have a direct influence on the transport of dislodged sediment and soil particles down slope. Even very erosive soils on flat slopes will not produce large amounts of sediment because there is not sufficient potential gravitational force to accelerate the surface runoff to velocities that will suspend and transport sediments. As slopes become steeper, the velocity of flow of surface runoff increases with a subsequent increase in sediment loads. That is why velocity management is a critical part of any erosion control practice.

1.4 Erosion Control Concepts

1.4.1 Surface Protection

Protecting the soil surface will help minimize the amount of soil that is detached and transported as sediment.

1.4.2 Minimization of Concentrated Flows

Concentrated flows generate more energy and velocity than sheet flows. Greater depths and velocity generate more erosion and suspension of eroded materials. If concentrated flows develop, control measures, such as check dams, can be used to reduce the velocity. Where concentrated flows are directed to uniform surfaces, level spreaders can be used to reestablish sheet flows. Level spreaders can also improve the efficiency of other facilities, such as vegetated swales, filter strips, or infiltration devices, which are dependent on sheet flow to operate efficiently.

1.4.3 Velocity Reduction

Velocity reduction is a key component of BMP strategies. Control measures such as rock check dams, wattles, etc., are placed perpendicular to the direction of flow, whether sheet flow or concentrated flow, to slow the velocity of the water by creating a series of “speed bumps.” The BMP type must be selected based on the anticipated depth, velocity, and frequency of flows over the surface or in the channel.

1.4.4 Sediment Capture

Effective sediment control measures are designed and implemented to slow the runoff velocity and retain the sediment-laden water to allow soil particles to fall from suspension and settle out of the runoff. This will facilitate transport reduction and thereby the quantities of sediment that leave the site.

1.4.5 Runoff Management

Runoff management tools are designed to utilize proper grading, diversions, barriers, or interceptor ditches to minimize concentrated flows and divert runoff away from denuded slopes or other critical areas. This can be done by minimizing slope steepness and length through the use of benches, terraces, contour furrows, interceptor swales or diversion ditches. The concept is to divert clean runoff before it becomes sediment laden.

2 Inspections and Site Management

Inspections should be conducted by personnel who are familiar with permit conditions, as well as the proper installation and operation of pollution prevention measures.

Inspections should be performed at least once every seven (7) calendar days and within 24 hours of the end of a storm that is 0.5 inches or greater, or a snow melt event that causes surface erosion. Where runoff is unlikely due to winter conditions, inspections should be conducted at least once per month.

The inspections should include:

- disturbed areas of the construction site that have not been finally stabilized (achieved 70% of native cover),
- areas used for storage of materials,
- structural control measures, and
- locations where vehicles enter or exit the site.

These areas shall be inspected for evidence of, *or the potential for*, pollutants entering the drainage system, and erosion and sediment control measures identified in the plan shall be observed to ensure that they are operating correctly and sediment is not tracked offsite.

2.1 Inspection Reports

After every inspection, an inspection report should be completed and include:

- summary of the areas inspected,
- the name(s) and title(s) of personnel making the inspection,
- the date(s) of the inspection,
- major observations,
- corrective actions taken, and
- any incidents of non-compliance.

Based on the results of the inspection, the plan shall be revised and implemented in a timely matter, but in no case more than seven (7) calendar days following the inspection. Where an inspection does not identify any incidents of non-compliance, the report shall contain a certification that the site is in compliance with the plan and the permit.

The report shall be signed in accordance with the signatory requirements of the General Permit 6.7 2.a.

2.2 Retention of Records

These reports shall be retained as part of the plan for at least three (3) years after the site has reached final stabilization and coverage under the permit has been terminated.

A copy of the SWPPP and SD DENR's letter granting coverage under the permit from the date of project initiation to the date of final stabilization should also be retained on site, or made readily available.

2.3 Site Management

2.3.1 Solid Waste Management

Description

Solid waste management consists of procedures and practices designed to minimize and prevent solid waste (plastic, fabrics, Styrofoam, general litter) associated with construction activities from entering storm drains and water courses.

Inspection and Maintenance

Waste collection sites must be provided on the site. Water-tight collection receptacles should be provided within the construction boundaries but not near drainage inlets or water courses.

These receptacles must be emptied and cleaned out on a regular basis to avoid overflow. Receptacles may not be washed out on site.

Sediment barriers such as berms and dikes should be used to prevent storm water from contacting collected waste.



Figure 1: Unsatisfactory House Keeping

2.3.2 Protective Fence

Description

Protective fence is used to delineate areas that are off limits to vehicles, pedestrians, and equipment. This can be any suitable fencing material such as chain link and plastic safety fence. These areas may be environmentally sensitive areas, critically erodible areas, or areas of vegetation that need protection.



Figure 2: Construction Fence Marking Edge of Site

Fencing must be in place prior to construction activity commencing. Signage may be necessary to keep activity away from designated areas. Silt fence can be used in conjunction with the other fence material where drainage patterns require sediment control protection; however, protective fencing is not a sediment control device.

Inspection and Maintenance

Inspect protective fence routinely to make sure that it is functioning to protect the designated area.

If fencing is not placed prior to construction activity and sensitive areas are disturbed by vehicle and equipment parking, fencing should be installed as soon as possible to prevent further damage.

2.3.3 *Stabilized Construction Access*

Description

Stabilized construction access is a temporary sediment removal device installed at the approach from a construction site to a public roadway. This BMP is used to limit sediment tracking from vehicles and equipment leaving the construction site. There are three types used: rock bed, cattle guard, and log/timber.

This BMP is used as a *sediment control* measure at all locations where construction vehicles leave the site and enter a public road and at all locations where there is a risk of sediment being transported off-site by construction traffic. They must be sized to accommodate vehicle length and turning radius if necessary.



Figure 3: Construction Entrance Filled in by Sediment

Inspection and Maintenance

Inspect exit for excessive sediment build up. Remove sediment and rebuild the exit as necessary to retain effectiveness and prevent off-site tracking. Additional street cleaning may be required if unable to retain sediment on site.

2.3.4 *Dust Control*

Description

Dust control procedures and practices are designed to suppress dust on a construction site during the construction process.

Inspection and Maintenance

Applying water or other dust suppressants is the most common application to control dust.

Temperature, humidity, wind velocity and direction will determine amount and frequency of applications. Typically, chemical stabilizers require less frequent applications than water.



Figure 4: Chemical Dust Control

Other techniques for controlling dust include surface roughening, wind barriers, walls, etc.

The best method of controlling dust is to *prevent* dust production. This can best be accomplished by limiting the amount of bare soil exposed at one time.

Dust control measures require constant attention and special care should be taken with storing and handling chemicals used for dust control.

2.3.5 Spill Prevention/Material Handling

Description

Spill prevention and material handling procedures and practices are designed to help prevent spilled materials (fuels, lubricants, de-icing chemicals, fertilizers, etc.) from entering drainage system or water course.

Inspection and Maintenance

1. Stop the source of the spill.
2. Be sure the contractor contains and cleans up the spill using absorbent materials rather than hosing down or redistributing the spilled material. If spilled on soil, construct earth dikes to prevent spreading.
3. Dispose of spilled material and clean up materials.
4. Plans to prevent future spills. What did you learn that can prevent this from happening again?
5. **Be prepared!** Don't wait until there is a problem. Be sure the contractor has a plan in place and has educated employees and subcontractors.



Figure 5: Clean Up Spills Promptly

Make sure that the contractor updates spill prevention/control plans regularly and stocks appropriate cleanup materials.

2.3.6 Stock Pile Management

Description

Stock pile management consists of procedures and practices designed to minimize or eliminate the discharge of stockpiled material (soil, topsoil, base material, rubble) from entering drainage systems or water courses.

Maintenance and Inspections

Protect all stockpiles from storm water runoff using perimeter barriers such as silt fences, berms, sandbags, or dikes.



Figure 6: Silt Fence Must Be Installed Properly To Be Effective

Locate stockpiles away from concentrated storm water flow, drainage paths, and inlets. Stockpiles should be protected with temporary soil stabilization measures ranging from seed/vegetation to tarps, which should be repaired or replaced as needed.

2.3.7 *Snow Management*

Description

Snow Management is the use of plowing, dozing or blowing snow to relocate to an area less likely to be impacted by melting. This can be used in conjunction with snow fences or windrows to redirect snow accumulation.

Inspection and Maintenance

Projects that extend through the winter months or high elevation areas of the state where snow accumulation lasts several months will need to move, store, and/or remove snow as necessary to reduce impact to sensitive areas that may be affected by snow accumulation or heavy snow melts.

Avoid snow accumulation near drainage areas or conveyance systems so that melting snow does not cause flooding due to overwhelming quantities or blockage from snow and ice accumulations. Snow should be placed in a stabilized area of the site to reduce negative snow melt impacts.



Figure 7: Rapid Snow Melt Must Be Monitored

2.3.8 *Concrete Waste Management*

Description

Procedures/practices designed to minimize or eliminate the discharge of concrete waste materials (washout, etc.) from entering the drainage system or water course.

Inspection and Maintenance

Temporary concrete washout areas must be constructed and maintained to contain all water and concrete waste generated by washout operations.

A sign should be placed at the washout site to inform concrete equipment operators of the facility location.

These washout areas should be placed a minimum of 50 feet from any storm drain inlet, water course, or drainage facility. They must be located in an area with easy access for the concrete equipment and away from traffic.

Existing facilities must be cleaned or replaced when they reach 75% capacity.



Figure 8: Improper Concrete Waste Disposal

2.3.9 Street Sweeping

Description

Street sweeping procedures and practices work to reduce the total suspended solids (TSS) and associated pollutants from public and private streets from entering drainage areas or water courses.

Inspection and Maintenance

When construction exits are not keeping construction site sediment from the roadway, other forms of sediment removal must be employed. Street sweeping is often overlooked, but should be considered an effective BMP.

Street sweeping is effective at cleaning construction entrances and exits, shoulders, and maintenance yards.

Depending on the desired level of sediment removal, street sweeping should occur on a regular basis and may warrant daily sweeping if the site is located in a highly erosive area.

Street sweeping frequency should increase just prior to wet seasons to remove sediment accumulated during dry periods.

This method is not typically effective for removing oil/grease.

2.3.10 Vehicle/Equipment Maintenance

Description

Vehicle and equipment maintenance procedures and practices are designed to eliminate or reduce the discharge of pollutants from vehicle and equipment maintenance areas from entering drainage areas or water courses.

Inspection and Maintenance

Equipment and vehicles must be cleaned regularly to prevent a build up of oil and grease.

Berms, sandbags, or other barriers should be used around the perimeter of the maintenance area to prevent storm water contamination. Maintenance areas should be clearly designated.

Secondary containment (capable of handling 110% of material) must be provided for all fluids greater than 55 gallons. All waste fluids must be in leak-proof containers. Regularly inspect all on-site equipment, as well as those entering and exiting the site.



Figure 9: Street Sweeper



Figure 10: Examples of Spills That Must be Corrected Immediately

2.3.11 Check Dam

Description

Check dams are small dams constructed across a swale or drainage ditch. Check dams are used for the purpose of reducing the velocity of concentrated storm water flows to non-erosive velocities, thereby reducing erosion.

Check dams are generally placed in areas where the steepness of slope is 6% or greater combined with a large drainage area and/or where rocky soil conditions prevent the proper installation of other erosion or sediment control devices. Check dams can be used as temporary or permanent controls. The BMP should be selected for strength in performance and longevity based upon site conditions. Rock check dams will tolerate the highest velocity and volume flows.

Erosion bales and silt fence should only be used in low volume, low velocity situations such as minor swales. Check dams reduce the velocity of the runoff, promote soil infiltration, retain the sediment-laden water and allow for sedimentation and prevents discharge of sediment-laden storm water.

Inspection and Maintenance

Check dams must be wider than the channel to prevent undercutting and the center of the dam must be lower than either edge. Make sure to provide a stabilized outlet below the lowest edge. Check for damage after each storm event and rebuild if necessary. Sediment should be removed from behind the dam when the level reaches one third the height of the dam.



Figure 11: Rock Check Dams

2.3.12 Rolled Erosion Control Products

Description

Erosion control blankets are applied from a roll and anchored into place to provide a continuous sheet over the exposed slope or surface. Erosion control blankets can be organic (biodegradable) which include straw, excelsior, coir, jute/hemp and biodegradable synthetics or synthetic (non-biodegradable) blankets which are usually made of a geosynthetic material, or a composite of both types. These products are designed to dissipate the energy of raindrop impact or flow depths and help keep soil particles from being detached and transported.

Inspection and Maintenance

Inspect the site during installation to ensure that the soil surface is properly prepared. Inspect the installation before, during and after significant rain events. Repair or replace all damaged materials. Re-compact and reseed all eroded areas.



Figure 12: Examples of Improper Installation



Figure 13: Results of Improper Installation

2.3.13 *Hydraulically Applied Mulch*

Description

Hydraulically Applied Mulch (hydro-mulching) is a process where seed, wood fiber, and fertilizer are applied in water slurry to provide *temporary* slope stabilization. This provides uniform, economical slope protection. It may be applied in either a 1-step or 2-step process. The 1-step process applies the seed, water, fertilizer and mulch together. The 2-step process applies the seed, water and fertilizer in the first application and then applies the mulch as a cover. The 2-step process receives double the application of water which may be beneficial in arid areas. Dyes, usually green, and tackifiers are added to the mixture. This has two purposes, as a visual aid to the applicator and as an aesthetic treatment. The mulch fosters vegetation establishment by retaining soil moisture and protecting the soil surface.

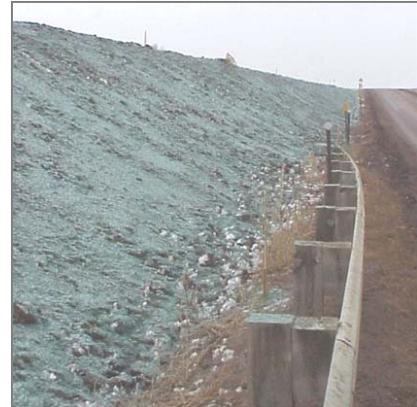


Figure 14: Rill Formation in Hydromulched Slope



Figure 15: Hydromulching Long Slope

Inspection and Maintenance

Inspect slopes for rill formation. If necessary, reseed and reapply mulch as necessary.

2.3.14 *Crimped (Poked) Straw*

Description

Poked or crimped straw consists of a layer of straw or hay spread or blown over the seeded and fertilized soil surface. The straw is then mechanically anchored to the soil surface. The action of rolling an implement over the surface of the straw creates rows of straw that stand up. The remainder of the straw protects the soil's surface. This reduces the velocity of the runoff, promotes infiltration and vegetation establishment and reduces erosion.



Figure 16: Straw Crimping

Inspection and Maintenance

Inspect slopes for rill formation. If necessary, reseed and reapply straw as necessary.

2.3.15 Silt Fence

Description

Silt fence consists of a temporary vertical barrier of geotextile fabric (filter fabric) attached to and supported by woven wire and wood or steel posts. The bottom of the silt fence material must be entrenched into the ground. Silt fence is placed before earth disturbing activities have begun and left in place until vegetation is established. Exceptions are at those locations where it is impractical to do so because of interference with construction activities. Silt fence reduces the velocity of the runoff, retains the sediment-laden water and allows for sedimentation and discharge of less sediment-laden storm water. Silt fence provides minimal filtration.

Inspection and Maintenance

If the flows are too great for silt fence to handle, use a supplemental BMP, berm, rock check, triangular silt dike, etc. Inspect silt fence for sediment build up. Remove sediment build-up or muck out the silt fence when build-up reaches one third the height of the silt fence. Check for damage to silt fence materials.



Figure 17: Improper Silt Fence Installation

2.3.16 Turf Reinforcing Mats

Description

Turf reinforcing mats (TRMs) are flexible three-dimensional turf reinforcement systems. They are made from synthetic fibers (non-degradable) or have a composite of organic fibers such as straw, excelsior, and coir as an inner material with a synthetic exterior. TRMs provide solutions on steep slopes and in channels where desired performance exceeds the limits of natural vegetation. TRMs help vegetative establishment and then anchor the mature plants to the soil.



Figure 18: TRM Lined Channel

Inspection and Maintenance

Inspect the site during installation to ensure that the soil surface is properly prepared. Inspect the installation before, during, and after significant rain events. Repair or replace all damaged materials. Re-compact and reseed all eroded areas.

For more information about BMPs and special applications please see the online design manual for erosion and sediment control.

3 Checklists

Four check lists are available to be used at different points in the project development and construction process. The most important for construction activities are the Mobilization, Site Inspection, and Final Inspection. Each of these documents focuses on specific areas that need to be checked to ensure NPDES compliance.

3.1 SWPPP Checklist Description

The SWPPP checklist ensures that all SWPPP requirements are complete. The following information should be recorded on the checklist:

- Site Description
- Site Maps
- Erosion and Sediment Controls
- Other Controls
- Maintenance
- Signature and Plan Review

3.2 Mobilization Checklist Description

The mobilization checklist aids the inspection of your site and covers the following areas of mobilization:

- General Permit Documentation (SWPPP & NOI)
- Deployment of Erosion & Sediment Control BMPs
- Waste Disposal & Spill Management

3.3 SWPPP Site Inspection Form Description

The SWPPP site inspection form records required site inspections during a construction project, including the following:

- Project Information
- Inspection Findings

3.4 Final Inspection Checklist Description

The final inspection checklist aids in the preparation and filing of the NOI by documenting the following:

- Removal of Structural Erosion & Sediment Control BMPs
- Waste Disposal and Spill Management

SWPPP CHECKLIST

Chk	Permit Citation	Action/SWPPP Requirement	SWPPP Page
Site Description (4.2.1)			
<input type="checkbox"/>	4.2.1.a	Plan Notes Sheet D-1 cites the appropriate cover sheet for the project.	
<input type="checkbox"/>	4.2.1.b	The total area of the site is recorded and correct.	
<input type="checkbox"/>	4.2.1.c	All soil disturbing activities to be performed are noted.	
<input type="checkbox"/>	4.2.1.d	Soil characteristics are noted in the space provided (D-1).	
<input type="checkbox"/>	4.2.1.e	All surface bodies are noted that may receive runoff from the site.	
Site Maps (4.2.1.f)			
<input type="checkbox"/>	4.2.1.f.(1)	Cover sheet and attached plan sheets show sufficient detail of drainage patterns and approximate slopes after major grading has taken place.	
<input type="checkbox"/>	4.2.1.f.(2)	Plan sheets show areas of soil disturbance.	
<input type="checkbox"/>	4.2.1.f.(3)	Plan sheets show the location of major structural and nonstructural erosion and sediment controls (temporary and permanent).	
<input type="checkbox"/>	4.2.1.f.(4)	Areas where stabilization activities will occur are shown on the plan sheets.	
<input type="checkbox"/>	4.2.1.f.(5)	The area map of the cover sheet shows surface waters including the extent of wetland acreage (if no an additional area map should be included with the Section D Plan notes).	
<input type="checkbox"/>	4.2.1.f.(6)	Map and/or plan sheets show points where storm water is discharged into surface waters or conveyances that will discharge into an adjacent water body.	
Erosion and Sediment Controls (4.2.2) ¹			
<input type="checkbox"/>	4.2.2.a (1)	For each disturbed area and construction activity of the site approved erosion and sediment controls have been shown. <i>NOTE: In the event that these controls impact on flood plains or wetlands, Section 404 may apply.</i>	
<input type="checkbox"/>		Slopes and all exposed surfaces show appropriate temporary controls and the permanent controls to be used.	
<input type="checkbox"/>		Long, steep slopes have diversions or some means of preventing run-on and reducing velocity.	
<input type="checkbox"/>		Suitable perimeter protection is provided in all areas where sheet flow leaves the site and will impact adjacent land or waterway(s).	
<input type="checkbox"/>		Culverts (inlets and outlets) and drain inlets have appropriate temporary controls to prevent sediment from entering or leaving the site.	
<input type="checkbox"/>		Ditches have proper velocity controls where concentrated flows enter and have appropriate surface protection.	
<input type="checkbox"/>		Channels and creek banks have appropriate temporary cover and permanent controls are specified.	
<input type="checkbox"/>		Appropriate in-channel protection has been provided in and around perennial streams.	
<input type="checkbox"/>	4.2.2.c(1)	Appropriate construction entrances/exits have been at all points of access to the project site to prevent tracking of sediment onto adjacent roads.	
<input type="checkbox"/>	4.2.2.d	The design capacity of all sediment traps and silt basins is shown on the plan sheets.	

¹ In so far as possible, the terms used to describe the stabilization, structural, storm water management, and housekeeping BMPs should use the terms as defined in the SD DENR "General Permit for Storm Water Discharges Associated with Construction Activities."

SWPPP CHECKLIST (cont.)

Chk	Permit Citation	Action/SWPPP Requirement	SWPPP Page
<input type="checkbox"/>	4.2.2.f	Notes are provided on the plan sheets to indicate the contractor's responsibility for locating and providing appropriate erosion and sediment controls for material storage and staging areas.	
<input type="checkbox"/>	4.3.3.(3)(a)	In common drainage locations, provisions have been made to store at least 3,600cf of sediment per acre drained by some approved means. <i>Note: Small traps are only used where the right-of-way will not accommodate larger, single structures.</i>	
Storm Water Management (4.2.2.b)			
<input type="checkbox"/>	4.22.(3)b(1)	Plan sheets describe permanent structures for storm water management after construction. Provisions may include the following:	
<input type="checkbox"/>		Grassed medians or improved vegetated ditches and swales	
<input type="checkbox"/>		Storm water ponds and basins	
<input type="checkbox"/>		Velocity dissipation devices at discharge points	
<input type="checkbox"/>		Sand or media filters	
<input type="checkbox"/>		Underground vaults and structures	
<input type="checkbox"/>	4.2.2(3)b(1) 4.2.2(3)b(2)	Plan and/or notes pages provide a technical explanation of the controls used in 4.2.2. (b) (1) and (2).	
Stabilization Practices (4.2.2.2)			
<input type="checkbox"/>	4.2.2.2	Section D notes pages provide a schedule and description of interim and permanent stabilization practices to be included.	
<input type="checkbox"/>	4.2.2.2	Estimated/actual dates provided for when disturbance will occur.	
<input type="checkbox"/>	4.2.2.2	Estimated/actual date of when construction activities are suspended temporarily or permanently on an area of the site.	
<input type="checkbox"/>	4.2.2.2	Estimated/actual dates when temporary or permanent stabilization measures are initiated.	
Other Controls (4.2.2.(3)c)			
<input type="checkbox"/>	4.2.2.(3).c (1)	Plan provides narrative of procedures to maintain vegetation, erosion and sediment control measures (see Section D notes).	
<input type="checkbox"/>	4.2.2.(3).c (2)	Plan provides narrative of how waste and construction materials are to be stored on the site, along with the means to prevent spills and or clean them up should they occur (see Section D notes).	
<input type="checkbox"/>	4.2.2.(3).d	Plan cites any applicable local controls or plans that are in addition to the general permit requirements.	
Maintenance (4.2.3)			
<input type="checkbox"/>	4.2.3	Plan provides a description of maintenance provisions and requirements for all BMP types (See Section D notes).	

SWPPP CHECKLIST (cont.)

Inspections (4.2.4)			
<i>Note: Regular inspections ensure the project remains in compliance with the general permit. Therefore, inspections are the focus of the construction period maintenance program.</i>			
<input type="checkbox"/>	4.2.4	The narrative addresses the inspection schedule and reporting requirements (see Section D notes).	
<input type="checkbox"/>	4.2.4	The narrative stipulates the basic requirements that inspections occur once every 7 calendar days and within 24 hours of the end of any event or snow melt of 0.5 in (12mm) (see Section D notes).	
<input type="checkbox"/>	4.2.4	The plan includes a copy of the required inspection forms to be used.	
<input type="checkbox"/>	4.2.4	Plan requires implementation of needed corrections within 7 days of the inspection (see Section D Notes).	
Signature and Plan Review			
<input type="checkbox"/>	4.3.1, 6.7.1.c and 6.7.3	Signatures have been executed properly by individuals with proper authority to sign.	

² Stabilization must be initiated within 14 days of the suspension of construction activities unless earth-disturbing activities will be resumed within 21 days. Any other exceptions must be approved by the SD DENR secretary. ³ It is recommended that maintenance be addressed by BMP type. The specification sheets and templates can carry standard maintenance requirements and be cited in the narrative.

MOBILIZATION CHECKLIST

(Inspection)

Use this checklist to aid your inspection of the site. Make sure this form is maintained with the required SWPPP project records. *Note: No construction activities should take place until all items on this list have been completed.*

General Permit Documentation (SWPPP and NOI)

- Approval of the NOI and SWPPP received from SD DENR.
- SD DENR authorization letter, NOI, name of contacts, and SWPPP location posted so they can be read without entering the site (this may be a construction entrance or a visible corner).
- Contractor information, site superintendent name(s), contact numbers, and address has been appended to the SWPPP and posted along with the other required information (see above).
- Contractor's designated site superintendent has successfully completed the SDDOT Water Quality Enhancement Certification Program.
- The conformed SWPPP is in place as posted.
- The contractor and the designated site superintendent have been instructed with regard to regular inspections, record keeping, and SWPPP maintenance.
- Contractor has secured coverage under the SD DENR permit for all offsite facilities: batching plants, staging sites, borrows, or other areas that will provide materials to the project.

Deployment of Erosion and Sediment Control BMPs

- Areas that will be disturbed in the initial phase of work have erosion controls shown on the plan, and are in place and properly installed.¹
- The installed erosion controls appear to cover all potential erosion hazards of the site.² Provide notes and corrections required on the appropriate forms and attach them to this checklist.
- Sediment controls are provided in all disturbed side slopes and down slopes that may direct runoff to adjacent properties or water bodies. Note any deficiencies on the appropriate forms and attach them to this checklist.
- All ingress and egress to the construction site occurs at designated points designed to prevent tracking of sediment from the site.
- Contractor has made provisions for wind erosion control and dust control.

¹ It is understood that, depending on the scope of the project, the contractor is encouraged to phase the work to minimize the amount of area disturbed at one time. This item applies only to the areas of the project that will be disturbed in the initial phase of the work. In subsequent phases the erosion and sediment controls must be in place prior to any disturbance of the surface.

² Inspectors should be alert for any potential erosion hazards that may not have been identified during the plan preparation process.

SWPPP SITE INSPECTION FORM

Use this form to record required site inspections during the course of constructing a project. It is a primary tool for ensuring compliance with SD DENR's General Permit for Storm Water Discharges Associated with Construction Activities. Forms are to be completed and maintained with the other SWPPP documentation.

Project Information					
Project Number:		Inspection Type		Inspection Date:	
PCN:		<input type="checkbox"/> 24 hr. after a > 0.5" Event		Date of Last Rainfall:	
County:		<input type="checkbox"/> Regular 7 th Day Inspection		Depth of Last Rainfall:	
Areas Inspected					
Area Type	Inspected	Area Type	Inspected	Area Type	Inspected
	✓/NA		✓/NA		✓/NA
Disturbed Areas		Structural BMPs		Construction Entrance(s)	
Material Storage Areas		Sediment Controls		Other:	
How was inspection conducted? (check all that apply)					
		<input type="checkbox"/> Windshield	<input type="checkbox"/> Walking	<input type="checkbox"/> Aerial	
Erosion and Sediment Controls Inspected					
Except for the instances listed below, all structural sediment and erosion controls have been inspected and were found to be in working order, to require no maintenance, corrective actions, or additional controls.					
BMP Type (see table)	Approximate Station		Left or Right of centerline	BMP Maintenance or Corrective Action Needed <small>Describe required corrective actions, maintenance, or additions needed, conducted, or directions given to the contractor or subcontractor responsible.</small>	
	From	To			
Additional BMPs Needed					
Any additional BMPs not shown on the SWPPP must be approved by the Project Engineer. If multiple locations are involved, identify the exact location of each addition.					
Approximate Station		Right or Left of Centerline	Description		
From	To				

SWPPP MODIFICATION FORM

Use this form to record changes made to the SWPPP which correct any deficiencies or unanticipated erosion and sediment control needs.

SWPPP Modification			
Project Number:		PCN:	
County		Project Length:	
Changes			
Certification			
I certify under penalty of law that I understand the terms and conditions of the General Storm Water Permit for Construction Activities from the SD DENR that authorized the storm water discharges from the construction site, and will follow these requirements as detailed in this plan.			
Signed: _____ Contractor's Project Superintendent		Date: _____	
Title: _____			
The South Dakota Department of Transportation approves the modifications to the Storm Water Pollution Prevention Plan as described above and authorizes the Contractor to proceed with construction.			
Signed: _____ Contractor's Project Superintendent		Date: _____	
Title: _____			

FINAL INSPECTION CHECKLIST

Use this form for the final inspection of the site leading up to the NOT filing. Prior to filing the NOT, all temporary erosion and sediment controls are to be removed from the site. This checklist should be used to inspect the site and should be maintained with the required SWPPP project records as required by the SD DENR.

Removal of Structural Erosion and Sediment Control BMPs

- All erosion and sediment controls shown on the revised SWPPP and plan sheets have been removed.
- Any additional disturbance caused by the removal of BMPs has been reseeded or repaired so that no sediment-laden discharge will leave the site.
- All side slopes and embankments have achieved a cover equivalent to 70% of adjacent surface cover. Cover is generally uniform with no large bare spots, and no significant rilling is present.
- All ingress and egress points to the site have been restored and have either permanent paved surfaces or have been revegetated to the standard of 70% of adjacent cover.

Waste Disposal and Spill Management

- No areas of the site have, or appear to have, any residual contamination from spills. Any spills that did occur have been completely cleaned and appropriate surface cover is in place.
- There is no evidence of petroleum residue or spills left in areas used for equipment or material storage, and surfaces have been properly restored.

NOTES:

In this section note any deficiencies, additions, or corrections that need to be made prior to filing the NOT.

Signature: _____

Date: _____

SDDOT Project Engineer

Signature: _____

Contractor Site Superintendent

4 Construction Specifications

4.1 Seeding (Spec. 730.1)

This work consists of preparing a seedbed and furnishing and planting seed on disturbed areas, except roadbeds, within the limits of the work.

Types of Seeding

SDDOT uses two types of seeding: *permanent seeding* and *cover crop seeding*.

- Permanent seeding is the planting of grass mixtures that are to become the permanent roadside growth.
- Cover crop seeding is the vegetation used to temporarily protect slopes and channels until the permanent seeding is applied.

Materials (730.2)

- Seed furnished must have been grown in South Dakota, North Dakota, Montana, Wyoming, Nebraska, Iowa, or Minnesota.
- Seed grown outside these areas may be used only after the Contractor provides written certification from three seed suppliers confirming that the required seed is not available in this area.

SOUTH DAKOTA	
MATERIALS AND WEIGHT TICKETS	
PROJECT	I 90-5(4) 247
MATERIAL	Perm. Seed
DATE	July 22, 1999
TANK OR CAR NO.	SAMPLE NO.
TRUCK NO.	M. GALS.
GROSS WT.	LANE
TARE WT.	SECTION
NET WT.	STATION
TONS	SPREAD
WEIGHER	END STA.
	CHECKER CC
CONCRETE MIX (TREATED MAT (LS)	WATER MAX. ACTUAL
TIME START MIX DISCHARGED	BATCH SIZE
REVOLUTIONS: RATE	INSPECTORS
FINAL INITIAL	PLANT
NET	PLACING
REMARKS	130# Sec 3 - 213# Sec 4
No. D 617601	BOOK QUANTITY
	PREV. TICKET
	THIS TICKET
	TOTAL

Seed Testing (730.2 C)

- For seed amounts over 100 lbs (45 kg) a certified test report shall be furnished by the Contractor prior to the start of all seeding operations.
- The certification must have been conducted within the prior 9 months stating the seed has been tested for noxious weed seed, dormant seed, and germination.
 - When seed is harvested it is impossible to collect only the seed itself. Typically, chaff, husks, pebbles and even weed seed are collected along with the desired seed. In other words, a bag of grass seed is not PURE seed. Furthermore, not all seed is LIVE or viable and may never germinate.
 - Using the information from the seed bag tag you can determine what percentage of the seed bag is actually pure, live seed (PLS). To calculate PLS use the following formula based on the information on the seed tag:

$$\% \text{ Purity} \times \% \text{ Germination} = \% \text{ PLS}$$

Labeling (730.2 D)

- Every bag of seed delivered to the project must bear a tag which indicates the following information:
 - Name/address of supplier
 - County and project number for which seed is to be used
 - Supplier's lot number for each kind of seed in the mixture

- Origin for each seed type
- Purity and germination of each seed type
- Pounds of bulk seed in each bag
- Total pounds of bulk seed mixture in each bag
- Pounds of PLS of each seed of each type of seed in each bag
- Total pounds of PLS mixture in each bag
- Dormant seed and hard seed
- Legumes (alfalfa, clover, etc) must include a label of certification indicating that the seed has been inoculated with nitrogen fixing bacteria to ensure nitrogen is available for germination.

General Seeding Requirements (730.3)

- Seeding should take place as soon as finish grading and topsoiling on each section has been completed with the following exceptions:
 - Frozen ground
 - High winds
 - Area under water
- During site preparation and drilling, slopes shall be worked longitudinally parallel to contour.
- The Engineer may approve necessary adjustments in the requirements to obtain satisfactory results under varying conditions.

Seasonal Limitations (730.3 B)

- Permanent seeding shall not be done between June 1 and August 1 without written authorization from the Region Engineer.
- There are no seasonal limitations for cover crop seeding.
 - Oats can be used from April through July
 - Winter Wheat can be used from August through November
 - Both of these shall be applied at 56 lbs (26 kg) per acre with a minimum 75% PLS.

Seedbed Preparation (730.3 E)

- Initial preparation of newly graded areas for seeding shall be worked to a depth of approximately 3 inches. This should be accomplished in one pass if possible.
- The final prepared seedbed should be left in a roughened condition consisting of lumps of two to three inches for maximum resistance to erosion. Working the soil to a fine pulverized condition should be avoided.

4.2 Fertilizing (Spec. 731.1)

This work consists of furnishing and applying fertilizer material on areas to be seeded or sodded.

Materials (731.2)

- Fertilizer must be a dry, standard commercial product conforming to the South Dakota Fertilizer Law.
- Each bag or container shall clearly show the following information:
 - Net weight of the contents
 - Name and address of the manufacturer
 - Brand and grade of fertilizer
 - Guaranteed analysis showing minimum percentages of total nitrogen, phosphoric acid, and water soluble potash, in that order (N-P-K).
- The Contractor shall submit a certified statement that the fertilizer is certified for sale in South Dakota and complies with the South Dakota Fertilizer Law.

SOUTH DAKOTA	
MATERIALS AND WEIGHT TICKETS	
PROJECT	I 90-5(4)247
MATERIAL	Fertilizer
DATE	July 22, 1999
TANK OR CAR NO.	SAMPLE NO.
TRUCK NO.	M. GALS.
GROSS WT.	LANE
TARE WT.	SECTION
NET WT.	STATION
TONS	SPREAD.
WEIGHER	END STA.
	CHECKER CC
CONCRETE MIX (TREATED MAT'L S)	WATER MAX. ACTUAL
TIME START MIX	BATCH
DISCHARGED	SIZE
REVOLUTIONS: RATE	INSPECTORS
FINAL INITIAL	PLANT
NET	PLACING
REMARKS	WIN * 26.3 - 1240 * 36.0
No. D 617602	BOOK QUANTITY
	PREV TICKET
	THIS TICKET
	TOTAL

Construction Requirements (731.3)

- Fertilizer shall not be applied more than 48 hours prior to seeding.
- Fertilizer shall be applied by one of the following methods:
 - With a drill at the time the seed is planted (preferred method)
 - Drilling prior to seeding
 - Mixed with the water and applied during hydro-seeding process
 - By hand-operated broadcaster following sod installation
 - By equipment mounted broadcast spreaders on slopes flatter than 6:1

4.3 Mulching (Spec. 732.1)

This work consists of placing a mulch cover on slopes or designated areas following seeding and fertilizing operations.

Materials (732.2)

- Grass Hay or Straw Mulch (732.2 A)
 - Shall be free of noxious weed seeds and objectionable foreign matter
 - Bromegrass is not an acceptable mulch
- Fiber Mulch (732.2 B)
 - Fiber mulch that is blended with recycled paper is not allowed.
 - When properly applied, the fibers shall readily absorb water and allow infiltration to the underlying soil without restricting emergence of seedlings.
- Bonded Fiber Matrix – BFM (732.2 C)
 - The BFM shall be 100% biodegradable and composed of 90% wood fiber, 9% natural water resistant binder, and 1% organic activators (all by weight)
 - Shall be uniformly applied and shall have no gaps between the product and the seeded soil.

SOUTH DAKOTA	
MATERIALS AND WEIGHT TICKETS	
PROJECT	F 90-6(18) 15
MATERIAL	Fiber Mulch
DATE	July 22, 1999
TANK OR CAR NO.	
TRUCK NO.	
GROSS WT	
TARE WT	
NET WT	7918#
TONS	3.96
WEIGHER	
SAMPLE NO	
M. GALS	
LANE	
SECTION	10
STATION	
SPREAD	
END STA	
CHECKER	CC
CONCRETE MIX (TREATED MAT'LS)	WATER: MAX _____ ACTUAL _____
TIME START MIX _____	BATCH SIZE _____
DISCHARGED _____	INSPECTORS _____
REVOLUTIONS: RATE _____	PLANT _____
FINAL _____	PLACING _____
INITIAL _____	
NET _____	
REMARKS:	Section 6-952# - 1011# - 981# 943# - 1032# - 1008# - 973# - 987#
No. D 617604	BOOK QUANTITY _____
	PREV TICKET _____
	THIS TICKET _____
	TOTAL _____
LEAVE THIS SLIP IN BOOK	

Construction Requirements (732.3)

- During mulching operations, suitable warning signs shall be provided in accordance with Section 7.10.
- Grass Hay or Straw Mulch (732.3 A)
 - Placing
 - Mulch shall be applied within 48 hours after the seeding has been completed. Mulching operations shall not be performed during periods of high winds.
 - Mulch shall be placed evenly over seeded areas. Approximately 10% of the soil surface shall be visible through the mulch blanket.
 - Mulch shall be applied at a rate of 4000 lbs/acre.
 - Punching
 - Immediately following the placement of the application of the hay or straw mulch, the material shall be punched into the soil approximately 3 inches.
 - See the equipment section (section 4.6) for equipment requirements.
- Fiber Mulch (732.3 B)
 - Fiber mulch shall be applied at the rate of 2,000 lbs/acre. Excessive thickness should be avoided so that seedlings will not be smothered.
 - Fiber mulch should be placed within 48 hours of seeding.

- Bonded Fiber Matrix (732.3 C)
 - BFM shall be applied at the rate of 3900 lbs/acre with a mixing rate of 50 lbs of BFM to 125 gallons of water.
 - BFM should be placed within 48 hours of seeding.
- Care During Construction (732.3 D)
 - All equipment, vehicles, and foot traffic shall be avoided on the seeded and mulched areas.
 - Any areas where the original mulch has been displaced or damaged shall be re-mulched.

4.4 Sodding (Spec. 733.3)

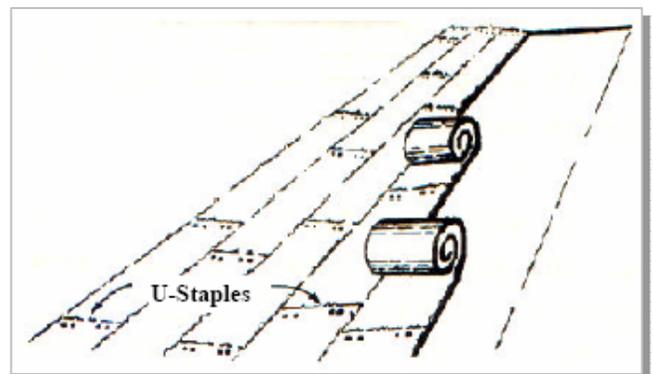
This work consists of preparing the ground surface, as well as furnishing, transporting, placing, and fertilizing live sod.

Materials (733.2)

- The sod shall consist of a dense, well rooted growth of Kentucky Bluegrass or other approved grass native to the locality of the project. It shall be free of noxious weeds and other foreign material.
- At the time of cutting, the grass must be approximately 2 inches and raked free of debris.
- Sod must be kept moist so that it does not crumble or break when delivered using a municipal, domestic water source.

Construction Requirements (733.3)

- Cutting sod (733.3 A)
 - Sod shall be machine cut in rectangular sections and uniform in width.
 - Sod strips which crumble, tear, or fall apart will not be accepted.
 - Sod shall be laid within 36 hours of being cut.
- Preparing surface for planting (733.3 B)
 - Surface must be smooth, uniform, and free of stones, roots and other debris. The surface shall be undercut to sufficient depth below adjacent areas so the top of the newly laid sod will be flush with any adjacent seeded areas and 1 inch below the top of sidewalks, curbs, and other structures.
 - Immediately prior to placing the sod, the soil shall be loosened to a fine granular texture to a depth of not less than 1 inch.
 - If the ground is dry or hot, prewatering of the bed to a depth of 1 inch may be required. Allow sufficient drying time to avoid tracking during installation of the sod.
- Laying sod (733.3 C)
 - Sod shall be laid by hand horizontally on slopes beginning at the bottom and working up. In waterways, strips should be laid parallel to direction of flow.
 - Strips shall be laid tightly together without overlap.



- Fertilizing (733.3 D)
 - Immediately following sod installation, fertilize the sod at the specified rate.
- Anchoring (733.3 E)
 - On slopes steeper than 6:1 anchor sod using 1 inch x 6 inch ungalvanized steel staples. A minimum of 4 staples per sod strip in every other row shall be used.
 - In waterways, place two staples on the upstream end of the sod strip.
- Watering (733.3 F)
 - Sod shall be kept moist throughout the entire depth for four weeks after installation.
 - At the end of the four week period an inspection will determine if the sod is alive and growing. Any replaced sod will be watered as required for original sod.
- Rolling (733.3 G)
 - Rolling is not required but may be ordered where smooth and level surfaces are required.

4.5 Erosion Control and Water Pollution Control (Spec. 734.1)

This work consists of permanent and temporary measures to control erosion, sedimentation, and water pollution.

Materials (734.2)

- **Temporary Erosion Control (734.2 B)**
 - Silt fence shall consist of temporary vertical fabric supported by woven wire (26" wide with 6 horizontal wires with 6" or 12" vertical spacing) with wood (minimum 5' x 3" diameter) or steel posts (minimum 5') and entrenched into the ground.
 - Erosion bales shall consist of straw or hay anchored as detailed in the plans.
 - Silt fence shall be placed at locations designated on the plans (or at locations selected by the engineer) before earth disturbing activities have begun (except for those areas which are impractical because it may interfere with construction activities).
 - When a trench can not be excavated, 30 – 40 pound sandbags shall be used to prevent underflow at the bottom of the silt fence.
- **Permanent Erosion Control (734.2 C)**
 - Erosion Control Blanket (ECB) shall be installed in accordance with the plan. Only erosion control blankets on the approved product list shall be allowed.

Water Pollution Control (734.3 A)

- Materials used in water pollution control work shall conform to the requirements set forth in the contract.
- The Contractor is required to perform water pollution control measures in the sequence and manner outlined in the contract.
- The Engineer has the authority to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other water courses. Such work may include the construction of temporary structures, berms, dikes, basins, slope drains, mulches, mats or seeding.

- Contractor equipment yards and service areas shall have containment berms or be located so runoff does not reach waterways or other water impoundments.
- If any conflicts between these specifications and federal, state or local regulations occur, the more restrictive regulation shall apply.

Temporary Erosion Control (734.2 B)

- The Contractor shall not begin the removal of surfacing or topsoil until all temporary erosion control measures are placed beyond the work limits but within the ROW/easements.
- The Contractor shall not begin earth moving operations in a third mile until erosion control measures have begun in the first mile.

Permanent Erosion Control (734.2 C)

- This work shall be done as soon as possible after finish grading and topsoil placement is complete, and if practical, prior to seeding, fertilizing, and mulching of adjacent areas.
- Ditches, channels, and other water courses should be shaped, and topsoil should be placed according to plans.
- Immediately following the shaping and preparation of the area, seed and fertilizer should be placed. Where drilling is not practical, other methods such as broadcasting, raking, and dragging seed and fertilizer is permitted.
- Erosion control blanket shall be installed, placed, and anchored according to manufacturer's installation guidelines. Manufacturer's recommendations shall be submitted to the Engineer prior to installation.

4.6 Equipment

Seed Drills

The Standard Specifications call for using a press drill for seeding. However, other drills may be used if they are equipped with packer wheels that follow directly behind double disk furrow openers and provide the same compaction obtained by a press drill.

The drill must be equipped with double disk and individually mounted furrow openers spaced no greater than 8 inches apart. Each furrow opener must be spring loaded and fitted with a depth band. The depth band is a 1 inch metal ring or drum attached to the side of each disk and keeps the furrow opener from cutting too deep into the soil, which results in the seed being planted too deep. It is important to check the depth bands regularly as they tend to vibrate and become loose or fall off completely.



The pressure spring pushes the furrow opener into the soil and maintains constant pressure. It is important to make sure that the springs are of equal pressure to achieve uniform seed planting depth.

The seed box is equipped with a gear or chain-driven vane which accurately meters out the seed at the required rate. Seed rate is controlled by the speed at which the vane operates or by adjusting a sliding gate in the feed opening. There is an agitator over the feed opening to help keep the seed thoroughly mixed. When seeding on a slope, the seed box must contain dividers (spaced no further than 2 feet apart). This will prevent the seed from sliding to the lower end of the box, resulting in no seed being planted by part of the drill.

The drill is to have press wheels which follow directly behind each furrow opener. These wheels should carry the major portion of the drill's weight and be mounted independently of the furrow openers. Their purpose is to compact the soil over the seed which helps keep the seed in place and help retain moisture. The seed should be planted between $\frac{3}{4}$ inch and 1 inch after the press wheels have passed over them. Planting too shallow will cause the seed to dry out too soon (less moisture). Planting too deep will cause the seedling to die before reaching the surface and sunlight.

The drill should be equipped with a metering device which measures the area covered by the drill (usually in acres). Using this meter eliminates the need to measure the seeded area. Calibration to the metering device is critical to ensure proper application rates.

There is no speed requirement for the seed drill. However, experience shows that 5 mph should be the maximum. Seeding faster than this may cause the openers to bounce, resulting in the seed not being placed at the right depth. Bouncing may also cause the feed hoses to disconnect from the openers.

Calibrating Seed Drill

Calibration is necessary to ensure the seed is applied at the designated seed rate on the plans. To calibrate a drill follow these simple steps:

1. Set the feeder to a known opening.
2. Place a known amount of seed in each seed box.
3. Start the seeding on a uniform surface at a known station.
4. Watch the seed in the seed box. Stop when seed box is empty.
5. Determine the distance traveled.
6. Multiply the distance traveled by the drill width. Divide that total by 43,560 sf (area of an acre). This will give you the number of acres seeded.
7. Divide the pounds of PLS indicated on the plan sheet to determine how many target acres should have been planted.

The calibration will be considered satisfactory if the actual acreage seeded is within +/- 5%. Calibration is required with every new type of seed mixture since the physical characteristics of the seed may change. Large, light, fluffy seed will apply different than small, hard seed.

The acreage meter should be calibrated at the same time as the seed calibration. This is done by resetting the meter and driving a known distance to make sure they match. If the meter is not accurate, a meter factor should be used. To find the actual acres seeded, multiply the meter factor times the metered acres. To calculate the meter factor use the following formula:

$$\text{meter factor} = \frac{\text{actual miles (nearest 0.01)}}{\text{metered acres}}$$

All calibration figures and calculations must be included in the project diary. It is also a good idea to document the number of acres seeded and keep track of what areas were seeded (backslope, easement, borrow area etc.).

No-Till Drill

No-till drills are specifically designed to plant seeds directly through existing vegetation. Typically, no-till drills are used to plant permanent seed directly into the existing cover crop planted earlier. By seeding directly through the existing vegetation, the existing soil is disturbed less, which reduces the possibility for erosion to occur. When this method is used, mulching is not necessary. No-till drill should not be used on areas that have been disked as the seed would be planted too deep for germination.



Hydroseeder

The hydroseeder is composed of two main parts: the large tank and the pressure pump. The mixture of seed, water, and fertilizer are mixed in the tank and applied in one application. When hydromulch is included, it will be applied as a separate application.

The tank should be equipped with either an auger-type agitator or jet spray. The agitator must be used at all times to ensure a uniform seed coverage. The amount of water used depends on the specific site. Experience will help determine the correct amount of water. The ground should be damp once the hydromulch is applied. Care should be taken not to use too much water as this will cause runoff from the slope and the seed will be carried offsite.



When applying on a slope, the contractor should start at the top of the slope and work his way down the slope. Do not allow wind to carry the mulch offsite as this will cause a reduction in the seed application rate. Do not apply mulch to standing water.

5 Reference Tables

Material Selection/Application Table

	Erosion Control Slopes 3:1 or flatter	Erosion Control Slopes 2:1 or steeper	Sediment Control Slopes	Velocity Reduction Channels	Surface Protection Channels	Perimeter Protection	Inlet Protection	Outlet Protection
BFM		X						
Rock Check Dams				X				
Compost	X							
Compost Berms			X			X		
Continuous Berm			X			X		
Crimped Straw	X							
Cover Crop Seeding	X							
ECB	X	X						

	Erosion Control Slopes 3:1 or flatter	Erosion Control Slopes 2:1 or steeper	Sediment Control Slopes	Velocity Reduction Channels	Surface Protection Channels	Perimeter Protection	Inlet Protection	Outlet Protection
Erosion Bales				X		X	X	
Fiber Roving	X							
Floating Silt Curtain						X		
Gabions					X			X
Hydraulic Mulch	X							
Interceptor Swale			X					
Pipe Slope Drain	X	X						
Riprap					X			X
Sand/Gravel bags				X		X	X	
Silt Fence						X	X	

Material Selection/Application Table (Continued)

	Erosion Control Slopes 3:1 or flatter	Erosion Control Slopes 2:1 or steeper	Sediment Control Slopes	Velocity Reduction Channels	Surface Protection Channels	Perimeter Protection	Inlet Protection	Outlet Protection
Slope Roughening	X	X						
Sodding	X							
Street Sweeping						X	X	
Triangular Silt Dike			X	X		X	X	
TRM					X			
Vegetated Buffer Strip			X			X		
Wattles			X	X		X		

Conversion Tables

Slope Measurements

Rise:Run	% Grade	Degree of Slope
1 : 1	100	45
1.25 : 1	80	38.7
1.50 : 1	66.7	33.7
1.75 : 1	57	29.7
2 : 1	50	26.6
2.25 : 1	44.4	24
2.50 : 1	40	21.8
2.75 : 1	36.4	20
3 : 1	33.3	18.4
3.50 : 1	28.6	15.9
4 : 1	25	14
5 : 1	20	11.3

Run = horizontal change in slope

Rise = vertical change in slope

% Grade = percentage difference between the run and the rise.

Degree of Slope = Angle of slope at the toe of slope.

Conversion Tables (cont.)

Length

Known	Multiply by	Results
Inches	2.54	Centimeters
Feet	0.304	Meters
Yards	.914	Meters
Mile	1.161	Kilometers
Centimeters	0.394	Inches
Meters	3.28	Feet
Meters	1.09	Yards
Kilometers	.621	Mile

Area

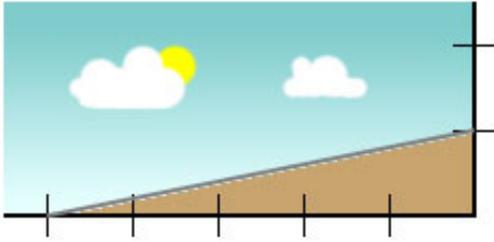
Known	Multiply by	Results
Sq. In.	6.45	Sq. Cm.
Sq. Ft.	.093	Sq. M.
Sq. Yd.	0.836	Sq. M.
Acres	4,840	Sq. Yd.
Acres	0.40	Hectares
Sq. Cm.	.155	Sq. In.
Sq. M.	10.8	Sq. Ft.
Sq. M.	1.20	Sq. Yd.
Hectares	2.47	Acres

Weight

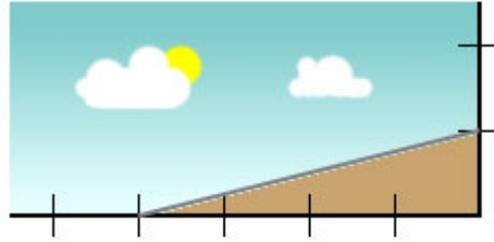
Known	Multiply by	Results
Ounce	28.4	Gram
Pound	0.45	Kilogram
Ton	.907	Metric Ton
Gram	.035	Ounce
Kilogram	2.20	Pound
Metric Ton	1.10	Ton

Slope Gradient

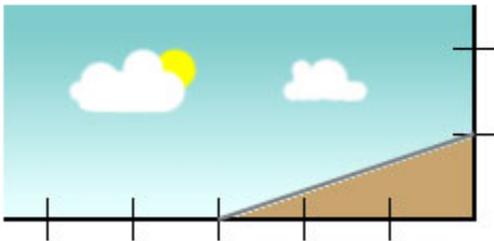
5.0:1.0 Slope Gradient



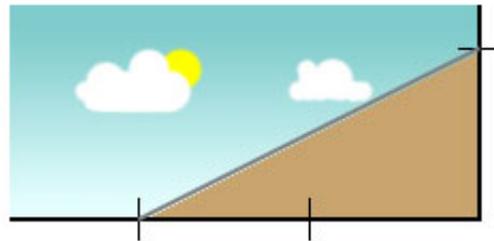
4.0:1.0 Slope Gradient



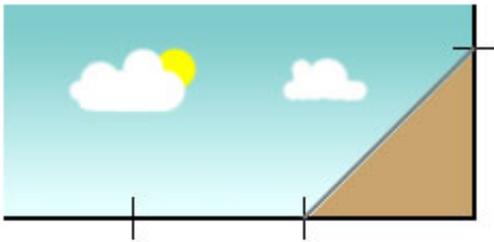
3.0:1.0 Slope Gradient



2.0:1.0 Slope Gradient



1.0:1.0 Slope Gradient



0.5:1.0 Slope Gradient

