DPW Environmental Division-Prevention & Compliance Branch
Borrow Pit Excavation Management Requirements
Fort Stewart and Hunter Army Airfield, Georgia

Reference 391-3-6 Rules for Water Quality Control; 391-3-7 Rules for Erosion & Sedimentation; OCGA 12-5-20 GA Water Quality Control Act; OCGA 12-7-1 GA Erosion & Sedimentation Control Act of 1975 [amended 2003]; and OCGA 12-7-6 Stream Buffer Variance requirements.

The following are the Standard Operating Procedural requirements for Fort Stewart/Hunter Army Airfield Borrow Pit excavation and usage for National Pollution Discharge Elimination Systems Permitted and Siviculture Non-Permitted Borrow Pits:

For any Borrow Pit activity a Fort Stewart/Hunter Army Airfield Borrow Pit Permit application needs to be submitted to the Fort Stewart DPW, Environmental Division.

1. The Directorate of Public Works, Environmental Division, and Prevention & Compliance Branch Borrow Pit Management section will review **BORROW PIT EXCAVATION PERMIT APPLICATION** for completeness/adequacy. If complete, a permit will be issued and the data will be entered into the Borrow Pit Management database. The following criteria and management objectives will be used to formulate a permit decision on an individual Borrow Pit Excavation.

2. All borrow pit sites will require the project Contracting Officer Representative to coordinate with the Fort Stewart Environmental office to obtain a Borrow Pit Permit for an approved borrow pit site. Upon completion of the work at Fort Stewart/HAAF, a DPW Environmental Division, Borrow Pit Management representative will inspect the completed work for compliance with the individual Borrow Pit Excavation Plan and provide a release date and authorization. This will be noted on the Permit. In the event that an excavator has adversely deviated from the individual Borrow Pit Excavation Plan, the COR will be notified for corrective action. After a favorable final inspection the Permit information will reside on the Borrow Pit database as archived information with comments and notes as required for future reference, but it will no longer be marked as an Active Permit. A new application is required for any new work by the same contractor.

A. Excavation Procedure

• The Operator shall show an individual plan as to how the Borrow Pit will be excavated, the limits of the affected acreage, the natural drainage features and water disposal, the initial overburden (debris) area(s), the erosion and sedimentation controls, the ingress/egress area(s), the direction and schedule of excavation advancement, the area to be left undisturbed (buffer) where necessary, and a plan that shows projected final reclamation of the site.

• The Operator (user) of the borrow pit will create and maintain a rim-ditch *from the first day* of excavation operations to maximize accessibility to borrow pit materials and ultimately to optimize excavation of that material.

• The Operator will be required to utilize a water pump, where and when appropriate to fully extract all fill materials in a manner consistent with proper surfacing mining procedures and adhering to the Erosion

& Sedimentation Control Act of Georgia. Also, a sediment basin may become necessary and will be the responsibility of the contractor/operator for its construction.

• All borrow pit design and excavation actions shall support the objective of the borrow pit eventually becoming a recreational fishpond, if soil conditions, location and ground water resources favor such development. To accomplish this objective the following procedures should be employed, but will not take precedent over the need to obtain fill material. The requirement for fill material supersedes the use of the Borrow Pit as a fish pond. In certain cases excavation to greater depth may occur if soils are suitable for the specific project.

1. Average depth, when abandoned, will be 6 feet minimum and 15 feet maximum (water depth will range from 3-8 feet).

2. Borrow pits will be excavated in a manner, *from the beginning*, to ultimately move them to a useable recreational fishpond.

DAILY: the pit Operator shall be responsible for maintaining a 4:1 slope on all pit walls/edges and marking the slopes/edges in a manner so as to prevent any foot or vehicle traffic from inadvertently falling into the pit excavation.

B. Water Quality Control Measures

• The OCGA 12-5-20 GA Water Quality Control Act will be adhered too.

• No Point Source discharges *(i.e. dewatering operations)* shall be allowed without prior coordination with the Environmental Branch and BMPs will be followed at all times.

• Borrow pit excavation shall not be conducted within 100 feet of the banks of any waters of the State of Georgia, nor discharges to the water or ground to ensure no adverse affects on these waters.

C. Erosion & Sedimentation Control Measures

• The 391-3-7 Rules for Erosion & Sedimentation and the OCGA 12-7-1 GA Erosion & Sedimentation Control Act of 1975 [amended 2003] will be adhered too.

• Remain within the boundaries of the borrow pit (*which are marked by "red paint on the surrounding trees, and/or the perimeter road*) while making every effort to retain and/or create a buffer zone(s) of undisturbed/natural vegetation following all guidelines within *Georgia's Manual for Erosion and Sediment Control Best Management Practices* to prevent silts and sediments from leaving the borrow pit area and entering the waters of the State or wetland areas.

> **VEGETATION:** All marketable timber will be salvaged. Top soil will be salvaged, stockpiled and spread on areas to be vegetated. Trees outside of the clearing line will be protected from damage by appropriate markings. Supplemental vegetation will be established.
>
> **BUFFER REQUIREMENTS:** An undisturbed natural vegetative buffer of 25 feet measured from the stream banks (100 feet measured horizontally, adjacent to trout streams) shall be retained adjacent to any state waters except where a drainage structure must be constructed, provided that adequate erosion control measures are incorporated in the project plans and specifications are implemented.

EROSION CONTROL PROGRAM: Clearing will be kept to an absolute minimum. Land-disturbing will be scheduled to limit exposure of exposed soils to erosive elements. Stormwater management structures will be employed to prevent erosion in areas of concentrated water flows. Erosion at the exits of all stormwater structures will be prevented by the installation of storm drain outlet protection devices.

SEDIMENT CONTROL PROGRAM: Sediment control basins will be installed when appropriate, approximately 375 feet of temporary brush barriers. Diversions will be installed to divert sediment laden runoff into the sediment basins and to protect cut and fill slopes from erosive water flow.

MAINTENANCE PROGRAM: Sediment and erosion control measures will be inspected daily by the operators. Any damages observed will be repaired by the end of that day. Cleanout of sediment control structures will be accomplished in accordance with the specifications and sediment disposal accomplished by spreading on the site. When applicable, Sediment basins and barriers will remain in place until sediment contributing areas are stabilized.

NOTE: See attached guidelines from the *Manual for Erosion & Sedimentation Control in Georgia*

• All slopes will be stabilized with an appropriate ground cover so as to prevent the erosion of the borrow pit's slopes. If the first application is not sufficient to prevent erosion *the pit operator will be responsible for returning to the borrow pit to correct the deficiencies that have resulted in erosion of the borrow pit's slopes.*

D. Air Quality Measures

• Where applicable, adverse effects from atmospheric elements, specifically fugitive dust, are to be prevented so as to avoid any significant deterioration of the air quality.

E. Solid/Hazardous Waste Measures

• All solid and hazardous wastes shall be disposed of properly.

• No debris, trash, or other garbage will be left at, in, or adjacent to the borrow pit.

E. Borrow Pit Expansions:

• Any borrow pit expansions must be pre approved and coordinated with the DPW Environmental Division.

F. Inspections:

• The operator‘s utilizing borrow pits must ensure all Standard Operating Procedures are being adhered too. Random or impromptu site inspections will be performed by DPW Environmental Division personnel to ensure continuing compliance and the proper maintenance of erosion and sediment control measures.

Waters of the United States and Erosion and Sediment Control

Wetlands are defined as areas that are inundated by surface or ground water for a long enough period of time that the area supports the growth of vegetation that can perpetuate in saturated soil. Wetlands are a valuable resource, and it is imperative that these areas are protected from damage caused by adjacent erosion and subsequent sedimentation. While state law does not necessarily require buffers adjacent to wetlands, these areas are still considered valuable, and all efforts must be made to protect these areas during land disturbing activities. Obviously, the best and most effective method for protecting wetlands is maintaining a buffer between and land-disturbing activity and the wetland. If this is not possible, standard erosion and sediment control devices can be utilized to protect these areas. As always, it is imperative that these devices be designed, installed, and properly maintained.

The Georgia Erosion and Sediment Control (E&SC) Act requires that land-disturbing activities in Georgia are protected from erosion and subsequent sedimentation up to and including a 25-year storm. Few realize that activities that impact Waters of the United States can mean stricter Federal requirements for erosion and sediment control. Waters of the United States are navigable waters as well as adjacent wetlands and tributaries to navigable waters. Discharge of dredged of fill material into Waters of the United States is regulated by the United States Army Corps of Engineers under Section 404 of the Clean Water Act (33 U.S.C. 1344).

While State Law requires E&SC protection for a 25-year storm, Federal Law requires that adequate erosion and sediment control must be implemented during land-disturbing activities where a section 404 permit (usually known as a wetland permit) is required. Few realize that minor activities of filling and dredging, while not requiring U.S. Army Corps of Engineers notification, still must meet the Federal requirement of "adequate erosion and sediment control" as if a permit had been issued. According to Federal Law, "adequate equates to "no failures tolerated." In short, when filling or dredging activity impacts any Waters of the United States, adequate erosion control must occur at the site. Therefore, during land-disturbing activities regulated by the state, erosion and sediment control regulations fall under stricter Federal guidelines as well as the standard State guidelines if Waters of the United States are impacted.

To get more information concerning discharge of dredged or fill material into Waters of the United States, permitting for these activities, and stipulations for permitting please contact the United States Army Corps of Engineers, Savannah District, Regulatory Branch, at 1-800-652-5065.

Buffer Zone

Bf

DEFINITION

A strip of undisturbed, original vegetation, enhanced or restored existing vegetation or the re-establishment of vegetation surrounding an area of disturbance or bordering streams, ponds, wetlands, lakes and coastal waters.

PURPOSE

To provide a buffer zone serving one or more of the following purposes:

- Reduce storm runoff velocities
- Act as screen for "visual pollution"
- Reduce construction noise
- Improve aesthetics on the disturbed land
- Filtering and infiltrating runoff
- Cooling rivers and streams by creating shade
- Provide food and cover for wildlife and aquatic organisms
- Flood protection
- Protect channel banks from scour and erosion.

CONDITIONS

A natural strip of vegetation should be preserved and, if needed, supplemented to form the buffer zone. There are two types of buffer zones.

General Buffers

A strip of undisturbed, original land surrounding the disturbed site. It can be useful not only to filter and infiltrate runoff, but also to act as a screen for "visual pollution" and reduce construction noise. General buffers may be enhanced to achieve desired goals.

Vegetated Stream Buffers

Buffers bordering streams are critical due to the invaluable protection of streams from sedimentation. Stream buffers are also useful in cooling rivers and providing food and cover for wildlife. Refer to the minimum requirements in Act 599 (O.C.G.A. 1-7-1, et. seq.) and Chapters 16 and 18 of the NRCS Engineering Field Handbook.

In most cases, the buffer zone will be incorporated into the permanent vegetative cover. Refer to specification **Ds3 - Disturbed Area Stabilization (With Permanent Vegetation).**

DESIGN SPECIFICATIONS

Important design factors such as slope, hydrology, width and structure shall be considered. While Georgia's Environmental Protection Division enforces minimum stream buffer requirements, expanding the stream buffer width is always encouraged. If any land-disturbing activity, including exempt and non-exempt practices, occurs within the EPD mandated stream buffers, cut and fills within the buffer shall be stabilized with appropriate matting or blanket.

General Buffers

A width should be selected to permit the zone to serve the purpose(s) as listed above. Supplemental plantings may be used to increase the effectiveness of the buffer zone.

Vegetated Stream Buffers

The structure of vegetated stream buffers should be considered to determine if the buffer must be enhanced to achieve the necessary goals. The size of the stream as well as the topography of the area must be considered to determine the appropriate width of the vegetated stream buffer. A vegetated stream buffer of 50 feet or greater can protect waters from excess sedimentation. The buffer should be increased 2 feet in width for every 1% slope (measured along a line perpendicular to the stream bank). Surface water pollution can be reduced with a 100 foot or wider vegetative buffer.

A general multipurpose riparian buffer consists of three zones.

1. Zone 1 The first 20 feet nearest the stream should consist of trees spaced 6-10 feet apart.
2. Zone 2 The next 10 feet should consist of managed forest.
3. Zone 3 The following 20 feet should be comprised of grasses.

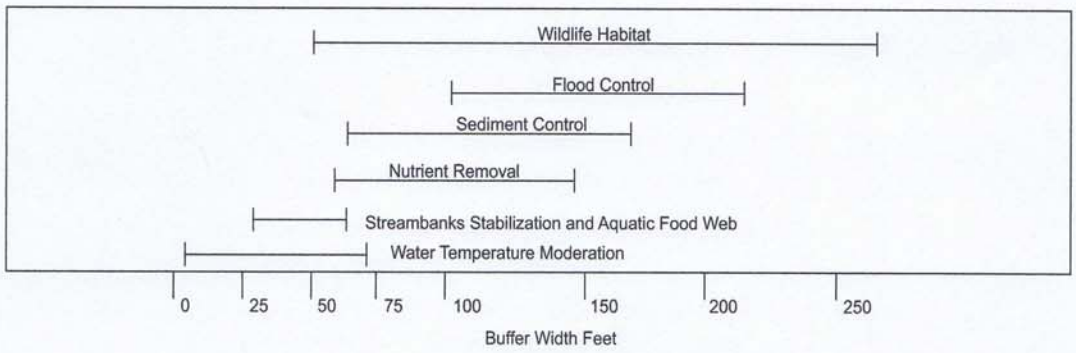


Figure 6-1.1 - Range of Minimum Width for Meeting Specific Buffer Objectives (Palone and Todd, draft)

This general multipurpose design contains trees and shrubs that help to stabilize stream banks and grasses which spread and reduce the flow from adjacent areas as well as increase settling and infiltration. See Tables 6-1.1 and 6-1.2 for suggested plant species.

If the ideal vegetated buffer width cannot be achieved; narrower buffers can still be used to obtain the goals concerning forest structure and riparian habitat. If this is the case, several design principals should be considered:

1. **Sheet flow** should be encouraged at the edge of the vegetated stream buffer.

2. The **structure** of the buffer should consist of under-story and canopy species.

3. The **width** should be proportional to the watershed area and slope.

4. **Native** and **non-invasive** plant species should be used.

5. **Density** must be considered to determine if the existing buffer must be enhanced to achieve the necessary goals. Vegetation must be dense enough to filter sediment and provide detrital nutrients for aquatic organism.

Streambank stabilization techniques may be required if steep slopes and hydrologic patterns deem it necessary. Refer to specification **Sb - Streambank Stabilization (Using Permanent Vegetation)**. Vegetated stream buffers on steep slopes may need to be wider to effectively filter overland flow. Corridors subject to intense flooding may require additional stream bank stabilization measures.

PLANTING TECHNIQUES

Plantings for buffer re-establishment and enhancement can consist of bare root seedlings, container-grown seedlings, container-grown plants, and balled and burlapped plants. Refer to Tables 6-1.1 and 6-1.2, and Wildlife Plantings in **Ds3 - Disturbed Area Stabilization (With Permanent Vegetation)**. Standard permanent erosion control grasses and legumes may be used in denuded areas for quick stabilization. Refer to specification **Ds3 - Disturbed Area Stabilization (With Permanent Vegetation)**. Availability, cost, associated risk, equipment, planting procedures, and planting density must be considered when choosing planting types.

Soil preparation and maintenance are essential for the establishment of planted vegetation. Soil fertility, weed control, herbaceous cover, as well as additional associated products may be required.

OPERATIONS AND MAINTENANCE

Areas closest to the stream should be maintained with minimal impact.

Watering

During periods of drought as well as during the initial year, watering may be necessary in all buffer areas planted for enhancement.

Weed Control

Weeds can be removed by hand or with careful spraying.

Replanting

It is imperative that the structure of the vegetated stream buffer be maintained. If the buffer has been planted, it is suggested that the area be monitored to determine if plant material must be replaced. See Tables 6-1.1 and 6-1.2 for suggested plant species. Provisions for the protection of new plantings from destruction or damage from beavers shall be incorporated into the plan.

Fertilizer

If appropriate vegetation is chosen, it is unlikely that fertilizer will be necessary.

Local Contacts:

USDA Natural Resources Conservation Service

Georgia Forestry Commission

Table 6-1.1 - Unrooted Hardwood Cuttings

PLANTS SUITABLE FOR USE AS UNROOTED (HARDWOOD) CUTTINGS					
Species	**Region**	**Tolerance To Flooding**	**Tolerance To Drought**	**Tolerance To Deposition**	**Tolerance To Shade**
Acer negundo Boxelder	C,P,M	H	H	H	L
Baccharis halimifolia Groundsel bush	C,P (lower)	M	M	H	L
Cornus amomum Silky dogwood	P,M	L	M	L	M
Cornus sericia Ssp. slolonifera Red osier dogwood	P,M	L	M	H	M
Crataegus sp. Hawthon	C,P,M	M	H	L	L
Populus deltoids Eastern cottonwood	C,P,M	M	M	H	L
Salix sp. interior Sandbar willow	C,P,M	H	L	H	L
Salix nigra Black willow	C,P,M	H	H	H	L
Salix purpurea Streamco willow	C,P,M	H	M	H	L
Salix x colleti Bankers willow	P,M	H	M	H	L
Sambucus canadensis American elderberry	P,M	H	M	M	M
Viburnum denlatum Arrowwood viburnum	C,P,M	M	M	M	M
Viburnum lentago Nannyberry viburnum	C,P,M	M	M	L	M

Adapted from the USDA/NRCS Engineering Field Handbook, Chapter 18

Table 6-1.1 - Unrooted Hardwood Cuttings - continued

Legend:

Tolerance to Flooding, Drought, Deposition, and Shade

H = High

M = Medium

L = Low

Region

C = Coastal

P = Piedmont

M = Mountain

Rooting of all species will be improved if nearby vegetation is pruned to increase sunlight penetration.

Whenever possible, harvest hardwood cuttings as close to the repair site as possible.

Many of the above grow naturally along streams, in adjacent wetlands, along sewer and power line easements, and where streams enter lakes and along lake shores. Willows generally grow profusely in stormwater detention ponds in urban areas.

ALWAYS OBTAIN PERMISSION FROM THE PROPERTY OWNER BEFORE HARVESTING PLANTS!

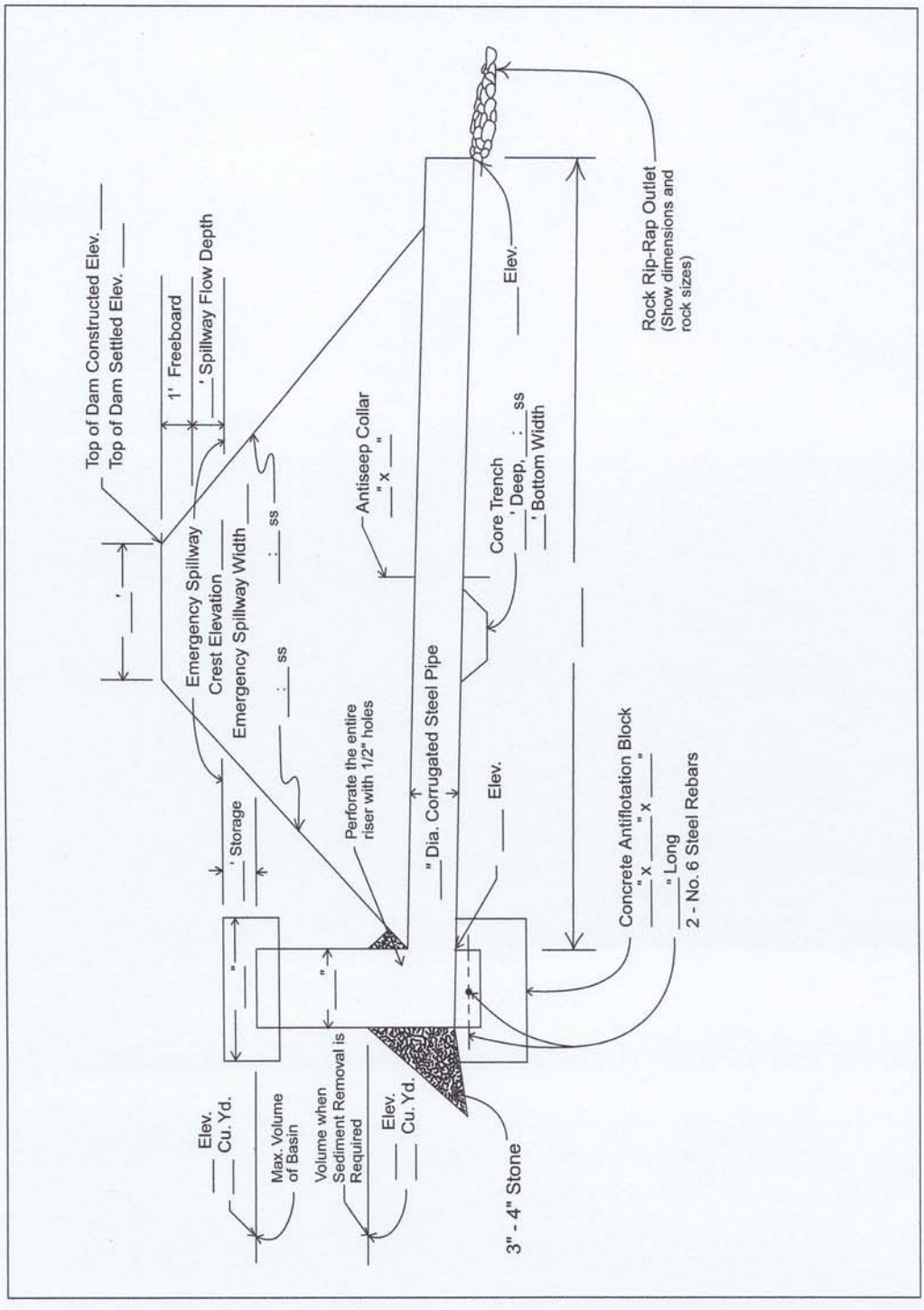
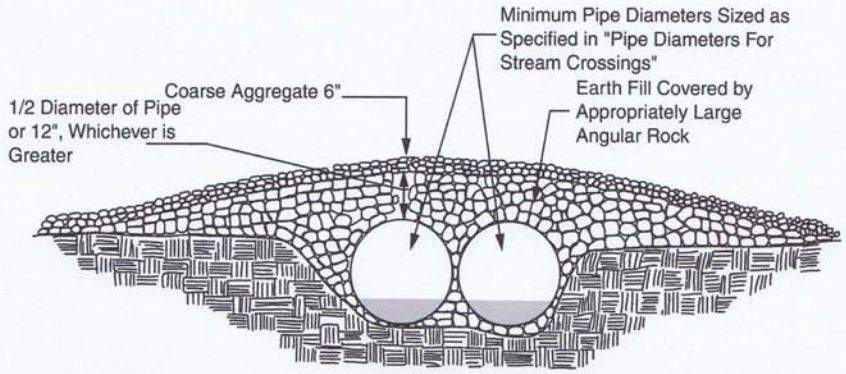
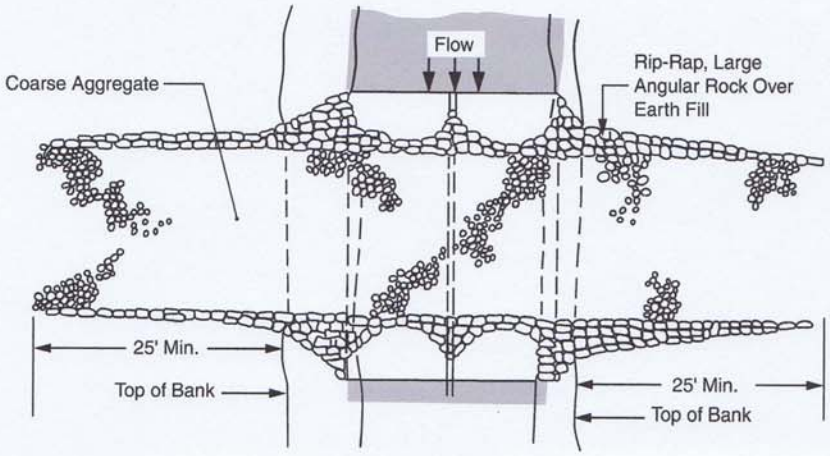


Figure 6-22.8 - Temporary Sediment Basin Cross-Sectional Detail



ELEVATION



PLAN

GENERAL NOTES:

1. Not to scale.
2. This type of crossing can be installed in both a wet or dry weather stream condition where the drainage area exceeds 10 acres.
3. Remove during cleanup.

Figure 6-23.2

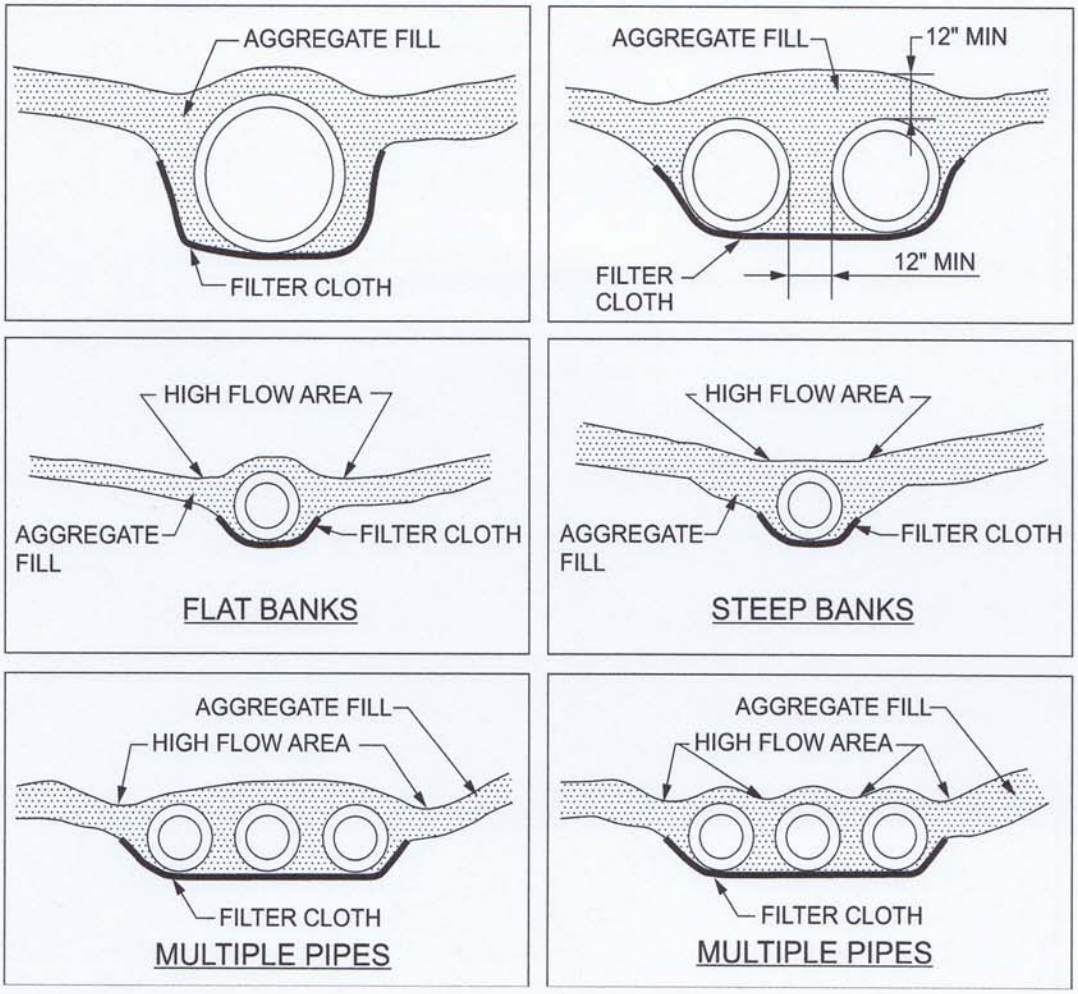


Figure 6-23.3 - Configuration of Temporary Culvert Crossing

Storm Drain Outlet Protection

St

DEFINITION

Paved and/or riprapped channel sections, placed below storm drain outlets.

PURPOSE

To reduce velocity of flow before entering receiving channels below storm drain outlets.

CONDITIONS

This standard applies to all storm drain outlets, road culverts, paved channel outlets, etc., discharging into natural or constructed channels. Analysis and/or treatment will extend from the end of the conduit, channel or structure to the point of entry into an existing stream or publicly maintained drainage system.

DESIGN CRITERIA

Structurally lined aprons at the outlets of pipes and paved channel sections shall be designed according to the following criteria:

Capacity

Peak stormflow from the 25-year, 24-hour frequency storm or the storm specified in Title 12-7-1 of the Official Code of Georgia Annotated or the design discharge of the water conveyance structure, whichever is greater.

Tailwater Depth

The depth of tailwater immediately below the pipe outlet must be determined for the design capacity of the pipe. Manning's Equation may be used to determine tailwater depth. If the tailwater depth is less than half the diameter of the outlet pipe, it shall be classified as a Minimum Tailwater Condition. If the tailwater depth is greater than half the pipe diameter, it shall be classified as a Maximum Tailwater Condition. Pipes which outlet onto flat areas with no defined channel may be assumed to have a Minimum Tailwater Condition.

Apron Length and Thickness

The apron length and d_{50}, stone median size, shall be determined from the curves according to tailwater conditions:

Minimum Tailwater- Use Figure 6-24.1

Maximum Tailwater- Use Figure 6-24.2

Maximum Stone Size = 1.5 x d50

Apron Thickness = 1.5 x dmax

Apron Width

If the pipe discharges directly into a well-defined channel, the apron shall extend across the channel bottom and up the channel banks to an elevation one foot above the maximum tailwater depth or to the top of the bank (whichever is less). If the pipe discharges onto a flat area with no defined channel, the width of the apron shall be determined as follows:

a. The upstream end of the apron, adjacent to the pipe, shall have a width three times the diameter of the outlet pipe.

b. For a Minimum Tailwater Condition, the downstream end of the apron shall have a width equal to the pipe diameter plus the length of the apron. Refer to Figure 6-24.1.

c. For a Maximum Tailwater Condition, the down stream end shall have a width equal to the pipe diameter plus 0.4 times the length of the apron.

Refer to Figure 6-24.2.

Bottom Grade

The apron shall be constructed with no slope along its length (0.0% grade). The invert elevation of the downstream end of the apron shall be equal to the elevation of the invert of the receiving channel. There shall be no overfall at the end of the apron.

Side Slope

If the pipe discharges into a well-defined channel, the side slopes of the channel shall not be steeper than 2:1.

Alignment

The apron shall be located so that there are no bends in the horizontal alignment.

Geotextile

Geotextiles should be used as a separator between the graded stone, the soil base, and the abutments. The geotextile will prevent the migration of soil particles from the subgrade into the graded stone. The geotextile shall be specified in accordance with AASHTO M288-96 Section 7.5, *Permanent Erosion Control Recommendations.* The geotextile should be placed immediately adjacent to the subgrade without any voids.

Materials

The apron may be lined with riprap, grouted riprap, or concrete. The median sized stone for riprap, d_{50}, shall be determined from the curves, Figures 6-24.1 and 6-24.2, according to the tailwater condition. The gradation, quality and placement of riprap shall conform to Appendix C.

Refer to Figure 6-24.4, for alternative structures to achieving energy dissipation at an outlet. For information regarding the selection and design of these alternative energy dissipators, refer to:

FHWA Standard (REF. Hydraulic Design of Energy Dissipators for Culverts and Channels; HEC No. 14, FHWA, Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

CONSTRUCTION SPECIFICATIONS

1. Ensure that the subgrade for the filter and riprap follows the required lines and grades shown in the plan. Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil may also be filled by increasing the riprap thickness.

2. The riprap and gravel filter must conform to the specified grading limits shown on the plans.

3. Geotextile must meet design requirements and be properly protected from punching or tearing during installation. Repair any damage by removing the riprap and placing another piece of filter fabric over the damaged area. All connecting joints should overlap a minimum of 1 ft. If the damage is extensive, replace the entire filter fabric.

4. Riprap may be placed by equipment, but take care to avoid damaging the filter.

5. The minimum thickness of the riprap should be 1.5 times the maximum stone diameter.

6. Construct the apron on zero grade with no overfall at the end. Make the top of the riprap at the downstream end level with the receiving area or slightly below it.

7. Ensure that the apron is properly aligned with the receiving stream and preferably straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.

8. Immediately after construction, stabilize all disturbed areas with vegetation.

9. Stone quality - Select stone for riprap from field stone or quarry stone. The stone should be hard, angular, and highly weather-resistant. The specific gravity of the individual stones should be at least 2.5.

10. Filter - Install a filter to prevent soil movement through the openings in the riprap. The filter should consist of a graded gravel layer or a synthetic filter cloth. See Appendix C; p. C-1.

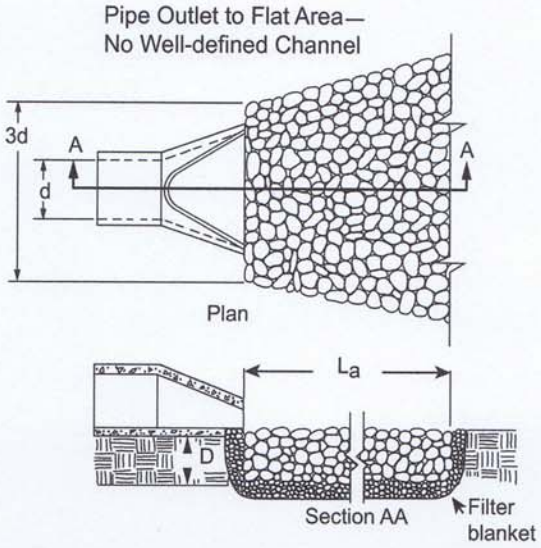
MAINTENANCE

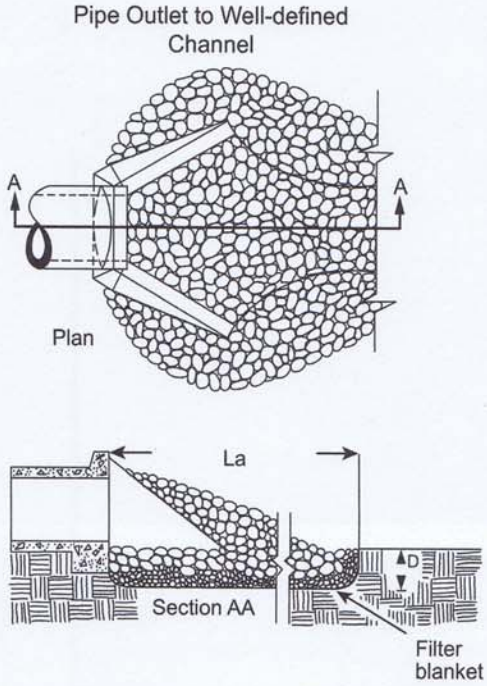
Inspect riprap outlet structures after heavy rains to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

1. The flow characteristics of the pipe at full flow including pipe diameter, flow rate (cfs), velocity (fps), and tailwater condition.

2. The dimensions of the apron including length (La), width at the headwall (W_1), downstream width (W_2), average stone diameter (d50), and stone depth (D) designed in accordance with Figures 6-24.1 and 6-24.2.





Notes

1. L_a is the length of the riprap apron.
2. D = 1.5 times the maximum stone diameter but not less than 6".
3. In a well-defined channel extend the apron up the channel banks to an elevation of 6" above the maximum tailwater depth of to the top of the bank, whichever is less.
4. A filter blanket or filter fabric should be installed between the riprap and soil foundation.

Figure 6-24.3 - Riprap Outlet Protection (Modified From Va SWCC)

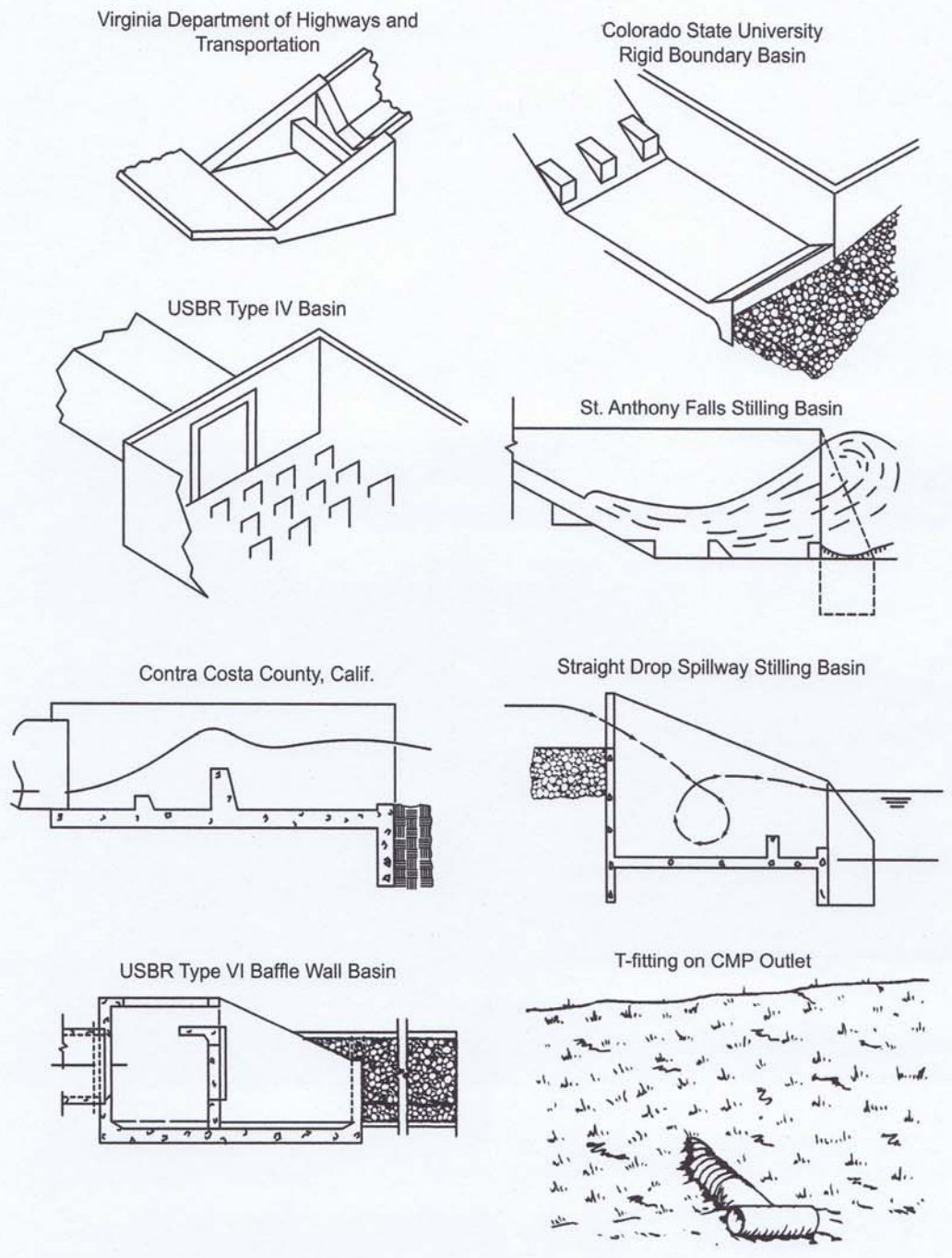


Figure 6-24.4 - Alternative Structures For Energy Dissipation at an Outlet (Modified From Goldman, Jackson, and Bursztynsky)

Dust Control on Disturbed Areas

Du

DEFINITION

Controlling surface and air movement of dust on construction sites, roads, and demolition sites.

PURPOSE

- To prevent surface and air movement of dust from exposed soil surfaces.

- To reduce the presence of airborne substances which may be harmful or injurious to human health, welfare, or safety, or to animals or plant life.

CONDITIONS

This practice is applicable to areas subject to surface and air movement of dust where on and off-site damage may occur without treatment.

METHOD AND MATERIALS

A. TEMPORARY METHODS

Mulches. See standard **Ds1 - Disturbed Area Stabilization (With Mulching Only)**. Synthetic resins may be used instead of asphalt to bind mulch material. Refer to standard **Tb-Tackifiers and Binders**. Resins such as Curasol or Terratack should be used according to manufacturer's recommendations.

Vegetative Cover. See standard **Ds2 - Disturbed Area Stabilization (With Temporary Seeding)**.

Spray-on Adhesives. These are used on mineral soils (not effective on muck soils). Keep traffic off these areas. Refer to standard **Tb-Tackifiers and Binders**.

Tillage. This practice is designed to roughen and bring clods to the surface. It is an emergency measure which should be used before wind erosion starts. Begin plowing on windward side of site. Chisel-type plows spaced about 12 inches apart, spring-toothed harrows, and similar plows are examples of equipment which may produce the desired effect.

Irrigation. This is generally done as an emergency treatment. Site is sprinkled with water until the surface is wet. Repeat as needed.

Barriers. Solid board fences, snowfences, burlap fences, crate walls, bales of hay and similar material can be used to control air currents and soil blowing. Barriers placed at right angles to prevailing currents at intervals of about 15 times their height are effective in controlling wind erosion.

Calcium Chloride. Apply at rate that will keep surface moist. May need retreatment.

B. PERMANENT METHODS

Permanent Vegetation. See standard **Ds3 -Disturbed Area Stabilization (With Permanent Vegetation)**. Existing trees and large shrubs may afford valuable protection if left in place.

Topsoiling. This entails covering the surface with less erosive soil material. See standard **Tp - Topsoiling**.

Stone. Cover surface with crushed stone or coarse gravel. See standard **Cr-Construction Road Stabilization**.