

Approved SWPPPs Do Not Illustrate How to Prevent Sediment Discharges or Erosion

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Do not allow sediment to leave the site by preventing erosion.

Does this mean “all” sediments are to be removed?

Sediment caused by accelerated soil erosion shall be removed from runoff water before it leaves the construction site.

The escape of sediment from the site shall be prevented by the installation of erosion and sediment control measures and practices prior to, or concurrent with, land disturbing activities.

Example of Rules, Regulations and Specifications Found for “Preventing” Erosion and Sediment Discharges

Can this be accomplished?

Eroded sediments and other pollutants must be retained on-site and may not be transported from the site via sheet flow, swales, area drains, natural drainage courses, or wind.

All sediment must be prevented from entering any public or private storm drainage system.

The escape of sediment from the site shall be prevented by the installation of erosion and sediment measures and practices prior to, or concurrent with, land disturbing activities

What is the definition of “Prevent”?

to keep from happening or existing

Merriam-Webster Dictionary

to stop something from happening or
someone from doing something

Cambridge Academic Content Dictionary

Do not allow sediment to leave the site by ~~stopping~~ preventing erosion.

Nearly impossible
to achieve!

Does this mean "all" sediments
are to be removed?

Sediment caused by accelerated soil erosion shall be removed
from runoff water before it leaves the construction site.

The escape of sediment from the site shall be ~~stopped~~ prevented by the
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The escape of sediment from the site shall be ~~stopped~~ prevented by the
installation of erosion and sediment measures and practices
prior to, or concurrent with, land disturbing activities

Inspectors could be busy writing up NOVs because of these criteria



**How does one “stop” erosion or
sediment discharge**

Only by installing impervious BMPs



**These are the Real-World
Conditions for Sediment
and Erosion Control**



Is the problem sediment or is it runoff?



- > 20%
- > 15% to 20%
- > 10% to 15%
- > 5% to 10%
- > 1% to 5%



After 96
hours

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What will be Discussed

- **Obligations**
 - **Reviewers**
(Regulatory)
 - **Designers**
(Permittee)
 - **Contractors**
 - **Inspectors**
- **Sediment and/or Erosion Control Limitations**
 - Silt fence barriers
 - Fiber roll/log barriers
 - Inlet protection
 - Sediment basins/traps
 - Check structures
 - Mulches and RECPs

Construction Site Basic Definitions

- **Erosion**

- Soil particles displaced by the action of wind or water.

- **Sediment**

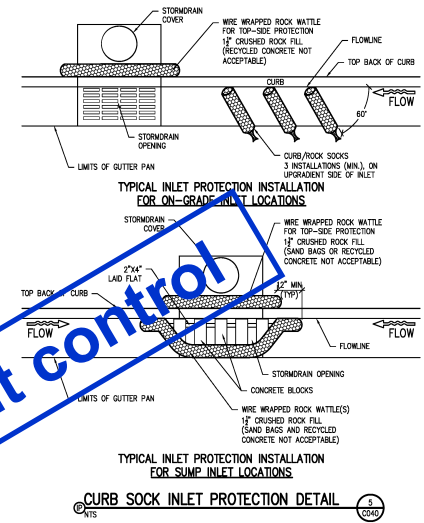
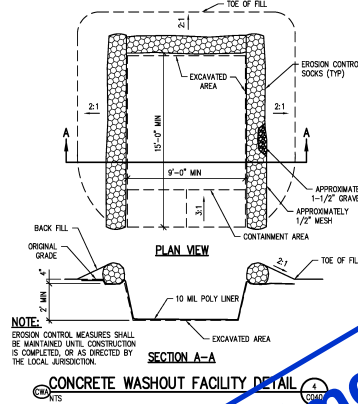
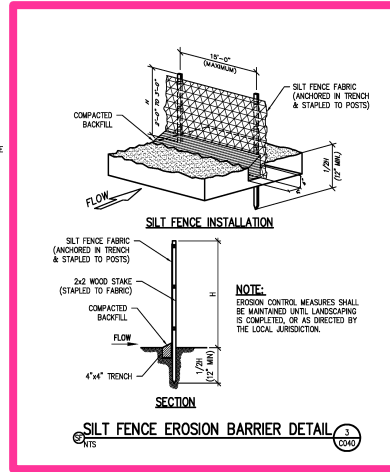
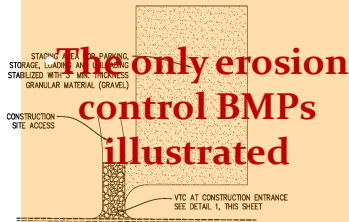
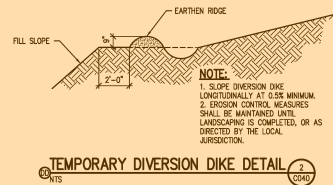
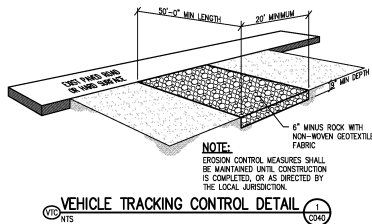
- Eroded material suspended in water or air.

- **Sedimentation**

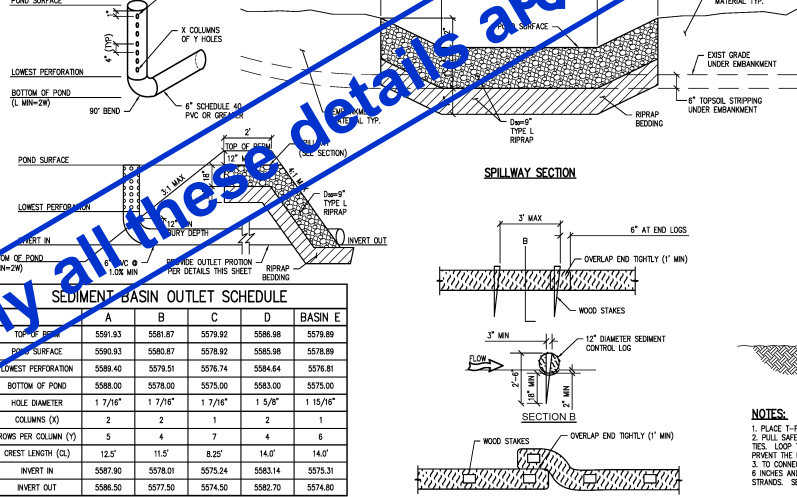
- The deposition of soil particles suspended in water or air.

Do Approved BMP Details for Sediment and/or Erosion Control Represent Local Climatic Conditions?

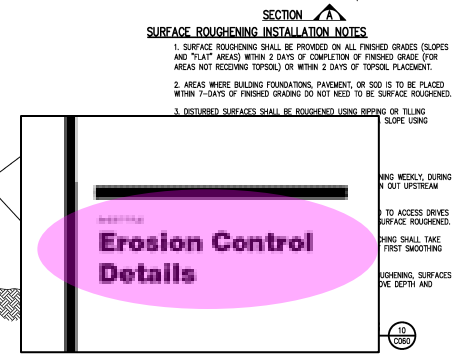
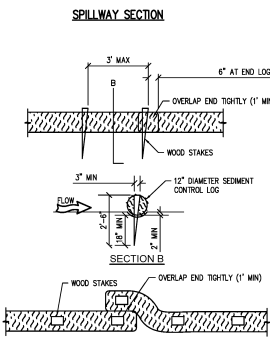
- East and north sides of the islands display tropical and/or humid climatic conditions
 - West and south sides of the islands display arid and/or semi-arid climatic conditions
- Detail sheets obtained from other sources should be evaluated and necessary updates completed to address local climatic conditions*



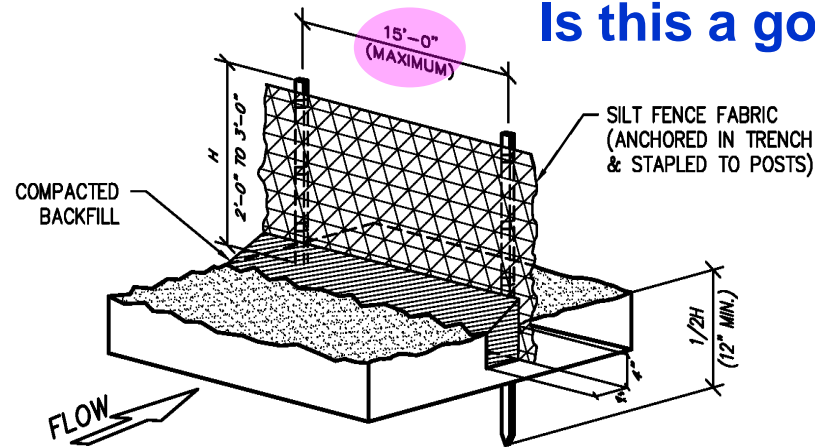
Let's Start with Typical BMP Details



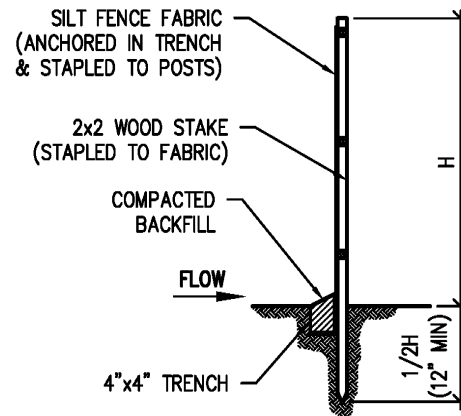
	A	B	C	D	BASIN E
TOP OF POND	5591.93	5591.87	5579.92	5598.98	5579.90
20' SURFACE	5590.93	5580.87	5578.92	5595.98	5578.89
LOWEST PERFORATION	5589.40	5579.51	5576.74	5584.64	5576.81
BOTTOM OF POND	5588.00	5578.00	5575.00	5583.00	5575.00
HOLE DIAMETER	1 7/16"	1 7/16"	1 7/16"	1 5/8"	1 15/16"
COLUMNS (X)	2	2	1	2	1
ROWS PER COLUMN (Y)	5	4	7	4	6
CREST LENGTH (L)	12.5'	11.5'	8.25'	14.0'	14.0'
INVERT IN	5587.90	5578.01	5575.24	5583.14	5575.31
INVERT OUT	5586.50	5577.50	5574.50	5582.70	5574.80



Is this a good criterion?



SILT FENCE INSTALLATION



SECTION

NOTE:

EROSION CONTROL MEASURES SHALL BE MAINTAINED UNTIL LANDSCAPING IS COMPLETED, OR AS DIRECTED BY THE LOCAL JURISDICTION.

SILT FENCE EROSION BARRIER DETAIL

SF
NTS

3
C040

HUH?

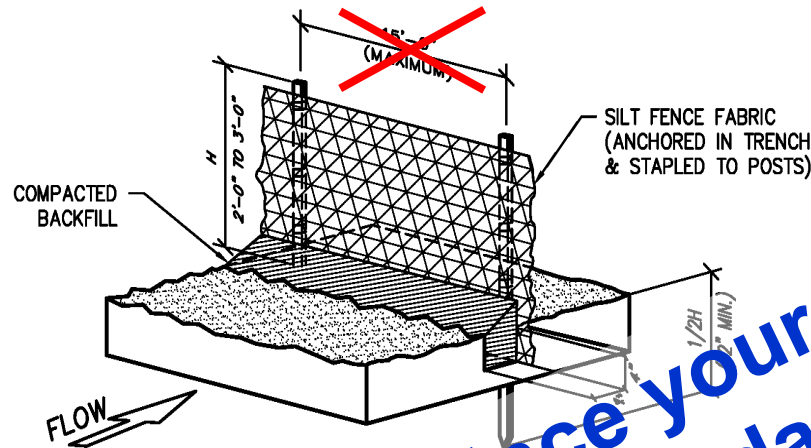




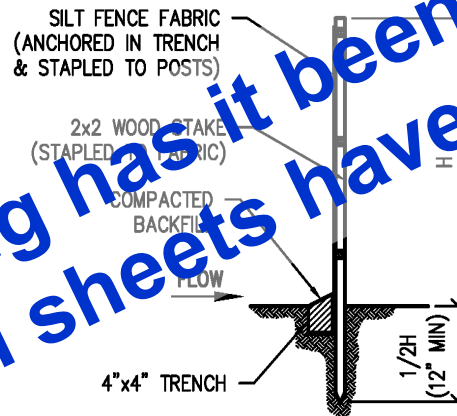
Remember this?
 Have you observed accelerated soil erosion
 during runoff events?
 Sediment caused by accelerated soil erosion
 shall be removed from runoff water before it
 leaves the construction site.



How long has it been since your BMP detail sheets have been updated?



SILT FENCE INSTALLATION



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SILT FENCE EROSION BARRIER DETAIL

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Updates to Silt Fence Barriers



Fact

**Silt Fence Barriers only “Minimize” the
Discharge of Sediment-Laden Runoff**

Fiber Roll/Log Barriers

Fiber Rolls/Logs

- What are Fiber Roll/Log Barriers?
 - Also known as “wattles”
 - Light weight units
 - Filled with light weight material such as straw, coconut fiber, wood chips, excelsior, etc.
 - May float when upstream water depths are less than the radius

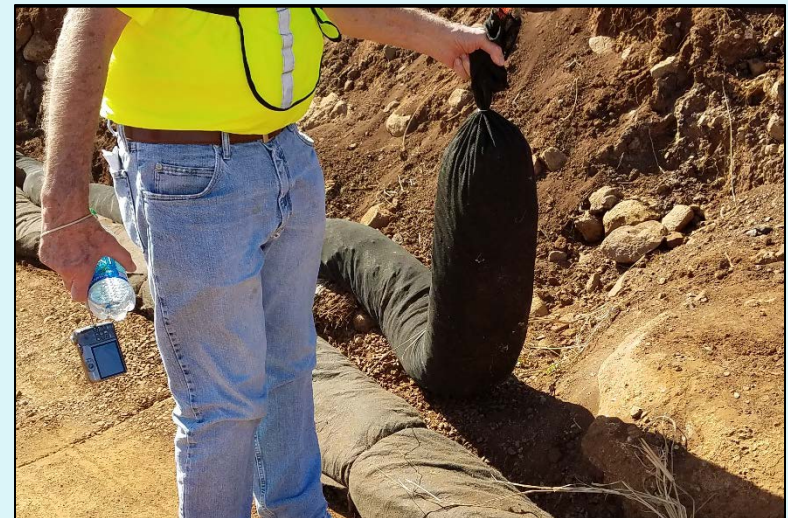




Fiber Rolls/Logs

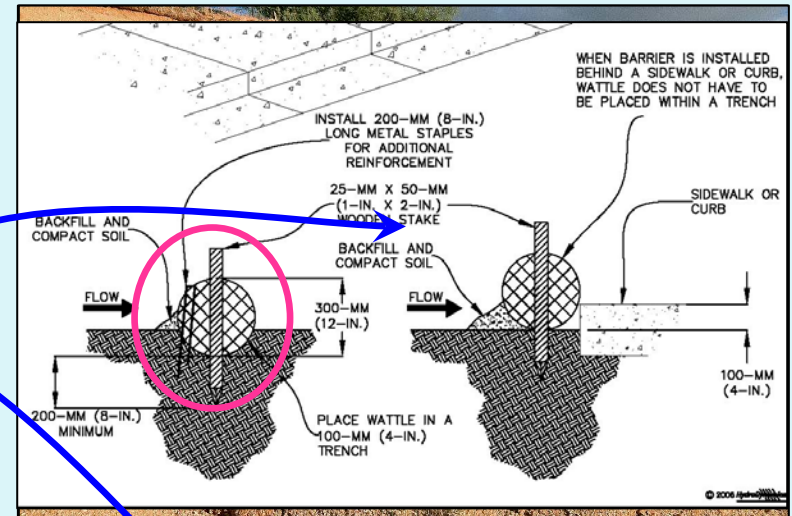
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- Also known as “wattles”
- Light weight units
 - Filled with light weight material such as straw, coconut fiber, wood chips, excelsior, etc.
 - May float when upstream water depths are less than the radius
- Heavy weight Units
 - Filled with heavy weight material such as compost, dense wood chips, sand & gravel, rubber material, etc.
 - Will not float when upstream water depths exceed the radius
 - Approximate mass (weight) per unit length to avoid floating
 - 150-mm (6-inch) \approx 1.8 kgs/m (1.2 lbs./ft.)
 - 230-mm (9-inch) \approx 3.9 kgs/m (2.6 lbs./ft.)
 - 300-mm (12-inch) \approx 6.8 kgs/m (4.6 lbs./ft.)



Fiber Rolls/Logs

- What are Fiber Rolls/Logs?
 - Also known as “wattles”
 - Two Types
 - Light
 - Heavy
- Basic Information
 - Are they sediment, dirt or erosion control barriers?
 - Minimal erosion control when slopes are greater than 5.0%
 - Must be in continuous contact with underlying material
 - Light weight units on soil require trenching, backfill and staking
 - Heavy units may need minimal staking



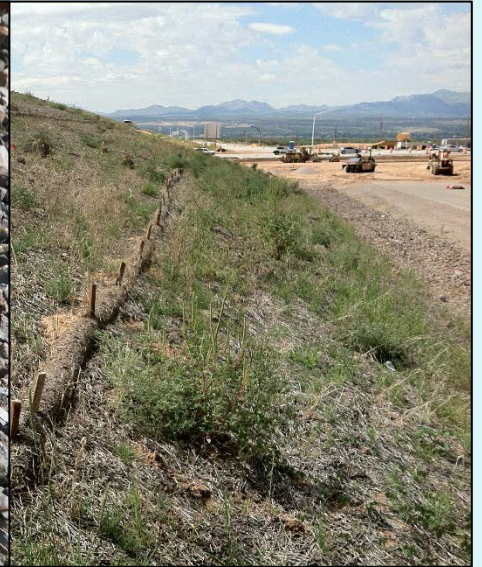
Fiber Roll/Log Hillside Barriers

- Are they for sediment and/or erosion control?
 - Were they designed for a specific storm event?
 - How was spacing determined?
 - What are the maintenance requirements?
 - Are they effective?

OR

Are they for “show and tell”







Fact

Fiber Roll/Log Barriers Installed on Hillsides

- **Do not Provide Erosion Control**
- **May Provide Minimal Sediment Control**

Inlet Protection

(EPA modified 2017 CGP)

2.2.10 Protect storm drain inlets.

- Install inlet protection measures that remove sediment from discharges prior to entry into any storm drain inlet that carries stormwater flow from your site to a water of the U.S., provided you have authority to access the storm drain inlet²³, and
- Clean, or remove and replace, the protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection measure, remove the deposited sediment by the end of the same business day in which it is found or by the end of the following business day if removal by the same business day is not feasible.

Today, the standard is to place barriers in front of all inlet openings

Effectiveness of Inlet Barriers to Remove Sediment out of Runoff

- How do barriers remove sediment from runoff waters?





Removing sediment from runoff occurs predominately by ponding---NOT filtering by a barrier

**What will Happen at this Location
During Runoff Events When the
Opening is Blocked?**



Inlet Protection

(EPA modified 2017 CGP)

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- b. Clean, or remove and replace, the protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection measure, remove the deposited sediment by the end of the same business day in which it is found or by the end of the following business day if removal by the same business day is not feasible.

²³ Inlet protection measures can be removed in the event of flood conditions or to prevent erosion

When Area Drains Are in a Sump



Fact

**Barriers for Sump Inlets “Minimize” the
Discharge of Sediment-Laden Runoff
into a Storm Sewer System**

Effectiveness of Inlet Barriers to Remove Sediment out of Runoff

- How do barriers remove sediment from runoff waters?
- Should barriers be placed in front of all inlet openings?





**Notice the ineffectiveness
of a barrier on a grade**



Remember This Criterion?

The escape of sediment from the site shall be prevented by the installation of erosion and sediment control measures and practices prior to, or concurrent with, land disturbing activities.

Fact

Barriers for Sump Inlets “Minimize” the
Discharge of Sediment-Laden Runoff
into a Storm Sewer System

**Barriers in Front of On-Grade Inlets
“Divert” Sediment-Laden Runoff and
can Cause Downstream Impacts**

Effectiveness of Inlet Barriers to Remove Sediment out of Runoff

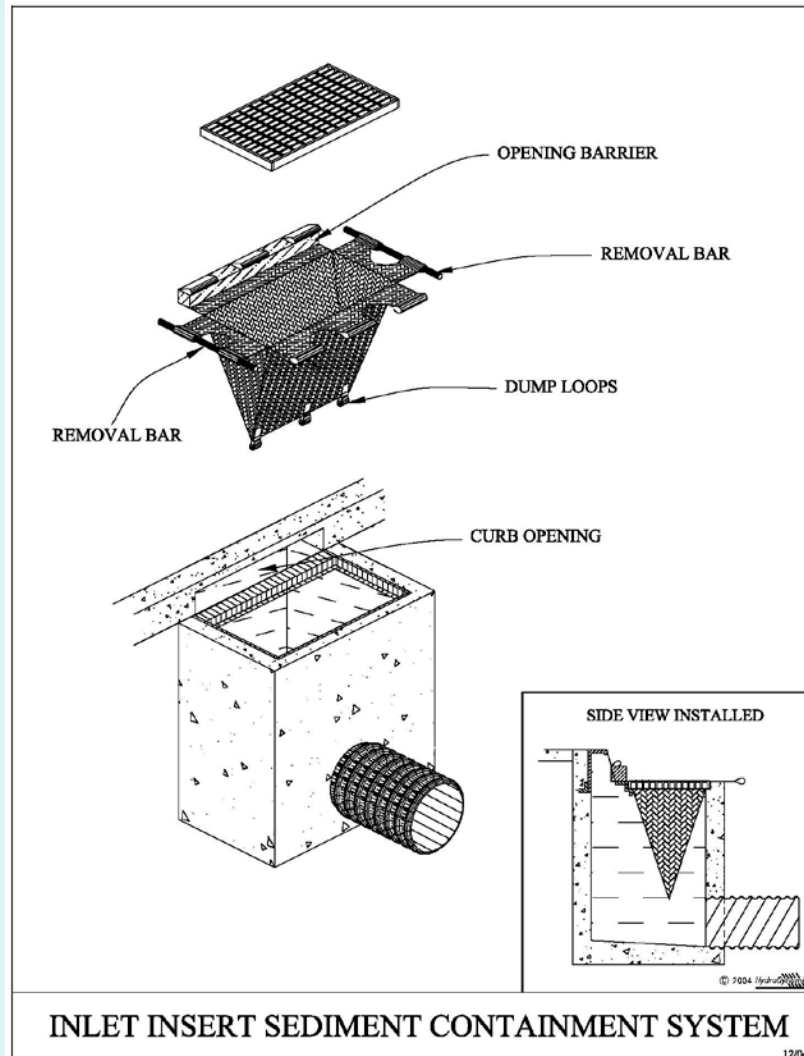
- How do barriers remove sediment from runoff waters?
- Should barriers be placed in front of all inlet openings?
- Do alternatives to inlet barriers exist?



Curb and Gutter Barriers



Inlet Insert





Fact

Barriers for Sump Inlets “Minimize” the Discharge of Sediment-Laden Runoff into a Storm Sewer System

Barriers in Front of On-Grade Inlets “Divert” Sediment-Laden Runoff and can Cause Downstream Impacts

Inlet Inserts “Minimize” the Discharge of Sediment-Laden Runoff



Sedimentation by Reducing Flow Velocities

Channel Check Structures

STABILIZED SECTION

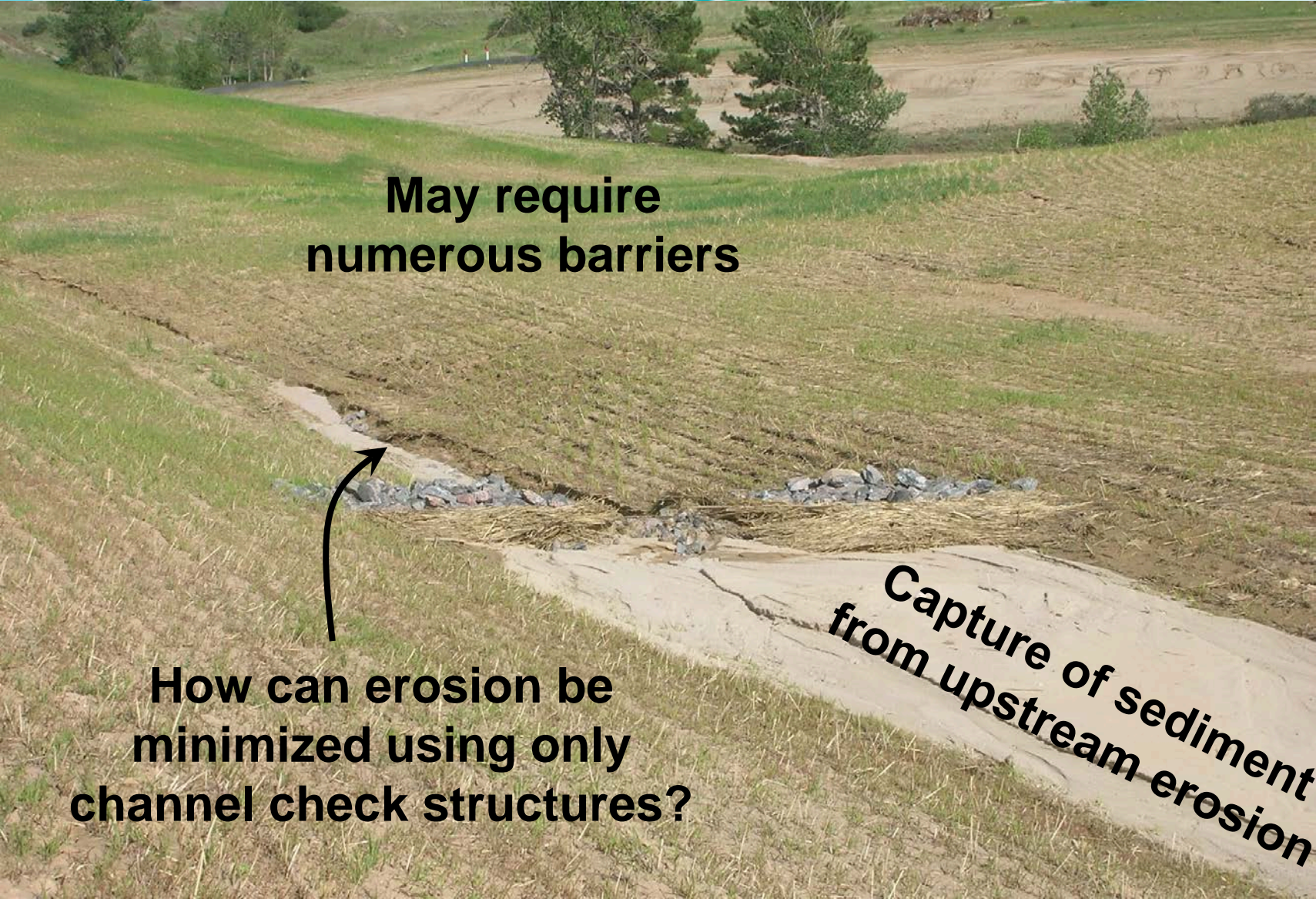
ERODED SECTION

Does This BMP Meet the Following Criterion?

Eroded sediments and other pollutants must be retained on-site and may not be transported from the site via sheet flow, swales, area drains, natural drainage courses, or wind.

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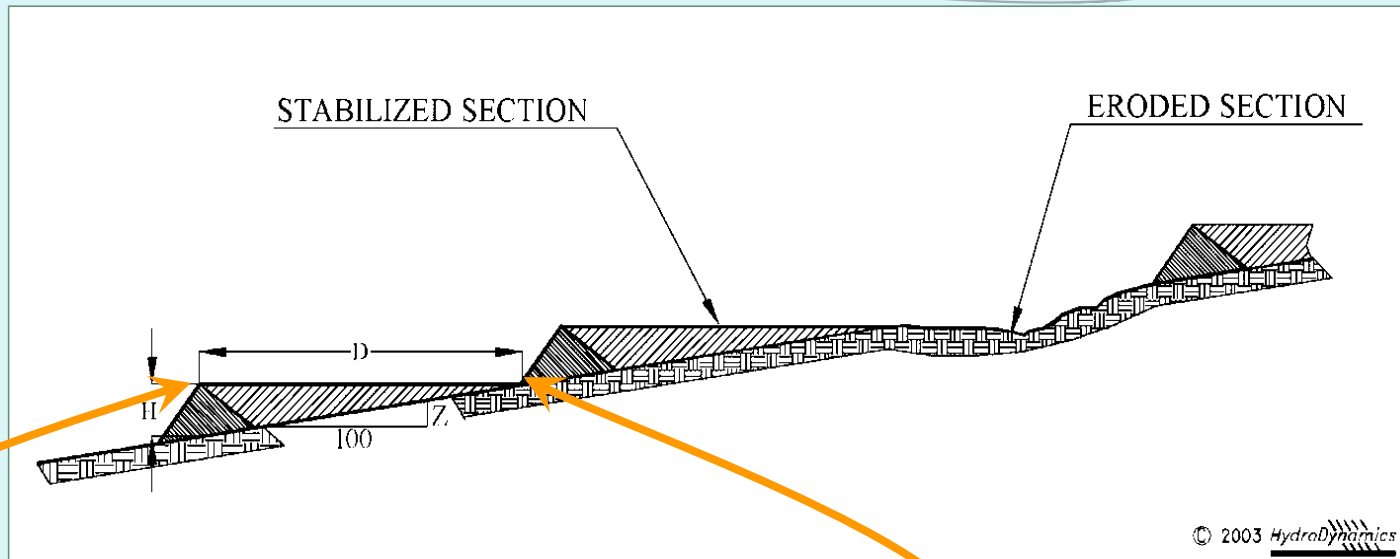


**May require
numerous barriers**

**How can erosion be
minimized using only
channel check structures?**

**Capture of sediment
from upstream erosion**

Using Check Structures for Erosion Control



- Spacing is critical between check structures for “some” erosion protection.
- Top of the downstream structure must be in line with the bottom of the upstream structure to minimize erosion.
- Must be viewed as a “temporary” method

Using Silt Fence Barriers as Check Structures in Drainage Channels

- As a “stand alone” barrier, silt fences not properly installed should not be used where concentrated flows occur
- Concentrated flows usually result in extensive damage and maintenance
- Without proper installation, failure is the norm





The escape of sediment from the site shall be prevented by the installation of erosion and sediment measures and practices prior to, or concurrent with, land disturbing activities

Unsuported and improperly installed silt fence barriers in drainage channels usually fail when runoff occurs.
Properly supported and installed silt fence barriers in drainage channels are rare.

Fact

Check Structures might “Minimize” Erosion of a Drainage Channel or might “Minimize” the Discharge of Sediment-Laden Runoff

What is the Most Effective Method to Remove Sediment from Runoff Waters?

**Large Sediment Containment Systems
such as Sediment Ponds/Traps**

The only Structure Using a Barrier that Maximizes the Capture of Sediment in all Runoff Waters





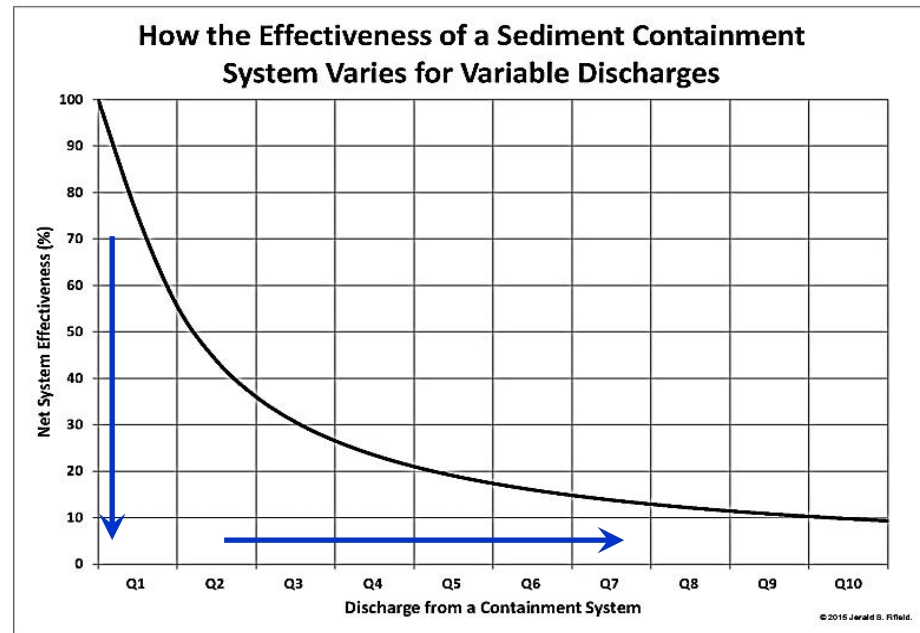
**But this represents what is often
installed**

**Remember, contractors
install what designers
provide and regulatory
agencies approve**



Important SCS Parameters

- Controlled discharges
 - Most important parameter
 - High discharge rates results in low effectiveness
- Pond surface area
- Internal flow distance
- Long detention times for contained waters
 - Up to 48+ hours
- Enough volume to detain runoff waters
 - Not the most important parameter
 - 250 m³/ha (3,600 ft.³/ac.)



Suggested Minimum SCS Volumes for 90% Containment of Runoff

- Based upon Trewartha** Climatic Classifications
 - $\text{Vol}_{\min} = 125 \text{ m}^3/\text{ha}$ ($\approx 1,800 \text{ ft.}^3/\text{ac.}$) for dry climates
 - Arid and semi-arid conditions
 - $\text{Vol}_{\min} = 250 \text{ m}^3/\text{ha}$ ($\approx 3,600 \text{ ft.}^3/\text{ac.}$) for temperate and continental climates
 - Humid conditions
 - $\text{Vol}_{\min} \geq 380 \text{ m}^3/\text{ha}$ ($\geq 5,450 \text{ ft.}^3/\text{ac.}$) for sub-tropical and tropical conditions
 - Where high frequency of rainfall events occur

** Trewartha GT, Horn LH. 1980. An introduction to climate. 5th edn. McGraw Hill, New York, NY

Vol_{\min} values should be developed for local climatic conditions

Porous Gabion



Perforated Riser Pipe

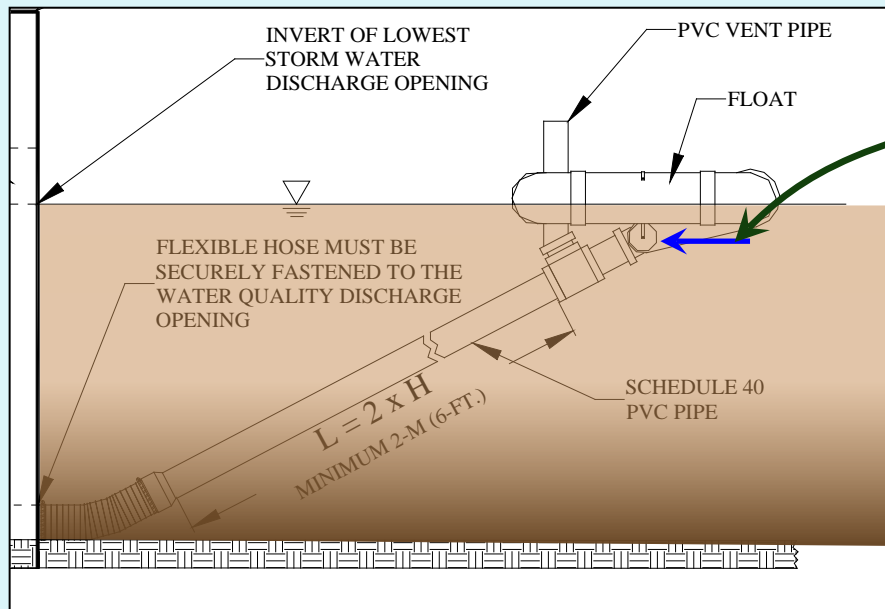


SCS Outlet Structures

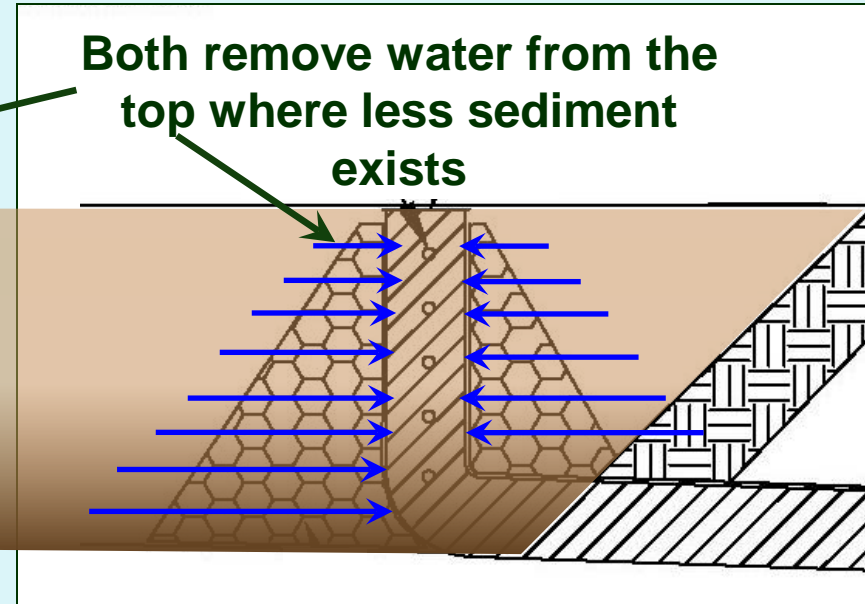
Skimmers



Why a Skimmer is Preferred Over a Riser Pipe



Removal of water occurs at the same rate due to constant water pressure which results in low sediment-laden discharges



Removal of water occurs at different rates due to variable water pressure which results in high sediment laden discharges

Perforated riser pipes can discharge large amounts of sediment-laden runoff waters



Fact

Properly Designed and Installed Sediment Basins/Traps “Minimize” the Discharge of Sediment-Laden Runoff Waters

Erosion Control BMPs

Hydraulic Mulches

- **Material**
 - Wood fiber
 - Paper
 - Binder
- **Application Rates**
 - 2.2 to 3.4 tonnes/ha
(1.0 to 1.5 tons/ac.)
- **Possible Problems**
 - Shadowing
 - Inadequate amount of material



Dry Mulches

- **Material**
 - Straw
 - Hay
- **Application Rate**
 - 3.4 to 4.5 tonnes/ha
(1.5 to 2.0 tons/ac.)
 - Minimum 150 mm (6 inches)
Fiber length
- **Coverage**
 - At least 80% of the bare
ground



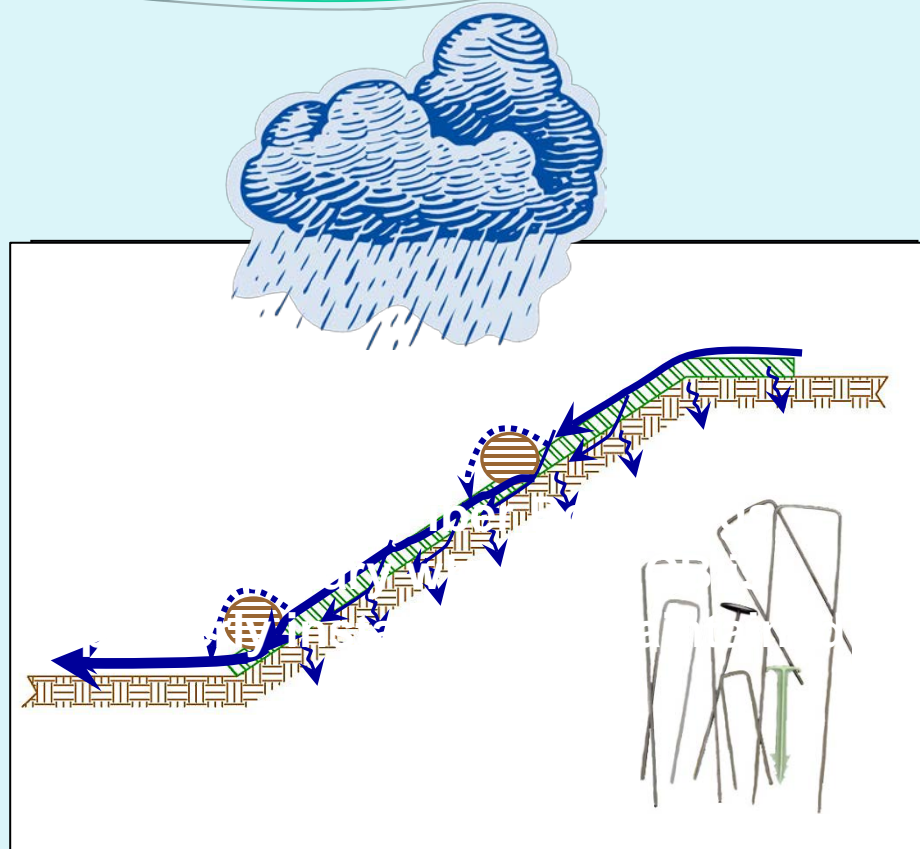
Rolled Erosion Control Products

- **Erosion Control Blankets (ECBs)**
 - Hillsides
 - Assists with vegetation establishment
 - Provides erosion control



Selecting a Hillside RECP

- What are you trying to accomplish?
 - Temporary erosion control
 - Assistance with final stabilization
 - What happens when it rains?
 - Are Fiber Rolls/Logs necessary?
 - Infiltration and underflow for “light” & “good” rainfall events
 - Infiltration, underflow, and (maybe) surface flows for “heavy” rainfall events



Optimal erosion control benefits will occur by ensuring the RECP has maximum soil contact by increasing the number of staples.

RECPs in Drainage Channels

- **Are Fiber Rolls Necessary?**
 - Properly designed channel RECP should not require the installation of fiber rolls.
 - Excessive cost
 - Little benefit
 - Cannot trench into the ground
 - Runoff waters flow on top and under the RECP.
 - Need to force underflow waters to the top.
 - Fiber rolls do not accomplish this task.



Fact

**Properly Installed and Maintained Mulches
and RECPs “Minimize” Erosion and Assist
with Vegetation Establishment**

Remember

**We Cannot Prevent Erosion and
Sediment Discharges**

But

We can Minimize Them



Reviewers

(Regulatory)

Designers

(Permittee)

Contractors

Inspectors

**To Meet Environmental Obligations and
Regulations, all Parties Must Continually
Communicate and Cooperate**

- Hydrology
- Hydraulics
- Biology
- Agronomy
- Physics
- Chemistry

- Practical rules and regulations
- Up-to-date details
- Understand BMP limitations
- Communicate
- Be innovative
- Engineering
- Mathematics
- Politics
- Common sense

- Understand BMP limitations
- Communicate & educate
- Provide practical advice

Qualifications do not belong to any one profession

Knowledgeable in pollution prevention

- Able to determine if impacts to stormwater quality will occur
- Able to assess if BMPs will function effectively

Inspectors

- Understand the SWPPP
- Understand BMP limitations
- Installation and maintenance
- Communicate & educate
- Protect the environment

Contractors

**Designers
(Permittee)**

- Practical and effective SWPPPs
- Understand BMP limitations
- Installation and maintenance
- Communicate & educate
- Be innovative

**Reviewers
(Regulatory)**

In Summary

- BMPs will not “prevent” erosion or sediment discharges.
- Update detail sheets to address local conditions.
- Understand limitations of sediment and/or erosion control BMPs.
- All parties must communicate with each other!
 - Regulatory
 - Designers
 - Contactors
 - Inspectors



Thank you

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