

CHAPTER 5

Temporary Runoff Control

Temporary runoff control is important on developing sites to minimize on-site erosion and to prevent off-site sediment discharge. Temporary runoff control primarily consists of two main strategies: keeping off site water clean and managing on site sediment laden water.

Off site water that passes through an active construction site should be kept as clean as possible. This is accomplished by routing this flow through the site without opportunity to mix with untreated site runoff or by diverting clean water can be diverted around construction areas. Sediment control practices generally will be more effective, less expensive and require less maintenance by not incorporating off site water. Diversions and temporary crossings are examples of runoff controls that are designed to keep off site water clean.

Once construction begins, erosion will occur. To minimize erosion, site runoff must be managed. This starts by minimizing the amount of disturbance and maintaining existing vegetation as much as possible to reduce the volume of runoff generated and subsequent erosion. It is important that the site

designer and contractor recognize these opportunities to reduce site runoff.

Sediment laden water must be routed to an appropriate sediment control device before leaving the site. Conveying runoff through stabilized temporary diversions and slope drains not only directs muddy water to treatment devices but also reduces further erosion and prevents costly re-grading associated with gully development. Effective runoff control also makes re-vegetation easier and less costly.

The practices outlined in this chapter will significantly increase the effectiveness of a sediment and erosion control plan.

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5.1 Check Dams



Description

Check dams are shaped rock dams constructed in swales, grassed waterways or diversions. They reduce the velocity of concentrated flows, thereby reducing erosion within the swale or waterway. While a rock check dam may trap sediment, its trapping efficiency is extremely poor, therefore it should not be used as the primary sediment-trapping practice.

As an alternative to rock, high flow compost filter socks may be used as check dams. While the primary use of compost socks as check dams is still to reduce flow velocity and subsequent channel erosion, these will have improved sediment removal.

Condition Where Practice Applies

This practice is limited to use in small channels where it is necessary to slow the velocity of flow in order to prevent gully erosion. Applications include grassed lined conveyances that need protection from gully erosion during the vegetative establishment or temporary swales (which due to short time of service do not practically lend themselves to a non-erodible lining). See other specifications for rock lined channels, gravel riffles and practices (chapter 4) that are more appropriate for larger channels and streams.

This practice is limited to small open channels with a drainage area less than 10 acres (5 ac. for filter socks) with the objective of limiting erosion and subsequent sedimentation in downstream areas. Examples include:

1. Ditches or swales that cannot receive a non-erodible lining and still need protection to reduce erosion.
2. Use during the interim period while the grassed lining is being established.
3. Use as an aid (not a substitute) to trap sediment from construction activity.

Planning Considerations

Rock check dams and filter sock check dams are superior to straw bale dams based on their reduced maintenance and increased effectiveness and because straw bale check dams are not a specified practice in this manual.

Rock check dams and filter sock check dams shall be placed where standing water or excessive siltation will be minimized or where damage to vegetative lining will be insignificant.

Rock check dams should be considered where the ditch or swale will not be mowed until after construction is complete.

Design Criteria

See the specifications below for design guidelines. For increased sediment control of rock check dams, smaller aggregate and or filter fabric on the upstream side may be used. It should be noted that increased ponding and the subsequent increase in the height of water behind a check dam raises the potential for erosion if overtopping occurs.

Table 5.1.1 Sock materials (The Sustainable Site, 2010)

Material	5 mil HDPE	5 mil HDPE / Cotton	Multi-Filament Polypropylene (A)	Multi-Filament Polypropylene (B)
Material characteristic	Photodegradable	Biodegradable	Photodegradable	Photodegradable
Mesh Opening	3/8" (10mm)	3/8" (10mm)	3/8" (10mm)	1/8" (3mm)
Tensile Strength	26 psi (1.83 kg/cm ²)	26 psi (1.83 kg/cm ²)	44 psi (1.83 kg/cm ²)	202 psi (1.83 kg/cm ²)
% Original Strength from UV Exposure	23% at 1000 hr	ND	100% at 1000 hr	100% at 1000 hr
Functional Longevity	9 mo. -3 year	6-12 months	1-4 years	2-5 years

Maintenance

Sediment shall be removed from behind check dam once it accumulates to one-half the original height of the check dam.

Removal

Depending upon the size and type, removal of check dams may be performed by hand or mechanical means. Stone and sediment should be removed and the area graded and seeded. Sediment accumulated behind filter socks shall be removed and then these may be cut open, and the filler material dispersed or incorporated into existing soil in order to aid vegetative establishment and reduce mowing safety concerns.

Filler material shall not be spread within the flow area of the channel or where shear stresses will mobilize sediment and compost before it can be incorporated into dense vegetation. Additionally filler material shall not be spread if it will retard or reduce the existing vegetation. Mesh netting and stakes shall be removed entirely and disposed of in the proper waste or recycling facility.

Common Problems/Concerns

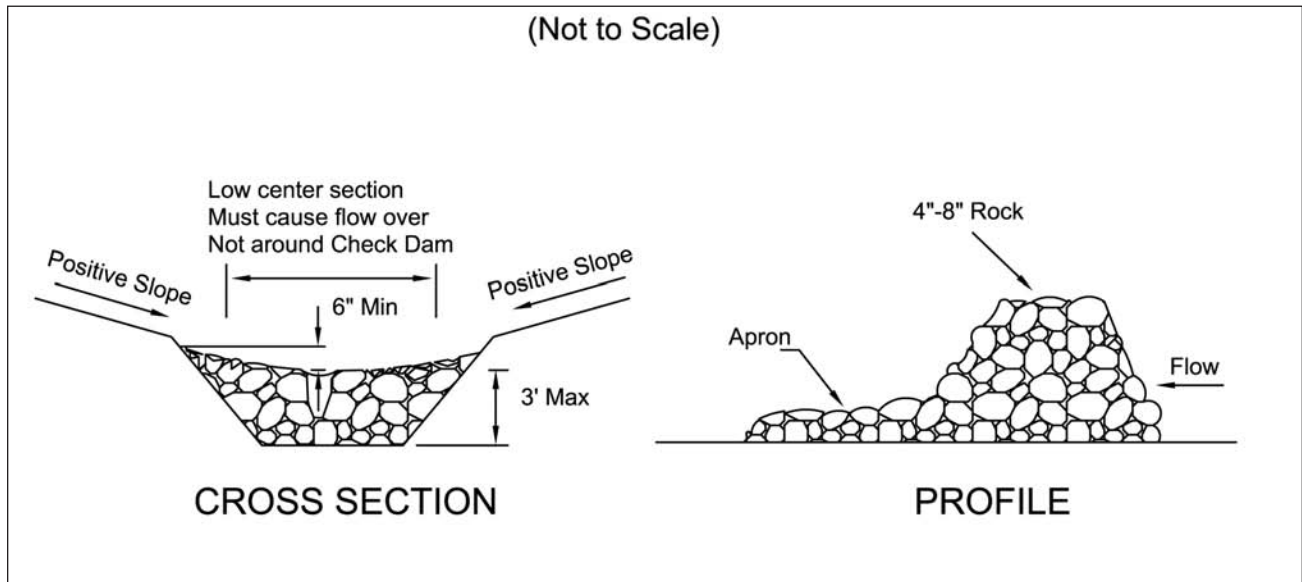
If the check dam materials are not entirely removed, maintenance issues or safety concerns may be created. Removal of check dams is necessary in order to allow complete vegetative establishment.

References

Tyler, R., A. Marks, B. Faucette. 2010. The Sustainable Site: Design Manual for Green Infrastructure and Low Impact Development Forester Press, Santa Barbara, CA.

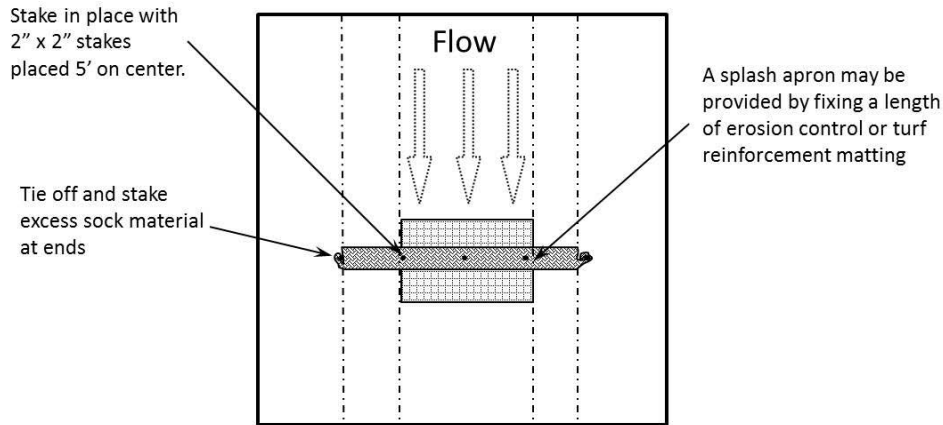
Maryland Department of Environment, 2011. Maryland Standards and Specifications for Soil Erosion and Sediment Control. Filter Log. Water Management Administration, Baltimore, MD.

Specifications
for
Rock Check Dam

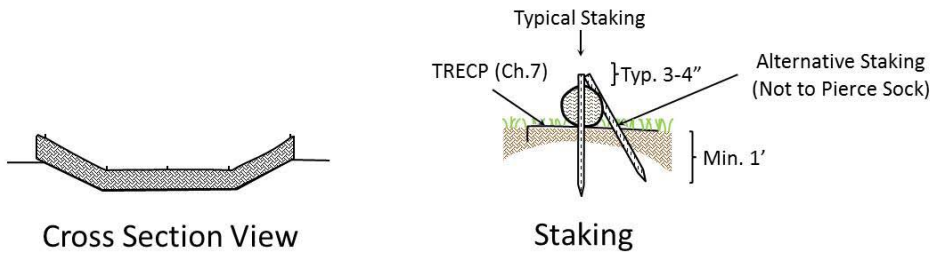


1. The check dam shall be constructed of 4-8 inch diameter stone, placed so that it completely covers the width of the channel. ODOT Type D stone is acceptable, but should be underlain with a gravel filter consisting of ODOT No. 3 or 4 or suitable filter fabric.
2. Maximum height of check dam shall not exceed 3.0 feet.
3. The midpoint of the rock check dam shall be a minimum of 6 inches lower than the sides in order to direct across the center and away from the channel sides.
4. The base of the check dam shall be entrenched approximately 6 inches.
5. Spacing of check dams shall be in a manner such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
6. A Splash Apron shall be constructed where check dams are expected to be in use for an extended period of time, a stone apron shall be constructed immediately downstream of the check dam to prevent flows from undercutting the structure. The apron should be 6 in. thick and its length two times the height of the dam.
7. Stone placement shall be performed either by hand or mechanically as long as the center of check dam is lower than the sides and extends across entire channel.
8. Side slopes shall be a minimum of 2:1.

Specifications for Compost Sock Check Dam



Plan View



Cross Section View

Staking

1. Compost sock netting shall use a knitted mesh fabric with 1/8-3/8 inch openings, and compost media with particle sizes 99% < 3 inches, and 60% > 3/8 inches (conforming to media described in Chapter 6 Filter Sock).
2. Compost sock check dams shall be used in areas that drain 5 acres or less.
3. Sediment shall be removed from behind the sock when it reaches 1/2 the height of the check dam.
4. Compost sock check dams shall be constructed with 12, 18, or 24 in diameter compost socks, and shall completely cover the width of the channel. The midpoint of the compost sock check dam shall be a minimum of 6 inches lower than the sides in order to direct flow across the center and away from the channel sides. Filter sock check dams shall be filled to a density such that they shall reach their intended height (diameter). After installation and use, they shall be considered unsuitable and in need of replacement after falling below 80% of their minimum required height (diameter).
5. Although no trenching is necessary, compost sock check dams shall be placed on a graded surface where consistent contact with the soil surface is made without bridging over gaps, rills, gullies, stones or other irregularities.
6. Place compost sock check dams so that the ends extend to the top of bank. Staking for compost sock check dams shall use 2 inch x 2 inch wooden stakes, placed 5 foot on center. Stake length shall allow them to be driven 12 inches into existing soil and allow at least 2 inches above the sock.
7. Space compost sock check dams so that the toe of the upstream dam is at the same elevation or lower elevation as the top of the downstream compost sock check dam (at the center of the channel). This will be influenced by the height of the sock and gradient of the waterway.
8. A splash apron may be needed where flows over the sock may erode the channel and undercut the compost sock check dam. Create the apron by fixing a length of Temporary Rolled Erosion Control Product (Erosion Control Matting) or Turf Reinforcement Matting starting upstream of the sock a distance equal to the sock height and extending a length two times the height of the compost sock check dam. See Chapter 7 for information regarding these materials. Materials used should be able to be left in place (e.g. biodegradable/photodegradable TREC) without creating problems for future mowing or maintenance of the channel.

5.2 Slope Drain



Description

A pipe or chute placed on a slope to convey surface runoff downslope without causing erosion. Slope drains provide a temporary outlet for either a diversion or terraced slope.

Condition Where Practice Applies

Slope drains are used wherever a temporary outlet is needed for a diversion, terrace or embankment. Slope drain are useful along road fills or other long fills where surface flow down the embankment would cause significant damage. This practice may be necessary where drainage cannot easily be directed to the ends of a section of fill. The maximum allowable drainage area for this practice is 5 acres.

Design Criteria

The slope drain shall be designed for non-pressure flow, and a minimum 10 year frequency event. The inlet shall be protected from scouring. In lieu of design computations, the following table may be used for sizing the drain:

Table 5.2.1 Slope Drain Sizing

Diameter (Inches)	Maximum Drainage Area (Acres)
12	0.5
18	1.5
21	2.5
24	3.5

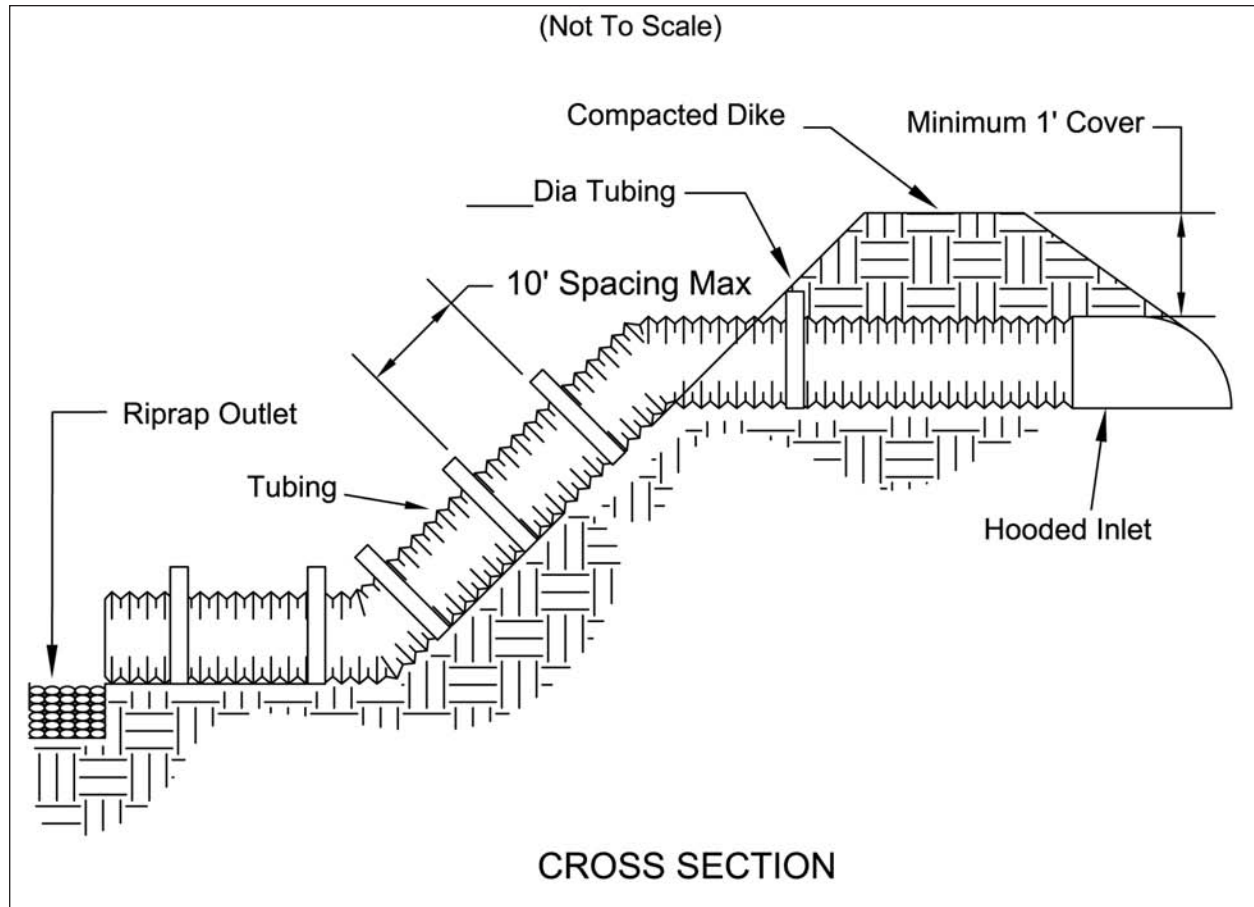
Outlet - When the drainage area is disturbed, the slope drain shall either have inlet protection, or the drain outlet shall be directed into a sediment trapping device. A hard armored apron shall be provided below the outlet where clean water is discharged into a stabilized area or channel.

Common Problems/Concerns

Piping of soil material appears around the pipe outlet. Care should be taken to adequately compact the fill material around and beneath the pipe structure to prevent the flow of water.

Scouring of fill material occurs around the pipe entrance. A vortex may occur at the pipe entrance during high flow conditions. Armoring of the entrance or the installation of an anti-vortex device may be necessary to prevent the failure of the earth fill/dike.

Specifications
for
Slope Drain



1. The slope drain shall be constructed on a minimum slope of 3 percent.
2. All points along the top of the dike/earthfill for the storage area shall be at least one (1) foot higher than the top of the inlet pipe.
3. The pipe drain may be constructed of corrugated metal or PVC pipe. All pipe connections shall be watertight. Flexible tubing may be used, provided rigid pipe is used for the inlet, the flexible tubing is of the same diameter as the inlet, and pipe connections are made with metal strapping or watertight connecting collars. The flexible pipe shall be constructed with hold down apparatus spaced on 10 foot centers for anchoring the pipe.
4. The entrance to the pipe shall be a hooded type.
5. The soil around and/or under the pipe shall be placed in 4-inch layers and hand compacted to the top of the earth dike.
6. A riprap apron shall be installed at the pipe outlet where clean water is discharged into a stabilized area or drainageway.

5.3 Temporary Diversion



Description

A temporary diversion is a dike and/or channel constructed to:

- Direct sediment-laden runoff to a settling pond.
- Route clean runoff away from disturbed areas.
- Divert runoff to reduce the effective length of the slope.
- Direct runoff away from steep cut or fill slopes.

Conditions Where Practice Applies

This practice applies to construction areas where runoff must be redirected in order to prevent offsite sedimentation, erosion or flooding of work areas. Temporary diversions are particularly applicable to prevent flow from damaging erodible or unstable areas.

Temporary diversions are appropriate for drainage areas less than 10 acres.

Planning Considerations

It is important that diversions are properly designed, constructed, and maintained since they concentrate water flow and may increase erosion potential. Particular care must be taken in planning diversion grades. Too much slope can result in erosion in the diversion channel or at the outlet. A change of slope from a steeper grade to a flatter may cause deposition to occur, reducing carrying capacity increasing chances of overtopping and failure.

It is usually less costly to excavate a channel and form a dike or dike on the downhill side with the spoil than to build diversions by other methods. Where space is limited, it may be necessary to build the dike by hauling in diking material. Use gravel to armor the diversion dike where vehicles must cross frequently.

Build and stabilize diversions and outlets or downstream sediment facilities before initiating other land-disturbing activities.

These structures generally have a life expectancy of 18 months or less, but can be prolonged with proper maintenance.

Compare: Temporary Diversion vs. Silt Fence at the perimeter of disturbed areas

Two approaches are commonly used to intercept and treat sediment-laden runoff at the perimeter of disturbed areas: silt fence or diversions that direct runoff to settling ponds. When determining which approach is more appropriate, consider the following:

Table 5.3.1 Temporary Diversion versus Silt Fence comparison.

Temporary Diversion	Silt Fence
Flows up to 10 acres of drainage area	Sheet flow from 1/4 acre per 100 feet of fence (see silt fence specification)
Constructed on positive grade to direct runoff	Must follow the contour of the land
Durable and usually low maintenance	High maintenance
Easily constructed with earth moving equipment	Labor Intensive
Requires additional Settling facilities	Treats Runoff for Sediment
Wider Disturbed area.	Requires little space and causes less disturbance around vegetation or structures

Design Criteria

These are provided in the specifications that follow.

Operation and Maintenance

Inspect temporary diversions once a week and after every storm event. Immediately remove sediment from the flow area and repair the diversion dike as needed.

Carefully check outlets and make necessary repairs immediately.

When the area protected is permanently stabilized, remove the dike and the channel to blend with the natural ground level and stabilize all disturbed areas with vegetation or other erosion control practice.

Mow grass as needed to maintain flow in channel.

Common Problems – Suggested Solutions

Sedimentation results in channel grade decreasing or reversing, leading to overtopping – realign or deepen the channel to maintain grade.

Low point in dike where diversion crosses a natural depression results in overtopping of the dike – build up the dike.

Erosion in channel before vegetation is established results in uneven channel grade, may lead to breach of dike---repair channel and install sod or synthetic liner.

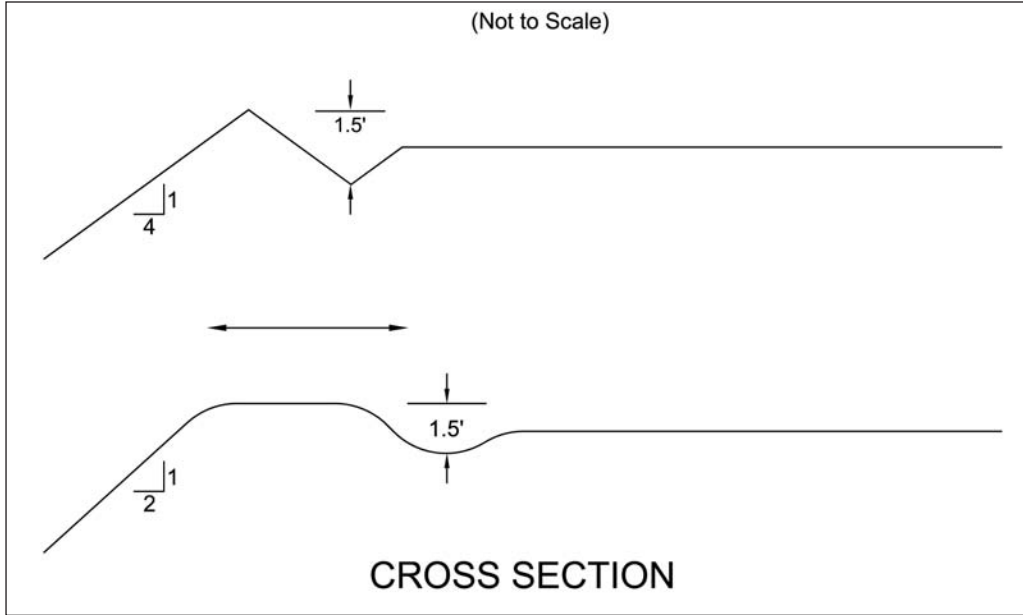
If seepage or poor drainage in channel results in poor vegetation establishment, it may be necessary to re-grade in order to create positive drainage or to install subsurface drains or stone channel bottom.

Vehicle crossings result in rutting and increased erosion – maintain the dike height, flatten the side slopes, protect the dike with gravel or hard surface at the crossing point.

Excessive velocity at the outlet results in erosion – install or repair ROCK OUTLET PROTECTION.

Excessive grade in channel results in gully erosion – repairs channel, and install an erosion resistant lining or realign to reduce the grade.

Specifications
for
Temporary Diversion



1. Drainage area should not exceed 10 acres. Larger areas require a more extensive design.
2. The channel cross section may be parabolic or trapezoidal. Disk the base of the dike before placing fill. Build the dike 10% higher than designed for settlement. The dike shall be compacted by traversing with tracked earth-moving equipment.
3. The minimum cross section of the levee or dike will be as follows: (Minimum design freeboard shall be 0.3 foot.) Where construction traffic will cross, the top width may be made wider and the side slopes flatter than specified above.
4. The grade may be variable depending upon the topography, but must have a positive drainage to the outlet and be stabilized to be non-erosive.

Table 5.3.2

Dike Top Width (ft.)	Height (ft.)	Side Slopes	Shape
0	1.5	4.1	Trapezoidal
4	1.5	2.1	Parabolic

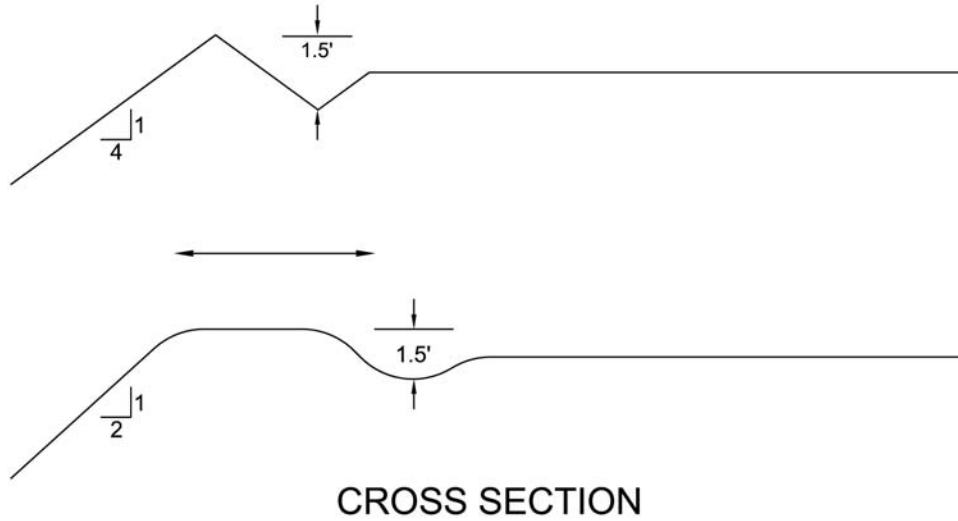
Table 5.3.3

Temporary Diversion Stabilization Treatment			
D i v e r s i o n S l o p e	< 2 ac.	2 - 5 ac.	5 - 10 ac.
0 - 3%	Seed and Straw	Seed and Straw	Seed and Straw
3 - 5%	Seed and Straw	Seed and Straw	Matting
5 - 8%	Seed and Straw	Matting	Matting
8 - 20%	Seed and Straw	Matting	Engineered
Note: Diversions with steeper slopes or greater drainage areas are beyond the scope of this standard and must be designed for stability. Seed, straw and matting used shall meet the Specifications for Temporary Seeding, Mulching and Matting.			

5. Outlet runoff onto a stabilized area, into a properly designed waterway, grade stabilization structure, or sediment trapping facility.
6. Diversions shall be seeded and mulched in accordance with the requirements in practice standards TEMPORARY SEEDING (or PERMANENT SEEDING) and MULCHING as soon as they are constructed or other suitable stabilization in order to preserve dike height and reduce maintenance.

Specifications
for
Temporary Diversion Above Steep Slopes

(Not to Scale)



1. Drainage area should not exceed 5 acres. Larger areas require a more extensive design.
2. The channel cross section may be parabolic, v-shaped, or trapezoidal. Disk the base of the dike before placing fill. Build the dike 10% higher than designed for settlement. The dike shall be compacted by traversing with tracked earth-moving equipment.
3. The minimum cross section of the levee or dike will be as follows: (Minimum design freeboard shall be 0.3 foot.)
4. The grade may be variable depending upon the topography, but must have a positive drainage to the outlet and be stabilized to be non-erosive.

Table 5.3.2

Dike Top Width (ft.)	Height (ft.)	Side Slopes	Shape
0	1.5	4.1	Trapezoidal
4	1.5	2.1	Parabolic

Table 5.3.3

Temporary Diversion Stabilization Treatment			
Diversion Slope	< 2 ac.	2 - 5 ac.	5 - 10 ac.
0 - 3%	Seed and Straw	Seed and Straw	Seed and Straw
3 - 5%	Seed and Straw	Seed and Straw	Matting
5 - 8%	Seed and Straw	Matting	Matting
8 - 20%	Seed and Straw	Matting	Engineered
<p>Note: Diversions with steeper slopes or greater drainage areas are beyond the scope of this standard and must be designed for stability. Seed, straw and matting used shall meet the Specifications for Temporary Seeding, Mulching and Matting.</p>			

5. Outlet runoff onto a stabilized area, settling pond, or into a drop structure.
6. Diversions shall be seeded and mulched in accordance with the requirements in practice standards TEMPORARY SEEDING (or PERMANENT SEEDING) and MULCHING as soon as they are constructed or other suitable stabilization in order to preserve dike height and reduce maintenance.

5.4 Stream Utility Crossing



Description

Stream Utility Crossings include pipeline, power line, or road construction projects that cross creeks or rivers. Measures used to minimize damage from the construction of utilities across streams start in the planning stages of a project and continue through site restoration. They include: determining the location of the utility, timing construction, construction techniques to reduce sediment pollution, and recreating favorable riparian conditions.

Conditions Where Practice Applies

Stream Utility Crossing apply to the following:

- Pipelines including but not limited to gas pipelines, electrical transmission lines, sanitary sewers, water lines, and etc.
- Overhead electric transmission lines,
- Road and bridge construction.

For temporary access of construction traffic across stream channels, see the specification for *Temporary Stream Crossings*.

Planning Considerations

Siting Stream Crossings – The first priority for minimizing the impacts of utility construction across streams is to minimize the length of channel disturbed. This often requires the values of the stream be acknowledged and carefully weighted through a stream assessment.

Routinely, the easiest and most inexpensive location of utilities, particularly sanitary sewers, is right down the stream channel itself. Unfortunately, this method of locating utilities causes long-term negative impacts to the stream and may necessitate higher maintenance costs to protect the utility.

Minimize the length of channel disturbed by:

- Routing utility lines well away from the stream channel and adjacent riparian area. Doing this may require more earthwork through irregular terrain and more bends in the utility.
- Crossing the stream as few times as possible.
- Crossing perpendicular to the Stream, where crossings do occur. Crossings deviating up to 30 degrees from perpendicular shall be considered perpendicular.
- Concentrate crossings of multiple utilities in one location, and/or encase into one conduit. This is most feasible where utilities are serving an individual housing development.

Within stream channels, there are areas, which are more sensitive to the work required for a utility crossing. Crossings should be located along the stream channel where they will cause the least impact. Crossings should occur where the streambanks are most stable such as the crossovers between bends where the curve of the stream changes direction or along fairly straight sections of channel. Sharp bends and steep banks, especially where showing signs of instability, should be avoided. Deep pools within the channel also should be avoided. These are locations where, during high flows, natural scour is occurring, opposed to riffle areas where deposition occurs. Generally, uniform stretches of stream will be least impacted by a utility crossing.

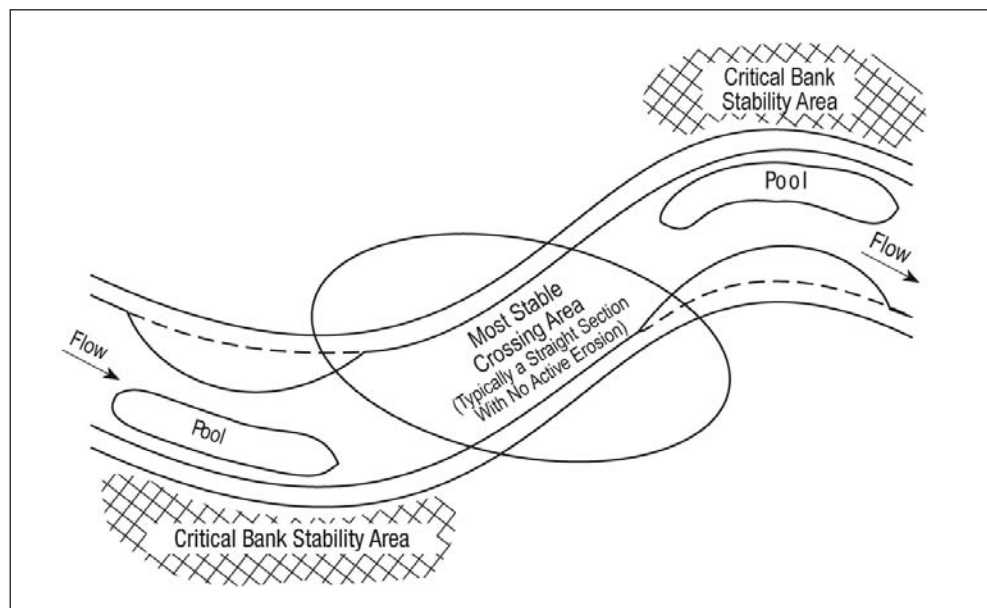


Figure 5.4.1 Stable location for utility crossing

Design Criteria

The following provide general criteria applicable to utility installations. Additional guidance is provided in the specifications that follow.

Construction Season -Utility stream crossing construction is best done during periods of low flow; generally July, August, and September. For perennial streams or important spawning streams, the worst time for construction may be during fish spawning and migration season from March 15 through June 15 or as determined for a particular stream or fish species. This should be taken into consideration along with other construction timing constraints.

Construction Method -In critical crossing situations, the method of construction may be specified. Drilling and boring utility lines under a stream channel cause much less impact than plow-in and trenching methods. Drilling and boring reduce the likelihood of erosion, as well as disturbance of the banks and bottom substrates which typically occurs with both the plow-in and trenching methods. Drilling and boring are usually more expensive and may be unreasonable for certain situations. If a utility line cannot be bored or drilled under the watercourse, the plow-in method should be used where possible. When crossing streams with the plow, a “dry run” is usually recommended prior to attaching the cable or pipe to clear out any possible stumps, logs or other obstructions.

Stream Flow Control -Stream flow should be diverted away from areas where intensive construction will occur.

Confining the Work Area -In large streams with limited areas of disturbance such as along one bank or around a bridge piling, a cofferdam or barricade can be constructed to keep the stream from continually flowing through the disturbed areas. Types of barricades include sheet pilings, sandbags, or turbidity curtains. Sheet pilings are the most durable. Sandbags can be constructed quickly in areas with shallow flow. Turbidity curtains are a geotextile material suspended from floats which hang down to the channel bottom. Unlike sheet pilings and sandbags, turbidity curtains cannot be specified for areas with strong currents or if the work area will be pumped dry.

Sediment Control: Stock piles of material shall be surrounded by silt fence or runoff routed to a sediment pond. Stabilized working pads shall be provided for the equipment in association with the construction of the crossing. Additional sediment control devices shall be implemented (ie. silt fence, sediment traps) when the trench falls within 100 feet of the stream.

Staged Construction -A cofferdam of sheet pilings or sand bags also can be used to confine, one-half of the channel until work there is completed and stabilized, then moved to the other side to complete the crossing without ever having the stream flow through the active work area.

Temporary Rerouting -When extensive or prolonged work will be done to the channel, the stream should be routed around the work area if permitted by terrain and the size of stream. Flow may be pumped around the work area or a temporary channel may be constructed. Temporary channels must be stabilized. A geotextile completely lining the channel bottom and side slopes is suitable temporary stabilization.

Limits on Each Crossing

Crossing Width -The limits of disturbance should be as narrow as possible where utilities cross streams. This includes not only construction operations within the channel itself, but also clearing done through the vegetation growing on the streambanks. The width of clearing should be minimized through the entire riparian area. To ensure minimal width of disturbance through the riparian area, materials excavated from trench construction should be placed well back from the streambanks. The width necessary for the crossing should also be clearly specified on the plans as well as the construction and clearing limits.

Duration of Construction -The time between initial disturbance of the stream and final stabilization should be kept to a minimum. The time necessary for an individual utility stream crossing varies significantly, depending on the specific project. Individual projects should be designed to encourage minimum duration of construction activity within the stream channel. Specific time limits may be specified or the crossing construction may be made dependent on other operations. For example, it could be specified that construction could not begin on the crossing until the utility line was in place to within 10 ft. of the streambanks on each side of the stream.

Fill Placed Within the Channel -The only fill permitted in the channel should be clean aggregate, stone or rock. No soil or other fine erodible material shall be placed in the channel. This restriction includes all fill for temporary crossings, diversions, and trench backfill when placed in flowing water. If the stream flow is diverted away from construction activity the material originally excavated from the trench may be used to back fill the trench.

Streambank Stabilization and Restoration - Streambanks should be restored to their original line and grade. Restoration must not result in a narrower channel or flow restriction. Stabilization of the area shall be conducted immediately upon completion of the stream crossing.

Plan specifications should define the type of stabilization, ideally woody vegetation, as described in the Stream Stabilization section of this book. Vegetation mats or Erosion Control Matting shall stabilize areas within 50' of either streambank. Some bank areas may need to be stabilized with riprap or stone in addition to matting and woody vegetation. Trees should be planted on the entire riparian area, especially the streambanks, to the extent permitted by the type of utility crossing. See the specifications for Streambank Stabilization.

Site Work Associated with Utility Stream Crossing

Runoff Control Along the Right-of-Way – Runoff and sediment controls should be used for the access road or utility easement approaching the stream crossing to prevent sediment-laden runoff from being routed directly to the stream. At a minimum distance of 50 ft. from the stream, runoff should be diverted with water bar or swales to a sediment trapping practice.

Dewatering – Trenches and excavations associated with stream crossings frequently require dewatering. Dewatering or pumping operations must not discharge turbid water directly to the stream. See the Dewatering Measures practice contained in this book for more guidance.

Permits – The specifications contained in this practice pertain primarily to the environmental impacts of stream utility crossings. The designer must also be aware that such structures are subject to the rules and regulations of the U.S. Army Corps of Engineers for instream modifications (404 permits) and Ohio Environmental Protection Agency’s State Water Quality Certification (401 permits).

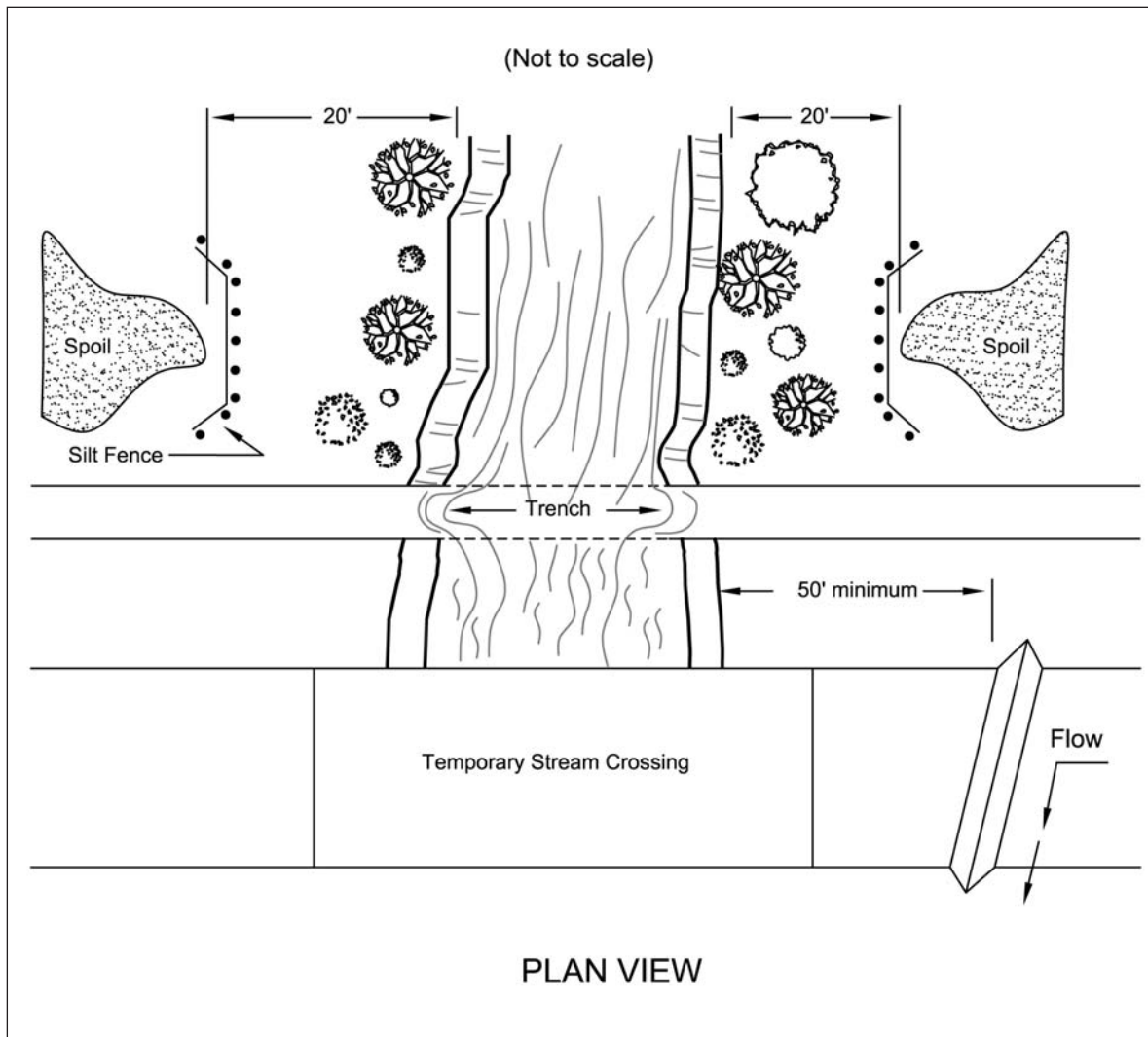
Maintenance

- Maintenance is essential to make sure that all items are functioning properly. This includes making sure only the areas that need to be exposed are exposed, and all other BMP practices are in good working order.
- The designated diversions should maintain the clean water through the site until the project has been completed.
- All desilting devices shall be maintained so that proper filtering occurs to the muddy water before it reenters the stream system.
- Dewatering devices shall be maintained at all times so that proper schedules can be kept for the utility crossing.

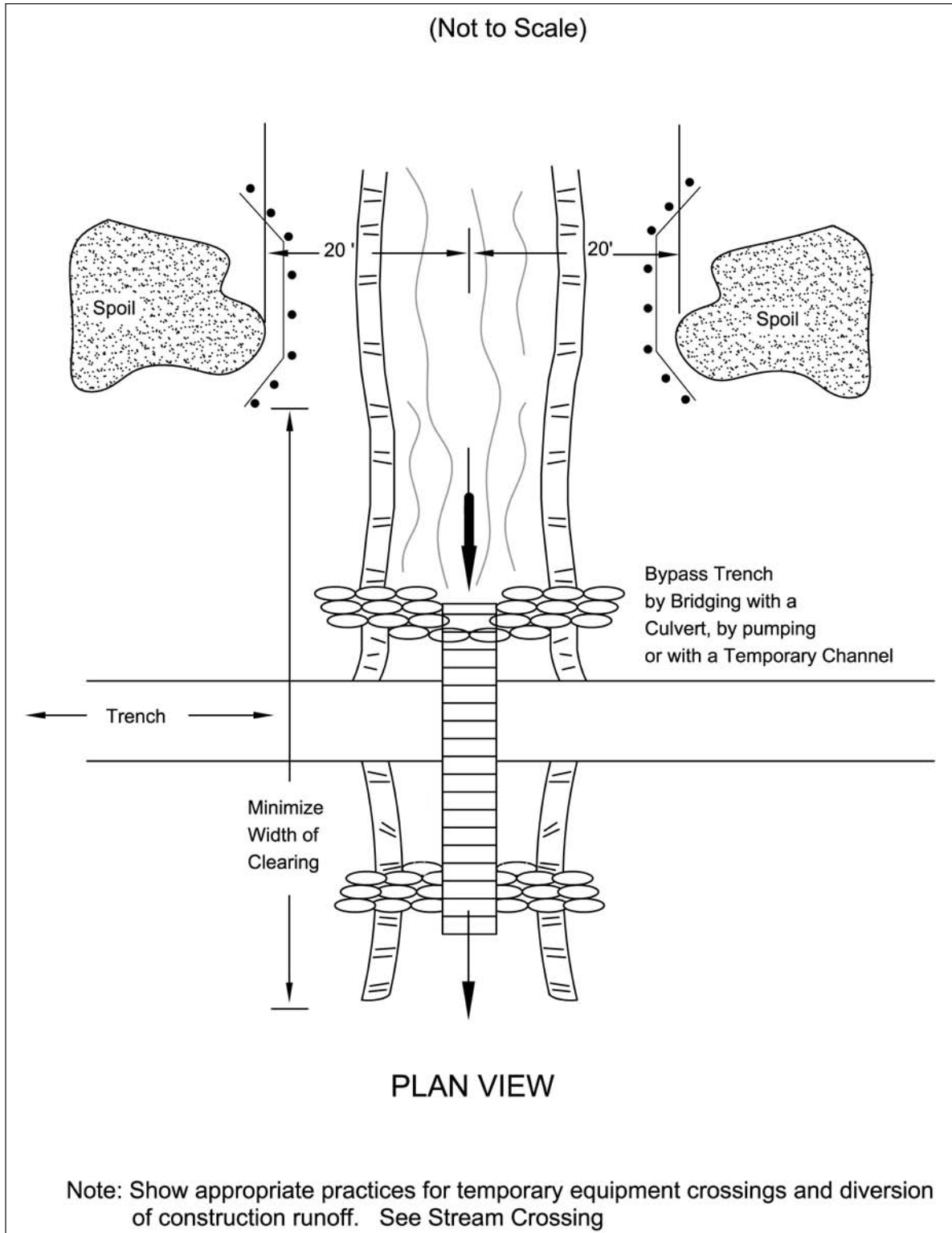
Common Problems/Concerns

- Improper staging and construction causes sediment damage because diversions, erosion control devices and dewatering does not occur in the proper order.
- Starting project during bad weather conditions so that a timely construction can occur.
- More area is opened up than for one day’s construction to be completed in the stream crossing.

Specifications
for
Large Stream Utility Crossing



Specifications
for
Small Stream Utility Crossing



Specifications
for
Stream Utility Crossing

1. When site conditions allow, one of the following shall be used to divert stream flow or keep the flow away from construction activity.
 - Drill or bore the utility lines under the stream channel.
 - Construct a cofferdam or barricade of sheet pilings, sandbags or a turbidity curtain to keep flow from moving through the disturbed area. Turbidity curtains shall be a pre-assembled system and used only parallel to flow.
 - Stage construction by confining first one-half of the channel until work there is completed and stabilized, then move to the other side to complete the crossing.
 - Route the stream flow around the work area by bridging the trench with a rigid culvert, pumping, or constructing a temporary channel. Temporary channels shall be stabilized by rock or a geotextile completely lining the channel bottom and side slopes.
2. Crossing Width -The width of clearing shall be minimized through the riparian area. The limits of disturbance shall be as narrow as possible including not only construction operations within the channel itself but also clearing done through the vegetation growing on the streambanks.
3. Clearing shall be done by cutting NOT grubbing. The roots and stumps shall be left in place to help stabilize the banks and accelerate revegetation.
4. Material excavated from the trench shall be placed at least 20 ft. from the streambanks.
5. To the extent other constraints allow, stream shall be crossed during periods of low flow.
6. Duration of Construction -The time between initial disturbance of the stream and final stabilization shall be kept to a minimum. Construction shall not begin on the crossing until the utility line is in place to within 10 ft. of the streambank.
7. Fill Placed Within the Channel -The only fill permitted in the channel should be clean aggregate, stone or rock. No soil or other fine erodible material shall be placed in the channel. This restriction includes all fill for temporary crossings, diversions, and trench backfill when placed in flowing water. If the stream flow is diverted away from construction activity the material originally excavated from the trench may be used to backfill the trench.
8. Streambank Restorations -Streambanks shall be restored to their original line and grade and stabilized with riprap or vegetative bank stabilization.
9. Runoff Control Along the Right-of-Way -To prevent sediment-laden runoff from flowing to the stream, runoff shall be diverted with water bar or swales to a sediment trapping practice a minimum of 50 ft. from the stream.
10. Sediment laden water from pumping or dewatering or pumping shall not be discharged directly to a stream. Flow shall be routed through a settling pond, dewatering sump or a flat, well-vegetated area adequate for removing sediment before the pumped water reaches the stream.
11. Dewatering operations shall not cause significant reductions in stream temperatures. If groundwater is to be discharged in high volumes during summer months, it shall first be routed through a settling pond or overland through a flat well-vegetated area.
12. Permits -In addition to these specifications, stream crossings shall conform to the rules and regulations of the U.S. Army Corps of Engineers for in-stream modifications (404 permits) and Ohio Environmental Protection Agency's State Water Quality Certification (401 permits).

5.5 Temporary Stream Crossing



Description

A stream crossing provides construction traffic temporary access across a stream while reducing the amount of disturbance and sediment pollution. It is a temporary practice which includes restoring the crossing area after construction. Specifications for three typical kinds of stream crossings are provided: bridges, culverts and fords. Each has specific applications and each is designed to minimize stream damage by leaving banks stable and vegetated and adding only coarse stone fill to the channel.

Conditions Where Practice Applies

Where heavy equipment must be moved from one side of a stream channel to another, or where light-duty construction vehicles must cross the stream channel frequently for a short period of time. Generally, a temporary stream crossing is applicable to flowing streams with drainage areas less than 5 square miles. More exacting engineering methods should be used on larger drainage areas.

Planning Considerations

A stream and its entire riparian area should be left undisturbed to the greatest extent feasible. However where construction equipment must cross a stream channel, a temporary stream crossing is necessary. The temporary nature of stream crossings should be stressed. These structures create a channel constriction, which can cause flow backups or washouts during periods of high flow. They should be planned to be in service for the shortest practical period of time and to be removed as soon as their function is completed.

The specifications contained in this practice pertain primarily to the environmental impacts of stream crossings. From a safety and utility standpoint, the designer must also be sure that bridge spans, if used, are capable of withstanding the expected loads from heavy construction

equipment. The designer must also be aware that such structures are subject to the rules and regulations of the U.S. Army Corps of Engineers for instream modifications (404 permits). For designated Scenic Rivers, approval for public projects must be obtained from the Ohio Department of Natural Resources, Division of Natural Areas and Preserves.

Locating Crossings -Stream crossings should be constructed where they will cause the least amount of disturbance to the channel and surrounding vegetation. Good locations generally include straight sections as opposed to bends and shallow areas rather than deep pools. When practical, locate and design temporary stream crossings at permanent crossing locations to minimize stream disturbance.

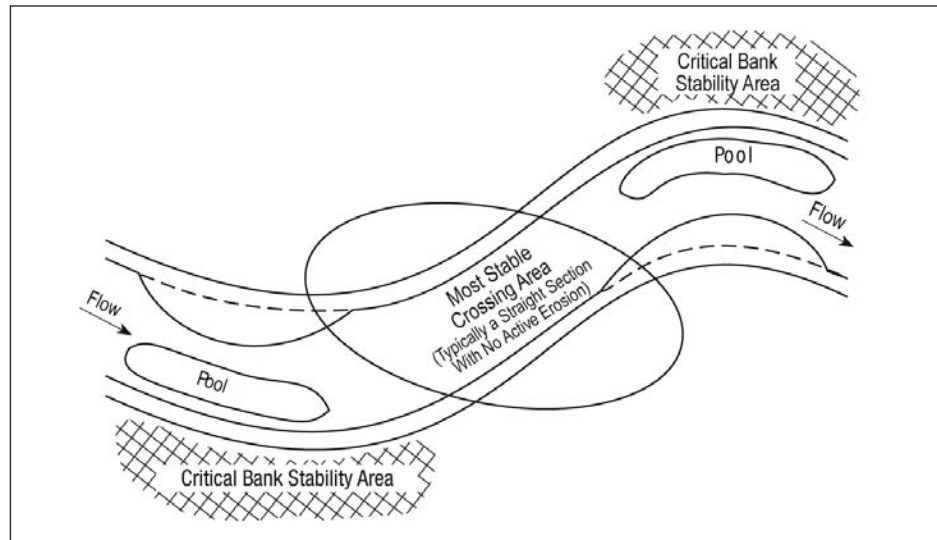


Figure 5.5.1 Stable locations for stream crossings.

Selecting Type of Stream Crossing:

Bridge:

- Can usually be installed anytime during the year.
- Bridges are preferable to the other types of stream crossings because they cause the least disturbance to the stream.
- Bridges are most applicable for narrow channels and deep channels.
- Must be adequately designed by a qualified professional for the load of the equipment expected during construction.

Culvert:

- Culvert stream crossings should NOT be constructed between March 15 and June 15 because of impacts to fish spawning.
- Culvert stream crossings are most suitable for wide-stream channels and for traffic that may be too heavy for a bridge.
- Usually constructed of readily available materials which can be salvaged after use.
- Installation and removal of culvert crossings causes considerable disturbance to the stream and greatest potential for obstruction during higher flows.

Ford:

- Stream fords should NOT be constructed between March 15 and June 15 because of impacts to fish spawning.
- Fords may be used where very little construction traffic is anticipated.
- Most applicable where normal flow is shallow or intermittent.
- Fords should not be used to cross channels with streambanks greater than 4 ft. high.
- Problems with fords include: approach sections are subject to erosion; the stone fill or surface area is subject to being washout and may need periodic replacement; mud may be directly introduced into the stream by vehicles.

Design Criteria

The following provide general criteria applicable for all types of temporary stream crossings. Additional guidance applicable to individual crossing types shall be consulted in the individual specification that follows.

Flow Capacity – For all types of crossings, the structure shall be designed to pass bankfull flow or the peak flow from a 2 year frequency 24 hour duration storm, whichever is less without overtopping. Also ensure that storms that overtop the structure can safely be conveyed without erosion, property damage or increased hazard. Flow velocity at the outlet of the structure must be non-erosive for the receiving stream.

Minimized Disturbance – Clearing shall be done by cutting and NOT grubbing except in the case of stream fords where approaches may require more grading. The roots and stumps shall be left in place to help stabilize the banks and accelerate re-vegetation.

Sediment Control – Stock piles of material shall be surrounded by silt fence or runoff routed to a sediment pond. Stabilized working pads shall be provided for the equipment in association with the construction of the crossing.

Approach Road – The road approaching the stream crossing shall not route sediment-laden runoff directly to the stream. At a minimum distance of 50 ft. from the stream, runoff shall be diverted with water bar or swales to an adequate sediment-trapping practice.

Roadway and practice materials – The aggregate for the roadway shall be a minimum of 6 inches thick stone or recycled concrete meeting one of the following ODOT coarse aggregate gradations: #1, #2, #3 or #4. The aggregate will be placed on geotextile fabric meeting the requirements in material specification filter fabric ODOT Type “B”. No soil may be used as cover or construction materials for these practices.

Width of Crossing – All crossings shall have one traffic lane. The minimum width shall be 12 feet with a maximum width of 20 feet.

Crossing Alignment – The temporary waterway crossing shall be at right angles to the stream, where approach conditions dictates, the crossing may vary 15° from a line perpendicular to the center line of the stream at the intended crossing location.

Fish Migration Barriers – Stream crossings shall not cause sudden changes in stream elevation, drops or waterfalls, which could create a barrier to migrating fish.

Trench and Groundwater Dewatering – All dewatering shall be passed through a sediment removal measure (see Dewatering Measures in this book). There should be no turbid discharges to streams resulting from dewatering.

Stabilization and Removal – Stabilization of the crossing area shall be conducted immediately upon completion of the stream crossing. The specifications should define the type of stabilization, ideally woody vegetation, as described in the Stream Stabilization section of this book. Vegetation mats or Erosion Control Matting shall stabilize the crossing of the stream, within 50' of either streambank.

To minimize obstructions and barriers, all temporary bridges, culverts, and other structures must be removed as soon as the crossing is no longer needed. However, clean stone and rock similar in size to stream bed material is usually best left in the channel because removing it causes more disturbance. Stone and rock left in the channel must be formed so that it does not impede fish passage or significantly change the slope, dimension or flow pattern of the stream.

Plans and Specifications

The plans and specifications will show the location of the crossing. They also will contain the required material specifications.

Operation and Maintenance

Inspect temporary stream crossings after runoff-producing rains to check for blockage in channel, erosion of abutments, channel scour, stone displacement, or piping along culverts. Make all repairs immediately to prevent further damage to the installation.

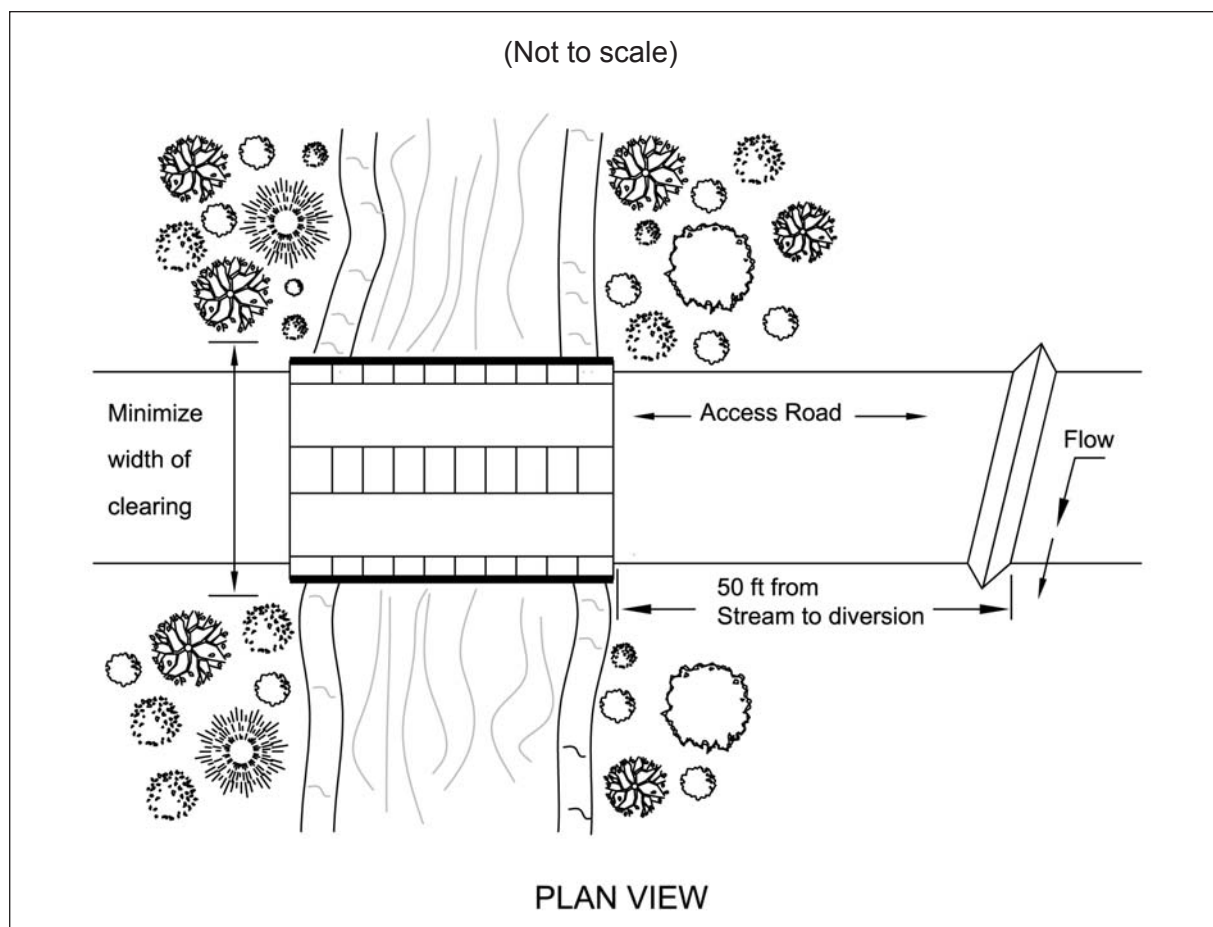
Remove temporary stream crossings immediately when they are no longer needed. Restore the stream channel to its original cross-section, and smooth and appropriately stabilize all disturbed areas.

Common Concerns

- Inadequate flow capacities and/or lack of overflow area around structure results in washout of the culvert or the bridge abatement.
- Inadequate stabilization of overflow area results in severe erosion around the bridge or culvert.
- Debris not removed after a storm event results in clogging that may cause washout of the culvert and/or bridge.
- Stone size too small causes the Ford to wash out.
- Inadequate compaction under or around culvert pipes, results in seepage and piping, causing the culvert to wash out.

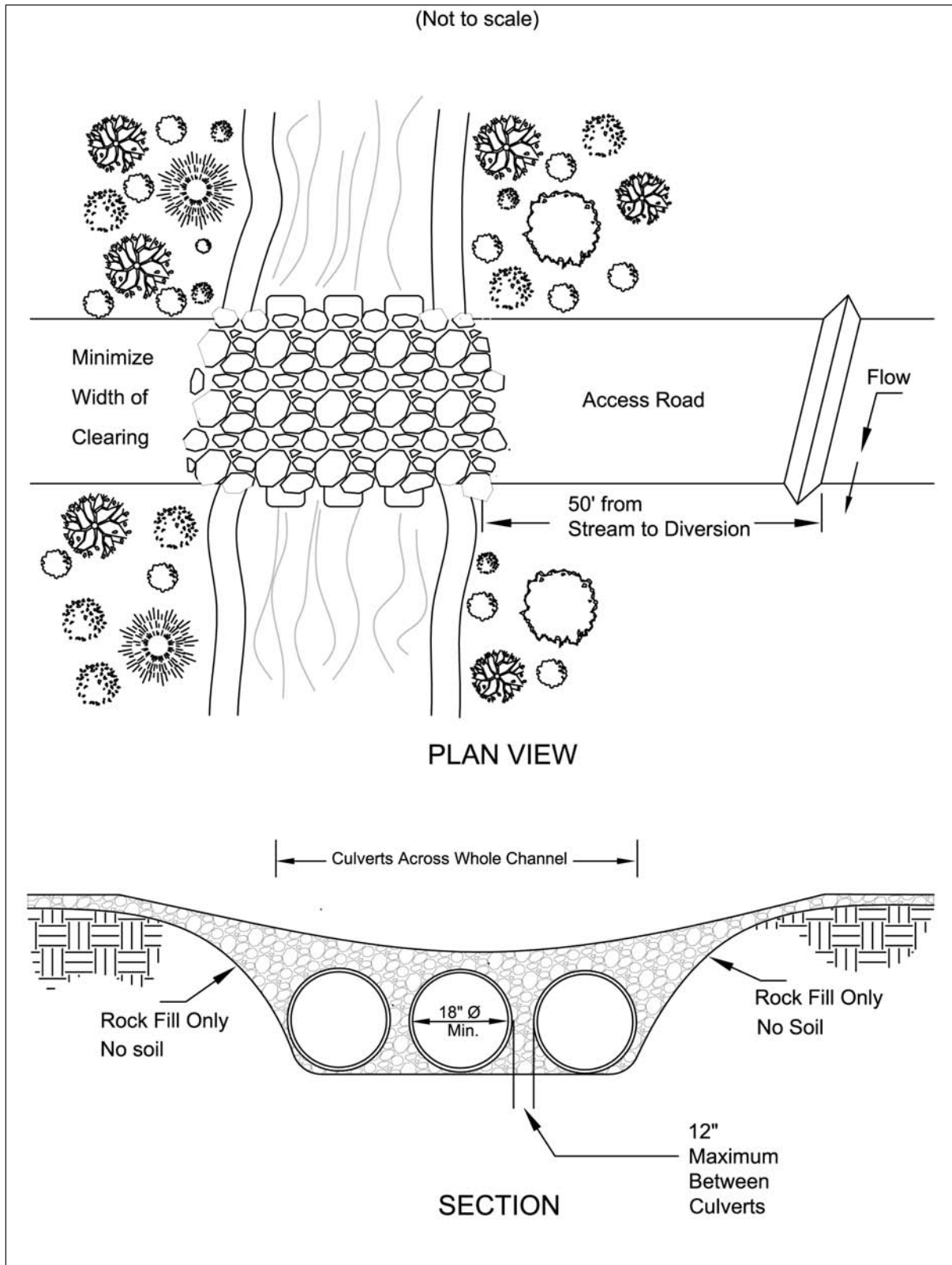
Specifications
for
Temporary Access Bridge

This specification does not define the strength of the temporary bridge. It shall be the designer's responsibility to select bridge construction materials with adequate strength for the anticipated construction traffic loads.



1. Stream Disturbance -Disturbance to the stream shall be kept to a minimum. Streambank vegetation shall be preserved to the maximum extent practical and the stream crossing shall be as narrow as practical.
2. Clearing shall be done by cutting NOT grubbing. The roots and stumps shall be left in place to help stabilize the banks and accelerate revegetation.
3. Water shall be prevented from flowing along the road directly to the stream. Diversions and swales shall direct runoff away from the access road to a sediment-control practice.
4. Bridges shall be constructed to span the entire channel. If the channel width exceeds 8 ft. as measured from the top-of-bank, then a footing, pier or bridge support may be constructed within the waterway. No more than one additional footing, pier or bridge support shall be permitted for each additional 8-ft. width of the channel. However, no footing, pier or bridge support will be permitted within the channel for waterways less than 8 ft. wide.
5. Some steep watersheds subject to flash flood events may require that the bridge be cabled ore secured to prevent downstream damage or hazard.
6. No fill other than clean stone free from soil shall be placed within the stream channel.

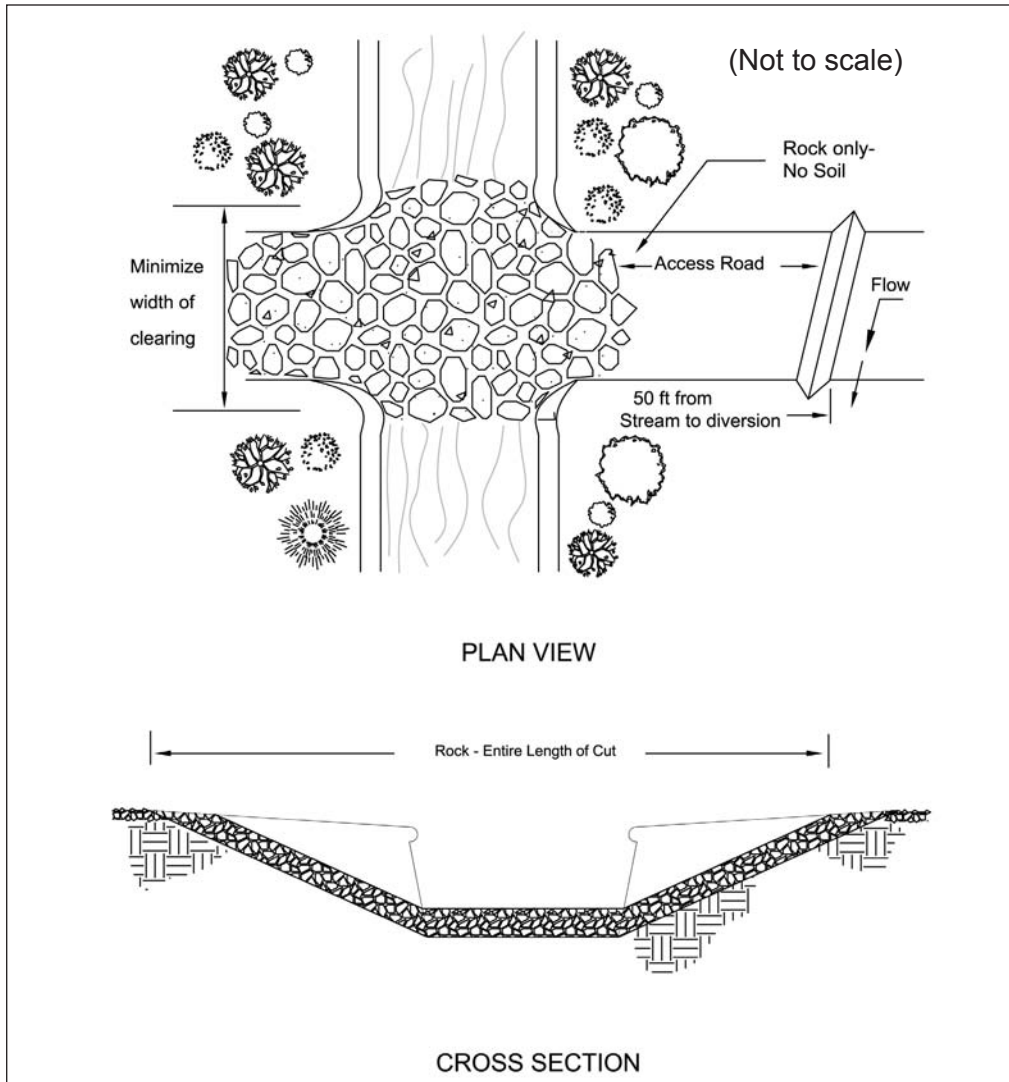
Specifications
for
Culvert Stream Crossing



Specifications
for
Culvert Stream Crossing

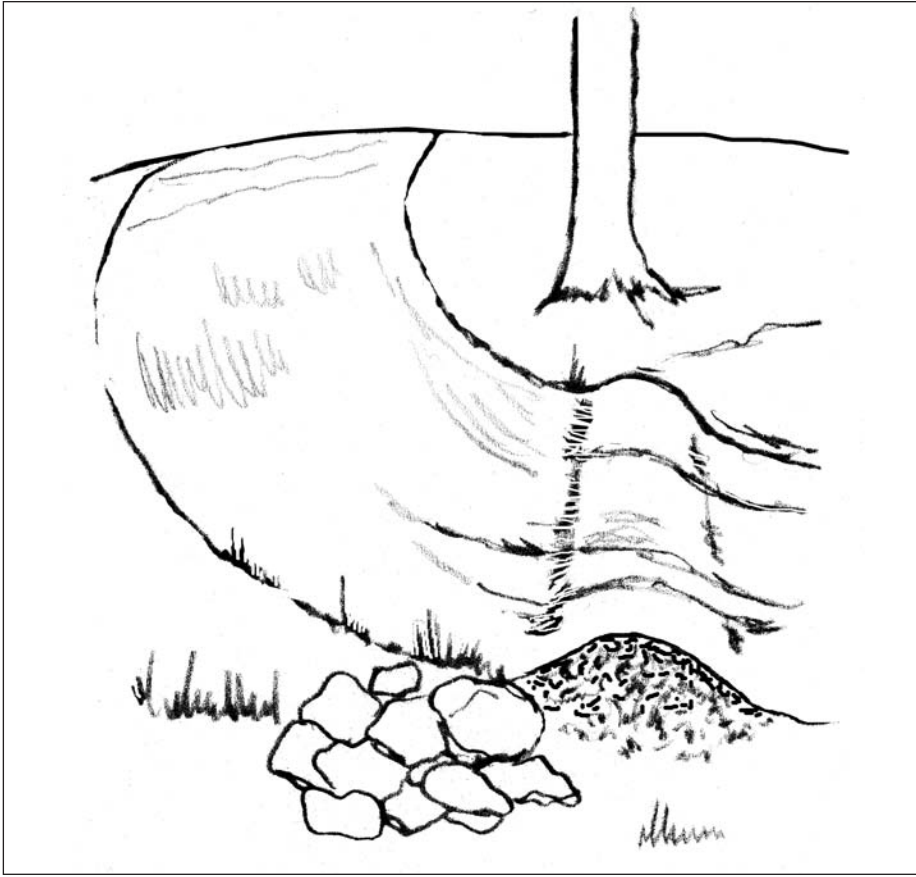
1. Stream Disturbance -Disturbance to the stream shall be kept to a minimum. Streambank vegetation shall be preserved to the maximum extent practical and the stream crossing shall be as narrow as practical.
2. Clearing shall be done by cutting NOT grubbing. The roots and stumps shall be left in place to help stabilize the banks and accelerate revegetation.
3. To minimize interference with fish spawning and migration, crossing construction should be avoided where practical from March 15 through June 15.
4. Water shall not be allowed to flow along the road directly to the stream. Diversions and swales shall direct runoff away from the access road to a sediment-control practice.
5. Placement -Culverts shall be placed on the existing streambed to avoid a drop or waterfall at the downstream end of the pipe, which would be a barrier to fish migration. Crossings shall be made in shallow areas rather than deep pools where possible.
6. Culvert Size -Culvert diameter shall be at least three times the depth of normal stream flow at the point of the stream crossing. If the crossing must be placed in deep, slow-moving pools, the culvert diameter may be reduced to twice the depth of normal stream flow. The minimum size culvert that may be used is 18 in.
7. Number of Culverts -There shall be sufficient number of culverts to completely cross the stream channel from streambank to streambank with no more than a 12-in. space between each one.
8. Fill and Surface Material -All material placed in the stream channel, around the culverts and on the surface of the crossing shall be stone, rock or aggregate. ODOT No. 1 shall be the minimum acceptable size. To prevent washouts, larger stone and rock may be used and they may be placed in gabion mattresses. NO SOIL SHALL BE USED IN THE CONSTRUCTION OF A STREAM CROSSING OR PLACED IN THE STREAM CHANNEL.
9. Removal -Aggregate stone and rock used for this structure does not need to be removed. Care should be taken so that any aggregate left does not create an impoundment or impede fish passage. All pipes, culverts, gabions or structures must be removed.
10. Stabilization -Streambanks shall be stabilized. Plantings shall include woody vegetation where practical.

Specifications
for
Temporary Stream Ford



1. Timing -No construction or removal of a temporary stream ford will be permitted on perennial streams from March 15 through June 15 to minimize interference with fish spawning and migration.
2. Stream Disturbance -Disturbance to the stream shall be kept to a minimum. Streambank vegetation shall be preserved to the maximum extent practical and the stream crossing shall be as narrow as practical. Clearing shall be done by cutting NOT grubbing where possible.
3. Surface Runoff -Water shall not be allowed to flow along the road directly to the stream. Diversions and swales shall direct runoff away from the access road to a sediment-control practice.
4. Fill and Surface Material -All material placed in the stream channel shall be stone, rock or aggregate. ODOT No. 1 shall be the minimum acceptable size. Larger stone and rock may be used. NO SOIL SHALL BE USED IN THE CONSTRUCTION OF A STREAM FORD OR PLACED IN THE STREAM CHANNEL.
5. Removal -Aggregate, stone and rock used for the stream crossing shall NOT be removed but shall be formed so it does not create an impoundment, impede fish passage, or cause erosion of streambanks.
6. Stabilization -Streambanks shall be stabilized. Plantings shall include woody vegetation where practical.

5.6 Water Bar



Description

A water bar is a diversion constructed across the slope of an access road or utility right-of-way. Water bars are used to reduce concentrated runoff on unpaved road surfaces, thus reducing water accumulation and erosion gullies from occurring. Water bars divert runoff to road side swales, vegetated areas or settling ponds.

Conditions Where Practice Applies

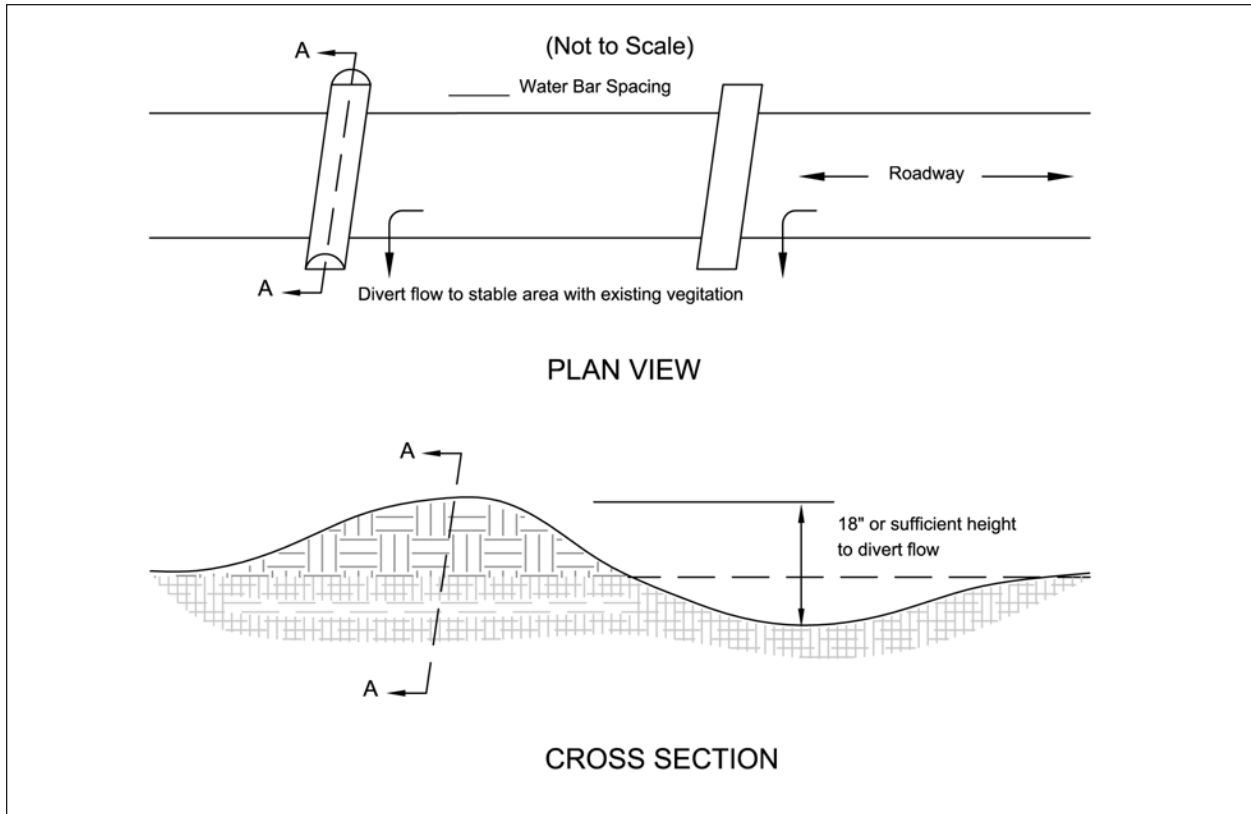
Water bars are used at construction site ingress/egress points, on long sloping access roads, on temporary construction roads, or at utility right-of-ways which do not have a stable surface or where runoff would otherwise collect and cause erosion.

Planning Considerations

If the contributing area is disturbed, this practice should be associated with sediment traps that will receive and treat the runoff.

The outlet of each water bar must be resistant to erosion. For small contributing areas, spreading the flow into a undisturbed vegetated area may be sufficient. For larger areas or higher velocities flow may need rock outlet protection to prevent gully erosion.

Specifications for Water Bar



1. The minimum water bar dimensions shall be:
 - Top width of berm/dike – 2 feet minimum.
 - Height/depth – 18 inches unless otherwise noted on plans.
 - Side Slopes – Sufficiently flat to accommodate the expected traffic.
2. The spacing between water bars shall be as noted:
3. The field location shall be adjusted as needed to provide a stabilized safe outlet.
4. The diverted runoff shall be directed onto an undisturbed vegetative area, to a settling trap or basin or trap if contributing area is stable.
5. Diversions/dikes shall be compacted by traversing with equipment during construction.
6. The water bars shall be angled slightly downslope across the centerline of the travel lane.

Table 5.6.1 Water Bar Spacing

Road Grade (%)	Distance (Ft.)
1	400
2	250
5	135
10	80
15	60
20	45

5.7 Dewatering Measures



Description

Dewatering measures provide a stable area for receiving and treating water pumped from excavation or work areas prior to being released off the site. These practices reduce sediment impacts to downstream water resources.

Conditions Where Practice Applies

De-watering measures are used whenever water, either surface or subsurface, prevents or hinders construction activities and has the potential of contributing sediment to streams. This practice is appropriate for any kind of pumping used in conjunction with construction activities.

Planning Considerations

Construction activities often require that water be pumped from an area to facilitate work. This water often has large amounts of suspended sediments. Rather than discharge this water directly to a stream, a means to settle or remove sediment must be provided.

A dewatering plan should be prepared utilizing ground water conditions and soils information to predict areas where de-watering will likely occur. Plans should include the length of time de-watering will occur, the method of de-watering (pumping, siphon...), the discharge point(s), methods to control sediment impacts and the contents of a written log to be kept on-site. These plans may need to be approved by local authorities prior to construction.

All dewatering discharges with suspended solids should pass through a practice to remove sediments. While a vegetated filter areas may be sufficient for some situations (e.g. short duration low pumping rates) many will need additional measures, such as sediment traps,

filter bag or flocculation. All structures must have adequate outlet protection to prevent gully erosion. Please note that the Ohio Environmental Protection Agency will find turbid discharges to the stream resulting from any dewatering activity a violation of Ohio Revised Code 6111.04 independent of the methods employed. Therefore even if one method is selected, additional measures may be required to fully treat turbid water.

The particle size distribution, that is the relative proportion of sands, silts and clays, of a soil that is suspended will determine the difficulty of removing sediments. Soils with coarser particle size distributions (large proportion of sand) will be easier to settle out with filter strips and settling ponds. Finer particle size distributions (predominantly silt and clays) will be increasingly difficult and may need a series of measures.

Ground Water Lowering: Often dewatering wells are established to lower the ground water table for utility installation or construction. Generally, this water is free from suspended solids and may be discharged to waters of the state provided the water is not contaminated.

Measures should be taken to ensure the discharge from the de-watering wells does not flow over disturbed areas and suspend sediments, resulting in contaminated discharge. Waterways established to transport dewatering flow should be protected from erosion from the point of discharge all the way to waters of the state. Extending hoses to waters of the state will ensure the discharge remains free from suspended solids. This practice is recommended for discharges of short duration.

Water pumped from wells is about 55° F, which may cause thermal impacts in some situations. High pumping rates near small streams in summer will have major changes in stream metabolism, i.e., throw off spawning. Where this potential occurs, groundwater should not be discharged directly to the stream but roughed through settling ponds or other shallow holding ponds.

The Ohio Department of Natural Resources, Division of Water requires a Water Withdraw Registration for the de-watering activities in the event the facility has the capacity of pumping in excess of 100, 000 gallons per day. This registration must be submitted to ODNR within 90 days following the completion of the project. A water withdraw registration can be obtained by contacting ODNR, Division of Water at 614-265-6735. Assistance regarding proper well installation and abandonment is also available.

Design Criteria

Vegetated Filter Areas: Densely vegetated areas may offer sufficient conditions to treat short duration discharges provided that: flow is not channelized directly to a water resource and the area encourages infiltration, slow overland flow and settling. A minimum of 100 feet is required to utilize a vegetated area. Dense grass or areas with natural depressions will provide the best conditions. Critical areas like wetlands (e.g. vernal pools) or areas with sensitive vegetation that will be damaged (smothering) by sedimentation should not be used.

Sediment trap or basin: In most cases, contaminated discharge should be directed to a sediment trap where the suspended solids can settle/filter out prior to the discharge to waters of the state. Sediment traps should have sufficient storage to receive all the discharged water from pumping and detain this water a minimum of 24 hours. The sediment storage volume is directly related to the pumping capacity and the amount of turbidity. The sediment pond should be designed to optimize the amount of travel time through the impoundment.

The sediment pond should not be more than 4 feet deep with the distance between the intake and outlet maximized to the extent practical.

Pump intakes should withdraw water from the surface of the trench or work area in order not to re-suspend or continually mix water. Continually drawing water from the floor of the area will draw the muddiest water and increase the amount of sediment that must be removed.

Geotextile Filter Bags are an increasingly common way to remove sediment from dewatering discharge. Commonly discharge is pumped into a filter bag chosen for the predominant sediment size. Filter bags are manufactured products made typically from woven monofilament polypropylene textile (coarse materials, e.g. sands) or non-woven geotextile (silts/clays). They are single use products that must be replaced when they become clogged or half full of sediment.

While they may be useful, they are generally high flow products, which have limited ability to treat fine-grained sediments. Gravity drained filter bags should apply the following:

- They should be placed outside of a vegetated filter area and not in close proximity to the stream or water resource.
- They must sit on a relatively flat grade so that water leaving the bag does not cause additional erosion. Placing the bag on a flat bed of aggregate will maximize the flow and useful surface area of the bag.
- They should be used in conjunction with a large vegetative buffer or a secondary pond or barrier

Enhanced Treatment Through Multiple Practices. The need for further reduction in turbidity will likely require more than one treatment measure. The following are devices or measures that when used in sequence with others will reduce turbidity.

Filter bags (gravity flow) are highly variable depending on the pore size and flow rate. Typically filter bags are limited to removing large particles (small sands and large silts).

Sediment traps, weir tanks, filter boxes are effective for the removal of large particles such as sand. Their effectiveness increases as detention times increase.

Sand Media Filters are effective for removal of smaller particles such as sand and large silts. These often have the ability to backflush and thus maintain effectiveness and flow rate.

Some commercially available additives are available for further decreasing turbidity. Chitosan and chitin based additives have been shown to significantly increase the effectiveness of filtration and settling. Chitosan (Poly-D-glucosamine) is a low-toxicity product extracted from Chitin (Poly-N-acetyl-D-glucosamine), a by-product of the shellfish industry. Other products such as anionic polyacrylamide (anionic PAM) are commercially available to increase settling. Often these are utilized through wet or dry dosing mechanisms or as water runs over a gel block upstream of a settling or filtration practice. Each product should be utilized within the manufacturer's specifications and tailored to the soil and site conditions.

Particulate filter units utilizing cartridges or enclosed filter bags can remove smaller particles depending on the filter size. This type of measure is usually necessary to treat clays. Filters may need to be changed daily or more frequently.

An example of an enhanced treatment might include: dewatering a trench with a trash pump to a settling tank or pit then pumping from the settling practice to a sand media filter or to a particulate filter.

Common Problems/Concerns

Complete settling of solids within the Sediment Basin does not occur prior to discharge. The length to width ratio of the pond must be increased to lengthen travel time through the structure. In addition, flocculent may be necessary to promote settlement.

Water discharged from subsurface/ground water pumping maybe significantly lower in temperature than that of the receiving stream. The water will need pre-conditioned in order to minimize the biological affects on the stream.

References

Virginia Department of Conservation and Recreation, 2002. *Erosion & Sediment Control Technical Bulletin #2: Application of Anionic Polyacrylimide for soil stabilization and stormwater management*. <http://www.dcr.state.va.us/sw/docs/anoinic.pdf>

Specifications
for
De-Watering

1. A de-watering plan shall be developed prior to the commencement of any pumping activities.
2. The de-watering plan shall include all pumps and related equipment necessary for the dewatering activities and designate areas for placement of practices. Outlets for practices shall be protected from scour either by riprap protection, fabric liner, or other acceptable method of outlet protection.
3. Water that is not discharged into a settling/treatment basin but directly into waters of the state shall be monitored hourly. Discharged water shall be within +/- 5° F of the receiving waters.
4. Settling basins shall not be greater than four (4) feet in depth. The basin shall be constructed for sediment storage as outlined in Chapter 6, SEDIMENT BASIN OR SEDIMENT TRAP. The inlet and outlet for the basin shall be located at the furthest points of the storage. A floating outlet shall be used to ensure that settled solids do not re-suspend during the discharge process. The settling basin shall be cleaned out when the storage has been reduced by 50% of its original capacity.
5. All necessary National, State and Local permits shall be secured prior to discharging into waters of the state