



**MONTANA  
DEPARTMENT OF  
ENVIRONMENTAL  
QUALITY**

**STORM WATER  
MANAGEMENT FOR  
OIL & GAS  
EXPLORATION &  
DEVELOPMENT  
FIELD GUIDE FOR  
BEST MANAGEMENT  
PRACTICES**



## **PURPOSE OF THIS FIELD GUIDE**

This MTDEQ BMP Field Guide has been designed and developed for use by storm water management professionals in the field during oil and gas exploration and development. This Field Guide includes:

- Construction Storm Water Permit information
- Storm water management fundamentals
- Erosion and sediment control practices
- Installation details for a wide range of Best Management Practices (BMPs)
- Photographic examples of correct and incorrect installations of BMPs
- Contact information

## **STORM WATER REGULATORY BACKGROUND**

The Montana Department of Environmental Quality (DEQ) administers the Montana Pollutant Discharge Elimination System (MPDES) Permit Program through the Montana Water Quality Act. The goal of the MPDES Permit Program is to control point source discharges of wastewater, process water and storm water, so water quality in state surface water is protected. The MPDES Permit Program is delegated to the State of Montana through the Clean Water Act and the United States Environmental Protection Agency. Tribal lands and federally funded projects on federal lands remain under the NPDES program.

Oil and Gas exploration and development activities that result in the “disturbance” of equal to or greater than one acre of total land area are required to obtain permit coverage under the General Permit for Storm Water Discharges Associated with Construction Activity (Construction General Permit). (Activities deemed to be maintenance, with less than 5-acres of disturbance are not included.) Additional

construction activities requiring permit coverage include the disturbance of less than one acre of total land area that is part of a “larger common plan of development or sale” if the larger common plan will ultimately disturb one acre or more. “Disturbance” related to construction activities is defined as any area that is subject to clearing, excavating, grading, stockpiling earth materials, and placement/removal of earth material.

The permittee is typically the oil and gas project owner, primary earthwork contractor, or general contractor for the project, although it could be another party.

### **WHAT IS THE CONCERN WITH STORM WATER RUN-OFF FROM OIL AND GAS EXPLORATION AND DEVELOPMENT ACTIVITIES?**

Storm water runoff is generated when precipitation from rain and snowmelt events flows over land or impervious surfaces and does not percolate into the ground. Oil and gas exploration and development activities are considered construction activities. Storm water runoff from oil and gas exploration and development activities can have a significant impact on water quality, because the runoff may carry pollutants from the development sites directly to a storm water conveyance and/or directly to a state water body.

Sediment runoff rates from construction activities are 10 to 20 times greater than those from agricultural lands, and 1,000 to 2,000 times greater than those of forestlands. During a short period of time, earth disturbing construction activities can contribute more sediment to streams than is naturally deposited over several decades.

## **THE FUNDAMENTALS OF STORM WATER MANAGEMENT DURING OIL AND GAS EXPLORATION AND DEVELOPMENT**

Individuals seeking permit coverage under the Construction General Permit are required to develop, implement, and maintain a Storm Water Pollution Prevention Plan (SWPPP). The purpose of the SWPPP is to identify potential sources of pollutants and select Best Management Practices (BMPs) to minimize or eliminate the potential for these pollutants to reach state surface waters in storm water runoff. State waters are defined as any waters on the earth's surface including but not limited to, streams, lakes, ponds, and reservoirs, and irrigation and drainage systems discharging directly into a stream, lake, pond, reservoir, or other surface water.

After assessing site characteristics and how storm water run-off may impact exploration and development sites, the permittee should identify all potential pollutant sources, such as sediment from disturbed areas, stored wastes and fuels. BMPs, which will function to minimize or eliminate the potential for these pollutants to reach surface waters through storm water runoff, should then be selected and implemented. These BMPs are then detailed in the site specific SWPPP, which provides a written (through the narrative) and visual (through the detail drawings and site map) strategy for successful pollution control and storm water management.

BMPs at exploration and development sites should consist of a variety of erosion and sediment control measures for exposed soils, as well as materials handling, equipment and waste management measures. These practices and control measures are either installed (physical or structural in nature) or implemented (procedural

or activity driven). It is the responsibility of the permittee to verify potential BMP restrictions with other regulatory agencies (e.g., US Army Corps, local municipalities).

Erosion and sediment control for areas of disturbance and controls for equipment, materials and waste are best accomplished with the proper selection, installation, evaluation and maintenance of appropriate control features.

All control features require routine inspections and maintenance to ensure continuous, effective operation. Periodic site inspections by qualified personnel are required under the Construction General Permit and should focus on effective management of pollutants and preventive maintenance of BMPs. To maintain function and integrity, BMPs should be monitored for performance, with any accumulated sediments removed frequently.

Impacts on exposed soils from storm water runoff can generally be separated into two distinct categories; surface erosion and sedimentation, and there are different BMPs to manage them.

*Erosion Control* is preferred over *Sediment Control*, as *Erosion Control* is a preventive measure, focusing on the cause of sedimentation. *Sediment Controls* are considered secondary BMPs, because they are responsive as opposed to preventive. They come into play after the damage from erosion has already impacted the site.

### **Erosion Control**

Erosion control BMPs usually consist of a ground cover BMP that is used to prevent any of the forms of erosion from occurring. Emphasis should be placed on controlling erosion through

preventative practices and control measures, which include: planning, project phasing, managing vegetative cover, and grading controls.

### **Sediment Control**

Sediment control BMPs are designed to prevent soil particles already being carried in storm water from discharging from the construction site. Sediment control BMPs are not as effective as erosion control BMPs and are typically considered secondary practices installed after all opportunities for erosion control have been implemented. Examples of sediment control BMPs include: silt fence, straw wattles, sediment traps, and other perimeter control devices.

## **HOUSEKEEPING PRACTICES**

Additional pollutant sources associated with construction projects include the following sources: materials handling/management, equipment management and waste management practices.

**Materials Handling** includes the storage and use of construction materials. These areas include fueling operations, equipment staging areas, maintenance areas, chemicals, and material borrow areas.

**Waste Management** includes worker trash, portable sanitary facilities, demolition materials, remnants from construction, any liquid wastes and debris.

**Petroleum Products, Fertilizers, Herbicides, and Building Materials** that are stored and used on construction project sites can contribute hydrocarbons, metals, and other toxic substances in runoff.

## **ADDITIONAL DEQ PERMIT INFORMATION**

Construction Dewatering General Permit authorizes the discharge of water from cofferdams, trenches, excavation pits or other excavations associated with construction where sediment-laden groundwater or surface water inflow must be discharged to state surface water. This permit also applies to sediment laden water from well pump tests, well development, drill hole or pylon development when the discharged water may contain visible suspended and bed load sediment that must be settled prior to discharge.

318 Authorizations: authorizes a short term exceedence of a water quality standard for turbidity.

Petroleum Clean Up General Permit authorizes the discharge of petroleum-related, contaminated water treatment facilities to state waters. The purpose of the *Petroleum Cleanup General Permit* is to discharge wastewater from petroleum-related, contaminated water treatment facilities to state waters in accordance with effluent limitations, monitoring requirements and other conditions set forth in the General Permit.

A written authorization letter from the Department is required before and applicant is authorized to discharge under the General Permit.

## **ACKNOWLEDGEMENTS**

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# EROSION CONTROL BMPs

## GRADING TECHNIQUES

Controlling the amount of disturbed area and the amount of time these areas will remain open, is a valuable planning tool referred to as *Phasing*. *Phasing* the grading operations during construction is a specific erosion control strategy, achieved by managing the sequencing of the work. Clearing and grubbing only the areas that are on a schedule for completion, is an important planning BMP. Implementing this procedural BMP greatly reduces the costs associated with installing BMPs.

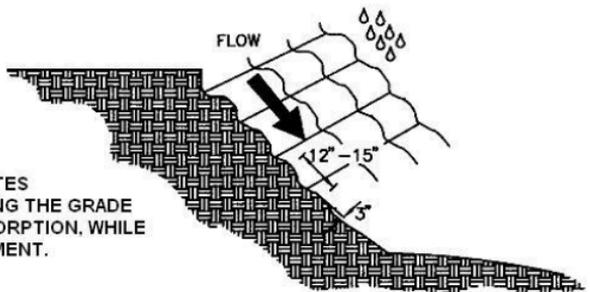
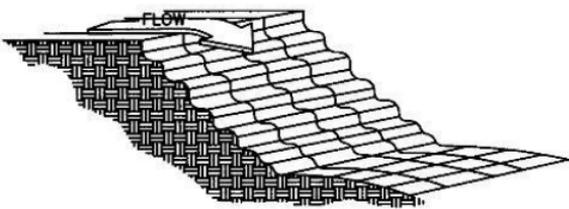
Other grading control BMPs are designed to focus on managing site drainage. Determining and controlling potential run-on points, along with controlling how run-off will convey through (or around) a construction site is fundamental to storm water management on oil and gas sites. Operators that are tuned into storm water management on their development sites will routinely assess how precipitation events will impact their sites.



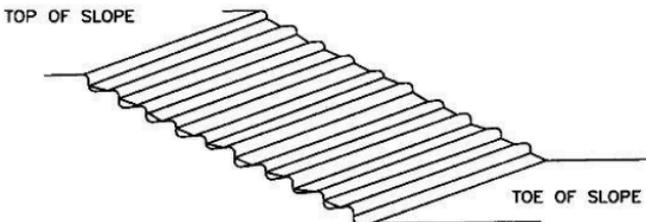
## SURFACE ROUGHENING

Disturbed areas that have become hard packed from vehicular traffic are not very conducive to absorbing run-off. As a result, this ponded precipitation is conveyed downgradient and can cause scouring and erosion in the process.

*Surface Roughening*, implemented as a grading control, breaks up the ground and makes it more receptive to absorption. By mechanically ripping, diking, tracking, or scarifying the ground, the surface area is increased and the absorption of run-off is facilitated.



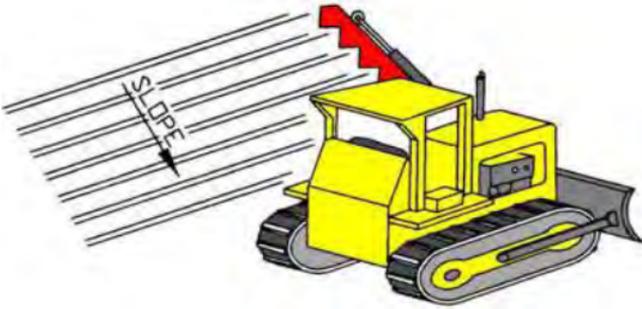
SURFACE ROUGHENING CREATES BENCHES AND FURROWS ALONG THE GRADE CONTOURS, PROMOTING ABSORPTION, WHILE TRAPPING RUN-OFF AND SEDIMENT.



Adapted from the City of Farmington, NM SWPPP

**If installed correctly, *Surface Roughening* will create furrows and small terraces that can slow down flows, promote infiltration and capture sediment.**

## SURFACE ROUGHENING (Con.)



**Surface Roughening**, through Mechanical modification of the soil, can be facilitated with many, varying equipment attachments. The application is similar to the harrow technique farmers use to scarify their fields. The degree or aggressiveness of the technique implemented should correspond to the steepness of the grade and soil type.



This disking technique turns the soil, breaks it up and increases the surface area, thus promoting infiltration.

## SURFACE ROUGHENING (Con.)

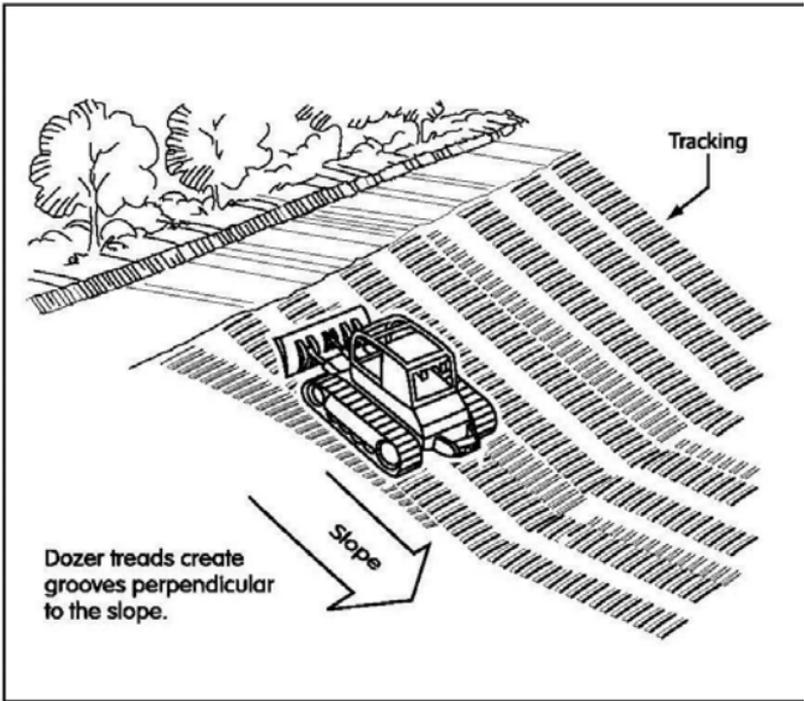


**Grooves or furrows created by *Surface Roughening* should follow along the contours of the grade, as noted in this example.**



**Inappropriate grading techniques will leave cutting running up and down the vertical plane, which facilitates channeling and erosion.**

## SURFACE ROUGHENING (Con.)



Source: WV DEP Erosion and Sediment Control Manual



**A lower profile dozer tracking technique may function well on shallower slopes. The ridges created by the equipment follow along the grade contours.**

## EROSION CONTROL BMPs (con.)

### DIVERSION DITCHES

*Diversion Ditches* can be cut in to capture run-on and divert flows around a well pad site, roadway or control site drainage by directing flows away from areas of disturbance and into detention facilities. They function as temporary conveyances, to direct run-off to a desired location.

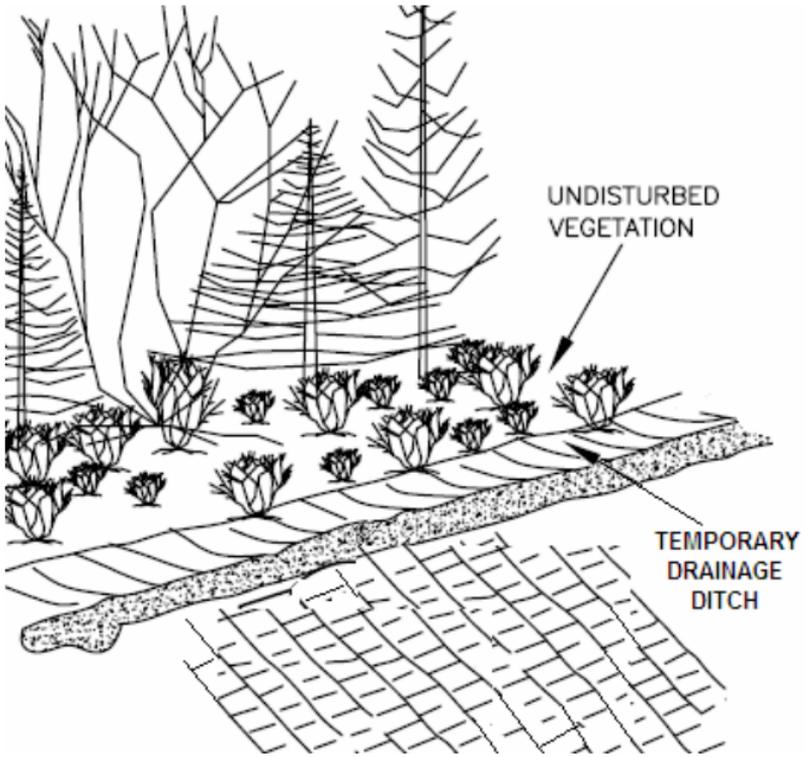
When diversions are constructed, they should have rounded or flat bottoms to avoid concentrating the flows at the bottom of the channel, which can lead to ditch cutting. Installation should also ensure positive drainage and include a well defined destination, such as a sediment trap or expansive vegetated area.

Inspections for diversions should verify that they conform to the original installation detail and can continue to function as intended. Periodic regrooming may be required to restore definition and function.

*Diversion Ditches* may be constructed in conjunction with an *Earthen Berm*. The addition of a compacted *Earthen Berm* will increase the capacity of the ditch and prevent the feature from being overwhelmed or by-passed.

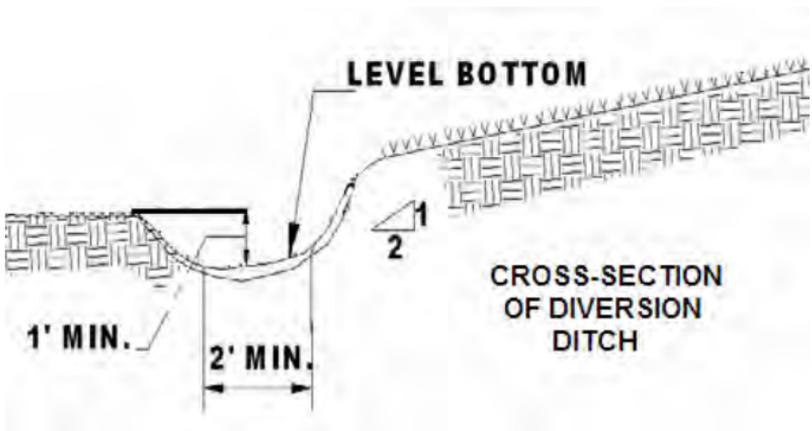
Diversions installed during construction may transition to permanent roadside ditches or drainage swales. In this scenario, it may be advantageous to work the feature to completion, i.e. grass or rock lined swale, rip rap run down, concrete pan, etc. By working the feature to its final disposition, the operator will avoid implementing transitional BMPs and the costs associated with their maintenance.

## DIVERSION DITCHES (con.)



Adapted from CleanWater Services

***Diversion Ditch*** used to intercept run-on,  
above a graded slope.



Adapted from Louisville MSD

## DIVERSION DITCHES (con.)



**A well constructed *Diversion Ditch* will convey flows within the feature without erosion.**



**Diversions should not include loose fill.**

## ROCK LINED SWALES

Diversion Ditches, Drainage Swales and Roadside Ditches are prone to erosion when they carry flows. It is a natural by-product of their function of carrying concentrated flows. Lining the conveyance with a rock layer and fabric liner can prove to be valuable for preventing erosion in the ditch bottom.

Rock will help to spread-out and diffuse the flows, thus controlling cutting in the swale. This is realized by forcing the flows higher, above the grade, and outward along the width of the swale. The volume of flows in the conveyance will help to determine rock size for optimal performance. The fabric layer will prevent scour under the rock.

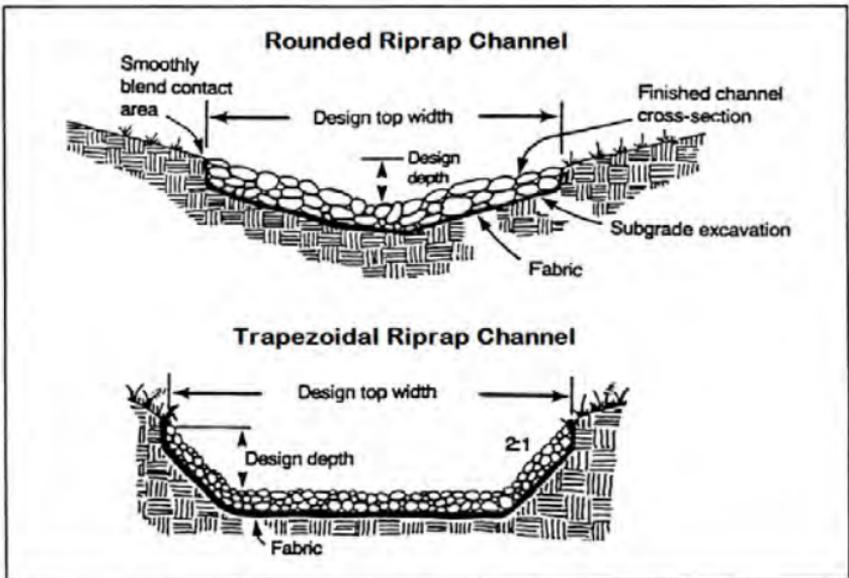


**Over time, every storm water conveyance will exhibit ditch cutting; damaging the feature and transporting sediment.**

## ROCK LINED SWALES (con.)



**Rock is a good stabilizer for temporary or permanent run-downs, ditches, swales and channels.**



Typical riprap-lined channel cross-sections.

Adapted from NC Dept. of Health and Natural Resources, BMP Field Manual

**Channel armoring installation for defusing flows within the conveyance feature, for erosion control.**

## SLOPE DRAINS

Managing site drainage on oil and gas sites that have steep grades can be challenging. With no controls in place, gravitational forces will concentrate run-off down these embankments, resulting in gully erosion. Subsequent storm events will quickly elevate the surface erosion to property damage.

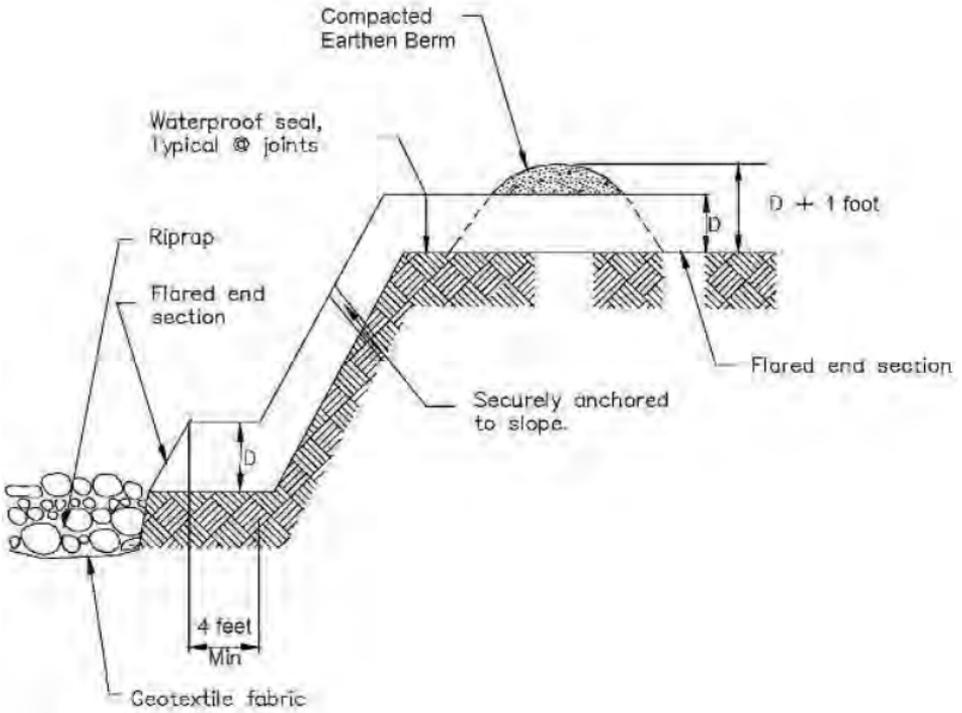
Installing temporary *Slope Drains* (also referred to as Embankment Protectors) allows the operator to determine where and how run-off will be conveyed down a grade. The *Slope Drain* is often a pipe, which functions as a conduit for storm water, to prevent erosion on the slope, whether the grade consists of exposed soils, is newly seeded or is blanketed.

*Slope Drains* are typically installed in conjunction with other drainage features, such as ditches, to direct the run-off to the pipe. This can help to complete the process of keeping run-off away from work areas and focusing it where the operator wants it to drain.

Installation for *Slope Drains* will include outfall protection to prevent scour, as there will be a concentrated flow with the point source discharge at the end of the feature. Outfall protection can be rip rap or a rolled erosion control product. If piping is used for the *Slope Drain*, the sections need to be tightly adjoined and adequately secured to prevent by-pass or displacement.

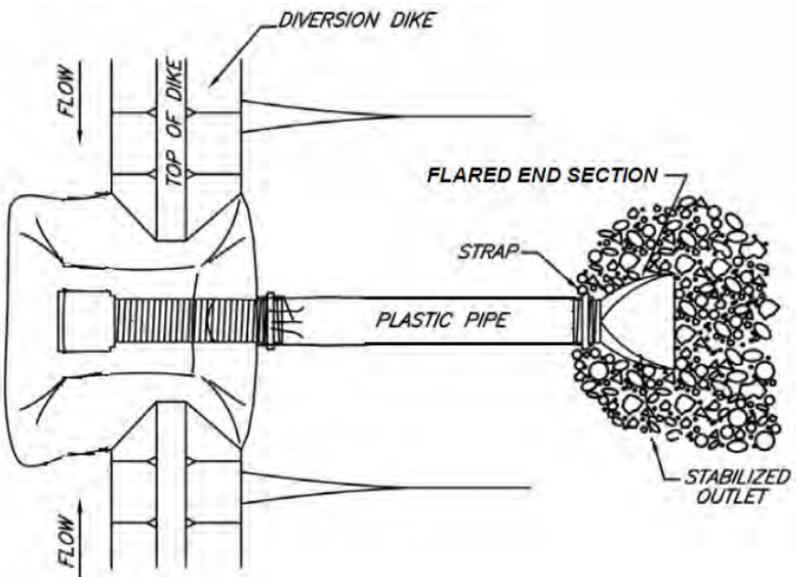
Inspections for *Slope Drains* should ensure on-going function: piping is intact and in place, run-off is being diverted to the feature, no accumulations of debris risk clogging the pipe, flows are being conveyed down the grade and there is no erosion at the outfall.

## SLOPE DRAINS (con.)



Adapted from CalTrans Div of Construction

***Slope Drain*** installation for safely conveying run-off down a grade without impacting the slope.



Adapted from Portland, OR Erosion Control Manual

## SLOPE DRAINS (con.)



***Slope Drains* can function effectively for conveying flows down an unstabilized grade.**



**Adequate outfall protection is required at the termination point to prevent scouring.**

## EROSION CONTROL BMPs (con.)

### CHECK DAMS

Ditches, channels and swales used to convey stormwater run-off can be impacted by erosive flows. Flows that are allowed to run unchecked in these features can rapidly erode the feature. If these features are not stabilized with a liner, or vegetation, *Check Dams* can be installed to provide erosion control.

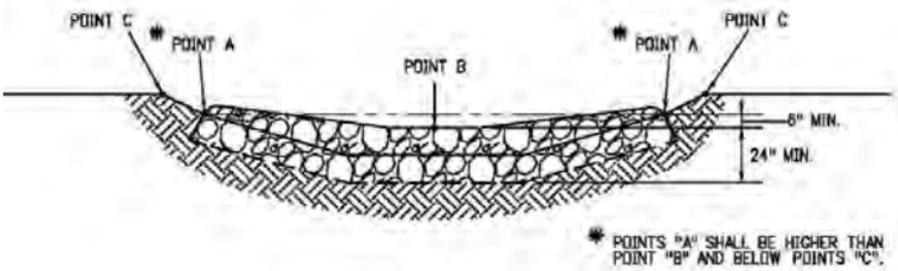
The function of the *Check Dam* in a storm water conveyance is to slow and spread the flow out to prevent erosion. This is accomplished by spreading out and breaking up the erosive velocity of the flow, allowing the flows to pass through or over the feature at a slower rate. The contour of the conveyance is equally important. As noted in the section on *Diversion Ditches*, the ditch bottom should be flat or rounded to promote a thinner layered or more laminar flow.

Many styles of *Check Dams* (constructed or prefabricated) can perform adequately. *Silt Fencing*, and other BMPS that do not function in concentrated flows, cannot perform as *Check Dams*. Features that have a tendency to pond large volumes of run-off should also be avoided.

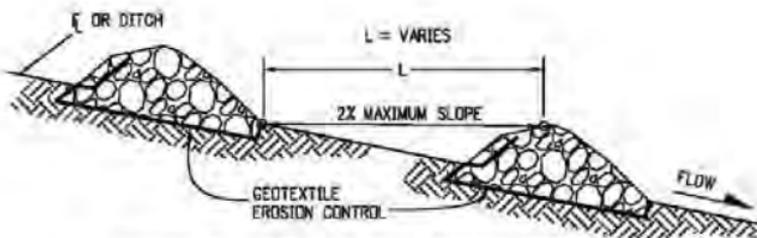
Installation of *Check Dams* will include trenching in the feature below grade (to prevent undermining), appropriate spacing (to prevent the flows from regaining erosive velocity) and keying into the adjoining grade/embankment (to prevent bypass around the ends).

Inspections should verify the *Check Dam* has not been damaged, or bypassed. Maintenance practices, including the removal of sediment and debris, should ensure on-going performance and allow flows to pass through and over the feature.

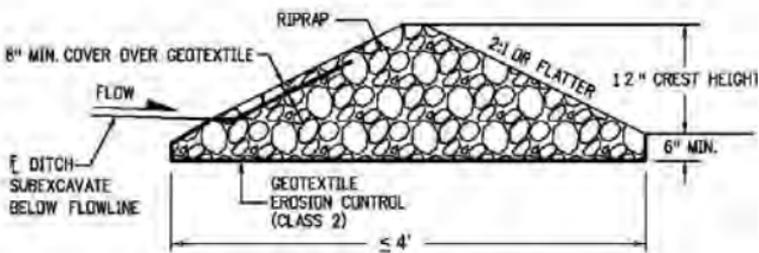
## CHECK DAMS (con.)



TYPICAL SECTION VIEW



SECTION VIEW ALONG DITCH FLOWLINE



SECTION DETAIL

NOTES:

1. RIPRAP SIZE  $D_{50} = 6"$  DR AS SHOWN ON THE PLANS.
2. THE ENDS OF RIPRAP CHECK DAM SHALL BE A MINIMUM OF 6 IN. HIGHER THAN CENTER OF CHECK DAM.

ROCK CHECK DAM

Adapted from Colorado DOT M-Standards

**Rock Check Dams will intercept, spread out and slow flows in ditches and swales, preventing ditch cutting and scour. Check Dams are not recommended for larger drainage areas or steep grades.**

## CHECK DAMS (con.)



**Correctly installed rock *Check Dams* will allow flows through and over the feature without bypass or undermining.**



**Straw Bales do not perform well as *Check Dams*. Flows do not penetrate the bales, which creates ponding and hydraulic pressure. This pressure will consistently force the water under the bales, creating erosion from the undermining.**

## VEGETATIVE BUFFERS

The potential for surface erosion is accelerated when vegetative cover is removed; hence a key goal of storm water management during construction entails using vegetation as a BMP. Understanding this, operators recognize undisturbed vegetation can be a powerful, natural erosion control tool at their disposal. Vegetation provides erosion control by promoting infiltration and maintaining runoff in sheet flow



**Any areas where *Vegetative Buffers* can be temporarily maintained in place will be greatly beneficial for erosion control. Preserving existing vegetation for even short periods will reduce areas of disturbance that require monitoring and costs for controls.**



# SEDIMENT CONTROL BMPs

## SILT FENCE

Sediment controls are secondary BMPs that are pursued after erosion control practices have been maximized. Therefore, *Silt Fencing*, and other sediment barriers, should be implemented after all other opportunities for erosion control have been exhausted.

*Silt Fencing* performs as a barrier. It intercepts sediment-laden runoff and impounds it, until it infiltrates, evaporates or weeps through the fabric. *Silt Fence* is not designed or intended to function as a filter, because very little run-off will actually discharge through the fabric.

*Silt Fencing* has many limitations that must be carefully evaluated prior to installation. Understanding these limitations will help to determine if it is the appropriate BMP for the site conditions and ensure that it can be sited correctly for maximum performance.

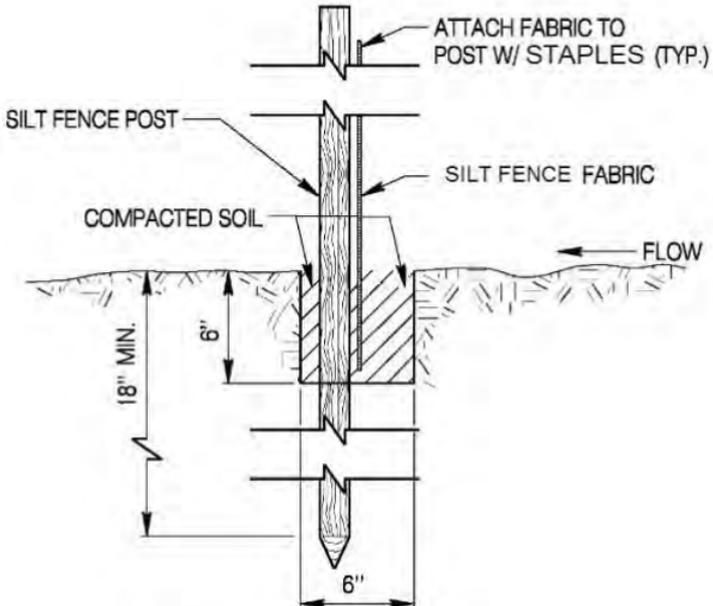
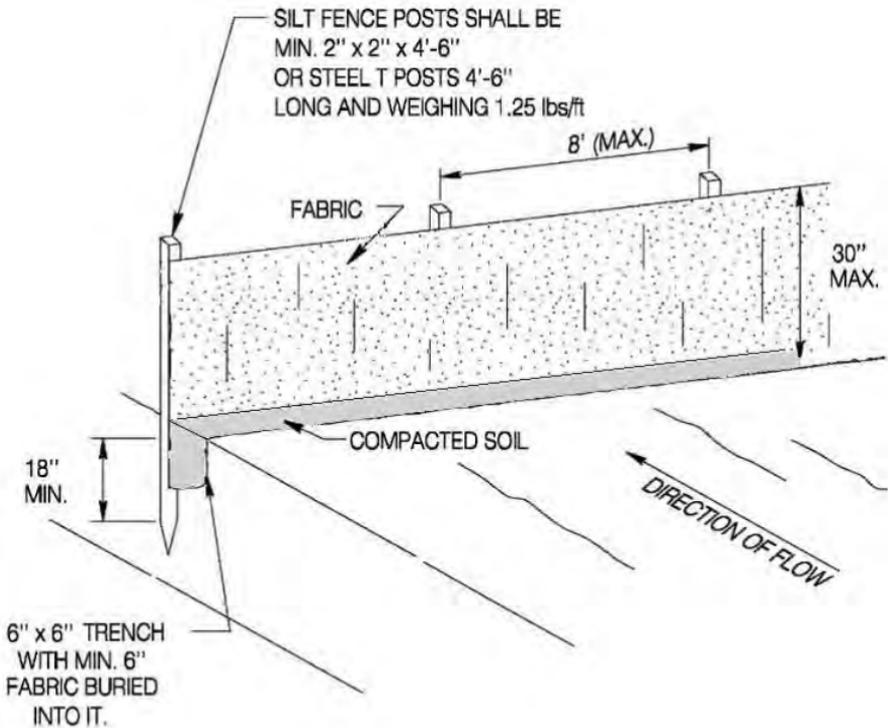
*Silt Fencing* can not:

- Function in concentrated flows
- Manage large drainage areas alone
- Perform unless installed along the grade contour
- Work well installed right at the toe of a slope

*Silt Fence* functions in limited drainage areas, typically no more that  $\frac{1}{4}$  acre of disturbance discharging to 100 linear ft. of fencing (if *Silt Fencing* is the only BMP to manage the area).

*Silt Fencing* has several key installation details that must be followed. Once installed, it can be a high cost BMP to maintain in place. It performs best, when used in conjunction with other BMPs, especially erosion control measures.

## SILT FENCE (con.)



Adapted from WYDOT Temp. Erosion Control Measures

**Silt Fencing must be installed correctly  
(according to the selected installation detail)  
in order to function as intended.**

## SILT FENCE (con.)



If sited and installed correctly, *Silt Fence* can perform well as a sediment barrier and to pond storm water run-off.



## SILT FENCE (con.)



**Silt Fence** functions best when backed away from the toe of a slope. Note the buffer zone of *Surface Roughening* here.



**Silt Fence** is not designed to work in a concentrated flow. Adding additional rows will not alter that design standard.

## STRAW WATTLES

*Straw Wattles* can function as a sediment barrier/perimeter control BMP for small drainage areas. Like *Silt Fencing* they can pond run-off. A common misconception with wattles is they filter run-off. During manufacture, the materials in the wattles are routinely packed so tight that they do not promote flows penetrating the material. Consequently, their function is restricted to ponding run-off and overtopping.

The low profile of the *Straw Wattle* installation places limitations on the field applications for the feature. The most appropriate applications for *Straw Wattles* that will allow them to function are:

- Smaller drainage areas with sheet flows
- Areas with flatter grades
- In conjunction with other BMPs, preferably erosion control

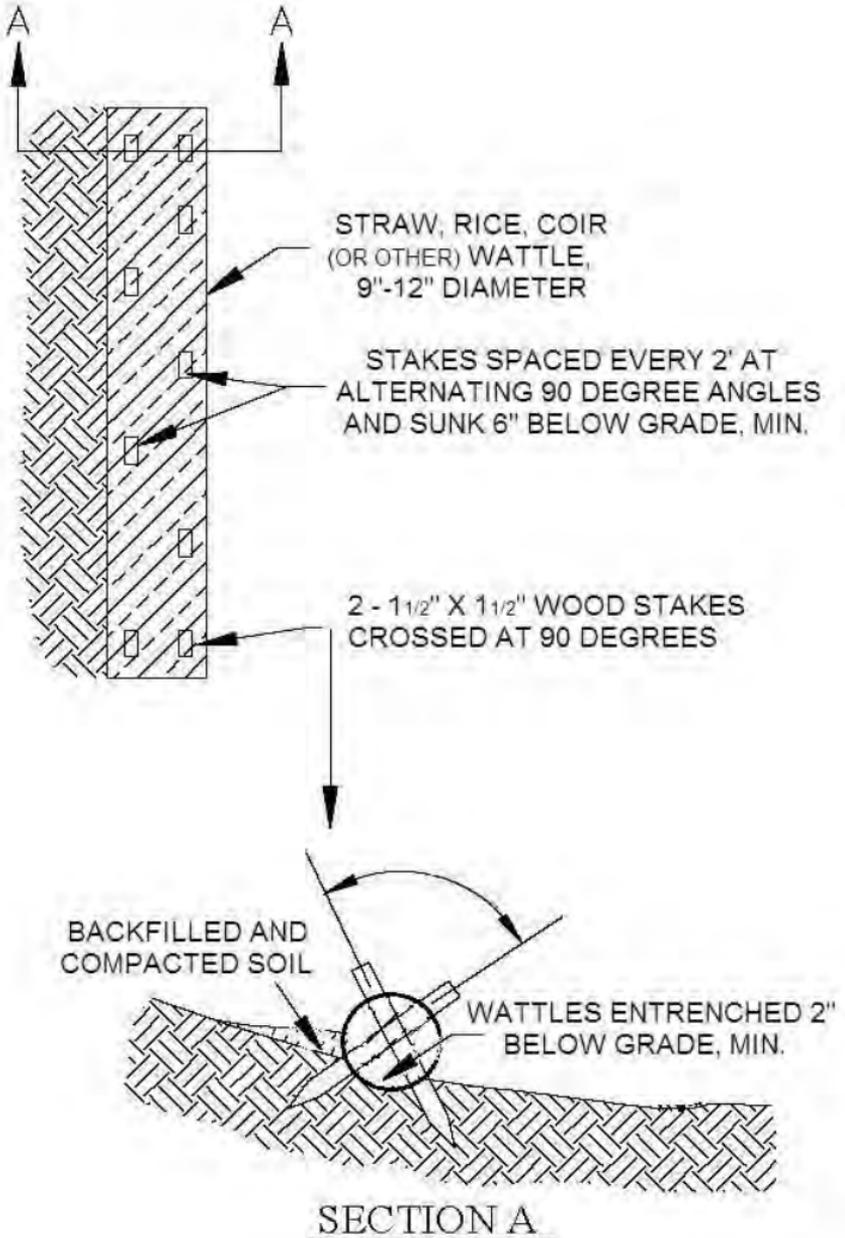
Installation details for *Straw Wattles* will consistently require them to be:

- Installed along the drainage contour
- Trenched below grade and backfilled
- Firmly secured down
- Hooked up at the ends
- Adequately overlapped at joints

The correct installation of *Straw Wattles* will include proper diameter selection and all of the above details. A frequent failure point is undermining. This can be minimized with trenching the wattle below grade, backfilling and compacting on the upgradient side.

Inspections should verify the wattles remain intact and secure. The wattles cannot be flattened by traffic or overwhelmed with sediment accumulation. Damaged features require replacement or removal.

## STRAW WATTLES (con.)



Adapted from City of Arvada, CO Erosion Control Details

**Straw Wattles must be installed correctly to ensure proper function, prevent by-pass and reduce maintenance costs.**

## STRAW WATTLES (con.)



**Good example of *Straw Wattles* installed as perimeter control/sediment barriers for small area of disturbance with no run-on.**



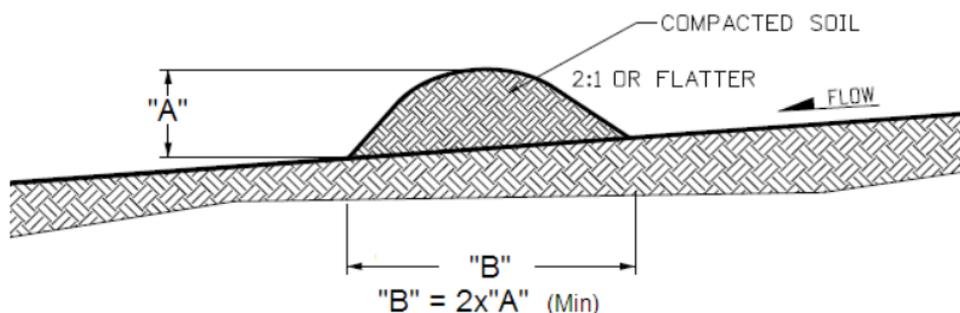
***Straw Wattles* need to be adequately secured down, aligned on the contour, back-filled and compacted to function. None of those components have been addressed here.**

## EARTHEN BERM

*Earthen Berms* (also referred to as *Dikes*) are grading techniques that function as barriers for sediment control. Similar to *Silt Fencing*, *Earthen Berms* intercept and pond run-off. However, unlike *Silt Fencing*, which will weep, there is no such discharge from a berm. If an *Earthen Berm* discharges, it is typically not installed correctly. If the storm water discharges through or under the feature, it is not compacted correctly. If it discharges around the feature, it has not been turned up at the ends to prevent by-pass. If it discharges over the berm, the drainage area is too large or the height has not been correctly determined. If the feature overtops, it can be disastrous. Overtopping can lead to embankment failure and loss of impoundment.

*Earthen Berms* can be used in conjunction with ditches to divert flows. The installation of an *Earthen Berm* should ensure:

- Compaction of fill material, built in lifts
- Uniform height of berm
- It is on the grade contour and has turned up ends, to facilitate ponding



### TEMPORARY BERM

#### NOTES:

1. BASE WIDTH WILL BE DETERMINED BY HEIGHT. HEIGHT WILL BE DETERMINED BY SIZE OF DRAINAGE AREA.
2. BERMS WILL FUNCTION TO INTERCEPT FLOWS AND IMPOUND THEM
3. BERMS WILL BE USED FOR LIMITED DRAINAGE AREAS, NOT TO EXCEED 1/4 ACRE FOR EVERY 100 LINEAR FEET OF BERM

Adapted from Colorado DOT M-Standards

## EARTHEN BERM (con.)



***Earthen Berms* can be viable, temporary barriers for run-off/on and sediment control.**



***Earthen Berms* require compaction, to function as a viable barrier. A bladed windrow of loose fill can easily erode and does not provide a barrier with integrity.**

## SEDIMENT TRAPS

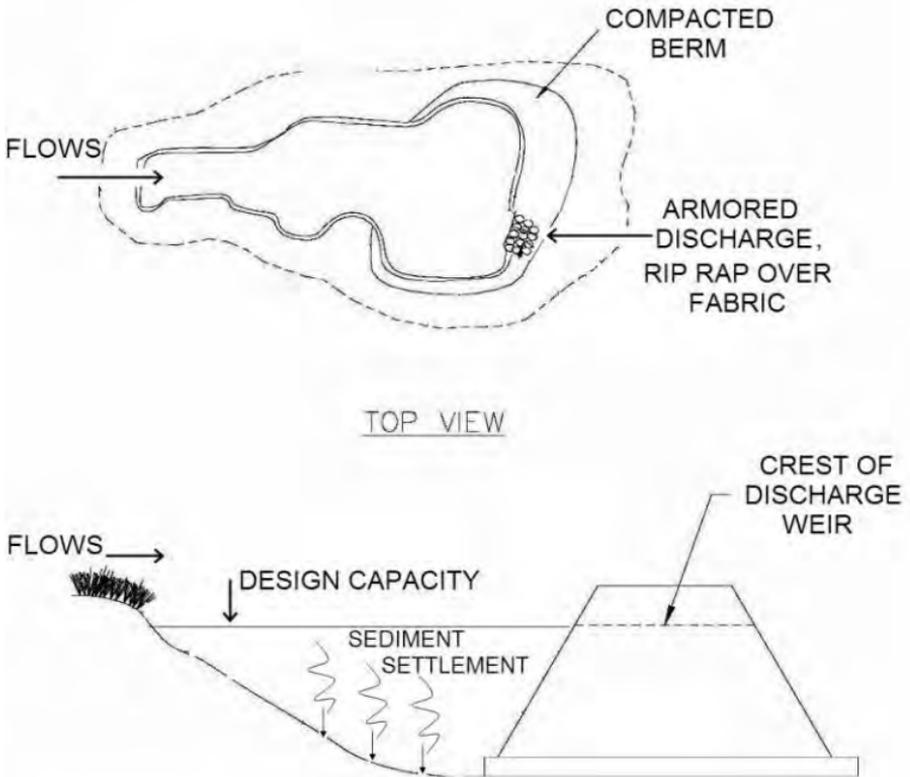
*Sediment Traps* can be used during site development to manage water quality as well as quantity, for small drainage areas. Functioning as sediment removal BMPs, traps will impound diverted flows and allow heavy particles to settle out. As entrapment facilities, traps can also help manage site drainage by providing temporary storage for run-on and run-off. Along with *Sediment Basins*, *Sediment Traps* are often the termination point for *Diversions Ditches*.

The installation of *Sediment Traps* will include design calculations for sizing, which is determined by size of contributing drainage area. Presuming there will be sediment accumulations, dry and wet storage capacity must be included in these calculations. Installation will also include planning, to ensure the selected location of the feature will facilitate function and not interfere with site operations.

Planning considerations for the location of the feature must consider discharge means and location. The trap must be allowed to discharge at a designed, designated point and this discharge point should be sited so it will not impact the work. Ponding features without a means of discharge are vulnerable to embankment and ultimately pond failure. Berms for *Sediment Traps* will have a low point, or weir, constructed to facilitate a non-erosive discharge. The weir will include a layer of non-woven geotextile and rip-rap armoring, to prevent scour and damage to the berm, during discharge.

Inspections and maintenance will focus on the function of the feature. Has the integrity of the BMP been compromised? Can it continue to function as intended? Sediment accumulations should not impact function or storage capacity.

## SEDIMENT TRAPS (con.)



Adapted from CalTrans Division of Construction

**Temporary *Sediment Trap* layout, with flows coming in one side and discharging out the other, over armored outfall. Capacity is determined by the size of drainage area discharging to the feature.**



***Sediment Traps* can be sized to be effective BMPs for any phase of construction.**

## SEDIMENT TRAPS (con.)



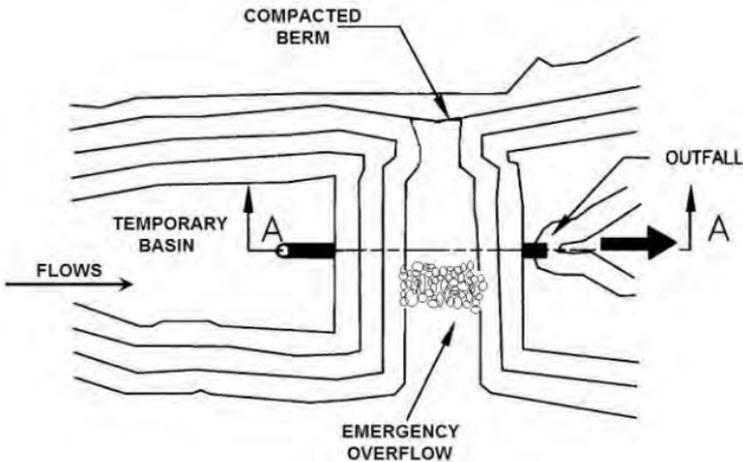
Run-off accumulates at the low point of this *Sediment Trap*. The feature will discharge when the ponded volume reaches the low point of the armored weir



*Sediment Traps* must be provided with a designed means of discharge. Note the eroded embankment here, which can lead to pond failure.

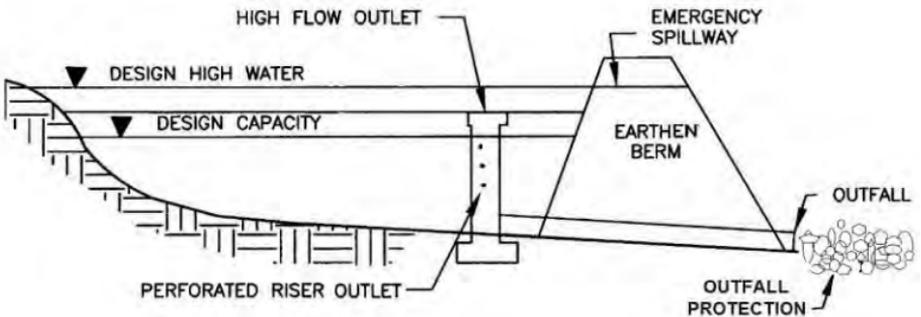
## SEDIMENT BASINS

*Sediment Basins*, intended for greater drainage areas, are larger versions of *Sediment Traps*. Aside from being larger, these temporary BMPs have a perforated riser pipe which functions as the primary discharge point. Permanent ponds often function as *Sediment Basins* during construction, until they are fully commissioned as the long-term, storm water management BMPs they are designed for.



### PLAN VIEW

NOT TO SCALE



### CROSS SECTION A-A

NOT TO SCALE

Adapted from: Farmington, NM Construction Standards

**Temporary *Sediment Basins* will be constructed with a perforated riser pipe and emergency overflow for discharge.**

## SEDIMENT BASINS (con.)



Typical temporary *Sediment Basin*, with perforated riser pipe and armored overflow designated as the discharge points. Basins will be sized in relation to the drainage area conveying to the feature.



Inspections for *Sediment Basins* need to evaluate sediment accumulations and basin function. Note the displaced riser pipe here.

## VEHICLE TRACK PADS

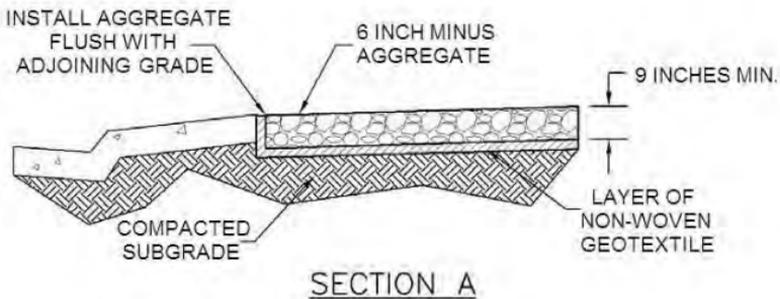
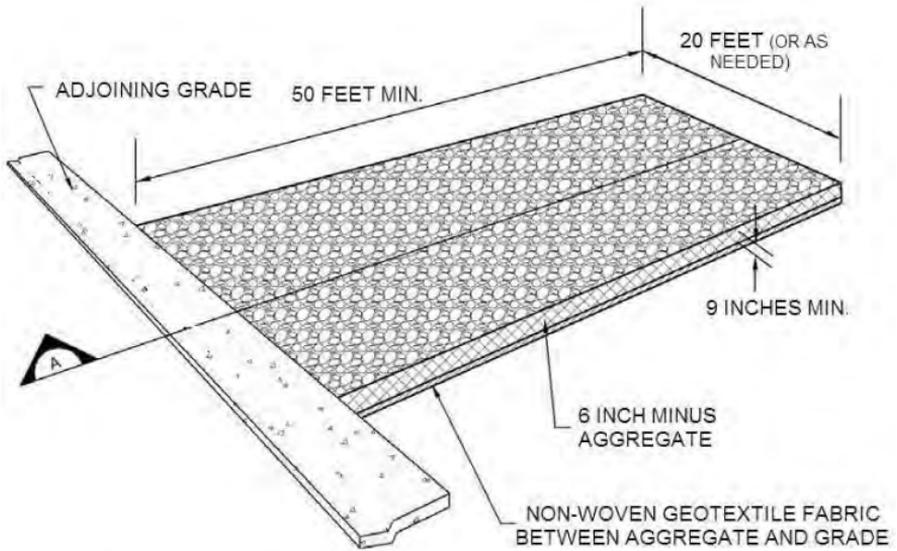
Sediment tracking from vehicular traffic on development sites can be a formidable challenge for operators. Once sediment is tracked off-site and/or onto roadways, it is extremely difficult to manage and readily transported with run-off. Evaluating soil conditions, site access, traffic patterns, seasonal weather and appropriate BMP alternatives will all factor into implementing a successful vehicle tracking control program.

It is understood some sediment will be tracked onto roadways during exploration and development operations. And while roadway remediation is a necessary procedural BMP, sediment tracking needs to be greatly minimized in order for it to be effective. A successful vehicle tracking program will include numerous administrative and structural BMPs to effectively minimize and control sediment tracking. These other BMPs can include; controlling site access, stabilized roadways, project scheduling changes, halting work, wheel wash stations, subcontractor training and rumble strips.

*Vehicle Track Pads* can help with the reduction of sediment tracking off disturbed areas from vehicular traffic transitioning to roadways. They are not intended to remove all of the sediment off tires, but provide a stabilized ingress/ingress point and prevent rutting.

The installation of a *Vehicle Track Pad* will include an underlayment of non-woven geotextile and uniform placement of aggregate. The installation may need to include flared ends, to provide coverage for vehicles turn onto or off of the pad. Inspections will ensure the feature continues to match the installation detail and has not become impacted with sediment. Roadways need to be cleaned to prevent further track out.

## VEHICLE TRACK PADS (con.)



Adapted from UDFCD Criteria Manual, Vol. 3

**Standard *Vehicle Tracking Control Pad* design.** Installed feature will include an underlayment of fabric to prevent the aggregate from being pressed into the subgrade. A flared entrance may be included to facilitate the turning radius of traffic.

**Track Pad will be regroomed, refreshed or replaced as needed to maintain a fully functional feature. Roadway cleaning is frequently required to collect tracked accumulations and prevent them from being tracked out further or conveyed into drainage ways.**

## VEHICLE TRACK PADS (con.)



***Vehicle Track Pads* can aid with sediment removal from tires. The dimensions of the feature can be adjusted to enhance effectiveness.**



***Vehicle Track Pads* by themselves will not control sediment tracking; other site management and traffic control measures will typically be required.**

## ROADWAY MANAGEMENT

Oil and Gas exploration and development operations rely heavily on dependable roads for heavy traffic. These roads then have the tendency to transition to long term when the site switches to production operations. Roads need to function as traffic conveyances and storm water run-off conveyances.

Planning is critical to assess the nature of site drainage. This has to be evaluated first, because we need to determine how the roadway will drain, before we can start selecting BMPs for drainage control. There are many styles of roads and just like any other storm water BMP; we need to approach our selection process, in a calculated manner.

What are some of the considerations?

- How is the area draining now, and does that need to be modified?
- Is there run-on? How Much? When?
- Where is the run-off going?
- Is there evidence of historical erosion now?
- How long will the roadway be in place?
- Will the road be dirt or gravel?

A re-occurring theme in storm water management: where's the water coming from? If there is run-on, coming onto areas of disturbance, it most likely will need to be addressed. Roads are no different; one of your goals should be to keep flows off of the road. It may not always be practical, or possible to address the upgradient source of run-on, but that is almost always the best first approach.

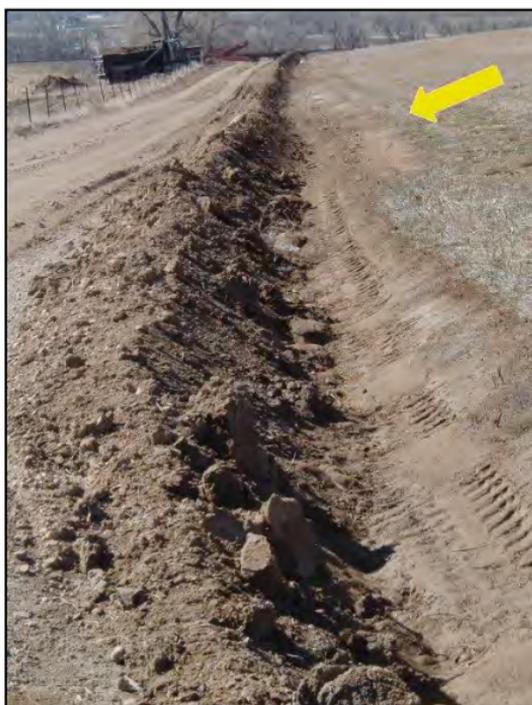


## ROADWAY MANAGEMENT (con.)

If it is possible to divert the flows away from areas of disturbance, or reduce them, you eliminate or minimize the concern. This can be managed with berms, diversions, and ponds reviewed in earlier sections of this Field Guide.

Remember, you are not responsible for the quality of run-on. So, when you capture this and divert it around or through your work zone, you do not need to treat it prior to discharge. This is assuming the run-on is not originating from your construction area and you do not allow it to engage any of your areas of disturbance or pollutants.

The only other approach for addressing run-on is to intercept the flows prior to discharge onto the road in a roadside ditch. Run-on is captured in the roadside ditch and then conveyed alongside the road. The new concern is the concentrated flow in the ditch, which can cause ditch cutting. See the section on *Rock Lined Swales* earlier in this Field Guide to manage this.



**Run-on can be captured in a roadside ditch to prevent the flows from eroding the road. The concentrated flow in the ditch can cause Erosion, which can be managed with a *Rock Lined Swale*.**

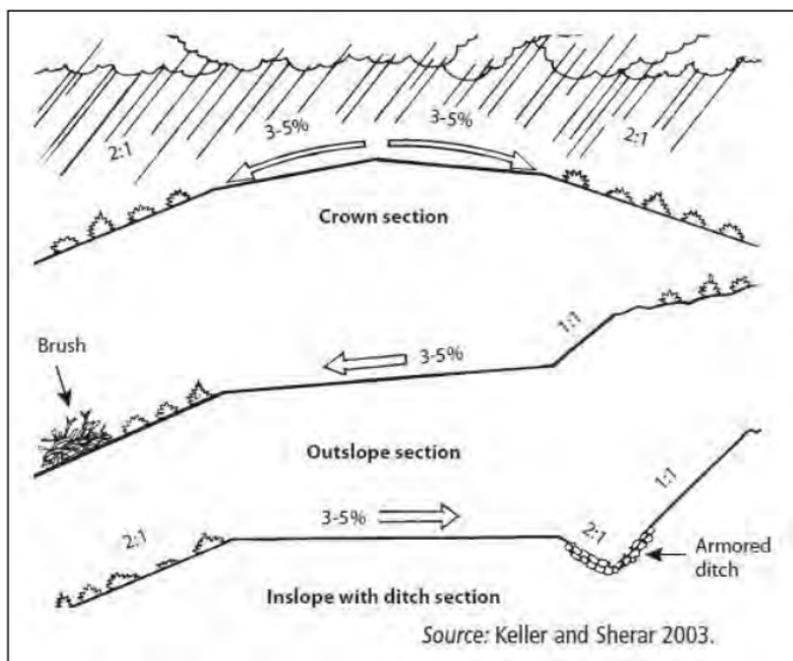
## ROADWAY MANAGEMENT (con.)

### ROAD CONSTRUCTION

Once run-on conditions have been addressed for the road, the next issue is how the roadway itself will drain. Erosion concerns for the road surface can largely be addressed with rock or other aggregate paving.



**Erosion control on roadways can be managed best with crushed aggregate material, to provide armoring.**



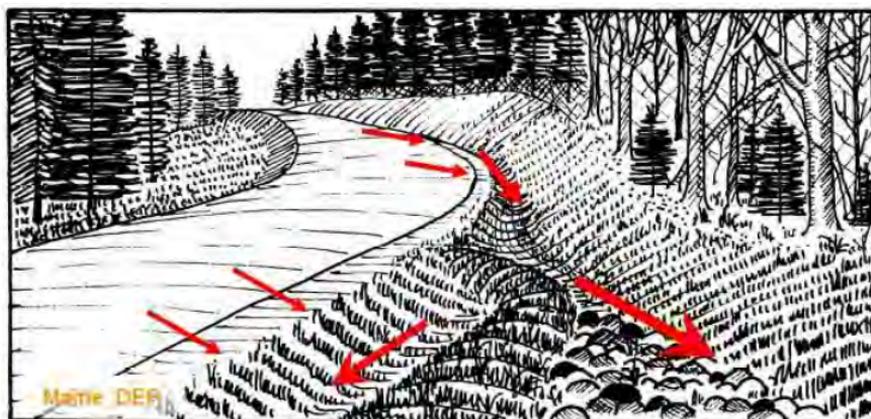
**Conveying flows off of roadways is crucial to preventing erosion and preserving the integrity of the road surface. These three styles facilitate roadway drainage.**

## ROAD CONSTRUCTION (con.)

For all of the styles of road construction noted above, there will be a need for erosion control to manage the discharges of the flows off the roadway. Note the vegetation in the drawings for the adjoining areas. Obviously, without some form of stabilization (vegetation, rock, etc.) on this adjoining grade, the flows sheeting off the roadway can cause erosion. It is also important to keep these discharges in sheet flow whenever possible, because repetitive concentrated flow discharges will uproot vegetation and wash away rock.

## DITCH TURN-OUTS

Ideally roadside ditches are vegetated, but as noted previously in this *Field Guide*, concentrated flows can be managed in ditches with *Check Dams* or *Rock Lined Swales*. Along with these features, other drainage tools to control the performance of the roadside ditch should be implemented. *Ditch Turn-Outs* reduce the volume of flows conveyed in the ditch. The function of the Turn-Out is to discharge the flows in long ditch runs to vegetated, adjoining grades for infiltration.



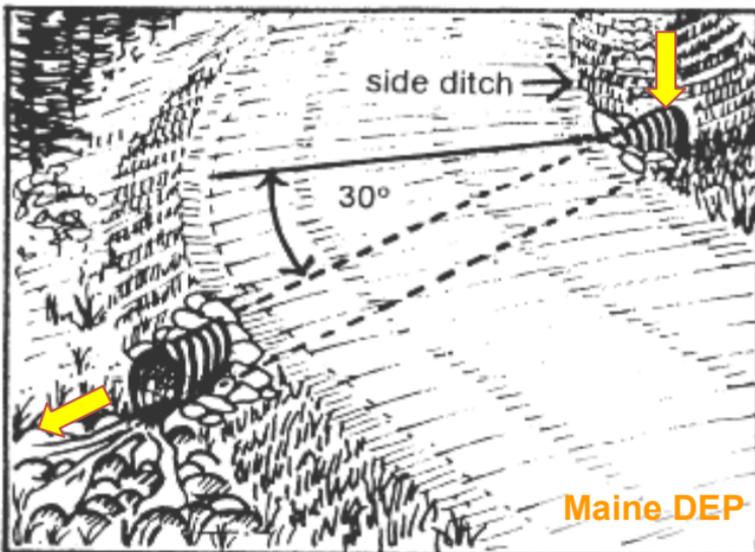
**Ditch Turn-Outs discharge the volume of the run-off in the ditch to adjoining, vegetated areas, where they infiltrate. The ditch resumes, and continues to capture run-off from the roadway.**

## CULVERTS

Along with *Ditch Turn-Outs*, installing road *Culverts* can be a valuable drainage tool for discharging road-side ditches. Similar to *Ditch Turn-Outs*, *Culverts* will limit the volume of flows conveyed down a ditch, thus controlling erosion within the road-side ditch.

Use *Culverts* when good point source discharge zones are available. Best case scenario, the discharge zone for culvert piping will be similar to that of the *Ditch Turn-Out*, relatively flat and vegetated. Vegetation is always important; however other BMPs can be implemented for conveying concentrated flows down steep slopes and over areas of poor vegetation. These would be the instances for considering a stabilized (rock or lined) run-down or *Slope Drain*.

Maintenance should ensure good flow, no erosion at either end and no obstructions or blockage from debris or sediment accumulations.



**Culverts should be set at an angle 30 -35 degrees downslope from a line perpendicular to the road's centerline. Culverts set on an angle improve their hydraulic efficiency and lessen erosion at the inlet.**

## CULVERTS (con.)



**Culverts that discharge to steep, unvegetated areas require a lined or stabilized run-down to prevent surface erosion.**



**Rock alone may not provide adequate erosion control for frequent and/or heavy discharges.**

**Grouting or a fabric underlayment may be needed to prevent scour under the rock pad.**

## WELL PAD CONSTRUCTION

Well pad construction for oil and gas development projects is not dynamically different from other styles of earth disturbing activities.

For earth work operations, there will still be grading, elevation changes, stockpiling and materials management. Distinct pollution sources may vary from other types of construction, but there will still be equipment, petroleum products, waste and chemicals that will need to be managed. All of which are discussed in this Field Guide.

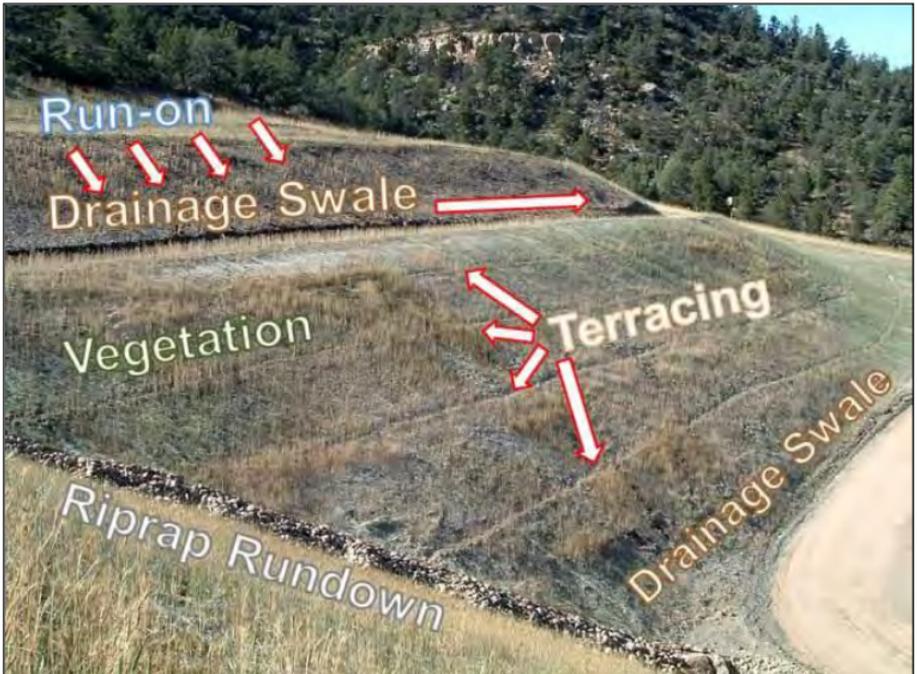
A well-considered planning strategy, prior to construction, will address the many considerations already noted (not necessarily in any order):

- Run-on
- Site Drainage patterns
- Soil characteristics
- Seasonal considerations
- Existing vegetation
- Construction phasing
- Project schedule
- Storage and work areas
- Site access



## WELL PAD CONSTRUCTION (con.)

Once the unique pad site conditions and characteristics have been assessed and evaluated, a BMP approach can be formulated for the sequence of major site development activities. For more diverse terrain, a layered approach to site drainage controls will prove valuable.



The photo above demonstrates a well-designed approach to storm water management on a well pad site. In this application, the site is post development and in production. However, take away the vegetation and you still note the comprehensive drainage tools in place to manage run-on, and site drainage. Erosion control is maximized, not only with the vegetation and terracing to promote infiltration, but with determining where the flows will be directed. The pad site drains to the swale around the perimeter, which also manages the concentrated run-on conveyed down the rock rundown.

## PIPELINE CONSTRUCTION

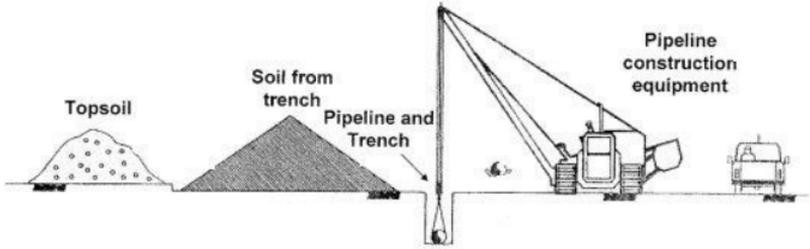
Laying miles of pipe will often entail numerous changes in terrain, elevation and site conditions. All of the evaluation points considered previously (see *Well Pad Construction* section) will need to be addressed for each segment of pipeline construction.

One of the planning tools that may be open to developers is scheduling. This may include working with and around seasonal considerations, as well as working areas to completion as quickly as possible. As noted previously, it is highly desirable to initiate stabilization practices as soon as earth work operations have been completed and areas are available for revegetation.

Additional project and installation considerations may include: dewatering operations, active stream crossings, directional borings, environmentally sensitive areas and other permitting conditions. It will be up to the individual developer to pursue and secure any additional permitting.



## PIPELINE CONSTRUCTION (con.)



Source: Journal of Environmental Management, Volume 91, Issue 12, December 2010

**Note the segregated stockpiles in the diagram above, with the stationing of materials on the upgradient side of the trench.**



**Tight work corridors for pipeline installations require fined tuned strategies and planning.**



# STABILIZATION BMPs

## SEEDING

Vegetative cover is regarded as the most powerful deterrent for surface erosion. Focusing on this aspect of erosion control, the strategy of quickly establishing vegetative growth on disturbed areas is a powerful planning BMP. Whether it is a permanent measure to achieve final stabilization or a temporary stabilization technique, a clear and steadfast focus should be given to *Seeding*.

### **Permanent Seeding**

Permanent seeding should be implemented on areas of disturbance as soon as they are completed and can be made available. It is not economically wise to wait until the end of development to implement the seeding program. More revenue can be expended installing and managing BMPs in areas with no work, then implementing final stabilization.

Many factors will impact the planning and execution of *Seeding*. Important considerations:

- What is native to the region/elevation
- Soil type, grade and access
- Time of year, weather patterns
- Drainage patterns (concentrated or sheet)

### **Temporary Seeding**

Areas that will be dormant, or that may not be fully readied for final stabilization, may be candidates for *Temporary Seeding* applications. This technique can provide interim erosion control and control costs associated with repairing grades damaged by surface erosion. Choices for *Temporary Seeding* may include the use of annual or perennial seed mixes and full mulch cover.

## **EROSION CONTROL BLANKETS**

The function of *Erosion Control Blankets* is to provide cover and moisture for newly seeded areas. If some means of cover is not provided, seed beds will be vulnerable to wind and surface erosion. Moisture retention in the blankets will also promote germination.

Blankets are routinely selected for applications that require more resilient and longer term protection than may be expected from other, mechanically installed applications (such as straw or hydro-mulch).

A wide-range of styles, composition and thicknesses are available for the installer to choose from. In order to determine the correct grade of blanket, site conditions/characteristics must be evaluated. These include the "Five S's":

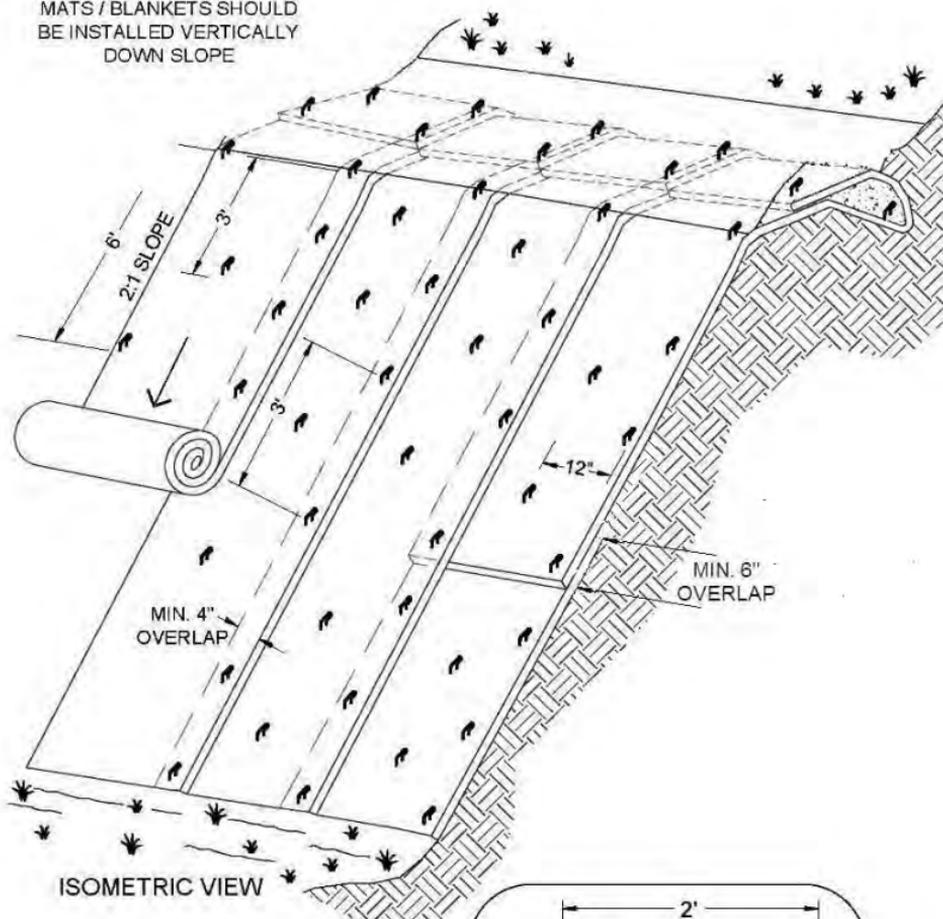
- Soil type
- Slope steepness and length
- Seed type, and number of years to yield established growth
- Season; projected precipitation or irrigated
- Sheet flow application, or concentrated flow

Correct installation will include; soil preparation, good soil contact, proper staking/pinning, overlapping, anchor slot, check slots and correct orientation.

Blanket maintenance can be relatively minor, if the correct grade of blanket has been selected for the application and it is installed correctly. However, they still require routine inspections to verify they demonstrate integrity, are intact and can continue to function until vegetative cover is established.

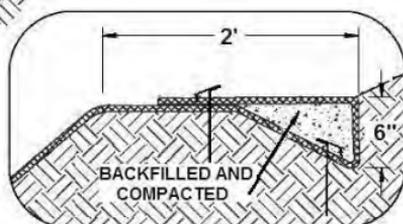
## EROSION CONTROL BLANKETS (con.)

MATS / BLANKETS SHOULD  
BE INSTALLED VERTICALLY  
DOWN SLOPE



ISOMETRIC VIEW

TYPICAL SLOPE  
SOIL STABILIZATION



### NOTES:

1. SLOPE SURFACE SHALL BE FREE OF ROCKS CLODS, STICKS AND GRASS. MATS / BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.

Adapted from Oklahoma City, OK SWQ Standards

***Erosion Control Blankets* must be installed running in the direction of the flow and adequately secured down. Good soil preparation, prior to placement, will prevent tenting or voids under the blanket.**

## EROSION CONTROL BLANKETS (con.)



A good *Erosion Control Blanket* installation can provide long-term erosion control, seed-bed protection and promote germination.



Correct Seeding and Erosion Control Blanket application methods need to be followed to ensure protection and vegetative growth.

## STRAW MULCH

A well crimped layer of *Straw Mulch* can function as an artificial root system, providing erosion control from wind and run-off. Applying *Straw Mulch* in conjunction with seeding provides a similar function as blankets, only not as robust or stable. The mulch will also protect the prepared grade from raindrop impact and then retain moisture to help germination. Crimped mulch can also be used alone, as a temporary stabilization (erosion control) technique in applications where disturbed areas are not ready to be seeded.

*Straw Mulch* performs best on flatter areas that receive sheet flows. Applications on slopes steeper than 4:1 and in concentrated flow scenarios (channels and drainage swales) must be avoided.

Installation of *Straw Mulch* will include:

- Selection of weed and seed free material
- Good, advanced soil preparation
- Appropriate broadcast method, to ensure uniform distribution of long strands and avoid fugitive material
- Determining the correct application rate for the site conditions/characteristics
- Proper crimping along the grade contour and to a significant depth,

Inspection and maintenance procedures will verify the material remains intact, is uniform and continues to function as a soil stabilization BMP. Mulch (and perhaps seed) will require reapplication if vegetation has not been established and the integrity of the application has been compromised. This will include areas; with little or no coverage, with straw no longer crimped in, with visible signs of surface erosion, paved over with sediment migrations and/or have been damaged by traffic or site activities.

## STRAW MULCH (con.)



**A good *Straw Mulch* application will ensure evenly distributed, uniform coverage. Crimping must be executed along the grade contour.**



**Correct application and installation methods should ensure secure and uniform *Straw Mulch* coverage. Maintenance, through re-installation, needs to be initiated for areas with sparse mulch coverage and little or no vegetative growth.**

## **MATERIALS MANAGEMENT, EQUIPMENT, AND WASTE HANDLING**

The MPDES *General Permit for Storm Water Discharges Associated with Construction Activity* requires minimum components be addressed and implemented “to help minimize other non-sediment pollutant contact with storm water runoff.”

Pollutants likely to be potential pollutant concerns at development sites are construction materials, fuels, oil, construction materials, wastes from demolition activities, worker trash and remnants from construction. Proper management of these wastes and materials is necessary to ensure these pollutants do not reach state surface waters through storm water runoff.

### **Materials**

The nature of the activity will dictate the type of materials that may be brought onto a project as part of the construction activity. Paints, fuels, concrete, cleaning agents and other chemicals are some examples of potential pollution sources that require management.

### **Equipment**

Every permitted oil and gas development activity will have many types of equipment used on-site. Since the permit is issued based on an earth disturbing activity, there will be some sort of grading equipment to create that disturbance, along with company and/or personal vehicles.

### **Wastes**

The nature of the activity will also determine the types of liquid and solid wastes generated onsite. At a minimum, most development sites are likely to have sanitary waste units, remnants from construction, liquid waste wash outs and worker trash to manage.

## BULK STORAGE



**Fuels and other construction materials that can become entrained in run-off and ultimately impact water quality should be in secondary containment or out of the weather.**



**Secondary containment features must be of adequate size and integrity to manage the main vessel and the stored product. Note the breach in this metal tub, which is too small to be functional.**

## EQUIPMENT MANAGEMENT



**Semi-stationary equipment like pumps, generators, welders, and compressors all require some form of secondary containment, due to the potential for leaks and equipment failure.**

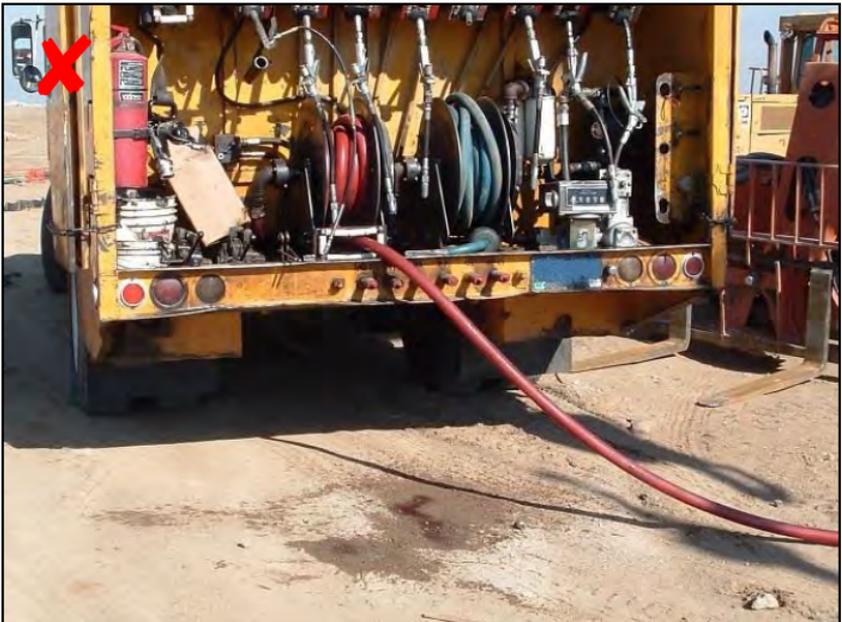


**Pumping and dewatering operations are especially sensitive, as the equipment is typically staged near the water source. Note the pumped discharge here, going directly into a surface water untreated.**

## EQUIPMENT MANAGEMENT (con.)



**Leaking and poorly maintained equipment should be removed from the site or repaired. Drip pans can serve as an interim control.**



**Fueling operations need to be executed with care, to prevent spills and cleanup. Spills should be promptly addressed.**

## SPILL PREVENTION AND RESPONSE

Leaks and spills are common occurrences on construction sites. Procedures and site protocols need to be established that focus on prevention first and then response measures. Personnel training and appropriate response materials standing-by are critically important for any successful spill prevention and response program.



**Cleaning up an oil spill on the Yellowstone River in Laurel, Montana.** Photo: Jim Urquhart

Spill prevention measures will focus on minimizing the potential for a spill. In the event a spill does occur, written response measures should be well communicated, to trigger the appropriate procedures. On-site personnel should be able to readily identify a major spill, versus an incidental spill they can respond to.



## WASTE MANAGEMENT



**Good housekeeping practices will ensure a construction site that is easy to manage and promotes worker safety.**



**Poor waste management practices create site-wide problems and promote a hazardous work environment.**

## PORTABLE TOILETS

Portable toilets will probably be available on virtually every development location and need to be recognized as potential pollution sources. The BMPs to manage these facilities are largely administrative and should be detailed in the SWPPP. Aside from monitoring and maintenance for these facilities, procedures for managing them will almost exclusively focus on how and where they are sited. These procedures can become standardized policies and implemented in every SWPPP the operator prepares. These include stationing the units:

- Out of harms way (away from traffic zones)
- On level, disturbed ground (not impervious surfaces)
- Away from drainage ways and conveyances
- Adequately secured down



**This portable toilet is stationed in an accessible and secure location that is easy to monitor.**

**In the event a toilet does tip or leak, it is easier to respond to it on disturbed ground, as opposed to a paved section. Note the leaked biocide.**



## CONTACT INFORMATION

### **MTDEQ Water Protection Bureau**

<http://deq.mt.gov/Permits.mcp#waterprotection>  
(406) 444-3080

### **MTDEQ Construction Permit Information**

**Storm Water** - (406) 444-5349  
**Dewatering** - (406) 444-3927

### **MTDEQ Spill Reporting**

(406) 444-0379

### **MTDES (Disaster and Emergency Services)**

(406) 431-0411

### **MDT's Environmental Services Bureau**

(406) 444-7228

### **US Army Corps of Engineers**

Helena - (406) 441-1375  
Billings - (406) 657-5910

### **EPA Region 8 – Montana Operations Office**

Helena - (406) 457-5025

### **Montana Board of Oil and Gas**

Billings - (406) 656-0040

### **Montana Contractors' Association**

Helena - (406) 442-4162



**ALTITUDE  
TRAINING**