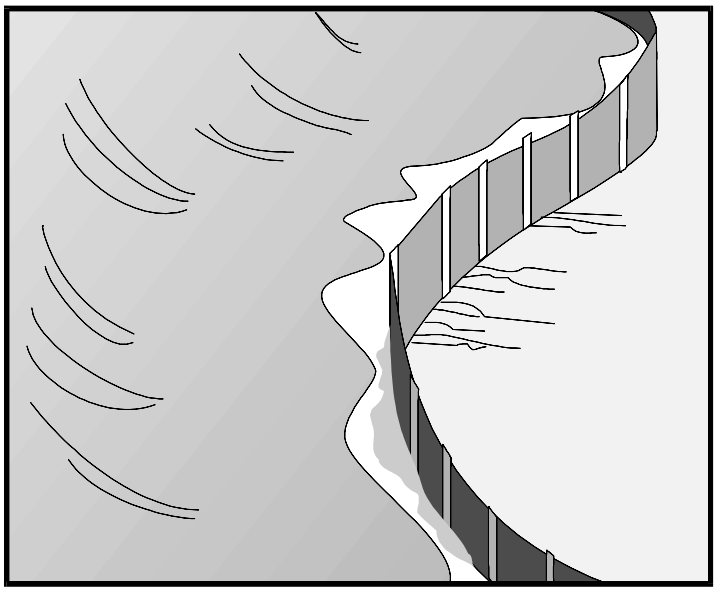
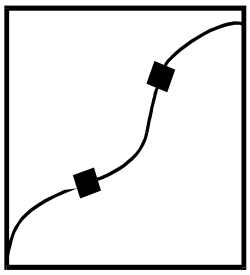
Silt Fence SC-1





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A silt fence is a temporary linear sediment barrier of permeable fabric designed to intercept and slow the flow of sediment-laden sheet flow runoff. Silt fences allow sediment to settle from runoff before water leaves the construction site.

Appropriate Applications

Silt fences are placed:

- Below the toe of exposed and erodible slopes.
- Down-slope of exposed soil areas.
- Around temporary stockpiles.
- Along streams and channels.

Limitations

- Not effective unless trenched and keyed in.
- Not intended for use as mid-slope protection on slopes greater than 4:1.
- Must be maintained to remain effective.
- Not intended for use in streams, channels, or anywhere flow is concentrated.
- Difficult to install and maintain in windy areas.
- Must be removed and disposed of.

Design Guidelines and Considerations

- Do not use below slopes subject to creep, slumping, or landslides.
- Do not use in streams, channels, or anywhere flow is concentrated.
- Do not use silt fences to divert flow.
- The maximum length of slope upgradient of the silt fence should be 60 m (200 ft) or less to minimize flow volumes and velocities and increase the effectiveness of the silt fence.
- Slope of areas draining to fence should be less than 1:1 but can be used below steeper slopes at the Engineers discretion.
- Limit to locations suitable for temporary ponding or deposition of sediment.
- Fabric life span generally limited to between five and eight months. Longer periods may require fabric replacement.
- Lay out in accordance with MDT Standard Specifications for Geosynthetics Construction and the Silt Fence (SC-1) Detail Drawing.
- For slopes steeper than 2:1 and that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to install additional protection immediately adjacent to the bottom of the slope, prior to installing silt fence or use stabilized silt fencing installation method as shown in the Silt Fence (SC-1) Detail Drawing.
- For slopes adjacent to water bodies, additional soil stabilization BMPs shall be used.
- Materials shall conform to MDT Standard Specification - Geosynthetic Construction and Miscellaneous Materials.
- Generally, silt fences should be used in conjunction with soil stabilization source controls up slope to provide effective control.
- Trenches should not be excavated wider and deeper than necessary for proper installation of the temporary linear sediment barriers.
- Excavation of the trenches should be performed immediately before installation of the temporary linear sediment barriers.
- Silt fences should be set back at least 1 m (3 ft) from the toe of a slope. Where a silt fence is determined to be not practicable due to specific site conditions, the silt fence may be constructed at the toe of the slope, but should be constructed as far from the toe of the slope as practicable.
- Construct the length of each silt fence section so that the change in base elevation along the section does not exceed 1/3 the height of the barrier. This will minimize the chance of storm water from the higher elevation areas traveling along the silt fence from overtopping the silt fence in the lower elevation areas. Each silt fence reach should be limited to 150 m

(500 ft) in order to minimize the amount of water that may accumulate in lower elevation areas.

- When stabilized silt fences are required, they should be installed with steel posts and wire backing following MDT Standard Specifications and the Silt Fence (SC-1) Detail Drawing.

- Cross barriers (barriers that limit water movement along the silt fence) should be a minimum of 1/3 and a maximum of 1/2 the height of the silt fence. Cross barrier placement along silt fencing is shown in the Silt Fence (SC-1) Detail Drawing.

Maintenance, Inspection, and Removal

- Repair undercut silt fences as soon as possible.

- Repair or replace split, torn, slumping, or weathered fabric as soon as possible.

- Inspect silt fence when rain is forecast. Perform necessary maintenance, or maintenance required by the Engineer.

- Inspect silt fence following rainfall events. Perform maintenance as necessary, or as required by the Engineer.

- Maintain silt fences to provide adequate sediment holding capacity. Sediment should be removed when the sediment accumulation reaches 1/3 of the barrier height. Removed sediment should be incorporated in the project at locations designated by the Engineer or disposed of outside the right-of-way as approved by the Engineer.

- Silt fences that are damaged and become unsuitable for the intended purpose, as determined by the Engineer, should be removed from the site and disposed of outside the right-of-way in conformance with the Standard Specifications. Replace damaged silt fence with new silt fence in accordance to MDT Special Provisions and Detail Drawings.

- Holes, depressions or other ground disturbance caused by the removal of the temporary silt fences should be backfilled and repaired.

- Remove silt fence when no longer needed or as required by the Engineer. Fill and compact postholes and anchorage trench, remove sediment accumulation, and grade fence alignment to blend with adjacent ground.

SYMBOL: ——————— ———SF———

SILT FENCE SC-1:

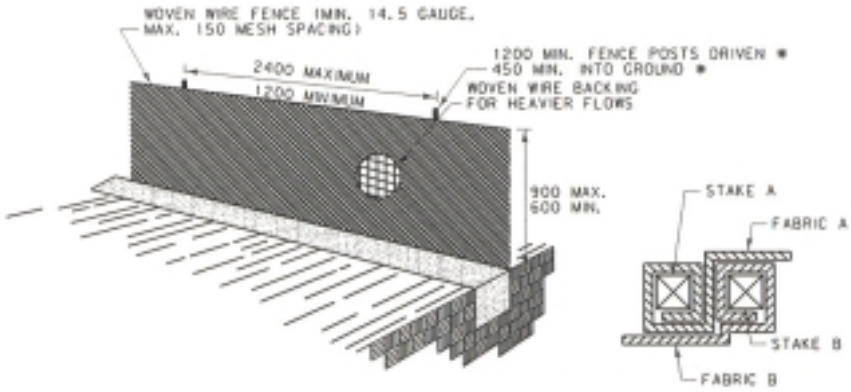
SILT FENCE IS A SINGLE OR SERIES OF FILTER FABRIC SEDIMENT BARRIER STRETCHED AND ATTACHED TO SUPPORTING POSTS. THE FENCE BOTTOM IS ENTRENCHED.

SILT FENCES ARE USED FOR SHEET FLOWS TO ASSIST IN SEDIMENT CONTROL BY RETAINING SOME OF THE ERODED SOIL PARTICLES AND SLOWING THE RUNOFF VELOCITY TO ALLOW PARTICLE SETTLING. APPLICATIONS INCLUDE WATER RESOURCE PROTECTION, INLET PROTECTION, BANK PROTECTION, AND TOE OF SLOPE PROTECTION. INSTALL SILT FENCES PRIOR TO DISTURBING AREAS REQUIRING THIS BMP OR AS SLOPE GRADES ARE ACHIEVED. MAXIMUM CUT OR FILL SLOPE FOR A SILT FENCE IS 2:1. FOLLOW MDT STANDARD SPECIFICATION 622 FOR SILT FENCE MATERIALS AND INSTALLATION.

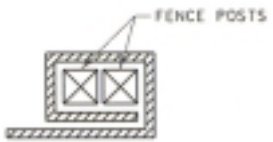
THERE ARE TWO TYPE OF SILT FENCE INSTALLATIONS:
- UNSTABILIZED - SILT FENCE SUPPORTED WITH EITHER WOOD OR METAL FENCE POSTS.
- STABILIZED - SILT FENCE SUPPORTED WITH METAL POSTS AND WITH WOVEN WIRE BACKING.

ENTRENCHMENT - THE INITIAL SILT FENCE INSTALLATION REQUIRES ONLY THE VERTICAL ENTRENCHMENT COMPONENT UNLESS THE ENGINEER DETERMINES BOTH VERTICAL AND HORIZONTAL ENTRENCHMENT COMPONENTS ARE NECESSARY. IF THE FENCE REQUIRES REPLACEMENT DUE TO FAILURE FROM PULLOUT OR UNDERCUTTING, THE SUBSEQUENT INSTALLATION WILL INCLUDE BOTH VERTICAL AND HORIZONTAL ENTRENCHMENT COMPONENTS.

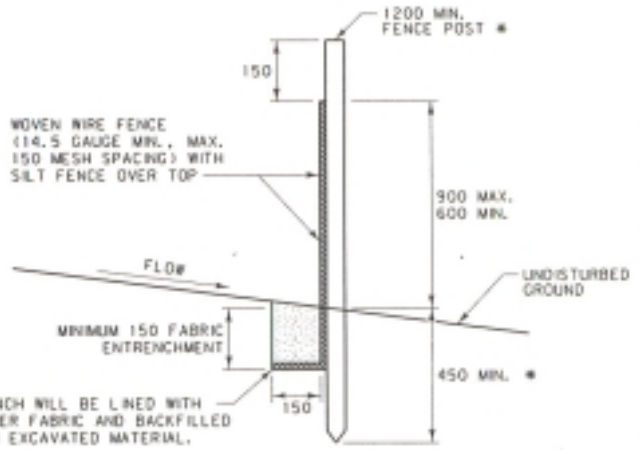
SILT FENCES ARE USED BETWEEN THE EDGE OF CONSTRUCTION DISTURBANCE AND A WATER RESOURCE, AND AT A CRITICAL RESOURCE OR RIGHT-OF-WAY LINE THAT IS ADJACENT TO CONSTRUCTION ACTIVITY. POSITION THE BARRIER TO PREVENT SEDIMENT FROM ENTERING DRAINAGES. DO NOT PLACE THE BARRIER ACROSS LIVE STREAMS. WOVEN WIRE BACKING IS NECESSARY WHEN DEALING WITH HEAVIER FLOW VELOCITIES AND SEDIMENT OR AS A ROCK BARRIER. REMOVE SEDIMENT FROM BEHIND THE FENCE WHEN IT ACCUMULATES TO ONE-THIRD THE ORIGINAL HEIGHT. EITHER GRADE AND SEED OR REMOVE THE SEDIMENT DEPOSITS PRIOR TO REMOVAL OF THE FENCE. DISTANCES BETWEEN SILT FENCE WHEN USED FOR SEDIMENT RETENTION ARE AS FOLLOWS:
- FROM 2% TO 3% PLACE SILT FENCE AT 150 METER SPACING
- FROM 3% TO 4% PLACE SILT FENCE AT 90 METER SPACING
- FROM 4% + PLACE SILT FENCE AT 45 METER SPACING



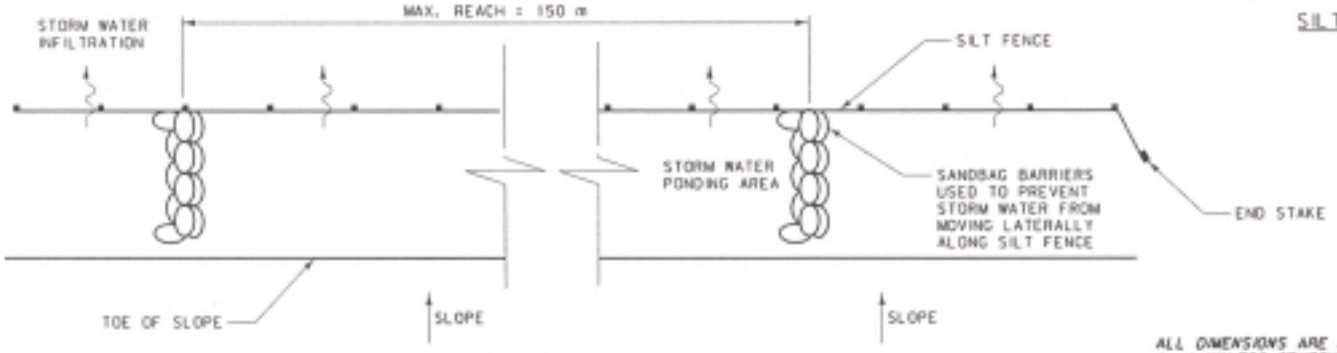
JOINING SECTION DETAIL



END STAKE DETAIL



SILT FENCE - CROSS SECTION



SILT FENCE - PLAN VIEW

* FOR CLEAR ZONE APPLICATIONS USE MAX. POST LENGTH OF 1500 mm WITH A MIN. BURIAL DEPTH OF 450 mm.

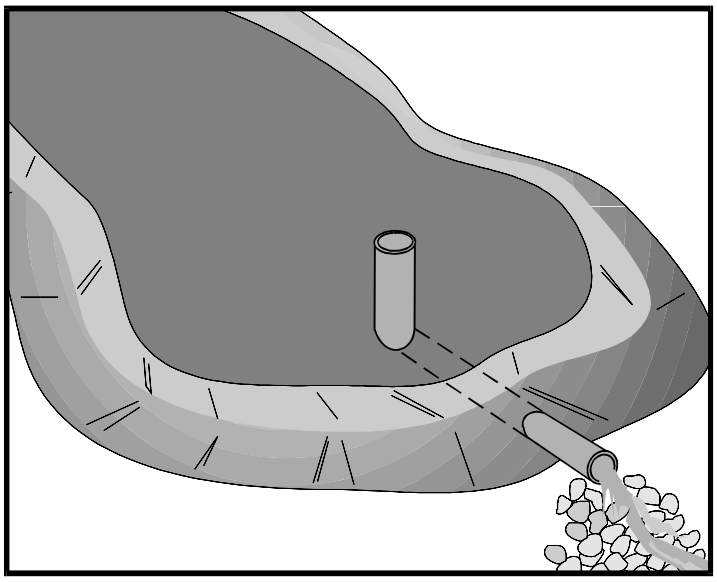
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

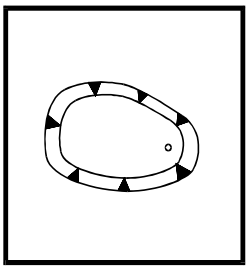
PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-22
SILT FENCE (SC-1)	
EFFECTIVE:	

CDM Camp Dresser & McKee Inc.

Desilting Basin SC-2





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A desilting basin is a temporary basin formed by excavation and/or constructing an embankment so that sediment-laden runoff is temporarily detained under slow flowing conditions, allowing sediment to settle out before the runoff is discharged. MDT's Hydraulics Section is responsible for the design of desilting basins that will be left as permanent structures.

Appropriate Applications

Desilting basins shall be considered for use:

- Where sediment-laden water may enter the drainage system or watercourses; and
- At outlets of disturbed soil areas with areas between 2 ha (5 acres) and 4 ha (10 acres).

Limitations

- Alternative BMPs must be thoroughly investigated for erosion control before selecting temporary desilting basins.
- Requires large surface areas to allow sediment to settle.
- Not appropriate for drainage areas greater than 30 ha (75 acres).
- Not to be located in live streams.
- If safety is a concern, basins may require protective fencing.
- Size may be limited by availability of right-of-way.

Design Guidelines and Considerations

- Limit the contributing area of the desilting basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the desilting basin.

- Desilting basins shall be designed to have a capacity equivalent to 100 m^3 (1500 ft^3) of storage (as measured from the top of the basin to the principal outlet,) per hectare (acre) of contributory area. This design is less than that required to capture 0.01 mm (0.0004 in) particle size, but larger than that required to capture particles 0.02 mm (0.0008 in) or larger.

- The length of the basin shall be more than twice the width of the basin; the length shall be determined by measuring the distance between the inlet and the outlet.

- The depth must be no less than 1 m (3 ft) nor greater than 1.5 m (5 ft).

- Any basin meeting the definition of a "High Hazard Dam" must be designed by a professional civil engineer registered in the state of Montana. Basins capable of impounding more than 1000 m^3 (35,000 ft^3), must also be designed by a professional Civil Engineer registered with the state of Montana. Temporary desilting basin design must be approved by the Engineer prior to the basin construction. The design shall include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.

- Design and locate desilting basins so that they can be maintained. Construct desilting basins prior to construction activities.

- Desilting basins, regardless of size and storage volume, shall include features to accommodate overflow or bypass flows that exceed the design storm event. The calculated basin volume and proposed location shall be submitted to the Engineer for approval prior to the basin construction.

- Basins shall be designed to drain within 72 hours following storm events.

- The outflow from the desilting basin shall be provided with outlet protection to prevent erosion and scouring of the embankment and channel.

- Basin shall be located: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where post-construction (permanent) detention basins will be constructed, (3) where failure would not cause loss of life or property damage, and (4) where the basins can be maintained on a year-round basins to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area, and to maintain the basin to provide the required capacity.

- Areas under embankments, structural works, and desilting basin must be cleared, stripped of vegetation.

- Basin inlets shall be located to maximize travel distance to the basin outlet.

- Rock or vegetation shall be used to protect the basin inlet and slopes against erosion.

- A forebay (a reservoir or channel constructed upstream of the basin) may be provided to remove debris and larger particles.

- Principal outlet shall consist of a corrugated metal, HDPE, or reinforced concrete riser pipe with dewatering holes and an anti-vortex device and trash rack attached to the top of the riser, to prevent floating debris from flowing out of the basin or obstructing the system. This principal structure shall be designed to accommodate the inflow design storm.

- Structure shall be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.

- Attach riser pipe (watertight connection) to a horizontal pipe (barrel) which extends through the embankment to toe of fill. Provide anti-seep collars on the barrel.

- Cleanout level shall be clearly marked on the riser pipe.

- Avoid dewatering of groundwater to the desilting basin during the rainy season. Insignificant quantities of accumulated precipitation may be dewatered to the desilting basin unless precipitation is forecasted within 24 hours.

- Chain link fencing around each desilting basin may be specified by the Engineer to prevent unauthorized entry to the basin or if safety is a concern. Fencing shall be in accordance with MDT Standard Specifications Section 607 - Fences.

- One of the dewatering configurations shown below for the principal outlet may be used. The Contractor shall verify that the outlet is properly designed to handle the design and peak flows.

Outlet #1, See Detailed Drawings

- Perforate the top 1/3 of the riser with 13 mm (1/2 in) diameter holes spaced 200 mm (8 in) vertically and 250 mm (10 in) - 300 mm (12 in) horizontally.

- Place 19 mm (3/4 in) gravel over perforated holes to approximately 50 mm (2 in) minimum thickness to assist in prevention of clogging of dewatering holes. Gravel will naturally settle into a cone surrounding the riser pipe.

Outlet #2, See Detailed Drawings

- Perforate the lower 1/2 of the riser pipe with 13 mm (1/2 in) diameter holes spaced approximately 75 mm (3 in) apart, in each outside valley (corrugated metal pipe).

- Place 19 mm (3/4 in) gravel over perforated holes to approximately 50 mm (2 in) minimum thickness to assist in prevention of clogging of dewatering holes. Gravel will naturally settle into a cone surrounding the riser pipe.

Outlet #3, See Detailed Drawings

- Provide two 25 mm (1 in) diameter holes above the sediment storage volume on opposite sides of the non-perforated riser pipe. This will typically provide sufficient detention time for basins to drain approximately 4 ha (10 acre).

- Construct an emergency spillway to accommodate flows not carried by the principal spillway. Spillway shall consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap.

- Spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, shall be a minimum of 6 m (20 ft) in length.

- Use outlet protection at the pipe outlet. See BMP SS-10, "Outlet Protection/Velocity Dissipation Devices."

Maintenance, Inspection, and Removal

- Inspect temporary desilting basins before and after rainfall events and weekly during the rest of the rainy season. During extended rainfall events, inspect at least every 24 hours.

- Examine basin banks for seepage and structural soundness.

- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed, or as directed by the Engineer.

- Check inlet and outlet area for erosion and stabilize if required, or if directed by the Engineer.

- Remove sediments when storage zone is 1/3 full.

- Check fencing for damage and repair as needed or as directed by the Engineer.

SYMBOL: ———————

DESILTING BASIN SC-2:

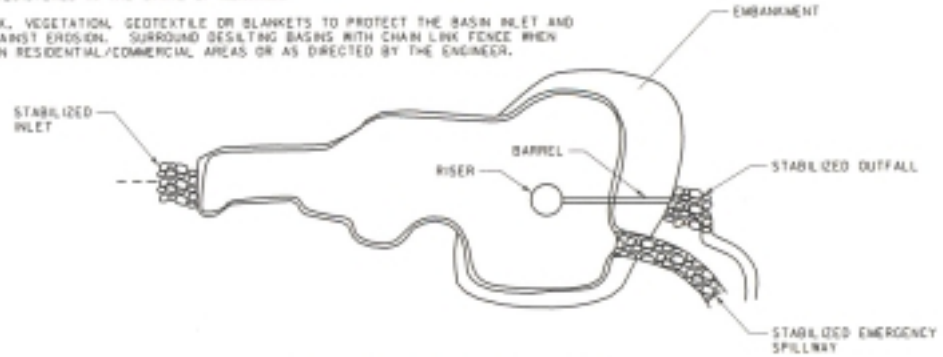
A DESILTING BASIN IS A TEMPORARY BASIN FORMED BY EXCAVATION AND/OR CONSTRUCTING AN EMBANKMENT SO THAT SEDIMENT-LADEN RUNOFF IS TEMPORARILY DETAINED UNDER SLOW FLOWING CONDITIONS, ALLOWING SEDIMENT TO SETTLE OUT BEFORE THE RUNOFF IS DISCHARGED.

USE DESILTING BASINS FOR DISTURBED AREAS BETWEEN 2 ha AND 4 ha WHERE SEDIMENT-LADEN WATER MAY ENTER THE DRAINAGE SYSTEM OR WATERCOURSE.

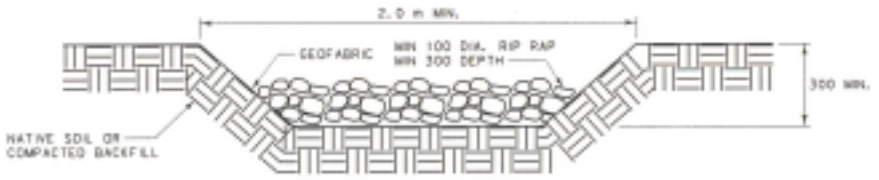
DO NOT USE DESILTING BASINS FOR DRAINAGE AREAS GREATER THEN 30 ha AND DO NOT LOCATE BASINS WITHIN LIVE STREAMS.

SIZE DESILTING BASINS SUCH THAT THERE IS 100 m³ PER 1 ha OF CONTRIBUTING AREA, LENGTH MUST BE EQUAL OR LARGER THAN TWICE THE WIDTH, DEPTH MUST BE BETWEEN 1 m AND 1.5 m. ANY BASIN MEETING THE DEFINITION OF A "HIGH HAZARD DAM" MUST BE DESIGNED BY A PROFESSIONAL CIVIL ENGINEER REGISTERED IN THE STATE OF MONTANA. BASINS LARGER THAN 1000 m³ MUST ALSO BE DESIGNED BY A PROFESSIONAL CIVIL ENGINEER REGISTERED IN THE STATE OF MONTANA.

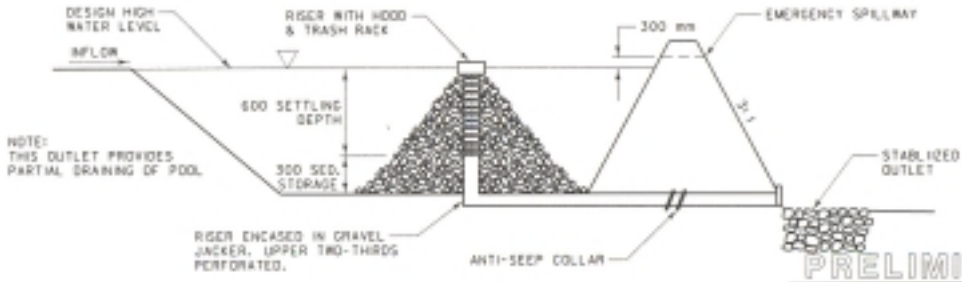
PLACE ROCK, VEGETATION, GEOTEXTILE OR BLANKETS TO PROTECT THE BASIN INLET AND SLOPES AGAINST EROSION. SURROUND DESILTING BASINS WITH CHAIN LINK FENCE WHEN DESIGNED IN RESIDENTIAL/COMMERCIAL AREAS OR AS DIRECTED BY THE ENGINEER.



TYPICAL DESILTING BASIN - TOP VIEW



TYPICAL DESILTING BASIN - EMERGENCY SPILLWAY CROSS SECTION

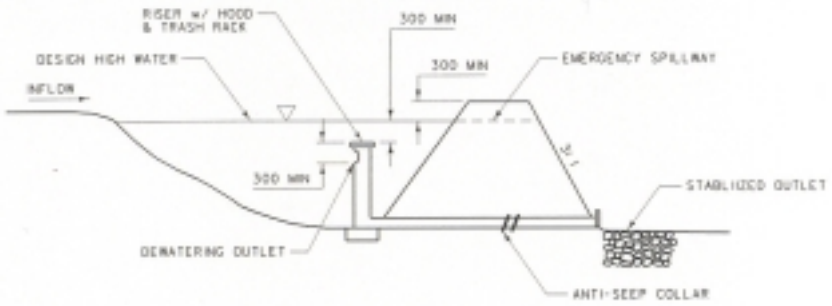


TYPICAL DESILTING BASIN - OUTLET #1

PRELIMINARY

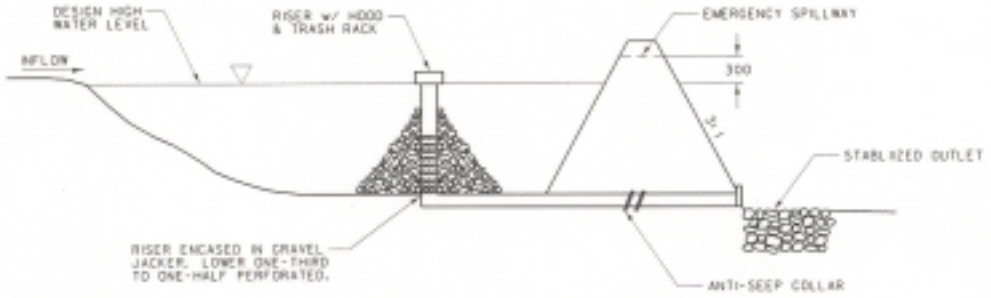
REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-77
DESILTING BASIN (SC-2) (SHEET 1)	
EFFECTIVE:	
CDM Camp Dresser & McKee Inc.	

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.



NOTE:
THIS OUTLET PROVIDES NO
DRAINING OF PERMANANT POOL

TYPICAL DESILTING BASIN - OUTLET #2



NOTE:
THIS OUTLET PROVIDES
COMPLETE DRAINING OF POOL

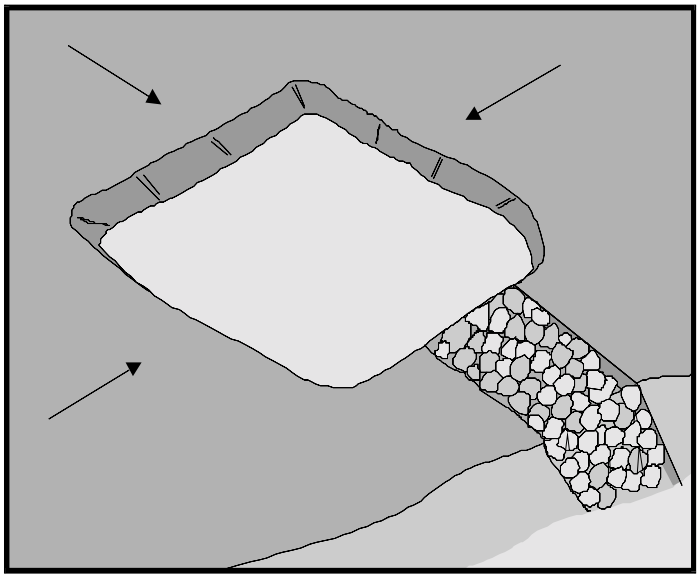
TYPICAL DESILTING BASIN - OUTLET #3

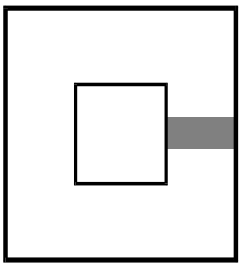
PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-77
DESILTING BASIN (SC-2) (SHEET 2)	
EFFECTIVE:	
CDM Camp Dresser & McKee Inc.	

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

Sediment Trap SC-3





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A sediment trap is a temporary basin with a controlled release structure, formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Appropriate Applications

- Sediment traps may be used on construction projects where the contributing drainage area is less than 2 ha (5 acres). Traps would be placed where sediment laden storm water may enter a storm drain or watercourse, and around and/or up-slope from storm drain inlet protection measures.
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Engineer.
- As a supplemental control, sediment traps provide additional protection for a water body or for reducing sediment before it enters a drainage system.

Limitations

- Requires large surface areas to allow sediment to settle.
- Not appropriate for drainage areas greater than 2 ha (5 acres).
- Only removes large and medium sized particles and requires upstream erosion control.
- Attractive and dangerous to children, requiring protective fencing.
- Not to be located in live streams.
- Size may be limited by availability of right-of-way.

Design Guidelines and Considerations

- Construct sediment traps prior to rainy season and construction activities.

- Trap shall be located: (1) where a low embankment can be constructed across a swale, (2) where failure would not cause loss of life or property damage, and (3) to provide access for maintenance.

- Trap shall be sized to accommodate a settling zone and sediment storage zone with recommended minimum volumes of 130 m^3/ha (1850 ft^3/acre) and 65 m^3/ha (925 ft^3/acre) of contributing drainage area, respectively, based on 12.7 mm (1/2 in) of runoff volume over a 24-hr period. Multiple traps and/or additional volume may be required to accommodate site-specific rainfall and soil conditions.

- Any sediment trap meeting the definition of a "High Hazard Dam" must be designed by a professional Civil Engineer registered in the state of Montana. Sediment traps capable of impounding more than 1000 m^3 (35000 ft^3), must also be designed by a professional Civil Engineer registered with the state of Montana. Sediment trap designs must be reviewed by the MDT Hydraulics Section and approved by the Engineer prior to the sediment trap construction. The design shall include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the trap outlet.

- Areas under embankments, structural works, and sediment traps shall be cleared and stripped of vegetation.

- Trap shall have a length to width ratio greater than 3:1 or baffles are required to prevent short circuiting of the inlet flow.

- Trap inlets shall be located to maximize the travel distance to the trap outlet. Use rock or vegetation to protect the trap outlets against erosion.

- Chain link fencing around large sediment traps may be specified by the Engineer to prevent unauthorized entry to the trap or if safety is a concern. Fencing shall be in accordance with MDT Standard Specifications.

- To dewater the trap, the outlet shall be constructed in one of the following two ways:

    - Use corrugated metal, HDPE, or reinforced concrete riser pipe with dewatering holes encased in gravel to prevent floating debris from flowing out of the trap or obstructing the system.

    - Construct a crushed stone outlet section of the embankment at the low point of the trap. The stone section serves as a non-erosive spillway outlet for flood flows and the bottom section provides a means of dewatering the trap between rainfall events.

Maintenance, Inspection, and Removal

- Inspect sediment traps before and after rainfall events and weekly during the rest of the rainy season. During extended rainfall events, inspect sediment traps at least every 24 hours.

- Check trap banks for seepage and structural soundness.
- Check outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed or as directed by the Engineer.
- Check outlet area for erosion and stabilize if required, or as directed by the Engineer.
- Remove accumulated sediment when the volume has reached 1/3 the original trap volume.
- Properly disposed of sediment and debris removed from the trap.
- Check fencing for damage and repair as needed or as directed by the Engineer.

SYMBOL:

SEDIMENT TRAP SC-31

A SEDIMENT TRAP IS A TEMPORARY BASIN THAT WITH A CONTROLLED RELEASE STRUCTURE, FORMED BY EXCAVATING OR CONSTRUCTION OF AN EARTHEN EMBANKMENT ACROSS A WATERWAY OR LOW DRAINAGE AREA.

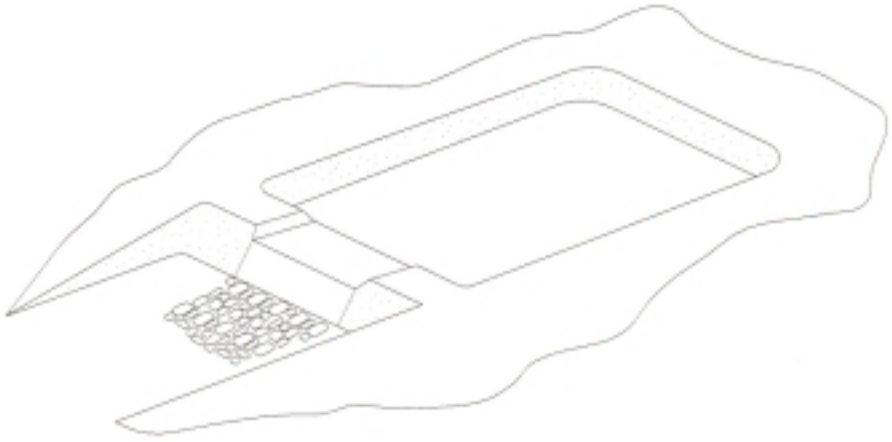
USE SEDIMENT TRAPS WHEN DISTURBED AREAS ARE LESS THAN 2 ha. THIS BMP CAN BE USED TO PROVIDE ADDITIONAL PROTECTION FOR A WATER BODY OR FOR REDUCING SEDIMENT BEFORE IT ENTERS A DRAINAGE SYSTEM.

SEDIMENT BASINS ARE NOT APPROPRIATE FOR DRAINAGE AREAS LARGER THAN 2 ha AND ONLY REMOVE LARGE TO MEDIUM SIZED PARTICLES. DO NOT USE SEDIMENT TRAPS IN LIVE STREAMS.

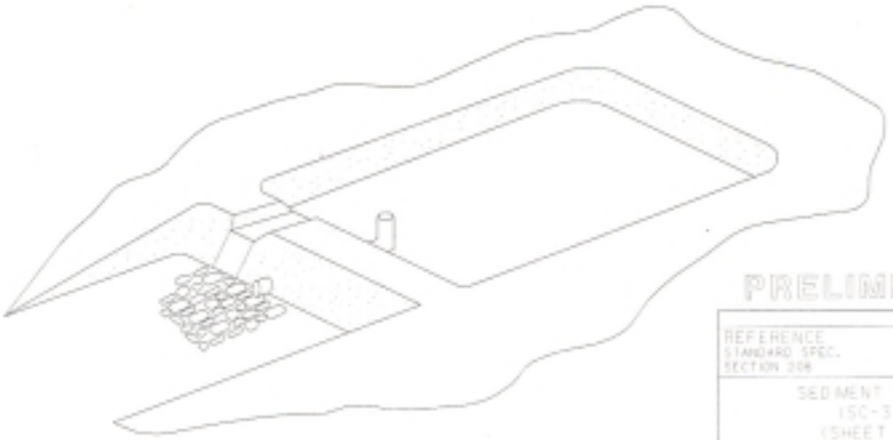
A MINIMUM SETTLING ZONE OF 130 m³ PER ha AND A MINIMUM SEDIMENT ZONE OF 65 m³ PER ha IS REQUIRED FOR EACH SEDIMENT TRAP. ANY TRAP MEETING THE DEFINITION OF A "HIGH HAZARD DAM" MUST BE DESIGNED BY A PROFESSIONAL CIVIL ENGINEER LICENSED IN THE STATE OF MONTANA. ALL TRAPS LARGER THAN 1000 m³ REQUIRE A DESIGN BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF MONTANA.

PLACE ROCK, VEGETATION, GEOTEXTILE OR BLANKETS TO PROTECT THE TRAP'S INLET, OUTLET AND SLOPES AGAINST EROSION. ENCLOSE THE SEDIMENT TRAP WITH CHAIN LINK FENCE WHEN PLACED IN RESIDENTIAL/COMMERCIAL AREAS OR AS DIRECTED BY THE ENGINEER.

REFER TO BMP SC-2 FOR RISER PIPE CONFIGURATIONS AND OVERFLOW SPILLWAY DESIGNS.



TYPICAL SEDIMENT TRAP WITH SPILLWAY TYPE OUTFALL



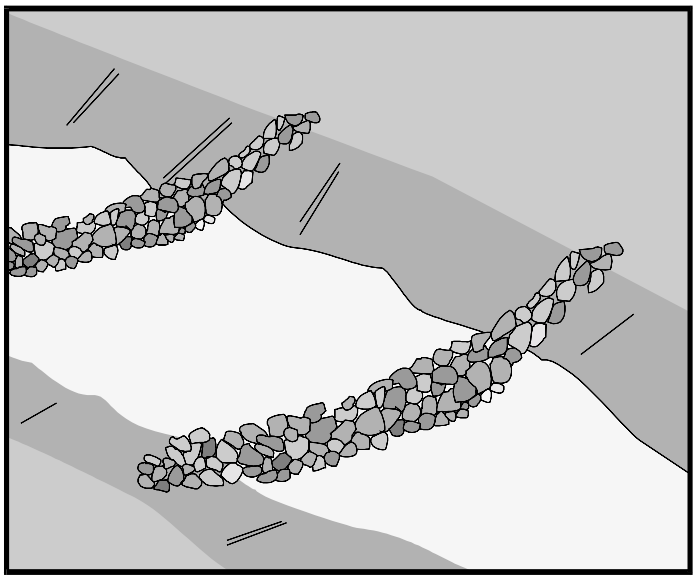
TYPICAL SEDIMENT TRAP WITH RISER PIPE TYPE OUTFALL

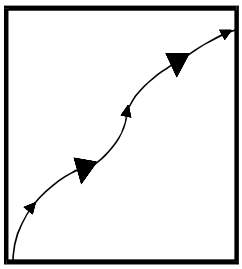
PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-77
SEDIMENT TRAP (SC-31) (SHEET 1)	
EFFECTIVE:	

CDM Camp Dresser & McKee Inc.

Check Dams SC-4





BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

A check dam is a small device constructed of rock, sandbags, or fiber rolls, placed across a natural or man-made channel or drainage ditch. Check dams reduce scour and channel erosion by reducing flow velocity and encouraging sediment dropout.

Appropriate Applications

- Check dams may be installed in the following:
  - In small open channels which drain 4 ha (10 acres) or less.
  - In steep channels where storm water runoff velocities exceed 1.5 m/s (5 ft/s).
  - During the establishment of grass linings in drainage ditches or channels.
  - In temporary ditches where a short length of service does not warrant establishment of erosion-resistant linings.
- Check dams can be left in place following construction activities and allowed to accumulate sediment and vegetation as approved by the Engineer.

Limitations

- Not to be used in live streams.
- Not appropriate in channels which drain areas greater than 4 ha (10 acres).
- Not to be placed in channels, which are already grass-lined unless erosion is expected, as installation may damage vegetation.

- Require extensive maintenance following high velocity flows and may have to be replaced.
- Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam. Check dams may be left in place and allowed to accumulate sediment and vegetation.
- Not to be constructed from straw bales or a silt fence.
- Can be difficult to seed around.

Design Guidelines and Considerations

- Check dams shall be placed at a distance and height to allow small pools to form behind them.
- Install the first check dam approximately 5 m (15 ft) from the outfall device and at regular intervals based on slope gradient and soil type.
- High flows (typically a 2-year storm or larger) shall safely flow over the check dam without an increase in upstream flooding or damage to the check dam.
- Where grass is used to line ditches, check dams may be removed when grass has matured sufficiently to protect the ditch or swale if the removal does not jeopardize the established vegetation.

Maintenance, Inspection, and Removal

- Inspect check dams after each storm event. Repair damage as needed or as required by the Engineer.
- Remove sediments when depth reaches 1/3 of the check dam height.
- Remove accumulated sediment prior to permanent seeding or soil stabilization or seed accumulated sediment to stabilize.
- Remove check dams and accumulated sediment when check dams are no longer needed or when required by the Engineer. Check dams can be left in place following construction activities and allowed to accumulate sediment and vegetation as approved by the Engineer.
- Removed sediment shall be incorporated in the project at locations designated by the Engineer or disposed of outside the right-of-way as approved by the Engineer.

SYMBOL:

CHECK DAMS SC-4:

A CHECK DAM IS A SMALL DEVICE CONSTRUCTED OF GRAVEL, SANDBAGS, OR FIBER ROLLS, PLACED ACROSS A NATURAL OR MAN-MADE CHANNEL OR DRAINAGE DITCH. CHECK DAMS REDUCE SCOUR AND CHANNEL EROSION BY REDUCING FLOW VELOCITIES AND ENCOURAGING SEDIMENT DROPOUT.

CHECK DAMS MAY BE INSTALLED IN SMALL CHANNELS WITH DRAINAGE AREAS OF 4 ha OR LESS AND/OR STEEP CHANNELS WHERE STORM WATER RUNOFF VELOCITIES EXCEED 1.5 m/s. THE MAXIMUM HEIGHT FOR CHECK DAMS WITHIN THE CLEAR ZONE IS 150 mm.

CHECK DAMS CANNOT BE USED IN LIVE STREAMS OR FOR DRAINAGE AREAS LARGER THAN 4 ha. IN ADDITION, CHECK DAMS CANNOT BE CONSTRUCTED FROM SILT FENCE.

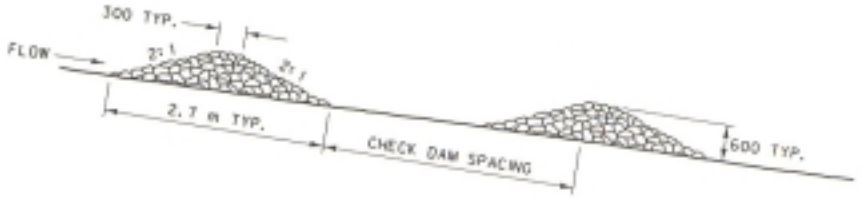
PLACE CHECK DAMS AT A DISTANCE THAT WILL ALLOW SMALL POOLS TO BE FORMED BEHIND EACH DAM. INSTALL THE FIST CHECK DAM APPROXIMATELY 5 METERS FROM THE OUTFALL DEVICE. PLACE MULTIPLE CHECK DAMS SUCH THAT BACKWATER FROM THE DOWNSTREAM DAM WILL REACH THE TOE OF THE UPSTREAM DAM. ROCK MAY BE PLACED BY HAND OR BY MECHANICAL METHOD TO ACHIEVE COMPLETE DITCH OR SWALE COVERAGE.

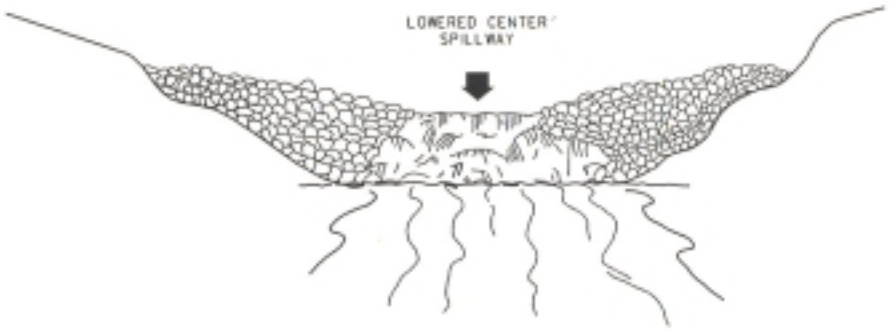
CHECK DAMS CONSTRUCTED FROM GRAVEL MUST BE 100% PASSING THE 50 mm SCREEN AND 10% MAXIMUM PASSING THE 4.75 mm SIEVE. DAM MATERIAL MAY BE PITRUN OR CRUSHED AGGREGATE. REFER TO BMPs SC-5 AND SC-6 FOR USE OF FIBER ROLLS AND SAND BAGS AS CHECK DAMS.

REMOVE SEDIMENT FROM BEHIND THE DAM WHEN IT ACCUMULATES TO ONE-HALF THE ORIGINAL HEIGHT UNLESS ITS DRAINAGE AREA HAS BEEN STABILIZED.

DISTANCES BETWEEN CHECK DAMS ARE AS FOLLOWS:
- FROM 1% TO 3% PLACE CHECK DAMS AT 90 METER SPACING
- FROM 3% TO 4% PLACE CHECK DAMS AT 60 METER SPACING
- FROM 4% + PLACE CHECK DAMS AT 30 METER SPACING

CHECK DAM SPACING MAY BE ADJUSTED ON A PROJECT-BY-PROJECT BASIS BY THE ENGINEER. DO NOT USE CHECK DAMS ON 1-2% GRADES UNLESS DETERMINED NECESSARY BY THE ENGINEER.





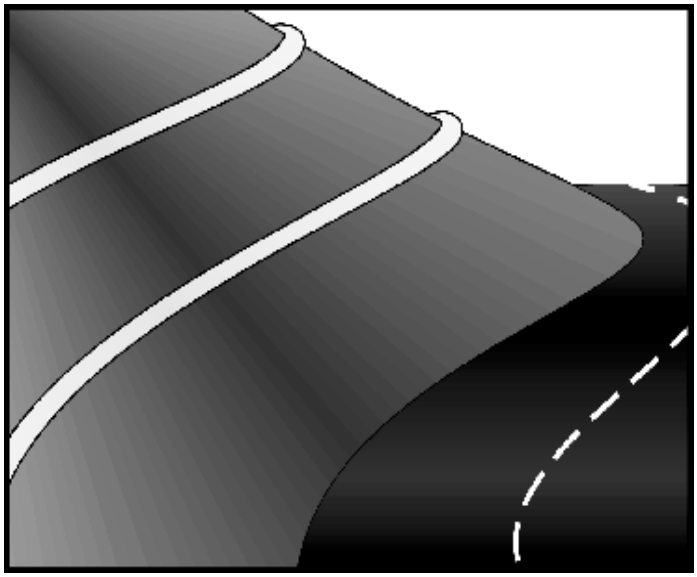
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

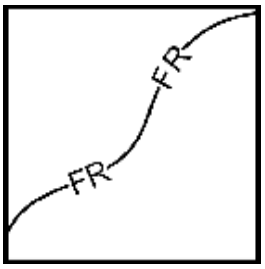
PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-77
CHECK DAMS (SC-4)	
EFFECTIVE:	

CDM Camp Dresser & McKee Inc.

Fiber Rolls SC-5





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A fiber roll consists of straw, flax, or other similar materials that are rolled and bound into a tight tubular roll and placed on the face of slopes at regular intervals to intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide some removal of sediment from the runoff.

Appropriate Applications

- May be used along the top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- Fiber rolls may be used as check dams if approved by the Engineer.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Engineer.

Limitations

- Although fiber rolls provide some sediment removal, this BMP is not to be used in place of a linear sediment barrier (i.e., a silt fence, sandbag barrier, or straw bale barrier).

Design Guidelines and Considerations

Fiber Roll Materials

- Fiber rolls shall be either:
  - prefabricated rolls; or,
  - rolled tubes of erosion control blanket.

Assembly of Field Rolled Fiber Roll

- Roll length of erosion control blanket into a tube of minimum 200 mm (8 in) diameter.

- Bind roll at each end and every 1.2 m (4 ft) along length of roll with jute-type twine.

Installation

- Entrench and install fiber rolls as shown in the Fiber Rolls (SC-5) Detail Drawing.
- If more than one fiber roll is placed in a row, the rolls shall be butted; not overlapped. Stake butted fiber rolls ends to maintain a tight joint.

Removal

- Fiber rolls are typically left in place as removals may cause damage to the stabilized slope.
- If fiber rolls are removed, collect and dispose of sediment accumulation, and fill, compact and seed holes, trenches, depressions or any other ground disturbance to blend with adjacent ground.

Maintenance, Inspection, and Removal

- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- Inspect fiber rolls when rain is forecast. Perform maintenance as needed or as required by the Engineer.
- Inspect fiber rolls as soon as possible following storm events and a least daily during prolonged rainfall. Perform maintenance as needed or as required by the Engineer.

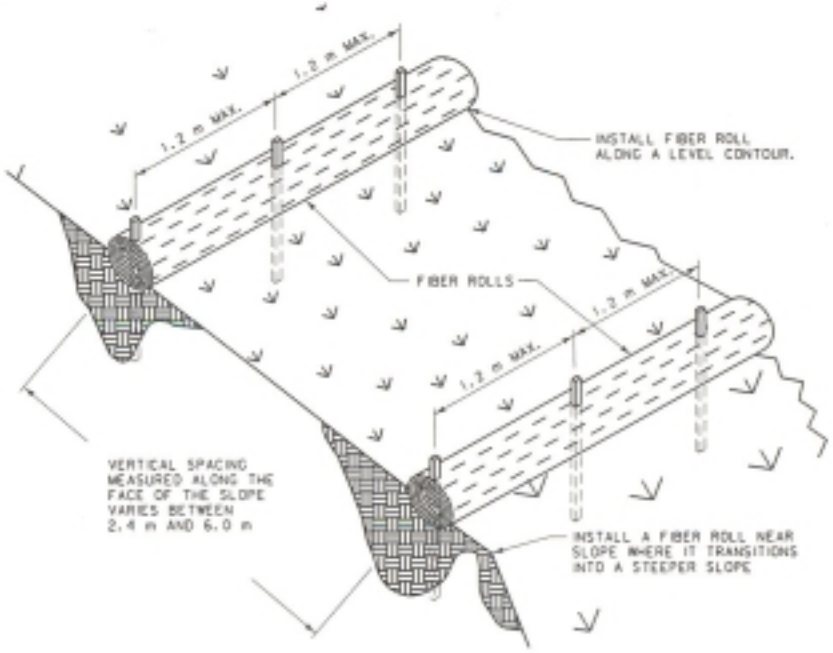
SYMBOL: ——————— —— FR ——

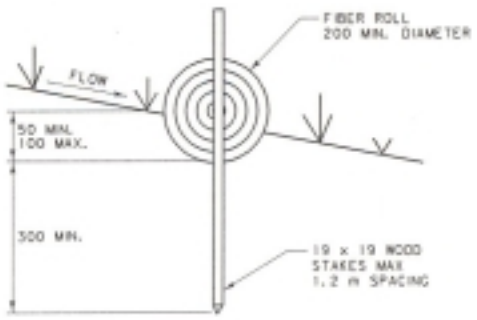
FIBER ROLLS SC-5:

A FIBER ROLL CONSISTS OF EROSION CONTROL BLANKET MATERIAL THAT IS PREFABRICATED, OR ROLLED AND BOUND IN THE FIELD INTO A TIGHT TUBULAR ROLL AND PLACED ON THE FACE OF SLOPES AT REGULAR INTERVALS TO INTERCEPT RUNOFF, REDUCE ITS FLOW VELOCITY, RELEASE THE RUNOFF AS SHEET FLOW, AND PROVIDE SOME REMOVAL OF SEDIMENT FROM THE RUNOFF.

FIBER ROLLS MAY BE USED ALONG THE TOP, FACE, AND AT GRADE BREAKS OF EXPOSED AND ERODIBLE SLOPES TO SHORTEN SLOPE LENGTH AND SPREAD RUNOFF AS SHEET FLOW. ROLLS MAY BE USED AS CHECK DAMS IF APPROVED BY THE ENGINEER. FOR USE AS CHECK DAMS, PLACE FIBER ROLLS AT 15 m MAXIMUM SPACING OR AS APPROVED BY THE ENGINEER.

ALTHOUGH FIBER ROLLS PROVIDE SOME SEDIMENT REMOVAL, FIBER ROLLS ARE NOT TO BE USED IN PLACE OF A LINEAR SEDIMENT BARRIER (I.E., SILT FENCE, SANDBAG BARRIER, OR STRAW BALE BARRIER).



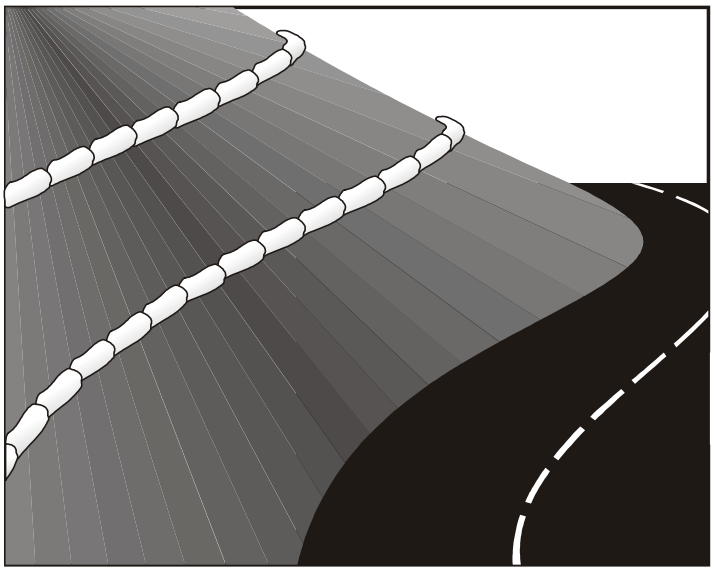


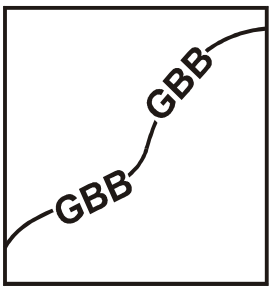
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-77
FIBER ROLLS (SC-5)	
EFFECTIVE:	
CDM Camp Dresser & McKee Inc.	

Gravel Bag Berm SC-6





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A gravel bag berm consists of a single row of gravel bags that are installed end-to-end to form a barrier across a slope to intercept runoff, reduce runoff velocity, release runoff as sheet flow, and provide some sediment removal.

Appropriate Applications

- Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Engineer.

Limitations

- Although this BMP will remove some sediment, it is not to be used in place of a linear sediment barrier (i.e., a silt fence, sandbag barrier, or straw bale barrier).
- Degraded gravel bags may rupture when removed, spilling contents.
- Installation can be labor intensive.
- Limited durability for long-term projects.

Design Guidelines and Considerations

- Bag material and size are shown in the Gravel Bag Berm (SC-6) Detail Drawing.
- Gravel Bag Berm installation is described in the Gravel Bag Berm (SC-6) Detail Drawing.
- Tightly abut bags.

Maintenance, Inspection, and Removal

- Inspect gravel bag berms before predicted storm events, as soon as possible after storm events, and weekly during construction activities.

- Reshape or replace gravel bags as needed, or as directed by the Engineer.

- Inspect gravel bag berms for sediment accumulation and remove sediments when accumulation reaches 1/3 the berm height. Removed sediment shall be incorporated within the project at locations designated by the Engineer or disposed of outside the right-of-way as approved by the Engineer.

- Remove gravel bag berms when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area. Sediment accumulation may remain if seeded and stabilized. Gravel from bags can be left in place; however, the bags should be removed.

SYMBOL: ——————— ———GBB———

GRAVEL BAG BERM SC-61

A GRAVEL BAG BERM CONSISTS OF A SINGLE ROW OF GRAVEL BAGS THAT ARE INSTALLED END-TO-END TO FORM A BARRIER ACROSS A SLOPE TO INTERCEPT RUNOFF, REDUCE RUNOFF VELOCITY, RELEASE RUNOFF AS SHEET FLOW, AND PROVIDE SOME SEDIMENT REMOVAL. GRAVEL BAG BERMS CAN BE USED ALONG THE FACE AND AT GRADE BREAKS OF EXPOSED AND ERODIBLE SLOPES TO SHORTEN SLOPE LENGTHS AND SPREAD RUNOFF AS SHEET FLOW.

THESE DEVICES ARE NOT TO BE USED IN PLACE OF A LINEAR SEDIMENT BARRIER (I.E., SILT FENCE, SANDBAG BARRIERS, OR STRAW BALE BARRIERS).

USE WOVEN POLYPROPYLENE, POLYETHYLENE, OR POLYAMIDE FABRIC OR BURLAP MATERIAL FOR BAGS. BAG MATERIAL IS REQUIRED TO HAVE A MINIMUM UNIT WEIGHT OF 135 g/m², MULLEN BURST STRENGTH EXCEEDING 2 070 kPa AND AN ULTRAVIOLET STABILIZATION EXCEEDING 70%.

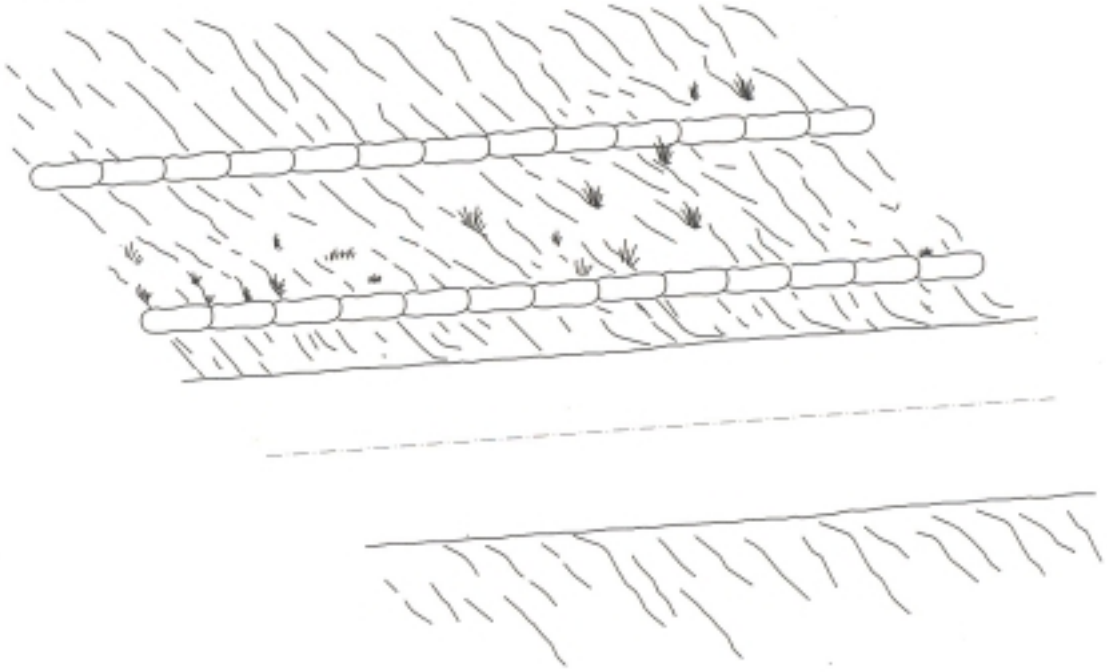
USE GRAVEL BAGS HAVING A LENGTH OF 450 mm, WIDTH OF 300 mm, THICKNESS OF 75 mm, AND A MASS OF APPROXIMATELY 15 kg. ALTERNATIVE BAG SIZES REQUIRE ENGINEERS APPROVAL PRIOR TO USE.

FILL GRAVEL BAGS APPROXIMATELY 75% FULL WITH GRAVEL CONSISTING OF 100% PASSING THE 19 mm SCREEN AND 10% MAXIMUM PASSING THE 4.75 mm SIEVE. FILL MATERIAL MAY BE PITRUN OR CRUSHED AGGREGATE. FILL MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER.

TIGHTLY PLACE GRAVEL BAGS TO MINIMIZE GAPS BETWEEN BAGS. BAGS MAY BE STAGGERED ON A PROJECT-BY PROJECT BASIS AS APPROVED BY THE ENGINEER.

PLACE GRAVEL BAG BERMS AT 2.4 TO 6 m SPACING ALONG THE SLOPE. FOR ABNORMALLY STEEP OR SHALLOW SLOPES FOLLOW ENGINEERS GUIDELINES.

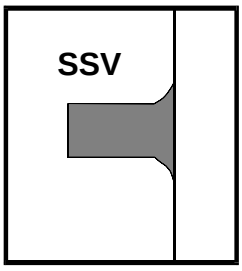
ALL BAGS PLACED WITHIN THE CLEAR ZONE REQUIRE MEASURES TO PROTECT GRAVEL FROM FREEZING. ALL FREEZE REDUCTION METHODS REQUIRE ENGINEERS APPROVAL PRIOR TO IMPLEMENTATION.



PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-77
GRAVEL BAG BERM (SC-61	
EFFECTIVE:	
CDM Camp Dresser & McKee Inc.	

Street Sweeping and Vacuuming SC-7



BMP Objectives
- ● Soil Stabilization
- ● Sediment Control
- ● Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Practices to remove tracked sediment to prevent the sediment from entering a storm drain or watercourse.

Appropriate Applications

These practices are implemented anywhere sediment is tracked from the project site onto public or private paved roads, typically at points of egress.

Limitations

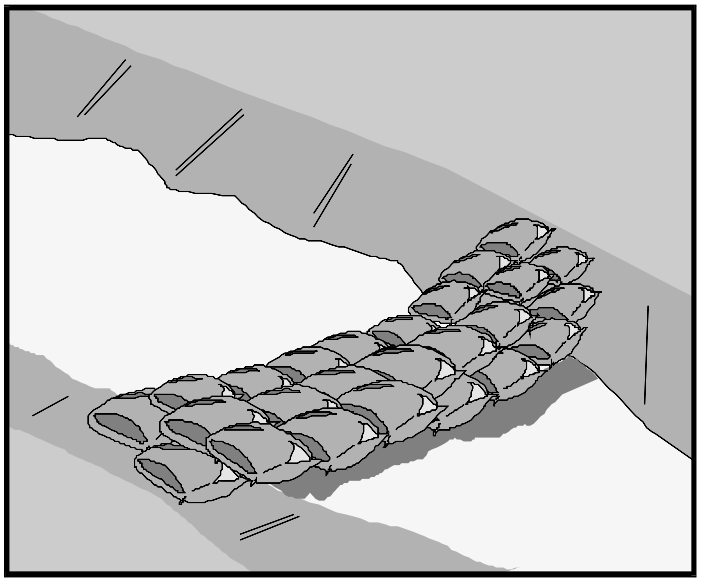
- Sweeping and vacuuming may not be effective when soil is wet or muddy.
- Do not use kick brooms or sweeper attachments.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking shall be swept and vacuumed on a daily basis.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project.

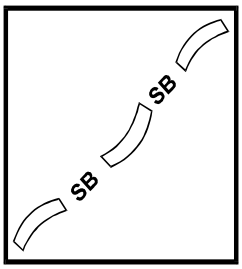
Maintenance, Inspection, and Removal

- Inspect ingress/egress access points daily and sweep tracked sediment as needed, or as required by the Engineer.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.

- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite in conformance with the provisions in MDT Standard Specifications.

Sandbag Barrier SC-8





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A sandbag barrier is a temporary linear sediment barrier consisting of stacked sandbags, designed to intercept and slow the flow of sediment-laden sheet flow runoff. Sandbag barriers allow sediment to settle from runoff before water leaves the construction site. Sandbags can also be used where flows are moderately concentrated, such as ditches, swales, and storm drain inlets (see BMP SC-10, "Storm Drain Inlet Protection") to divert and/or detain flows.

Appropriate Applications

- Along the perimeter of a site.
- Along streams and channels.
- Below the toe of exposed and erodible slopes.
- Down slope of exposed soil areas.
- Around stockpiles.
- Across channels to serve as a barrier for utility trenches or provide a temporary channel crossing for construction equipment, to reduce stream impacts.
- Parallel to a roadway to keep sediment off paved areas.
- At the top of slopes to divert roadway runoff away from disturbed slopes.
- To divert or direct flow or create a temporary sediment basin.
- During construction activities in stream beds when the contributing drainage area is less than 2 ha (5 acres).

- When extended construction period limits the use of either silt fences or straw bale barriers.
- Along the perimeter of vehicle and equipment fueling and maintenance areas or chemical storage areas.
- To capture and detain non-storm water flows until proper cleaning operations occur.
- When site conditions or construction sequencing require adjustments or relocation of the barrier to meet changing field conditions and needs during construction.
- To temporarily close or continue broken, damaged or incomplete curbs.
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Engineer.

Limitations

- Limit the drainage area upstream of the barrier to 2 ha (5 acres).
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Limited durability for long-term projects.
- When used to detain concentrated flows, maintenance requirements increase.

Design Guidelines and Considerations

- Bag material and size are shown in the Sand Bag Barrier (SC-8) Detail Drawing.
- Gravel Bag Berm installation is described in the Sand Bag Barrier (SC-8) Detail Drawing.
- When used as a linear control for sediment removal:
    - Install along a level contour.
    - Turn ends of sandbag row up slope to prevent flow around the ends.
    - Generally, sandbag barriers shall be used in conjunction with temporary soil stabilization controls up slope to provide effective control.
- When used for concentrated flows:
    - Stack sandbags to required height using a pyramid approach as shown in the Detailed Drawings.
    - Upper rows of sandbags shall overlap joints in lower rows.
- Construct sandbag barriers with a set-back of at least 1m (3 ft) from the toe of a slope. Where it is determined to be not practicable due to specific site conditions, the sandbag

barrier may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practicable.

Maintenance, Inspection, and Removal

- Inspect sandbag barriers before predicted and as soon as possible after each storm event, and weekly throughout the construction season.
- Reshape or replace sandbags as needed, or as directed by the Engineer.
- Repair washouts or other damages as needed, or as directed by the Engineer.
- Inspect sandbag barriers for sediment accumulations and remove sediments when accumulation reaches 1/3 the barrier height. Removed sediment shall be incorporated in the project at locations designated by the Engineer or disposed of outside the right-of-way in conformance with the Standard Specifications.
- Remove sandbags when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilized the area.

SYMBOL: ———— ——SB——

SAND BAG BARRIERS SC-8

A SANDBAG BARRIER IS A TEMPORARY LINEAR SEDIMENTATION BARRIER CONSISTING OF STACKED SANDBAGS, DESIGNED TO INTERCEPT AND SLOW THE FLOW OF SEDIMENT-LADEN SHEET FLOW RUNOFF. SANDBAGS CAN ALSO BE USED WHERE FLOWS ARE MODERATELY CONCENTRATED, SUCH AS DITCHES, SWALES, AND STORM DRAIN INLETS TO DIVERT AND/OR DETAIN FLOWS.

LIMIT THE USE OF SANDBAG BARRIERS TO DRAINAGE AREAS OF 2 ha OR SMALLER. DUE TO THE BAG MATERIAL, SANDBAG BARRIERS HAVE A TENDENCY TO FAIL OVER LONG-TERM PROJECTS.

USE WOVEN POLYPROPYLENE, POLYETHYLENE, OR POLYAMIDE FABRIC OR BURLAP MATERIAL FOR BAGS. BAG MATERIAL IS REQUIRED TO HAVE A MINIMUM UNIT WEIGHT OF 135 g/m², A MULLEN BURST STRENGTH EXCEEDING 2 070 kPa AND AN ULTRAVIOLET STABILIZATION EXCEEDING 70%.

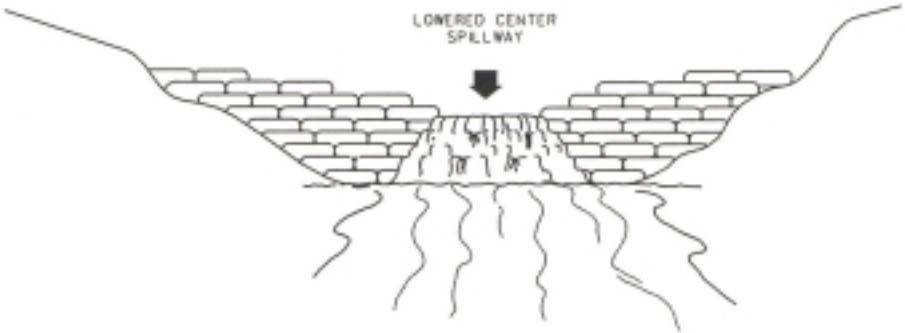
USE SANDBAGS HAVING A LENGTH OF 450 mm, WIDTH OF 300 mm, THICKNESS OF 75 mm, AND A MASS OF APPROXIMATELY 15 kg. ALTERNATIVE BAG SIZES MAY REQUIRE ENGINEER'S APPROVAL PRIOR TO USE.

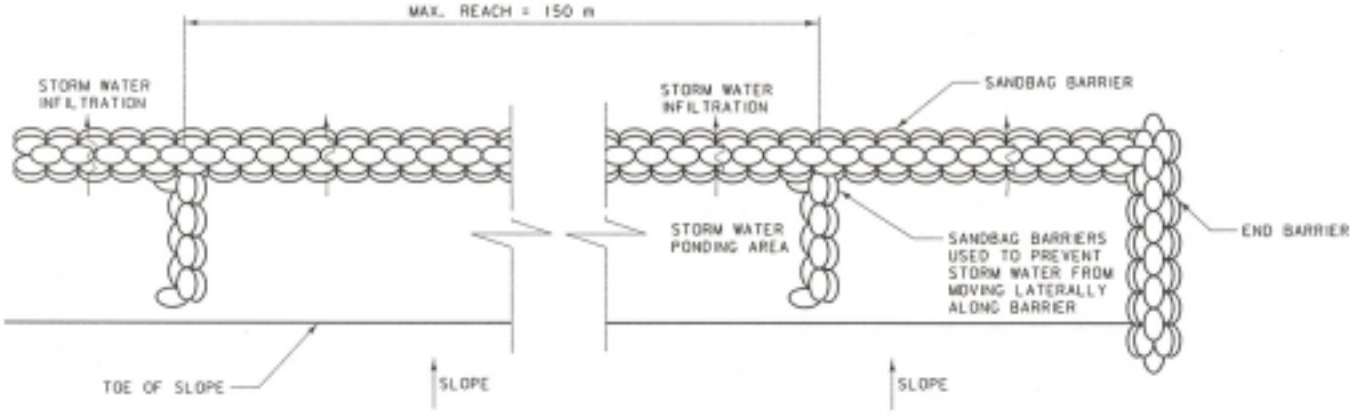
FILL SANDBAGS WITH SAND CONSISTING OF 100% PASSING THE 4.75 mm SCREEN, 50% PASSING THE 2.00 mm SIEVE, AND 20% MAXIMUM PASSING THE 0.075 mm SIEVE. FILL MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER.

WHEN INSTALLING SANDBAG BARRIERS AS LINEAR CONTROL, PLACE BAGS ALONG A LEVEL CONTOUR. UPON ENDING THE SANDBAG RUN, PLACE THE LAST BAGS TO ANGLE UP THE SLOPE SO THAT FLOWS DO NOT ESCAPE AROUND THE END.

WHEN SANDBAG BARRIERS ARE PLACED IN CONCENTRATED FLOWS, STACK SANDBAGS TO HEIGHT USING A PYRAMID APPROACH WITH THE UPPER SANDBAGS OVERLAPPING THE LOWER ROW. THIS APPLICATION MAY NOT BE USED WITHIN THE CLEAR ZONE UNLESS OVERALL HEIGHT IS 150 mm OR LESS.

ALL BAGS PLACED WITHIN THE CLEAR ZONE REQUIRE MEASURES TO PROTECT SAND FROM FREEZING. ALL FREEZE REDUCTION METHODS REQUIRE ENGINEERS APPROVAL PRIOR TO IMPLEMENTATION.





PRELIMINARY

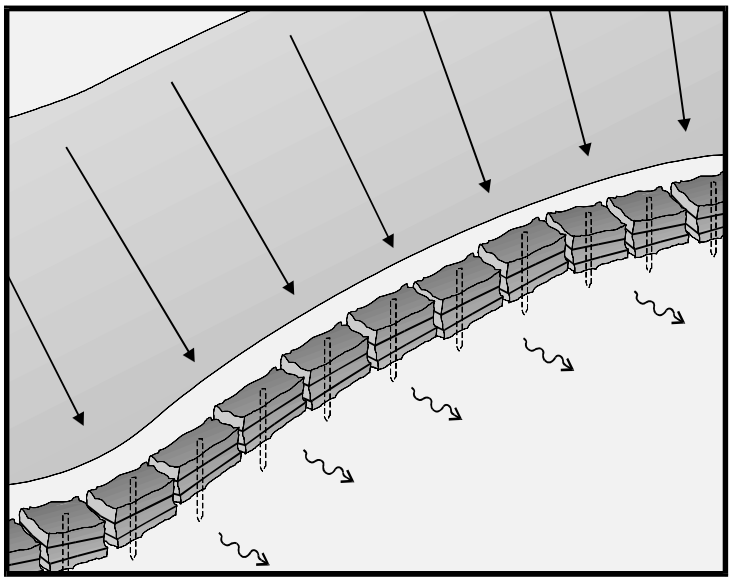
REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-77

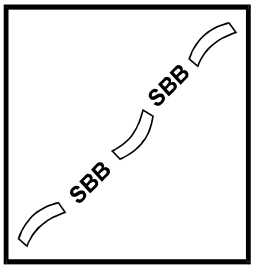
SAND BAG BARRIERS (SC-8)

EFFECTIVE:

CDM Camp Dresser & McKee Inc.

Straw Bale Barriers SC-9





BMP Objectives
- ● Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A straw bale barrier is a temporary linear sediment barrier consisting of straw bales, designed to intercept and slow sediment-laden sheet flow runoff. Straw bale barriers allow sediment to settle from runoff before water leaves the construction site.

Appropriate Applications

- Along the perimeter of a site.
- Along streams and channels.
- Below the toe of exposed and erodible slopes.
- Down slope of exposed soil areas.
- Around stockpiles.
- Across minor swales or ditches with small catchments.
- Around above grade type temporary concrete washouts (See BMP WM-8, “Concrete Waste Management”).
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Engineer.

Limitations

- Don’t use in areas subjected to highly concentrated flows, such as channels or live streams.
- Installation can be labor intensive.

- Straw bale barriers are maintenance intensive.
- Degraded straw bales may fall apart when removed or left in place for extended periods.
- Can not be used on paved surfaces.
- Shall not be used on lined ditches.
- Shall not be used with clear zone limits unless approved by the Engineer.

Design Guidelines and Considerations

- Straw bale materials and size are shown in the Straw Bale Barriers (SC-9) Detail Drawing.
- Straw Bale Barrier installation is described in the Straw Bale Barriers (SC-9) Detail Drawing.
- Limit the drainage area upstream of the barrier to 0.3 ha/100 m (0.75 ac/325 ft) of barrier.
- Limit the slope length draining to the straw bale barrier to 30 m (100 ft).
- Slopes of 50:1 or flatter are preferred. If the slope exceeds 10:1 the length of slope upstream of the barrier must be less than 15 m (50 ft).
- Straw bales shall be installed with two offset lines of bales and embedded to prevent holes between bales and bridging due to undercutting.
- Construct straw bale barriers with a set-back of at least 1 m (3 ft) from the toe of a slope. Where it is determined to be not practicable due to specific site conditions, the straw bale barrier may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practicable.

Maintenance, Inspection, and Removal

- Inspect straw bale barriers prior to forecasted storm events, as soon as possible after each storm event, and weekly throughout the rainy season.
- Inspect straw bale barriers for sediment accumulations and remove sediments when depth reaches 1/3 the barrier height. Removed sediment shall be incorporated in the project at locations designated by the Engineer or disposed of outside the right-of-way as approved by the Engineer.
- Replace or repair damage bales as needed or as directed by the Engineer.
- Repair washouts or other damages as needed or as directed by the Engineer.
- Bales can be scattered when their function as a storm water barrier is completed. Accumulated sediment can be removed or seeded and stabilized.

SYMBOL: ——————— ———SBB———

STRAW BALE BARRIERS SC-9:

STRAW BALE BARRIERS ARE A SEDIMENT BARRIER CONSISTING OF ENTRENCHED, OVERLAPPING AND ANCHORED STRAW BALES THAT REDUCE RUNOFF VELOCITIES AND RETAIN SEDIMENT. DO NOT USE STRAW BALE BARRIERS INSIDE THE CLEAR ZONE. STRAW BALES MUST BE CERTIFIED WEED-FREE.

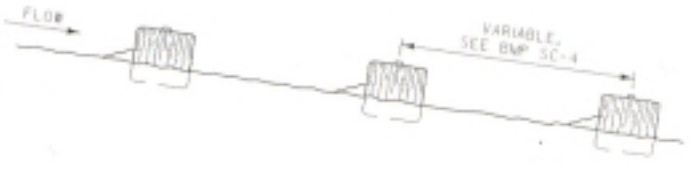
STRAW BALE BARRIERS ARE USED FOR SHEET OR CONCENTRATED FLOWS TO REDUCE RUNOFF VELOCITY, PROMOTE SEDIMENT RETENTION AND ALLOW SETTLING. DO NOT USE STRAW BALES IN HIGH FLOWS SUCH AS CHANNELS OR LIVE STREAMS. IN ADDITION, STRAW BALES CAN NOT BE USED ON SURFACE WHICH DO NOT ALLOW FOR ENTRENCHMENT.

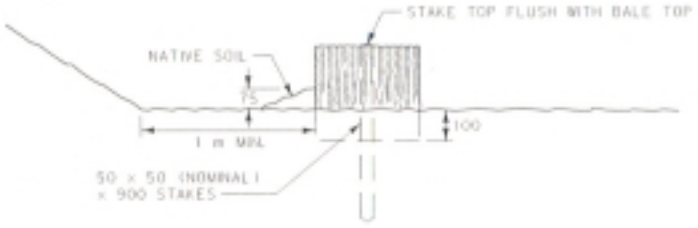
MINIMUM STRAW BALES SIZE REQUIREMENTS ARE A WIDTH OF 360 mm, HEIGHT OF 450 mm, LENGTH OF 900 mm AND A MASS OF 23 kg. USE STEEL WIRE (1.57 mm MIN. DIAMETER), NYLON OR POLYPROPYLENE STRING (2 mm MIN. DIAMETER) TO BIND BALES. MINIMUM BREAKING STRENGTH OF BINDING MATERIAL IS 360 N. USE 50 mm BY 50 mm (NOMINAL) BY 900 mm LONG WOODEN STAKES. DO NOT USE METAL STAKES.

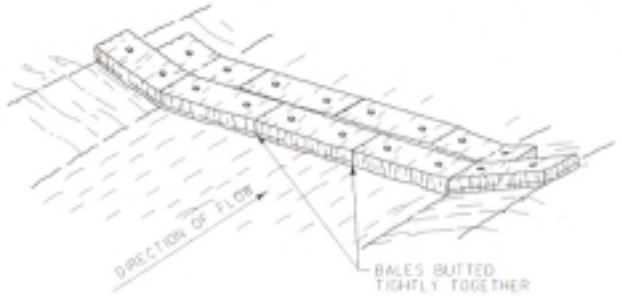
INSTALL STRAW BALES ALONG A LEVEL CONTOUR, WITH THE LAST BALE TURNED UP SLOPE. PLACE BALES IN A 100 mm DEEP TRENCH, TIGHTLY ABUT ADJACENT BALES, AND STAKE USING A MINIMUM OF TWO STAKES PER BALE. IF SLOPES EXCEED 10:1 THE LENGTH OF SLOPE UP STREAM OF THE BARRIER MUST BE LESS THAN 15 m. OFFSET BALES AT LEAST 1 m FROM THE TOE OF SLOPES. IF SITE CONDITIONS DO NOT ALLOW FOR OFFSET, BALES MAY BE PLACED AT TOE.

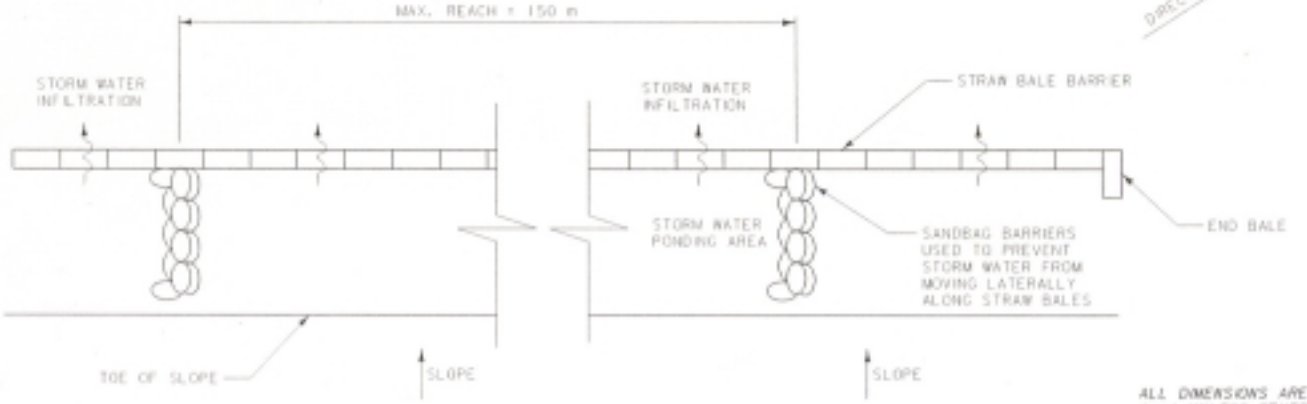
FOLLOW GUIDELINES IN BMP SC-4 IF BALES ARE USED AS CHECK DAMS.

REPAIR OR REPLACE DAMAGED, UNDER-CUT OR END RUN BALES. REMOVE SEDIMENT BUILDUP FROM BALES ONCE IT REACHES A HEIGHT OF 1/3 THE BALE HEIGHT.









ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

PRELIMINARY

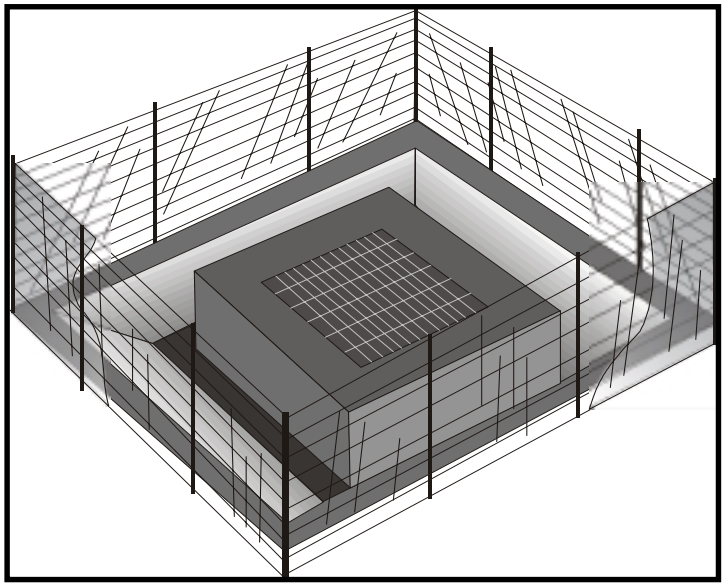
REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-22

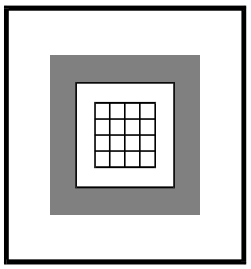
STRAW BALE BARRIERS (SC-9)

EFFECTIVE:

CDM Camp Dresser & McKee Inc.

Storm Drain Inlet Protection SC-10





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Storm Drain Inlet Protection is used at storm drain inlets that are subject to runoff from construction activities to detain and/or to filter sediment-laden runoff to allow sediment to settle and/or to filter sediment prior to discharge of storm water into storm water drainage systems or watercourses.

Appropriate Applications

- Where ponding will not encroach into highway traffic.
- Where sediment laden surface runoff may enter an inlet.
- Where disturbed drainage areas have not yet been permanently stabilized.
- Where the drainage area is 0.4 ha (1 acre) or less.
- Appropriate during wet and snow-melt seasons.

Limitations

- Use only when ponding will not encroach into highway traffic or onto erodible surfaces and slopes. If safety is a concern, use other methods of temporary protection to prevent sediment-laden storm water and non-storm water discharges to enter the storm drain system.
- Sediment removal may be difficult in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use other on-site sediment trapping techniques in conjunction with inlet protection.
- Frequent maintenance is required.

- For drainage areas larger than 0.4 ha (1 acre), runoff shall be routed to a sediment trapping device designed for larger flows. See BMPs SC-2, "Desilting Basin," and SC-3 "Sediment Traps."

- Filter fabric fence inlet protection appropriate in open areas is subject to sheet flow and for flows not exceeding 0.014 m^3/s (0.5 ft^3/s).

- Sandbag barriers for inlet protection are applicable when sheet flows or concentrated flows exceed 0.014 m^3/s (0.5 ft^3/s), and it is necessary to allow for overtopping to prevent flooding.

- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected and overflow capability is needed.

Design Guidelines and Considerations

- Identify existing and/or planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed, and which method to use.

- The Straw Bale Barrier method materials and installation are described in the Storm Drain Inlet Protection (SC-10) Detail Drawing.

- The Filter Fabric Fence method materials and installation are described in the Storm Drain Inlet Protection (SC-10) Detail Drawing.

- Do not place filter fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced.

- Use Sandbag Barriers and Gravel Check Dams for high flows as described in the Storm Drain Inlet Protection (SC-10) Detail Drawing.

- The Sandbag Barrier materials and installation are described in the Storm Drain Inlet Protection (SC-10) Detail Drawing.

- Flow from a severe storm should not overtop the sandbags. In areas of high clay and silts, use filter fabric and gravel as additional filter media.

- The Gravel Check Dam method materials and installation are described in the Storm Drain Inlet Protection (SC-10) Detail Drawing.

Maintenance, Inspection, and Removal

General

- Inspect all inlet protection devices before predicted storm events, as soon as possible after storm events, and weekly during the construction season. During extended rainfall events, inspect inlet protection devices at least once every 24 hours.

- Inspect the storm drain inlet after severe storms to check for bypassed material.

- Remove all inlet protection devices within thirty days after the site is stabilized, or when the inlet protection is no longer needed.

- Bring the disturbed area to final grade and smooth and compact it. Appropriately stabilize all bare areas around the inlet.

- Clean and re-grade area around the inlet and clean the inside of the storm drain inlet as it must be free of sediment and debris at the time of final inspection.

Requirements by Method

Straw Bale Barriers

- Inspect straw bale barriers prior to forecasted storm events, as soon as possible after each storm event, and weekly throughout the rainy season.

- Inspect straw bale barriers for sediment accumulations and remove sediments when depth reaches 1/3 the barrier height. Removed sediment shall be incorporated in the project at locations designated by the Engineer or disposed of outside the right-of-way as approved by the Engineer.

- Replace or repair damage bales as needed or as directed by the Engineer.

- Repair washouts or other damages as needed or as directed by the Engineer.

- Bales can be scattered when their function as a storm water barrier is completed. Accumulated sediment can be removed or seeded and stabilized.

Filter Fabric Fence

- Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes.

- Replace or clean the fabric when the fabric becomes clogged with sediment. Make sure the fabric does not have any holes or tears. Repair or replace fabric as needed or as directed by the Engineer.

- At a minimum, remove the sediment behind the fabric fence when accumulation reaches 1/3 the height of the fence or barrier height. Removed sediment shall be incorporated in the project at locations designated by the Engineer or disposed of outside the right-of-way as approved by the Engineer.

Sandbag Barrier

- Inspect bags for holes, gashes, and snags.

- Check sandbags for proper arrangement and displacement. Remove the sediment behind the barrier when it reaches 1/3 the height of the barrier. Removed sediment shall be incorporated in the project at locations designated by the Engineer or disposed of outside the right-of-way as approved by the Engineer.

Gravel Check Dam

- Inspect check dams after each storm event. Repair damage as needed or as required by the Engineer.

- Remove sediments when depth reaches 1/3 of the check dam height.

- Remove accumulated sediment prior to permanent seeding or soil stabilization or seed accumulated sediment to stabilize.

- Remove check dam and accumulated sediment when check dams are no longer needed or when required by the Engineer. Check dams can be left in place following construction activities and allowed to accumulate sediment and vegetation as approved by the Engineer.

- Removed sediment shall be incorporated in the project at locations designated by the Engineer or disposed of outside the right-of-way as approved by the Engineer.

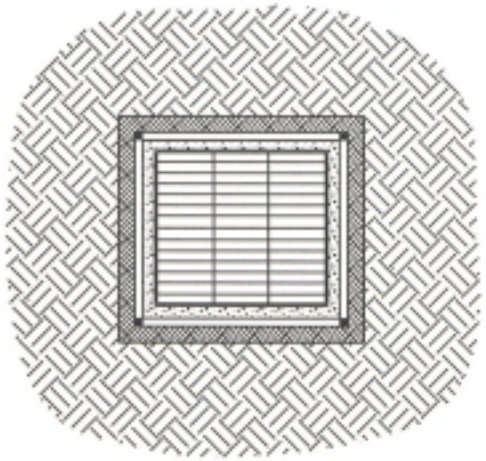
SYMBOL:

STORM DRAIN INLET PROTECTION SC-10:

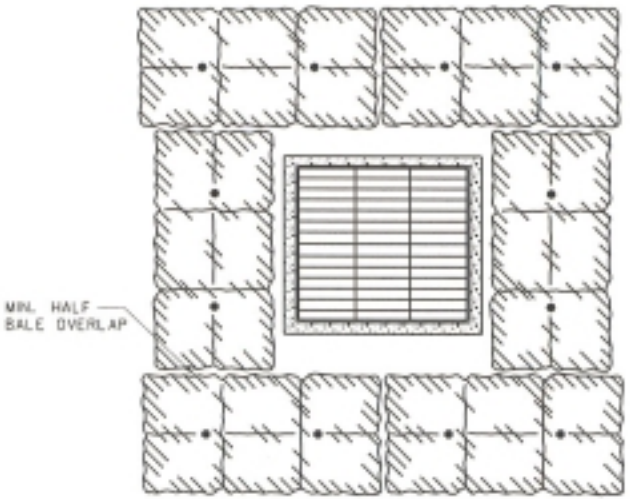
STORM DRAIN INLET PROTECTION IS USED AT STORM DRAIN INLETS THAT ARE SUBJECT TO RUNOFF FROM CONSTRUCTION ACTIVITIES. THESE DEVICES DRAIN AND/OR FILTER SEDIMENT-LADEN RUNOFF AND ALLOW SEDIMENT TO SETTLE PRIOR TO DISCHARGE OF STORM WATER INTO STORM WATER DRAINAGE SYSTEMS OR WATERCOURSES.

USE STORM DRAIN INLET PROTECTION WHEN PONDING WILL NOT ENCROACH INTO HIGHWAY AND FOR DRAINAGE AREAS OF 0.4 ha OR LESS. FOR FLOWS LESS THEN 0.014 m^3/s SILT FENCE OR STRAW BALES MAY BE USED. WHEN FLOWS EXCEED 0.014 m^3/s USE SANDBAG BARRIERS OR GRAVEL CHECK DAMS. FOLLOW SILT FENCE (SC-1), STRAW BALE BARRIERS (SC-9), SANDBAG BARRIERS (SC-8) AND CHECK DAMS (SC-4) FOR INSTALLATION REQUIREMENTS FOR EACH TYPE OF MATERIAL.

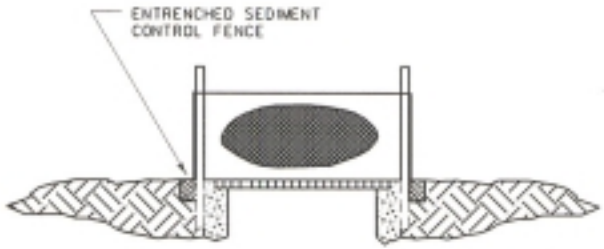
STRAW BALES, SAND BAGS, AND GRAVEL BERMS MAY BE USED WITHIN THE CLEAR ZONE UPON ENGINEERS APPROVAL. EXPEDIENTLY REMOVE ALL STRAW BALES, SAND BAGS, AND GRAVEL BERMS FROM THE CLEAR ZONE UPON COMPLETION OF CONSTRUCTION ACTIVITIES.



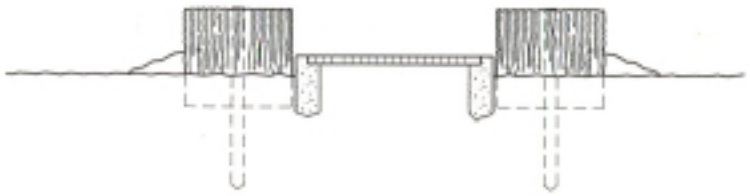
SILT FENCE - PLAN VIEW



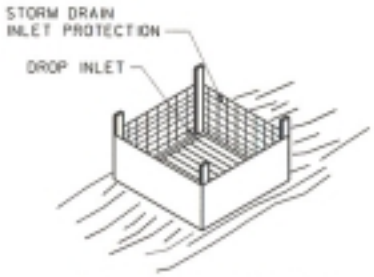
STRAW BALE BARRIER - PLAN VIEW



SILT FENCE - PROFILE VIEW



STRAW BALE BARRIER - PROFILE VIEW



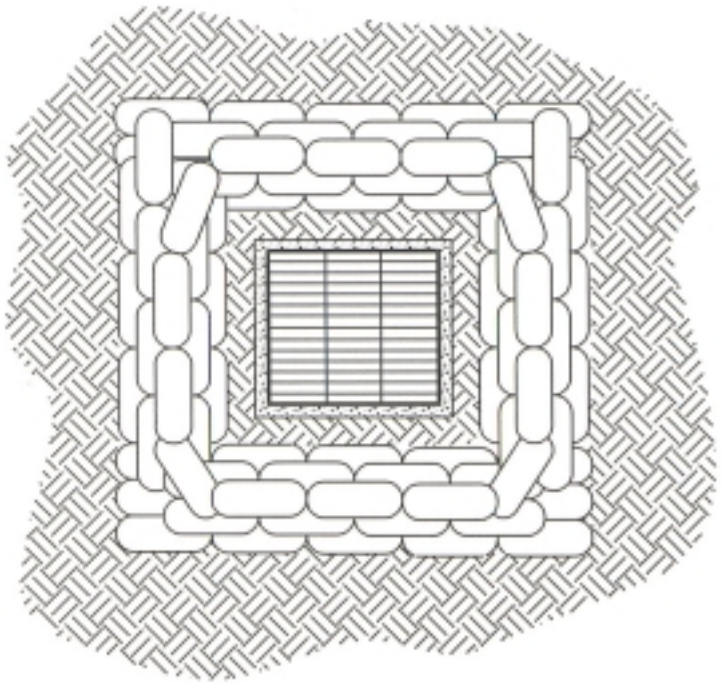
EXAMPLE ISOMETRIC VIEW

ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

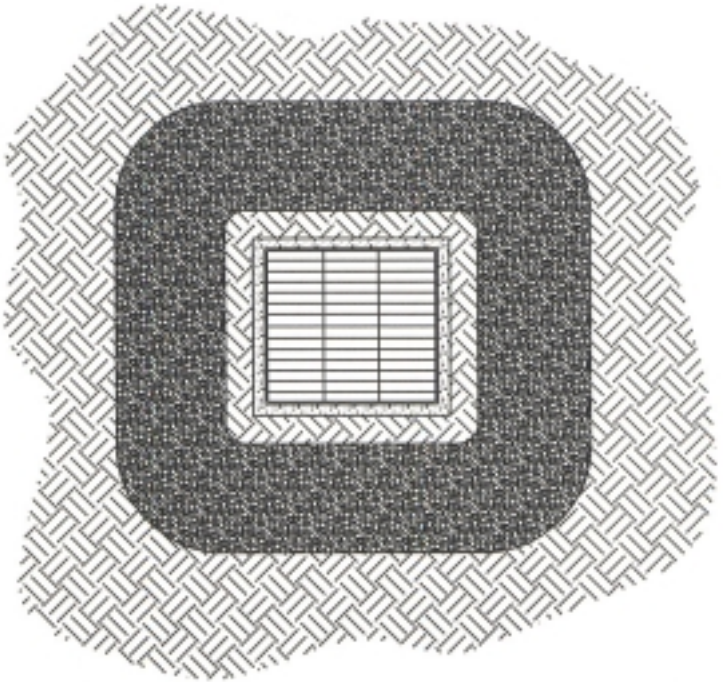
PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-22
STORM DRAIN INLET PROTECTION (SC-10) (SHEET 1)	
EFFECTIVE:	

CDM Camp Dresser & McKee Inc.



SANDBAG BARRIER - PLAN VIEW



GRAVEL CHECK DAM - PLAN VIEW

SANDBAG BARRIER - PROFILE VIEW

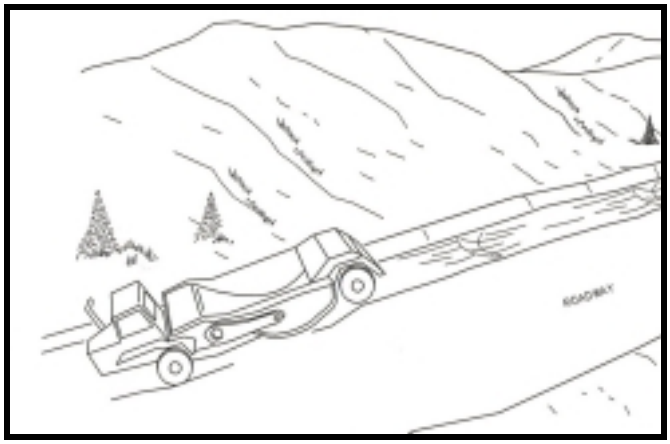
GRAVEL CHECK DAM - PROFILE VIEW

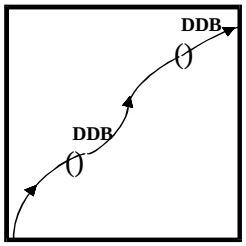
PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-??
STORM DRAIN INLET PROTECTION (SC-10) (SHEET 2)	
EFFECTIVE:	

CDM Camp Dresser & McKee Inc.

Dugout Ditch Basin SC-11





BMP Objectives

- ● Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Dugout ditch basins consist of one or a series of small dugout basins located within a flow channel. Dugout ditch basins are used to reduce runoff velocity, promote sediment retention and allow settling within longitudinal roadside ditches in a cut section or as longitudinal sediment retention basins at the toe of fills.

Appropriate Applications

- Dugout ditch basins are used for longitudinal slope steepness (grade) sediment retention. Applications include ditch sediment traps, interceptor ditches, and toe of slope protection.
- The Designer determines the locations requiring ditch sediment traps and the proper placement intervals of the basins.

Limitations

- Not to be used in live streams.
- Not to be placed in channels which are already grass lined unless erosion is expected, as installation may damage vegetation.
- Require maintenance following high velocity flows.
- Promotes sediment trapping which can be re-suspended during subsequent storms.

Design Guidelines and Considerations

- Dugout ditch basins shall be placed at a depth that allows small pools to form in them.
- The maximum height for dugout ditch basins used inside the errant vehicle recovery area is 150 mm (6 in).
- The distance between dugout ditch basins is dependent on the length of ditch section relating to the grade that needs sediment retention. The interval is as follows:

Ditch Slope	Dugout Ditch Basin Spacing
2% to 3%	91 meters
3% to 4%	46 meters
4% +	15 meters

- The dugout ditch basin spacing values are empirical and are the maximal interval distances for a 2 year, 24-hour rain event. Intervals may be shortened at the discretion of the Engineer if soil conditions and/or precipitation indicate a need to do so.

- Dugout ditch basins can remain in place and be seeded during permanent seeding of the ditch.

Maintenance, Inspection, and Removal

- Inspect basins prior to predicted storm events and as soon as possible after each storm event. Repair damage as needed or as required by the Engineer.

- Remove sediments when required by the Engineer.

- Removed sediment shall be incorporated in the project at locations designated by the Engineer or disposed of outside the right-of-way as approved by the Engineer.

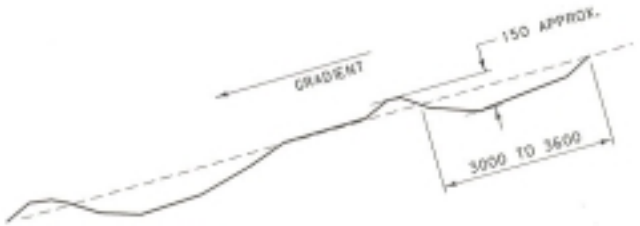
SYMBOL: ——————— ———DDB———

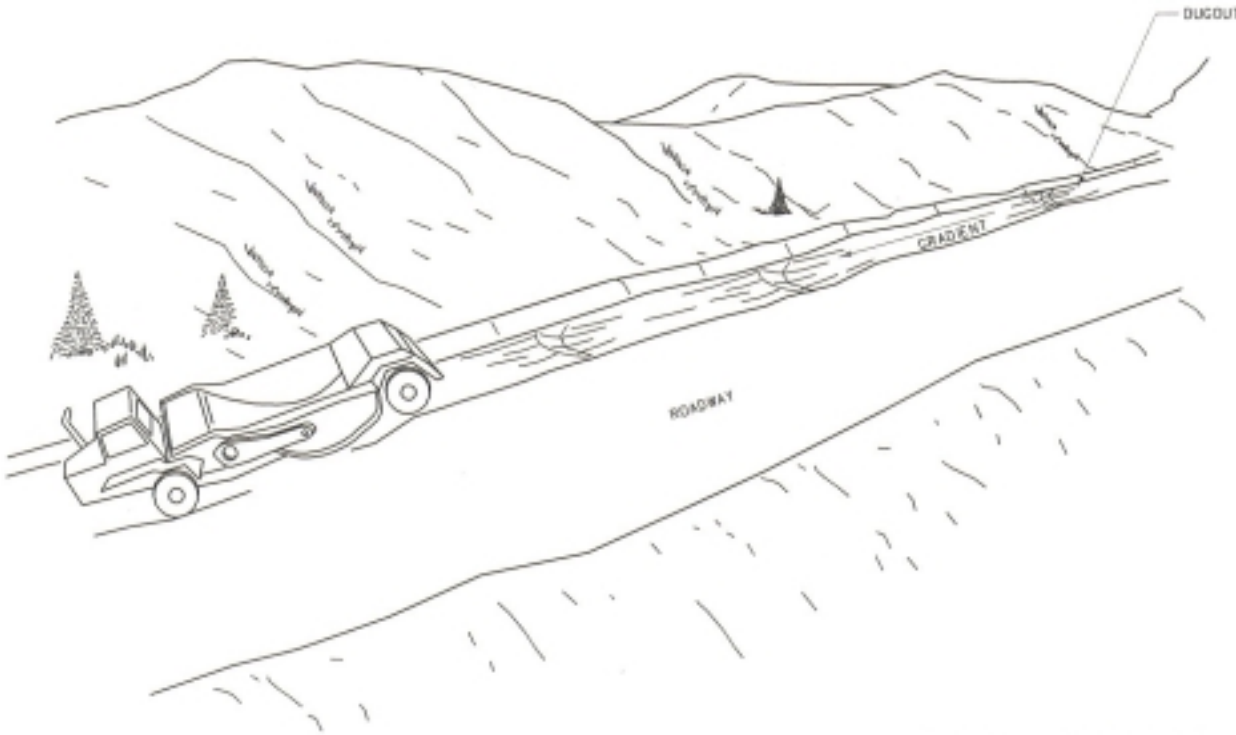
DUGOUT DITCH BASIN SC-111

DUGOUT DITCH BASINS CONSIST OF ONE OR A SERIES OF SMALL DUGOUT BASINS USED FOR CONCENTRATED FLOWS TO REDUCE RUNOFF VELOCITY, PROMOTE SEDIMENT RETENTION AND ALLOW SETTLING. THE MAXIMUM HEIGHT FOR DUGOUT DITCH BASINS USED INSIDE THE CLEAR ZONE IS 150 mm.

DUGOUT DITCH BASINS ARE USED FOR LONGITUDINAL SLOPE STEEPNESS (GRADE) SEDIMENT RETENTION. APPLICATIONS INCLUDE DITCH SEDIMENT TRAPS, INTERCEPTOR DITCHES AND TOE OF SLOPE PROTECTION. USE IS DEPENDENT ON SOIL TYPE. DISTANCES BETWEEN DUGOUT DITCH BASINS ARE AS FOLLOWS:
- FROM 2% TO 3% PLACE DUGOUT DITCH BASINS AT 90 METER SPACING
- FROM 3% TO 4% PLACE DUGOUT DITCH BASINS AT 45 METER SPACING
- FROM 4% + PLACE DUGOUT DITCH BASINS AT 15 METER SPACING

DUGOUT DITCH BASIN SPACING CAN BE ADJUSTED ON A PROJECT-BY-PROJECT BASIS FOLLOWING ENGINEERS APPROVAL.





ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-22
DUGOUT DITCH BASIN (SC-111)	
EFFECTIVE:	

CDM Camp Dresser & McKee Inc.