

WEST VIRGINIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

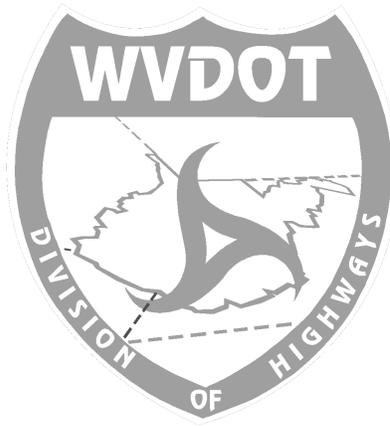
EROSION AND SEDIMENT CONTROL MANUAL



MARCH 1, 2003

WEST VIRGINIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

***EROSION
AND
SEDIMENT CONTROL
MANUAL***



MARCH 1, 2003

PREPARED BY: ENGINEERING DIVISION
TECHNICAL SERVICES SECTION
JAMES E. SOTHEN, DIRECTOR



WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

Division Of Highways

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Bob Wise
Governor

Fred VanKirk, P. E.
Secretary/Commissioner

October 1, 2004

MEMORANDUM

TO: ALL HOLDERS OF THE EROSION AND SEDIMENT CONTROL MANUAL

**FROM: JAMES E. SOTHEN, DIRECTOR
ENGINEERING DIVISION**

**SUBJECT: ADDENDUM 1 TO THE 2003
EROSION AND SEDIMENT CONTROL MANUAL**

Attached for your use is Addendum 1 to the 2003 Erosion and Sediment Control Manual. This addendum is necessary to revise the West Virginia Department of Transportation, Division of Highways, Erosion and Sediment Control Manual, dated March 1, 2003.

Also included in this package are the sections of the Erosion and Sediment Control Manual that are affected. The revisions are as follows:

- Remove and destroy the existing Section 20, Temporary erosion and Sediment Control Features, dated March 1, 2003 and replace it with the attached revised Section 20, Temporary erosion and Sediment Control Features, dated September 1, 2004.
- Remove and destroy the existing Section 30, Design, dated March 1, 2003 and replace it with the attached revised Section 20, Design, dated September 1, 2004.

JES:Lf

Attachments

PREFACE

This manual has been prepared in accordance with the American Association of State Highway and Transportation Officials (*AASHTO*) publication “Erosion and Sediment Control in Highway Construction,” Volume III, 1992.

The Federal Highway Administration has adopted this publication as their guidelines with a recommendation that all state highway agencies apply these guidelines or develop their own if it is equal to or more stringent than the *AASHTO* guidelines.

In addition this manual complies with the requirements of the National Pollutant Discharge Elimination System (NPDES) General Water Pollution Control Permit as administered by the West Virginia Department of Environmental Protection (WVDEP).

The intent is to provide Design, Construction, Maintenance and Contractor’s personnel with a set of erosion and sediment control guidelines that will fall within local, state and federal regulations.

Since the West Virginia Department of Transportation, Division of Highways (WVDOH) has designed projects utilizing both the English and Metric units of measurement this manual has been developed using both units of measurement and will be shown as follows:

English (*Metric*)

The exception to this rule will be any tables that have been developed for use in this manual. The General NPDES Permit contained in Section 70 contains only English units.

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SECTION

10

INTRODUCTION

10 – INTRODUCTION:

Soil erosion is the naturally occurring process by which the land is worn away by the action of water, wind, ice and gravity. This manual will deal primarily with water erosion and its resulting sedimentation. Water erosion occurs when soil particles are displaced by rainfall and carried away with the runoff. The erosion rate of the soil is dependent upon the soil properties, terrain characteristics, intensity and duration of rainfall, and the volume and characteristics of the water flow. The process is accelerated when the land has been disturbed by removal of the vegetative or other natural protection of the soil.

Sedimentation is the process of the deposition of the eroded soil particles. Sedimentation occurs when the velocity of the water containing suspended eroded soil particles is slowed to a sufficient degree and for a sufficient time, to allow the particles to settle out of suspension. This may occur in lakes, reservoirs, streams, or other drainage ways. As a result of sedimentation, drainage ways are restricted, culverts are plugged, property is damaged, and ecology systems of streams are affected. Sedimentation in terms of sheer volume ranks above domestic sewage, industrial wastes and chemicals as a major source of water pollution.

The WVDOT has committed to the use of “**Best Management Practices**” (BMP’s) to control soil erosion and its resulting sedimentation during the design, construction, and maintenance of its highways. A BMP is a physical, structural and/or management practice used either singularly or in combination to control, prevent, or eliminate pollution generated by non-point sources. The term “**best**” is applied when the practice is determined to be the most appropriate alternative for the specific situation.

Factors influencing the determination of the appropriate BMP are regulatory, economical, technological, social impacts, and effectiveness. The ultimate test of appropriateness comes once the BMP, approved by a regulatory agency, is installed properly and is functioning for its intended purpose.

The proper usage of erosion and sediment controls will allow the development of highways while accomplishing three general erosion control objectives. These objectives are:

- Limiting off-site effects to acceptable levels;
- Facilitating project construction and minimizing overall costs; and
- Complying with federal, state, and local regulations.

This manual has been prepared as a guide for use by WVDOT personnel, consultants, and contractors involved in the design, construction, and maintenance of highways. This information will aid all those involved in these activities to better perform the individual tasks concerning erosion and sediment control. This manual is not intended to incorporate all the available methodologies of erosion and sediment control. Each project will present its own unique situations that will require the designer, inspector, contractor, etc., to use their imagination. It is, therefore, imperative that all involved personnel become familiar with this manual and the principles behind it to allow appropriate decisions.

Every successful BMP has three main aspects that everyone is to consider when finalizing erosion and sediment control features that deal with erosion and sedimentation.

These are as follows:

- **Timely implementation;**
- **Proper installation and capacity; and**
- **Regular maintenance and inspection.**

These three aspects must be present to insure that the BMP functions as intended. Each aspect is equally important; however, the need for regular maintenance and inspection cannot be overemphasized.

SECTION

20

***TEMPORARY EROSION AND
SEDIMENT CONTROL FEATURES***

20 - TEMPORARY EROSION AND SEDIMENT CONTROL FEATURES:

The principle effect highway development projects have on the natural geologic erosion process consists of temporarily exposing disturbed soils to precipitation and to surface runoff. This exposure of the soil and resulting reshaping of the topography can create situations where detrimental erosion and sediment may temporarily occur.

This section will give a detailed description as well as typical details of applicable temporary erosion and sediment control features. Applicable features will be defined in terms of description, purpose, conditions where applicable, design criteria, and construction methods.

Temporary erosion and sediment control features may be divided into three groups as follows:

- Vegetative soil stabilization methods;
- Water conveyance and energy dissipation; and
- Sediment basins.

The first two groups are used to limit erosion. The last group is used to control, not contain, the sedimentation process to limit the deposition of off-site sediment in streams, ponds, lakes, rivers, etc.

20.1 - VEGETATIVE SOIL STABILIZATION METHODS:

This work shall cover all operations incidental to the establishment of grass and legume vegetation, including the furnishing and sowing of seed, furnishing and applying fertilizer, agricultural limestone, and mulch material.

Seeding and mulching shall be preformed on all cut and fill slopes, including cut and fill slopes associated with waste sites and borrow sites, during the construction process. The seeding and mulching of these exposed and/or disturbed areas as quickly as possible is essential for proper erosion and sediment control. When using straw or hay mulch, the sequence of application shall be as follows: (1) Seed and fertilizer shall be sown prior to mulching. (2) Mulch and mulch binder shall be placed within 24 hours of sowing seed.

All additional disturbed areas such as diversion ditches, sediment basins, areas around sediment structures, haul road cut and fill slopes, cleared and grubbed areas, storage areas, batch plant locations, etc., shall be seeded and mulched as quickly as possible following disturbance to minimize erosion.

Any areas failing to establish a satisfactory stand of grass due to weather conditions, adverse soil conditions, or due to erosion, shall be reseeded, fertilized, and mulched as defined in the Specifications.

Seeding and mulching of all disturbed areas shall be done at a minimum of once every 14 days unless otherwise noted in the plans. When all construction activities in an area is planned to cease for more than 14 days, that area shall be seeded and mulched within seven days.

All cut slope bench areas shall be seeded and mulched after completion of each bench, regardless of height.

All disturbed areas such as diversion ditches, sediment control structures, haul road slopes, etc., are to be seeded and mulched upon completion of each operation, including maintenance of such areas or within one week of completion of each operation, including maintenance.

Refer to Section 642 and 652 of the Standard Specifications and all applicable project special provision for details on application rates, mixtures, type, planting seasons, etc., for seed, mulch and fertilizer items.

20.2 - WATER CONVEYANCE AND ENERGY DISSIPATION:

These measures are used to divert, slow down, or convey storm runoff from or away from disturbed areas to stabilized controlled outlets. Through the use of these measures, erosion and its resulting sediment can be reduced. This group includes measures such as temporary berms, slope drains, temporary pipe, contour ditches, ditch checks, diversions, sediment traps, etc.

20.2.1 - TEMPORARY BERMS:

20.2.1.1 - Definition: A temporary ridge of compacted soil, with or without a shallow ditch, used to divert water flow.

20.2.1.2 - Purpose: To divert storm runoff from a recently constructed erodible area to a controlled, stabilized release point.

20.2.1.3 - Conditions Where Applicable: At the top of newly constructed erodible embankment slopes. Three types of temporary berms will be utilized under conditions listed below:

20.2.1.3.1 - Type "A" Berm:

- a) At the end of each day's operations on embankments.

20.2.1.3.2 - Type "B" Berm:

- a) When embankment operations are shut down over the winter season.
- b) When the embankment reaches final elevation and fine grading is not expected to begin within a one-week period on that embankment.
- c) When the fill slope just adjacent to the grade has been seeded and work is not expected to begin again on that embankment for at least one week.
- d) When work is to be discontinued for at least a month on that embankment. Temporary seeding and mulching of the berm must be done it will remain in place longer than 30 days.

20.2.1.3.3 - Transverse Berms:

- a) Are used to intercept water flow across the roadbed when grades in excess of one (1) percent are encountered. They are used to direct the water flow to a point where temporary or permanent slope drains will carry it over the fill slope.
- b) They are to be constructed at a 10⁰ minimum angle to a Type A or B berm. Transverse berms are to be placed at a maximum of 500 foot (**150 m**) spacing and immediately down station to the placement of a slope drain.

20.2.1.4 - Design Criteria: None. The construction details are shown on **Figure 20.2.1.**

20.2.1.5 - Construction Methods:

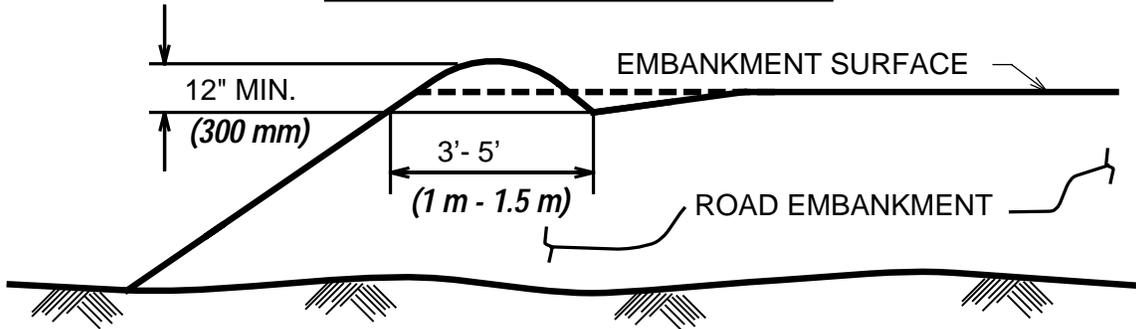
20.2.1.5.1 - Type "A" Berm: Type "A" Berms will be constructed to the approximate dimensions as shown on Figure 20.2.1. These berms will be machined compacted with a minimum of one pass over the entire width of the berm with a dozer track, grader wheel, etc.

20.2.1.5.2 - Type "B" Berm: Type "B" Berms will be constructed to the approximate dimensions as shown on Figure 20.2.1. These berms will be machine compacted with a minimum of 3 passes over the entire width of the berm with a dozer track, grader wheel, etc.

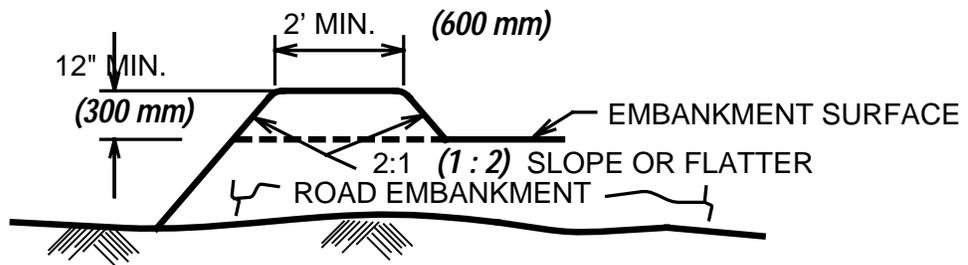
20.2.1.5.3 - Transverse Berms: Transverse Berms will be constructed to the approximate dimensions as shown on Figure 20.2.1. These berms will be machine compacted to the minimum number of passes over the entire width of the berm as the type of berm it is being used in conjunction with as described above.

20.2.1.5.4 - General: Temporary berms must have a positive grade draining to a compacted outlet. The area adjacent to the temporary berm in the vicinity of the outlet must be properly graded in order for the temporary berm/outlet combination to function efficiently. All transverse berms required to be on the downstream side of a temporary berm outlet will extend across the grade to the highest point at approximately a 10° angle with a line perpendicular to the centerline. The top width may be wider and the side slopes flatter on transverse berms to allow equipment to pass over with minimal disruption. When practical and until final roadway elevations are approved, embankments may be constructed with a gradual slope to one side of the embankment to permit placement of temporary berms on only one side of the embankment.

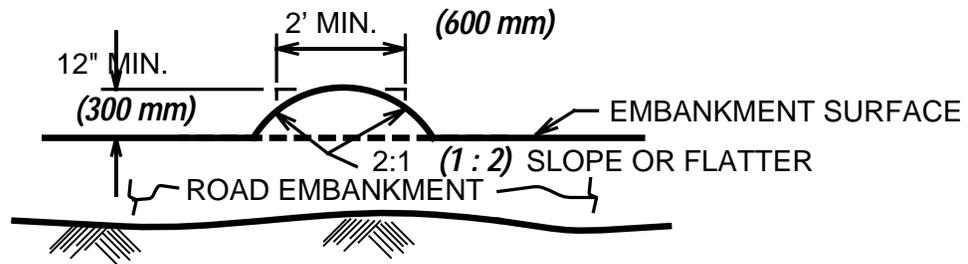
TEMPORARY BERMS



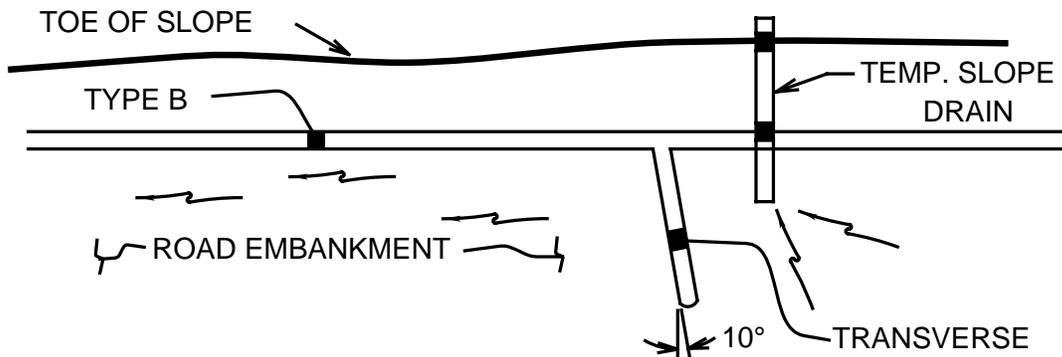
TYPE A



TYPE B



TRANSVERSE



20.2.2 - SLOPE DRAINS:

20.2.2.1 - Definition: A facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, metal pipe, plastic pipe, flexible rubber pipe, etc., used to transport water down slopes.

20.2.2.2 - Purpose: To transport collected water from cuts and fills down slopes prior to installation of permanent facilities and/or adequate vegetative cover on the slopes.

20.2.2.3 - Conditions Where Applicable: Slope drains are required at all outlets of temporary berms to carry water flowing on fill slopes. Also, they are required at all cut/fill transitions prior to the time permanent facilities are installed. If a gutter type slope drain is used, it should be placed to coincide with a permanent gutter if possible.

20.2.2.4 - Design Criteria: Slope drains should be placed at a maximum spacing of 250 feet (**75 m**) when draining temporary berms.

- 1) Use a conduit or gutter in accordance with Table 20.2.2.4 A (**20.2.2.4 B**).
- 2) Fiber matting and plastic sheeting should not be utilized on slopes steeper than 4:1 (**1:4**) except for short distances, 20 feet (**6 m**) or less, where water cannot reach erosive velocities.
- 3) Minimum bottom width of a temporary gutter will be 2 foot (**600 mm**) with a minimum depth of 8 inches (**200 mm**) with 2:1 (**1:2**) side slopes.

Where slope drains are required at the end of cut sections it may be necessary to increase the size of the pipe, or gutter to accommodate a greater flow if the area to be drained exceeds 5 acres (**2 ha**). Table 20.2.2.4 A can be used as a guideline for the sizes required when the drainage area is less than 5 acres; while Table 20.2.2.4 B can be utilized for sizes when the drainage area is less than 2 ha. For drainage areas greater than 5 acres (**2 ha**) the sizing of slope drains shall be in accordance with 20.2.3.4.

DRAINAGE AREA (Acres)	CORRUGATED PIPE SIZE (Inches)	GUTTERS (Inches)	
		Depth	Width
0 – 1.5	12	8	24
1.5 – 3.0	15	12	24
3.0 - 5.0	18	12	48

TABLE 20.2.2.4 A

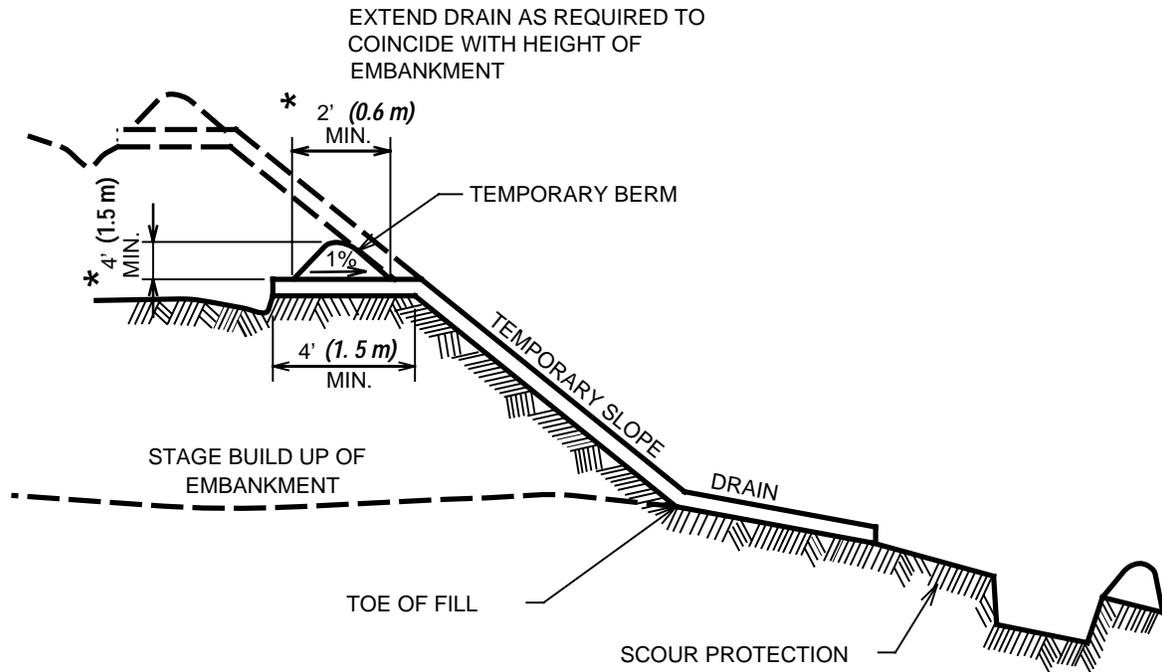
DRAINAGE AREA (<i>ha</i>)	CORRUGATED PIPE SIZE (<i>mm</i>)	GUTTERS (<i>mm</i>)	
		Depth	Width
<i>0 – 0.6</i>	<i>300</i>	<i>200</i>	<i>600</i>
<i>0.6 – 1.2</i>	<i>375</i>	<i>300</i>	<i>600</i>
<i>1.2 - 2.0</i>	<i>450</i>	<i>300</i>	<i>1200</i>

TABLE 20.2.2.4 B

20.2.2.5 - Construction Methods: Temporary slope drains must be adequately anchored to the slope to prevent disruption by the force of the water flowing in these drains. Anchors are to be placed at the pipe joints. Method of anchoring is to be submitted and approved by the Project Supervisor.

The outlet end of temporary slope drains must have a method of dissipating the energy of transported water to prevent downstream erosion. An ideal dissipater would be dumped rock gutter and/or a sediment basin that would slow the water as well as retain sediment (Figure 20.2.2.5).

TEMPORARY SLOPE DRAIN



NOTES:

1. TEMPORARY SLOPE DRAIN TO BE ANCHORED TO EMBANKMENT.
2. ROCK GUTTER OR CONTOUR DITCH MAY ALSO BE UTILIZED TO DIRECT STORM WATER.
3. SEE TABLE 1 & 2 FOR TEMPORARY SLOPE DRAIN SIZE.
- * 4. THE AMOUNT OF COVER PLACED ON THE SLOPE DRAIN SHALL BE ADEQUATE TO SECURE THE PIPE.

20.2.3 - TEMPORARY PIPE:

20.2.3.1 - Definition: A conduit utilized to carry water under a haul road.

20.2.3.2 - Purpose: To prevent equipment from coming in direct contact with water when crossing an active stream, intermittent stream or ephemeral stream created during heavy rainfall.

20.2.3.3 - Conditions Where Applicable: In streams that must be crossed by equipment or low areas that may become streams during heavy rainfall that are traversed by equipment.

20.2.3.4 - Design Criteria: The Contractor shall provide documentation to the Project Supervisor that Corps of Engineers Section 404 requirements have been satisfied prior to placing any temporary pipe in a stream. The temporary pipe shall be sized to handle a 1-year/24-hour storm event.

For drainage areas greater than 10 Acres (**4 ha**) or if the assumptions listed for Table 20.2.3.4 are not applicable, the Contractor shall submit the hydraulic calculations for sizing of temporary pipes as a part of the Erosion and Sediment Control Plan.

The following table is to be used as a guide for sizing temporary pipes utilizing the SCS Method. The following assumptions were used to develop the table:

24-Hour Precipitation = 2.5 inches (**62.5 mm**)

Hydrologic Soil Group = C

Steep Slope (SCS Method Assumes 16%)

Curve Number Based On Cultivated Land: CN=78, Rounded to 80

Pipe Slope = 1% (The pipe slope is the minimum slope of any part or section of the pipe run.)

HW/D = 1

n = 0.024

A tail water condition does not exist.

AREA		DISCHARGE		PIPE SIZE	
Acres	<i>ha</i>	cfs	<i>cms</i>	Inches	<i>mm</i>
5	2.0	6	0.17	18	450
6	2.4	7	0.20	24	600
7	2.8	9	0.25	24	600
8	3.2	10	0.28	24	600
9	3.6	11	0.31	24	600
10	4.0	12	0.34	24	600

TABLE 20.2.3.4

20.2.3.5 - Construction Methods: All temporary pipes shall be installed in the same manner as permanent pipe as defined in Section 604 of the Standard Specifications. Crushed aggregate backfill is not required. Compaction testing will not be required. However; at a minimum, the inlet end of the pipe shall be protected to prevent erosion.

20.2.4 - CONTOUR DITCHES:

20.2.4.1 - Definition: A channel constructed either across, at the top, at the midpoint, or at the toe of a slope.

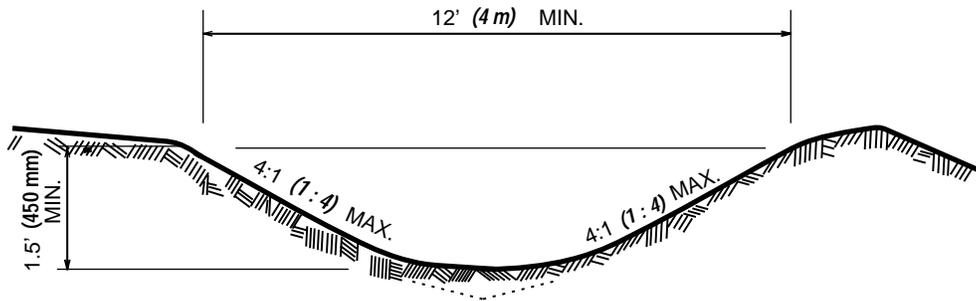
20.2.4.2 - Purpose: To intercept and convey water at non-erosive velocities to an adequate and stable outlet.

20.2.4.3 - Conditions Where Applicable: Contour ditches are utilized to convey sediment laden storm water to a sediment trapping structure. Contour ditching can also be utilized at the top of cut slopes to divert “clean” water away from the project thereby reducing the necessary capacities of sediment basins.

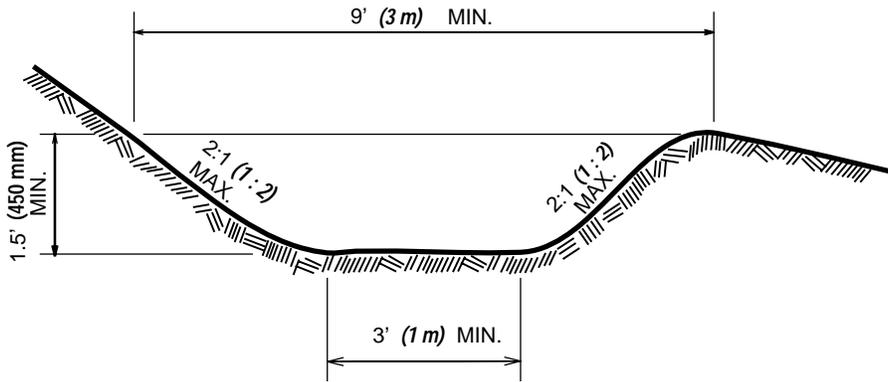
20.2.4.4 - Design Criteria: None. The construction details are shown on Figure 20.2.4.4.

20.2.4.5 - Construction Methods: Care must be taken to outlet contour ditches into adequately controlled, stabilized areas. All contour ditches are to be stabilized by seeding and mulching in accordance Section 642 and 652 of the Standard Specifications. It may be necessary to use matting and/or dumped rock gutter to stabilize contour ditches. If contour ditches are placed above the top of cut slopes, they should be set back a minimum of 10 feet (**3 m**).

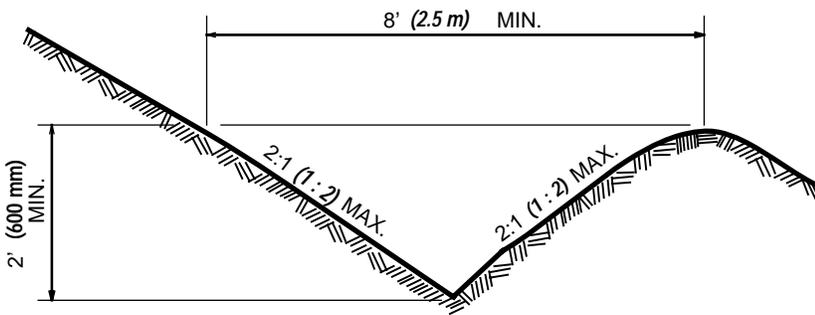
CONTOUR DITCHES



PARABOLIC



TRAPEZOIDAL



TRIANGULAR (VEE)

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MANUAL
FIGURE 20.2.4.4

20.2.5 - DITCH CHECKS:

20.2.5.1 - Definition: A barrier constructed of clean, non-erodible rock or other manufactured devices (i.e.; triangular site dikes, core logs, etc.) across a cut or median ditch.

20.2.5.2 - Purpose: The primary purpose is to control velocities thereby reducing erosion in the ditch.

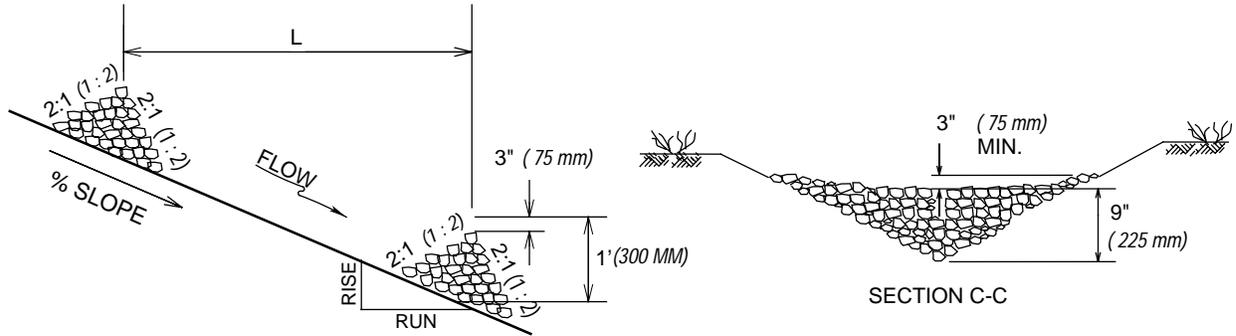
20.2.5.3 - Conditions Where Applicable:

- 1) Constructed median ditches or cut ditches until a vegetative cover has been established and permanent structures (i.e.; dumped rock gutter) have been placed.
- 2) In natural drain ways (ephemeral streams) close to disturbed areas to catch initial sediment loads.

20.2.5.4 - Design Criteria: Care shall be taken to insure that the ditch check will not erode around the end. The elevation of the ditch check should be lowest at the center of the ditch. Refer to the details on Figure 20.2.5.4.

20.2.5.5 - Construction Methods: Construction of a rock ditch check is to follow the criteria shown on Figure 20.2.5.4. All other methods or materials utilized to construct ditch checks must be clearly illustrated in the Contractor's Erosion and Sediment Control Plan. The prefabricated ditch checks shall be installed as outlined in the manufacturer's instructions. These methods or materials can be reviewed and approved, approved with modifications, or disapproved in conjunction with the total plan.

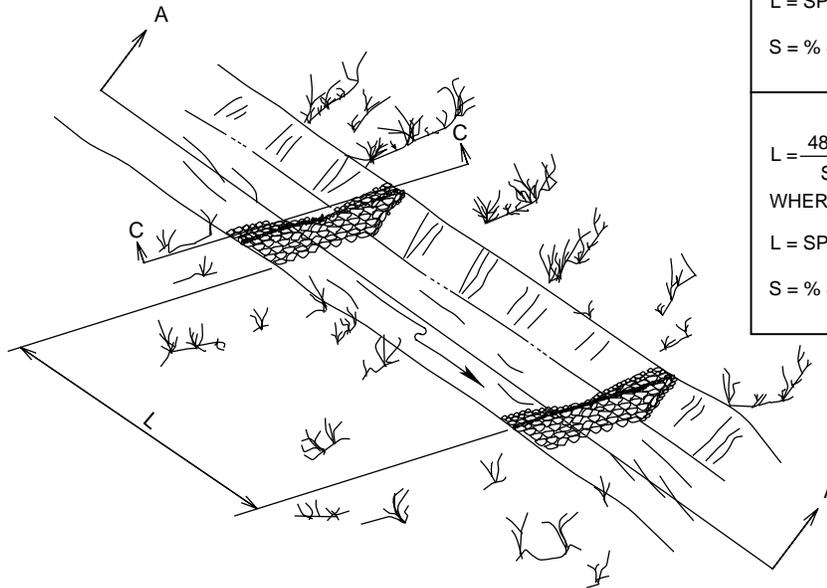
SPACING OF DITCH CHECKS



SECTION A-A

SECTION C-C

STONE DITCH CHECK



ENGLISH
$L = \frac{160}{S}$, WITH A 50' MAX
WHERE,
L = SPACING IN FEET
$S = \% \text{ SLOPE} = \frac{\text{RISE}}{\text{RUN}} \times 100$
METRIC
$L = \frac{48.8}{S}$, WITH A 15m MAX
WHERE,
L = SPACING IN METERS
$S = \% \text{ SLOPE} = \frac{\text{RISE}}{\text{RUN}} \times 100$

NOTE:
SPACING OF PREFABRICATED DITCH CHECKS SHALL
BE THE SAME AS STONE DITCH CHECKS.

THE MINIMUM DITCH DEPTH IS 1' (300 MM).

20.2.6 – STORM WATER DIVERSIONS:

20.2.6.1 - Definition: Bales of hay or straw, silt fence, contour ditches, etc. used as a means of controlling erosion and directing sediment to a basin.

20.2.6.2 - Purpose: To reduce the velocities of water and direct and/or divert the flow of water to a slope drain, sediment basin, or other erosion control structure.

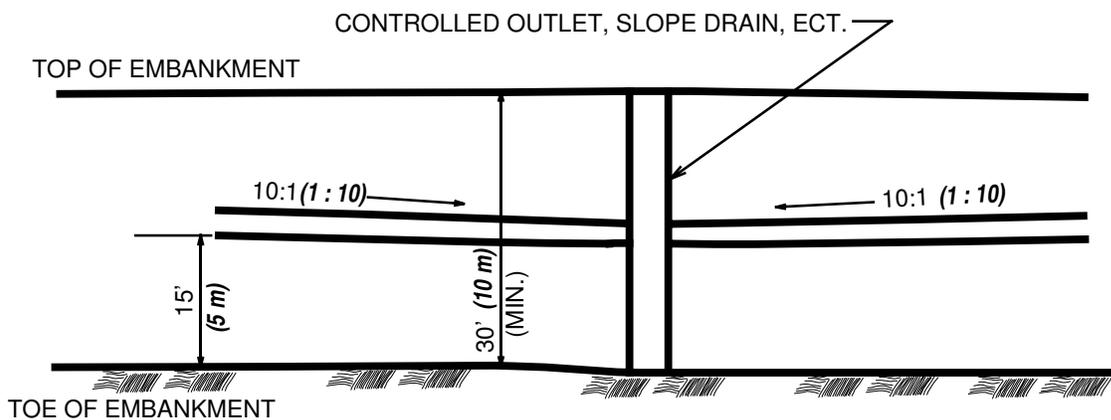
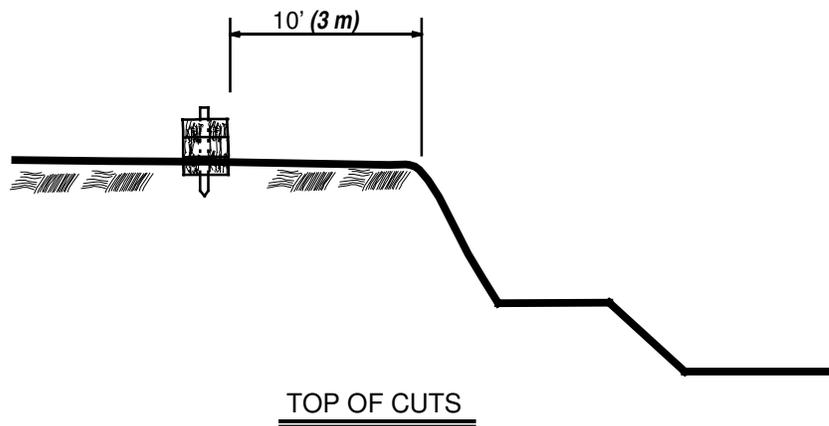
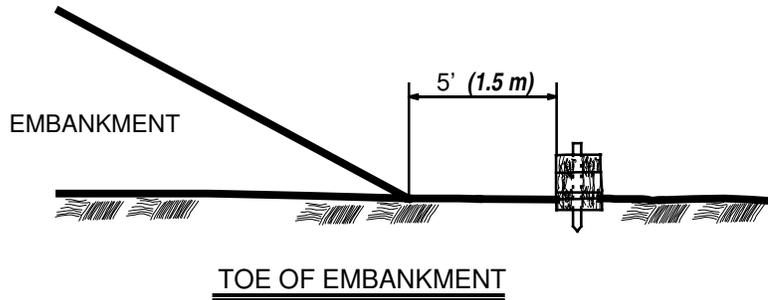
20.2.6.3 - Conditions Where Applicable: (Figure 20.2.6.3)

- 1) At the toe of embankment slopes.
- 2) At the top of cuts.
- 3) Across embankments once the embankment reaches 30 feet (**10 m**) in height. If the embankment has reached 30 feet (**10 m**), the diversions are to be placed at 15 feet (**5 m**) intervals.
- 4) On the lower side of cleared areas.

20.2.6.4 - Design Criteria: None.

20.2.6.5 - Construction Methods: Bales of hay or straw, or silt fence must be adequately trenched and braced into place as per Figures 20.2.6.5 A, B and C. The contour ditches are to be constructed in accordance with Figure 20.2.4.4. **BALES OF HAY OR STRAW AND SILT FENCE ARE NOT PERMITTED IN DITCH LINES BY SPECIFICATION.** Once the capacity of a diversion has been reduced by 50 percent, the accumulated sediment is to be removed and disposed of in an appropriate manner.

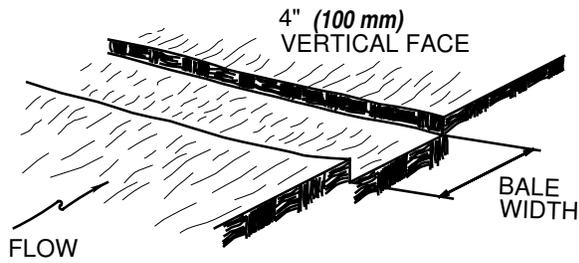
STORM WATER DIVERSIONS



WEST VIRGINIA
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DIVISION OF HIGHWAYS

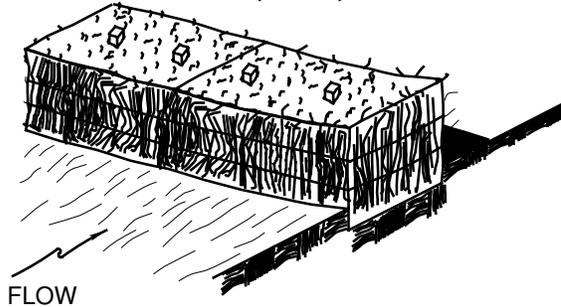
EROSION CONTROL
MANUAL
FIGURE 20.2.6.3

STORM WATER DIVERSIONS



1. EXCAVATE THE TRENCH

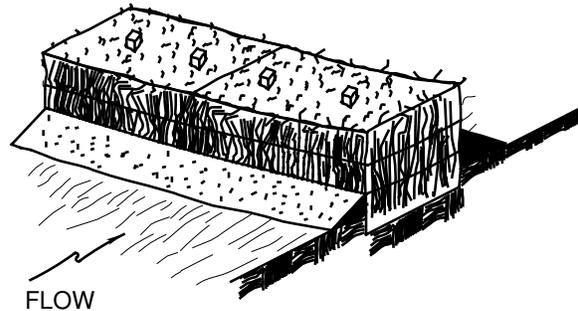
2 RE-BARS, STEEL PICKETS OR
2" X 2" (50 mm x 50 mm)
STAKES PER BALE
DRIVEN 1'(300 mm) MIN. INTO GROUND



2. PLACE AND STAKE THE BALES

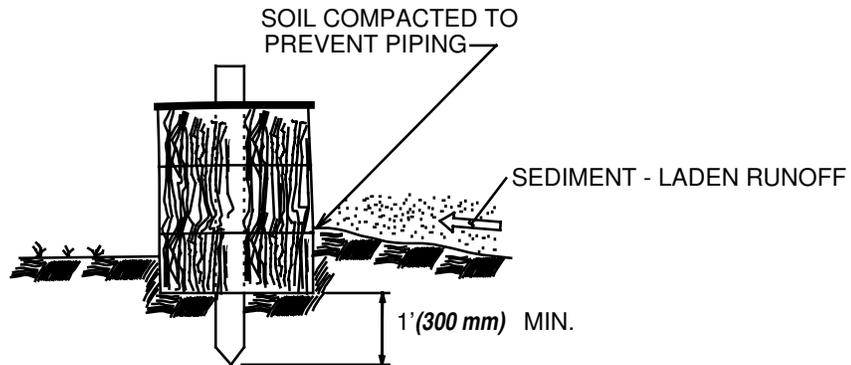


3. WEDGE LOOSE STRAW BETWEEN BALES



4. BACKFILL AND COMPACT THE EXCAVATED SOIL

HAY OR STRAW BALE INSTALLATION SEQUENCE

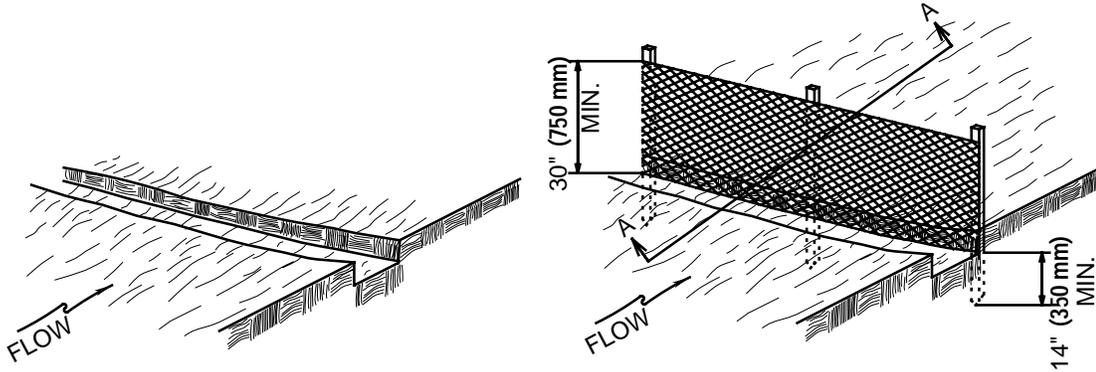


PROPERLY INSTALLED BALE

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EROSION CONTROL
MANUAL
FIGURE 20.2.6.5A

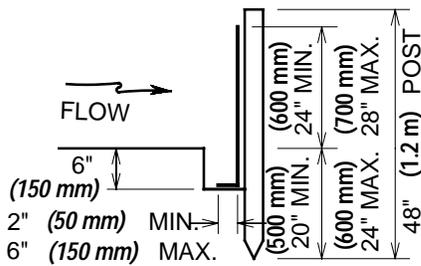
STORM WATER DIVERSIONS



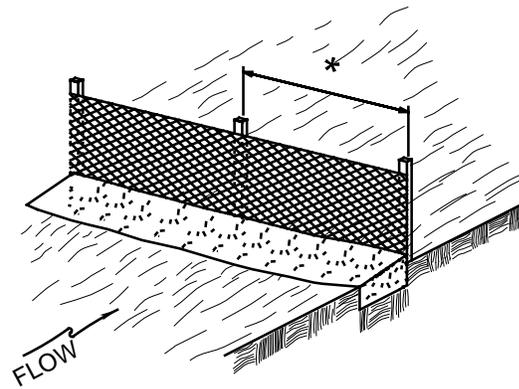
1. EXCAVATE 6" x 6" (150 mm x 150 mm) TRENCH

2. PLACE FENCE AT BACK EDGE OF TRENCH (FABRIC FACING DIRECTION OF FLOW)

3. DRIVE POST UNTIL FABRIC REACHES BOTTOM OF TRENCH



SECTION A-A



* SEE SPECIFICATIONS FOR REQUIRED POST SPACING.

4. FILL TRENCH W/ EMBANKMENT & TAMP

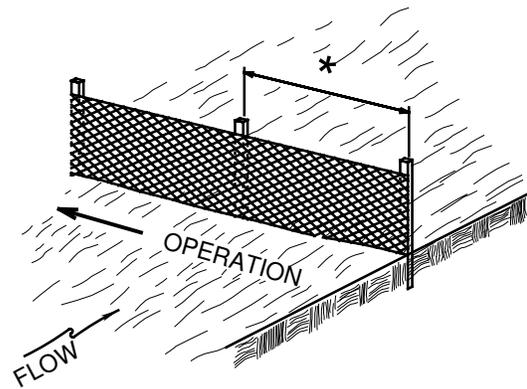
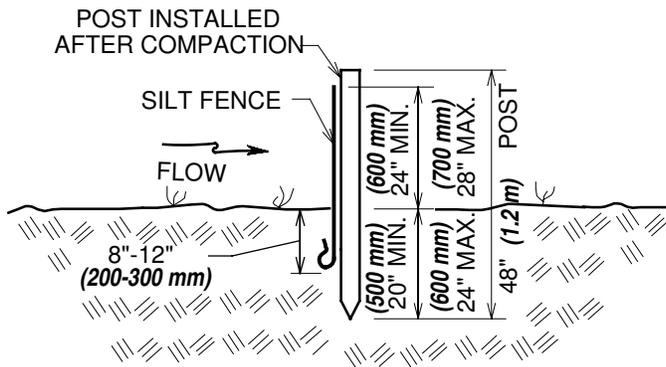
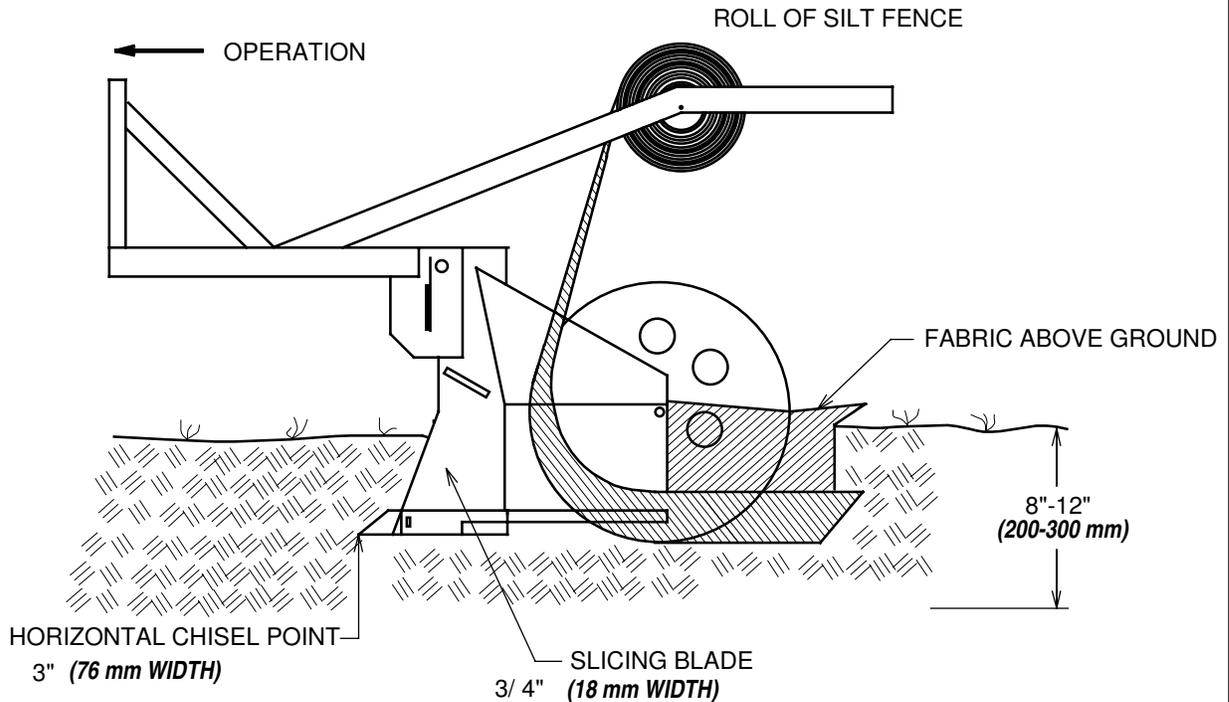
NOTE: WHEN MORE THAN ONE ROLL OF SILT FENCE IS USED, THE FENCE AT THE JUNCTURE MUST BE PLACED SO THAT THE LAST POST OF THE FIRST RUN & THE FIRST POST OF THE SECOND RUN OVERLAP & ARE TIED TOGETHER.

SILT FENCE INSTALLATION USING TRENCH METHOD

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EROSION CONTROL
MANUAL
FIGURE 20.2.6.5B

STORM WATER DIVERSIONS



* SEE SPECIFICATIONS FOR
REQUIRED POST SPACING.

COMPLETED INSTALLATION

SILT FENCE INSTALLATION USING SOIL SLICING METHOD

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DIVISION OF HIGHWAYS

EROSION CONTROL
MANUAL
FIGURE 20.2.6.5C

20.2.7 – SEDIMENT TRAP:

20.2.7.1 - Definition: A sediment trap is an excavated storage area without defined side slopes. The trap is to be stabilized by seeding and mulching as well as having a stabilized outlet. The trap is a short-term sediment control structure.

20.2.7.2 - Purpose: To trap and store sediment as well as reduce the velocities of water.

20.2.7.3 - Conditions Where Applicable:

- 1) As directed by the Project Supervisor and/or their designee.
- 2) At the foot of embankments where temporary and permanent slope drains outlet.
- 3) At the bottom as well as in the ditch lines of waste sites and in the ditch lines of borrow pits.
- 4) At the downgrade end of a cut section when saturation of this area would not harm the area.
- 5) In the median to prevent excessive siltation of pipe structures.

20.2.7.4 - Design Criteria: None

20.2.7.5 - Construction Methods: When traps are incorporated in a final grade situation, it may be necessary to line them with a material such as polyethylene to prevent saturation. When sediment removal is required, it should be performed with care because of the danger of rupturing the lining.

Once the capacity of the trap is 50 percent filled with sediment, the accumulated sediment is to be removed and disposed of in an appropriate manner.

20.3 - SEDIMENT BASINS:

Despite using vegetative soil stabilization methods and or water conveyance and energy dissipation devices, soil erosion is inevitable. Sediment basins are used to capture and retain sediment caused by erosion.

20.3.1. Definition: Sediment basins, as used in this manual, may be either a sediment pond or sediment dam.

- 1) A sediment pond has an excavated storage area in addition to an embankment to provide the required storage volume.
- 2) A sediment dam is an embankment sized to provide the required storage volume with minimal excavation.

20.3.2 - Purpose: To trap and store sediment.

20.3.3 - Conditions Where Applicable: They are required to control runoff and sediment from areas of disturbance that cannot be effectively controlled by utilizing ditch checks, sediment traps, etc., or are not appropriate for the particular area.

20.3.4 - Design Criteria:

20.3.4.1 – General:

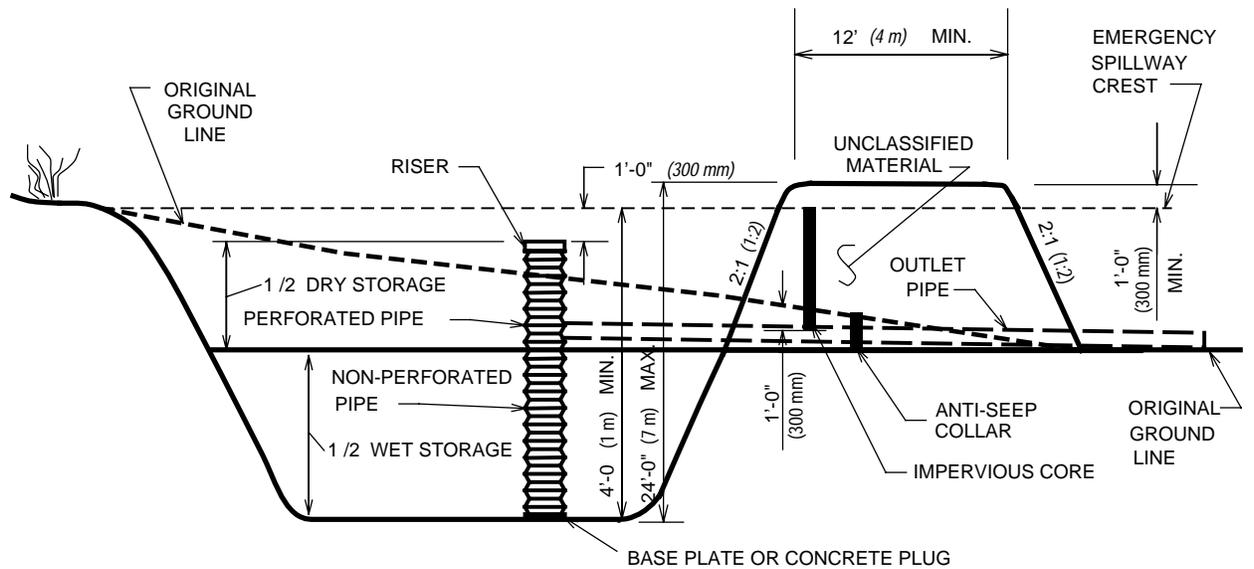
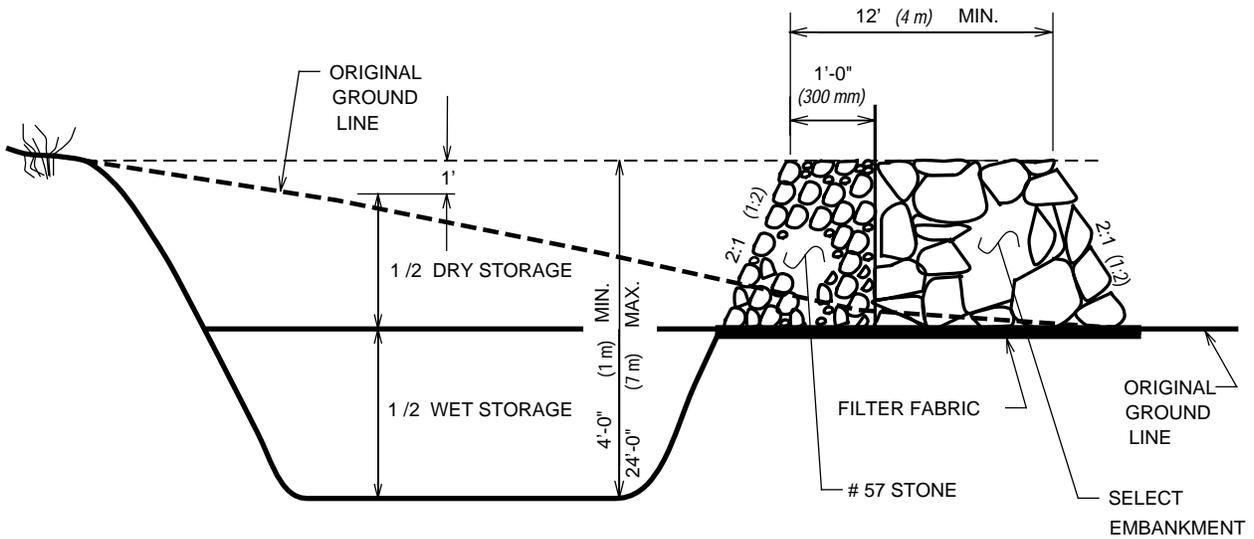
- a) Sediment basins are to be designed to provide a storage volume equal to 3600 cubic feet per acre (**252 cubic meter per ha**) of drainage area leading to the basin. **Half of this volume is to be dry storage while the remaining half is to be wet storage.**
- b) Sediment basins are to be designed to set outside the main watercourse and shall not be designed to set in a stream that would require a section 404 permit from the US Army Corp of Engineers without obtaining prior approval from the Deputy State Highway Engineer, Development.
- c) If “clean” water can be diverted from running through the disturbed areas of your project, the sediment basins can be designed for the remaining drainage area. The required storage volume remains as stated in a) above. This diversion feature is to be shown on the plans as the reason for downsizing the basin.
- d) Sediment basins are to have stabilized inlets and outlets.
- e) The basin length should be at least twice the basin width.
- f) Sediment basins should be built as close as possible to the source of the sediment.

- g) Sediment basins should be built outside the existing watercourse to minimize the quantity of water flowing through the basins thereby reducing the overall size of the basin.
- h) In some areas the minimum design criteria as defined herein may be unfeasible, impractical, or impossible to meet. In those cases, sediment basins shall be designed and constructed as close as possible to the design criteria specified. Under certain circumstances it may be desirable to build several small sediment basins in a series in lieu of one large basin. Documentation as to the reasons for not designing the basins to the required volume is necessary. **Right-of-way constraints are not justification for downsizing a basin.** The designer shall establish right-of-way limits that allow for the full development of a properly designed sediment basin. The exception to this rule would be the taking of an occupied building, cultural resources, or the disturbance to construct the basin is greater than the disturbed area leading to the basin.
- i) All sediment basins must be located and designed such that failure of the basin **would not** result in loss of life; damage to homes, commercial or industrial buildings, highways or streets; or in interruption of the use or service of public utilities.
- j) When a sediment basin is to remain in place it shall be fenced or incorporated within the controlled access fence.
- k) Construction of sediment basins in wetlands is prohibited.
- l) The retained volume in any one structure shall not exceed 48 acre-feet **(59,200 cubic meters)**.
- m) Sediment basins shall be removed at the end of construction unless approved to remain in place by the Deputy State Highway Engineer, Development. When a sediment basin is approved to remain in place after construction it shall be designed for overtopping in accordance with section 20.3.4.3.5.
- n) Since the removal of sediment basins will occur after access to the basins is limited, the designer shall provide a site restoration plan that provides the quantities required to remove the basins and shall consider the access required as a factor in preparing the plan. The designer should set the right-of-way limits for the required access to the sediment basins. The work required for the restoration plan shall be bid as its own category. See section 20.3.5 and section 30 for restoration plan requirements.

20.3.4.2. Sediment Ponds: (Figures 20.3.4.2 A and B)

- a) Inlet and outlet channels lined with select embankment-18" **(450 mm)** minimum thickness.
- b) Side Slopes: 2:1 **(1:2)**.
- c) Pond Depth: minimum 4' **(1 m)**, maximum 24' **(7 m)**.
- d) Length is to be at a minimum, twice the width.
- e) The minimum pond crest width shall be 12 feet **(4 meters)**.
- f) A riser outlet as shown in Figure 20.3.4.2A shall be utilized except when the contributing drainage area is less than 5 acres **(2 ha)** and one of the following is true:
 - 1) The pond pipe outlet can't be satisfactorily stabilized without causing damage to a environmentally sensitive area or
 - 2) The water velocity from the pond pipe outlet causes damage to the receiving stream and the water velocity can't be mitigated prior to entering the receiving stream or
 - 3) When other environmental concerns or requirements mandate a wick drain outlet.
- g) The spillways and riser will be designed in accordance with Section 20.3.4.3, when a riser outlet is utilized.

SEDIMENT POND PROFILE



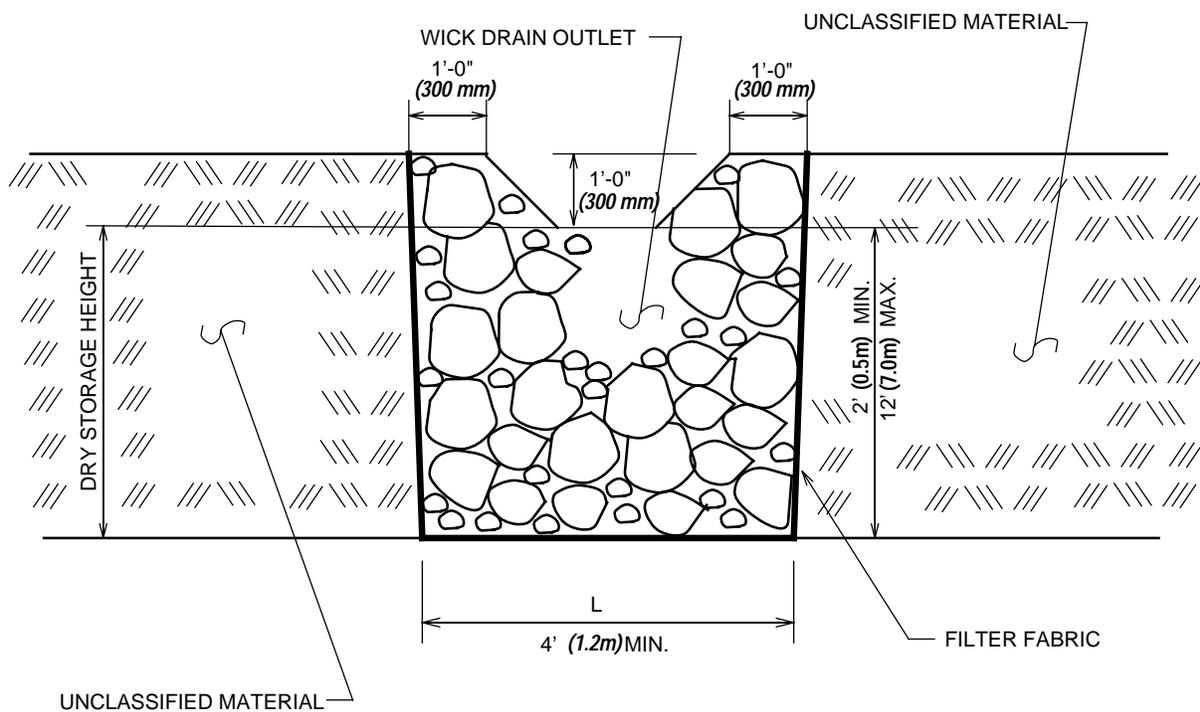
NOTE: MAX IMPOUNDMENT
48 ACRES-FT. (59,200 CU. METERS)

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DIVISION OF HIGHWAYS

EROSION CONTROL
MANUAL
FIGURE 20.3.4.2A

SEDIMENT POND

WICK DRAIN OUTLET X-SECTION



<u>ENGLISH</u>	<u>METRIC</u>
$L = (30/H) \times \text{AREA}$ WHERE, L = LENGTH IN FEET H = DRY STORAGE HEIGHT IN FEET AREA = CONTRIBUTING DRAINAGE AREA IN ACRES	$L = (6.9/H) \times \text{AREA}$ WHERE, L = LENGTH IN METERS H = DRY STORAGE HEIGHT IN METERS AREA = CONTRIBUTING DRAINAGE AREA IN HECTARES

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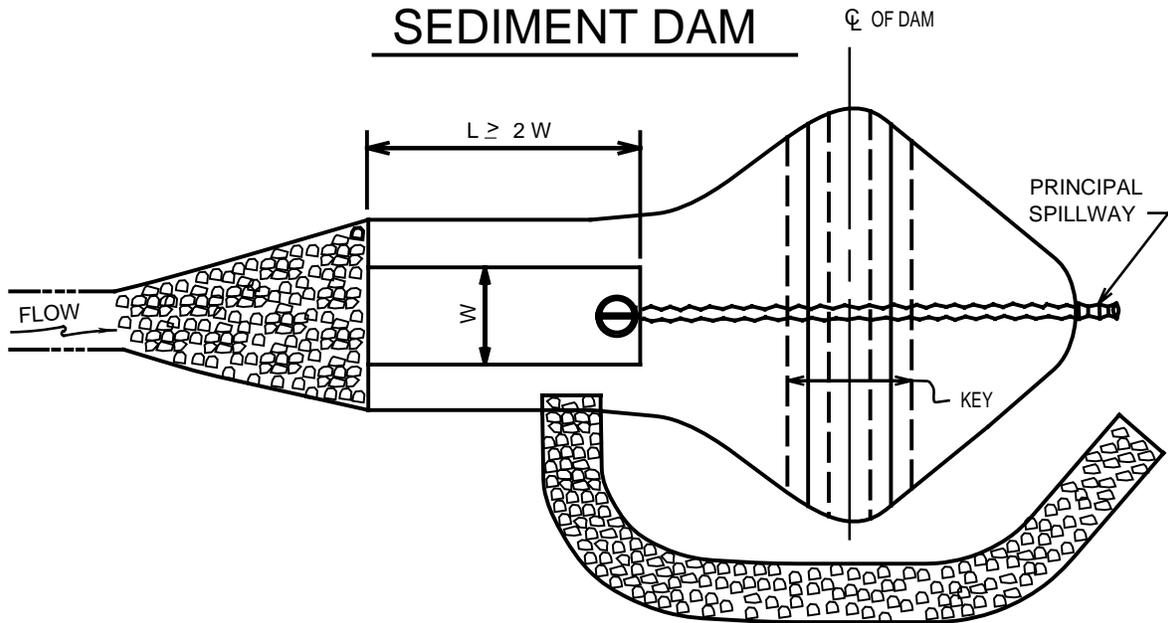
EROSION CONTROL
MANUAL
FIGURE 20.3.4.2B

20.3.4.3 - Sediment Dams: (Figures 20.3.4.3 A and B)

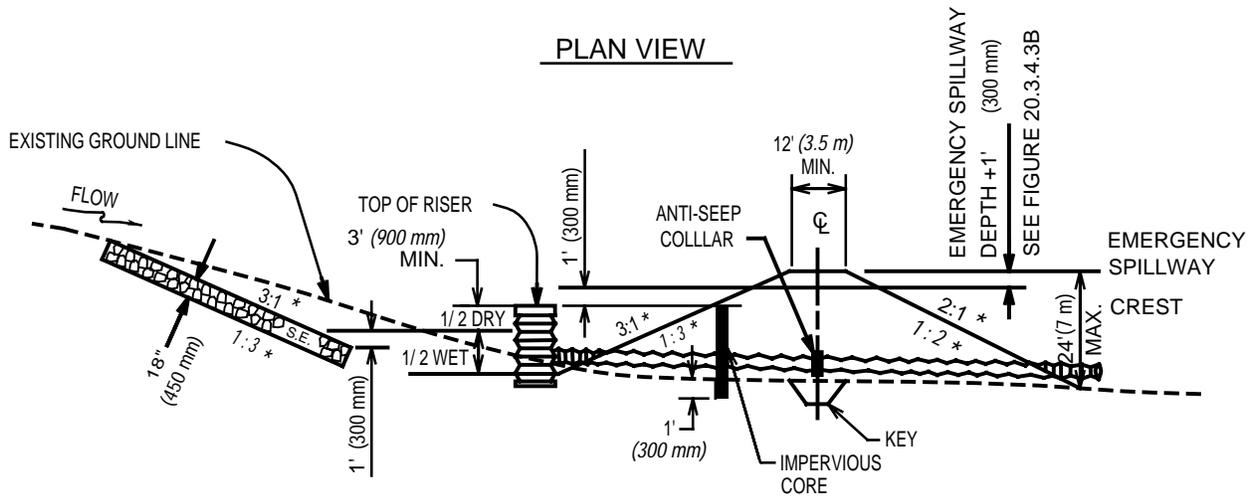
20.3.4.3.1- General:

- 1) The maximum height of the dam from the lowest point along the centerline of the dam to the crest of the emergency spillway shall not exceed 24' (**7 m**).
- 2) The minimum dam crest width shall be 12 feet (**4 meters**).
- 3) The upstream slope of the dam will be 3:1 (**1:3**) or flatter and the downstream slope will be 4:1 (**1:4**) or flatter.
- 4) If an emergency spillway is provided around the end of the dam, the downstream slope may be 2:1 (**1:2**) on the dam.
- 5) The dam will have an impervious core beginning a minimum of 1' (**300 mm**) below the original ground and ending at the top of the dry storage.
- 6) If the emergency spillway is provided over the dam face, it must be lined with clean, non-erodible rock to prevent erosion of the dam face.
- 7) In cases where an emergency spillway goes around the end of the dam, as shown in Figure 20.3.4.3A, rock will not be required to line the dam face, unless the structure is to remain in place after construction then rock may be required to Line the face of the dam see section 20.3.4.3.5.
- 8) Runoff will be calculated in accordance with the WVDOT, Division of Highways Drainage Manual and should be based on soil conditions expected to prevail during the anticipated effective life of the dam. Combined capacity of the principal and/or emergency spillways will be designed to handle a 25-year frequency storm (Q_{25}) with one foot of freeboard.

SEDIMENT DAM



PLAN VIEW



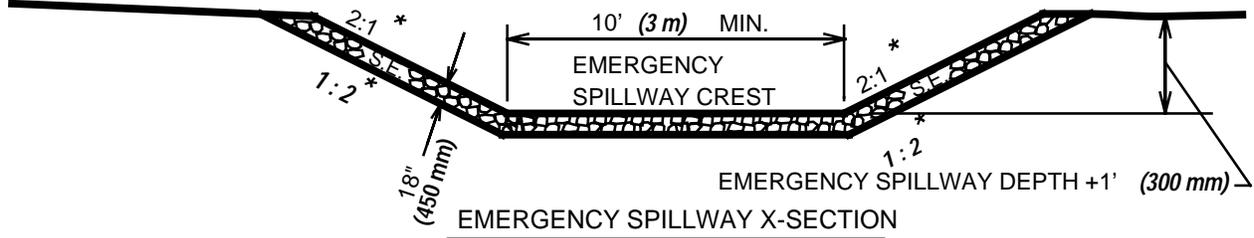
PROFILE

NOTE: STORAGE = DRY & WET
 SEE PAGE II -27
 MAX IMPOUNDMENT
 48 ACRE-FT. (59,200 CUBIC METERS)

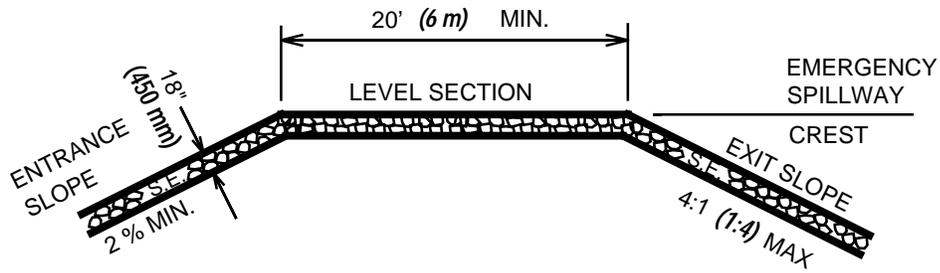
* SLOPE RATIOS
 MAY BE FLATTER

CONDUIT SPILLWAY (PG. 1 OF 2)

SEDIMENT DAM



NOTE: FOR EMERGENCY SPILLWAY DEPTH SEE TABLE 20.3.4.3.4A & B



NOTE: THE LEVEL SECTION OF THE SPILLWAY IS 1' (300 mm) ABOVE THE TOP OF THE RISER.

IF THE EMERGENCY SPILLWAY IS BUILT OVER THE SEDIMENT DAM, THE TOP OF THE DAM AND THE DOWNSTREAM SLOPE LINED WITH SELECT EMBANKMENT - 18" (450 mm) THICK. THE RATIO OF THE DOWNSTREAM SLOPE SHALL BE 4:1 (1:4) OR FLATTER.

* SLOPE RATIOS
MAY BE FLATTER

CONDUIT SPILLWAY (PG. 2 OF 2)

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DIVISION OF HIGHWAYS

EROSION CONTROL
MANUAL
FIGURE 20.3.4.3B

20.3.4.3.2 - Principal Spillway:

- 1) The principal spillway shall be a pipe and riser. The pipe shall meet the requirements of Section 604 of the Standard Specifications.
- 2) The principal spillway will be designed using one of the following methods:
 - a) If the basin has a contributing drainage area of 30 acres or less then normally the pipe used as the principal spillway is designed to carry the 25 yr 24 hour storm with the head on the pipe being at the dry storage elevation and an emergency spillway **is not** required.
 - b) If the basin has a contributing drainage area that is greater than 30 acres then the principle spillway is designed to carry a minimum of the 1 yr 24 hour storm with the head on the pipe being at the top of the dry storage elevation and an emergency spillway **is** required. The size of the principle spillway may need to be increased in order to provide the required freeboard of the emergency spillway when the height of the basin is limited.
- 3) An emergency spillway will be required if the principal spillway is designed to carry less than the 25 yr 24 hour storm or in order to provide the required freeboard when the height of the basin is limited.

20.3.4.3.3 – Riser:

- 1) When an emergency spillway is provided. The crest elevation of the principal spillway must be at least 1 foot **(300 mm)** below the crest elevation of the emergency spillway.

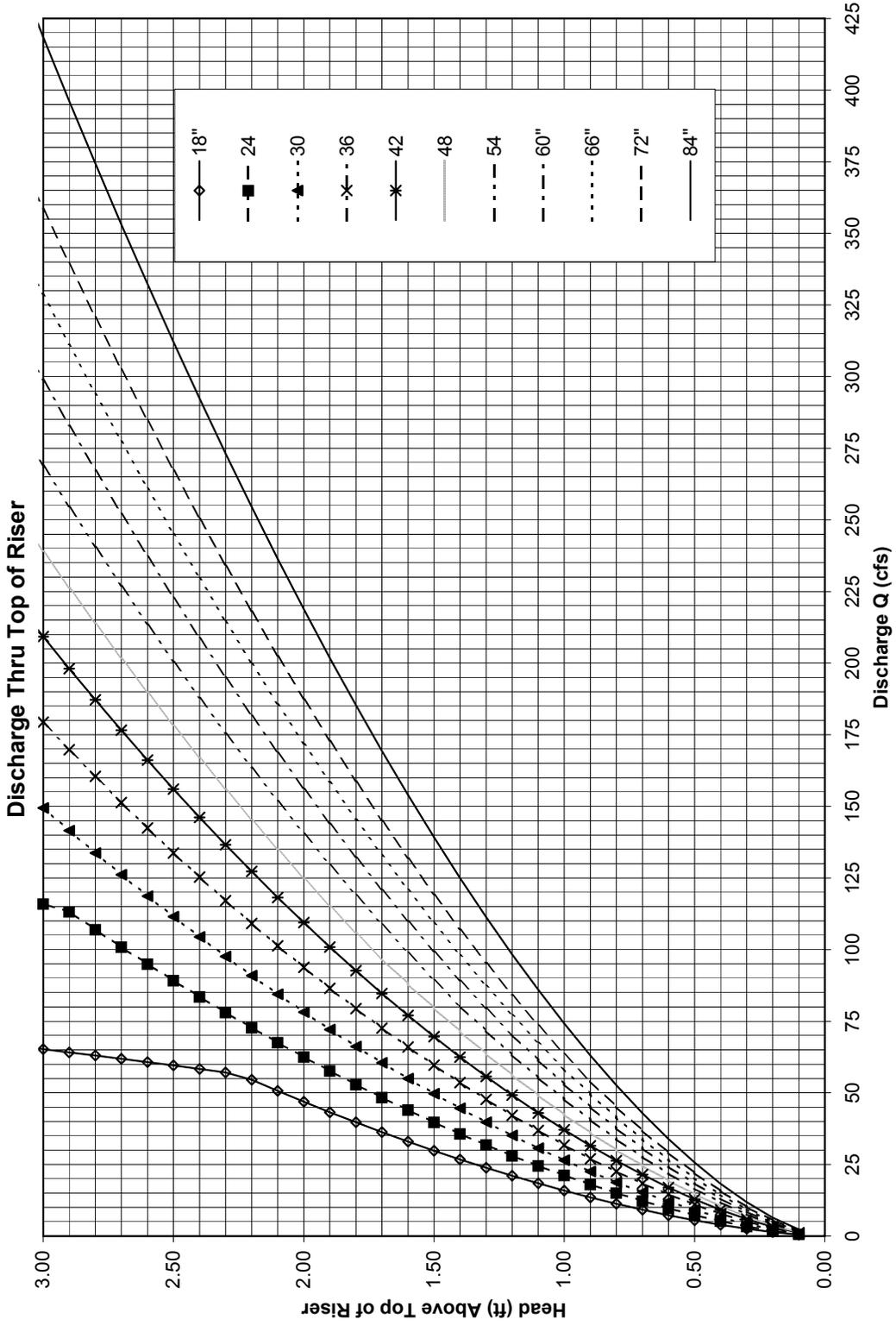
When an emergency spillway is not provided. The maximum design flow elevation of basin must be at least 1 foot **(300 mm)** below the crest elevation of the dam. Therefore the crest elevation of the riser must be at least 1 foot **(300 mm)** plus the depth of flow required over the riser below the crest of the dam.

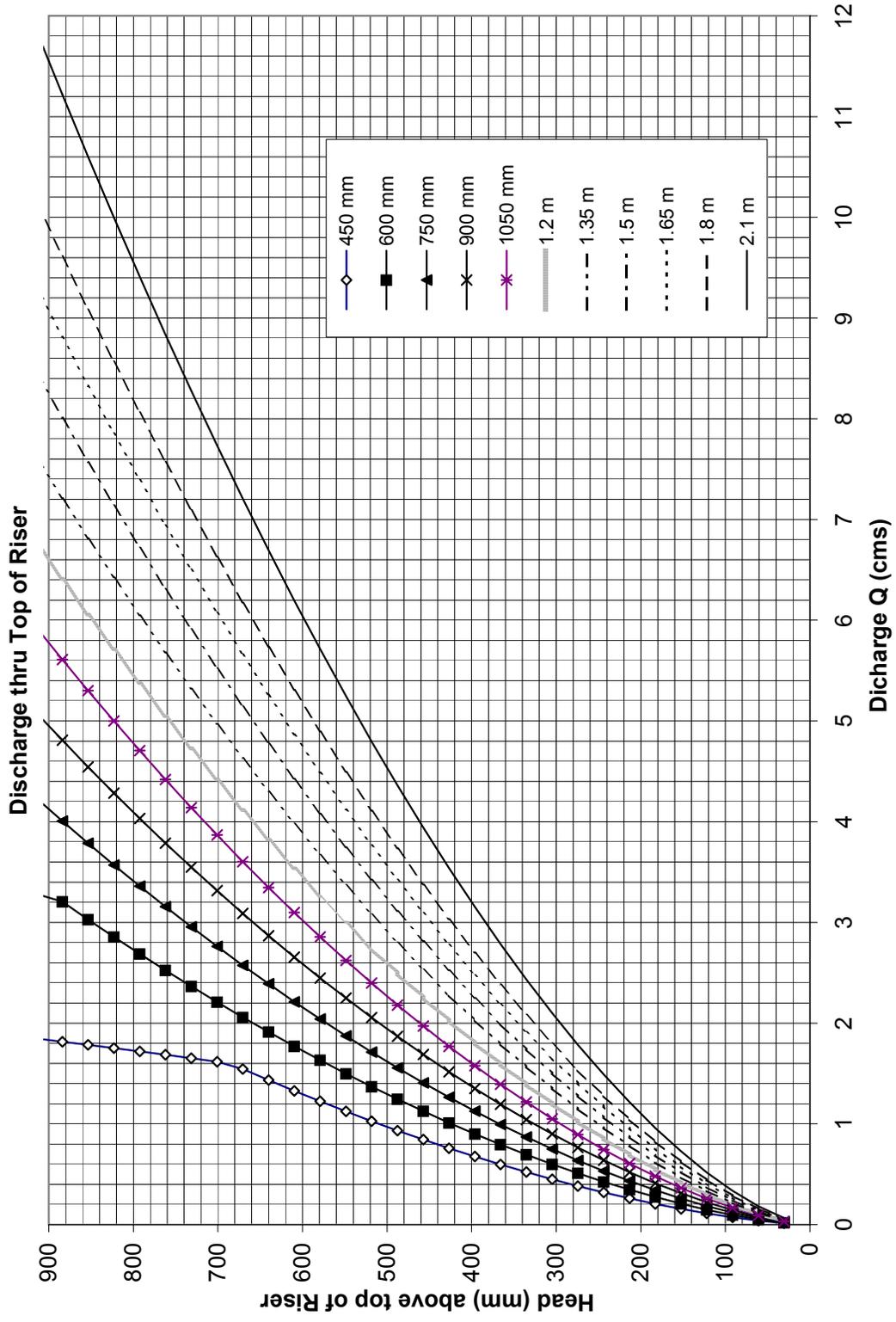
- 2) The riser shall have a diameter of at least 1 foot **(300 mm)** larger than the principal spillway and shall be designed to pass the flow of the principal spillway with the water elevation above the riser being 3 feet **(900 mm)** or less.
- 3) From Chart 20.3.4.3.3A & B the depth of flow required over the riser in order to pass the flow of the principle spillway can be obtained.

- 4) The dry storage portion of the riser will be perforated with holes. The wet storage portion of the riser shall be solid in order to provide the wet storage requirement.
- 5) The perforations in the dry storage portion of the riser shall be designed to dewater the dry storage volume of the dam in no less than 48 hours and no more than 72 hours. The hole spacing in the riser shall be designed utilizing a recognized storage routing method. For design purposes the basin shall be considered empty when the water discharge is 0.01 cfs **(0.00025 cms)** or less.

It is preferred that the perforations in the riser be 1½-inch **(35 mm)** diameter holes with a minimum of 2 horizontal rows with a minimum of 2 holes per row. When less than 5 holes are utilized or the hole diameter is less than ¾-inch **(18 mm)** then special protection of the perforations should be considered to ensure the perforations do not become clogged.

- 6) An anti-vortex device consisting of a thin vertical plate placed normal to the centerline of the dam and firmly attached to the top of the riser will be provided. The plate length is equal to the diameter of the riser pipe plus 12 inches **(300 mm)**; and the plate height is equal to the diameter of the horizontal pipe.
- 7) The riser shall have an attached base with sufficient weight to prevent flotation. Two acceptable bases are:
 - (a) A concrete base 18 inches **(450 mm)** thick with the riser imbedded 6 inches **(150 mm)** into the base. The base should be square with each dimension 1 foot **(300 mm)** greater than the riser diameter.
 - (b) A ¼ inch **(6 mm)** thick steel plate welded around the base of the riser to form a watertight connection. The plate shall be square with each side equal to 2 times the riser diameter. Two foot **(600 mm)** of stone, gravel, or tamped earth will be placed on the plate.
- 8) A trash rack must be attached to the top of the riser. It shall have openings no larger than ¾ of the conduit diameter and no smaller than 4 inches **(100 mm)**.
- 9) A minimum of one anti-seep collar must be utilized on each conduit through a sediment dam. It should be located at the centerline of the dam.





20.3.4.3.4 - Emergency Spillway:

- 1) The top of the dam must be at least 1 foot (**300 mm**) above the maximum design flow elevation of the emergency spillway.
- 2) The crest elevation of the emergency spillway must be at least 1 foot (**300 mm**) above the crest elevation of the principal spillway.
- 3) The minimum bottom width of an emergency spillway is 10 feet (**3 m**).
- 4) The minimum level distance of the emergency spillway in the direction of flow is 20 feet (**6 m**) unless the emergency spillway goes over the dam.
- 5) The emergency spillway should be placed in undisturbed ground. If field conditions require the emergency spillway to be constructed over the dam, the downstream slope must be constructed as shown on Figure 20.3.4.3 A.
- 6) Charts 20.3.4.3.4 A and B can be used to find the Q thru the emergency spillway. The velocity can be determined by the formula $V = Q/A$.

**CHART 20.3.4.3.4 A
EMERGENCY SPILLWAY HYDRAULICS**

SPILLWAY Width - b (Feet)	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	DISCHARGE (CUBIC FEET/SECOND)													
1.0	20	30	40	50	60	70	80	90	100	110	120	130	140	150
1.5	39	59	70	98	110	137	157	176	196	216	235	255	274	294
2.0	64	96	128	160	192	224	256	288	320	352	384	416	448	480
2.5	94	141	188	235	282	329	376	423	470	517	564	611	658	705
3.0	129	194	258	323	387	452	516	581	645	710	774	839	903	968
3.5	169	254	338	423	507	592	676	761	845	930	1014	1099	1183	1268
4.0	212	318	424	530	636	742	848	954	1060	1166	1272	1378	1484	1590
4.5	259	387	516	645	774	903	1032	1161	1290	1419	1548	1677	1806	1935
5.0	305	458	610	763	915	1068	1220	1373	1525	1678	1830			
5.5	364	546	728	910	1092	1274	1456	1638	1820					
6.0	422	633	844	1055	1266	1477	1688	1899						
6.5	482	723	964	1205	1448	1687	1928							
7.0	550	825	1100	1375	1650	1925								
7.5	618	927	1236	1545	1854									
8.0	690	1035	1360	1735										
8.5	764	1146	1538	1910										
9.0	845	1268	1690											
9.5	924	1386	1848											
10.0	1010	1515												

Reference: SCS Technical Release No. 35 (z=2, n=0.040, L=100 Ft.) April 1971

CHART 20.3.4.3.4 B

EMERGENCY SPILLWAY HYDRAULICS

SPILLWAY Width-b (m)	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
Height-H (m)	DISCHARGE (CUBIC METERS/SECOND)								
0.5	1.1	1.7	2.0	2.8	3.1	3.9	4.4	5.0	5.6
1.0	3.7	5.5	7.3	9.1	11.0	12.8	14.6	16.5	18.3
1.5	7.3	11.0	14.6	18.3	21.9	25.6	29.2	32.9	36.5
2.0	12.0	17.9	23.9	29.9	35.8	41.8	47.8	53.8	
2.5	17.5	26.2	35.0	43.7	52.5				
3.0	23.9	35.9	47.9						

(Assumed: z=2, n=0.040, L=30 m)

20.3.4.3.5 - Overtopping:

All sediment basin structures that are to remain in place shall be designed for overtopping.

If the combined capacity of the principal spillway (Q_{ps}) plus the emergency spillway (Q_{es}) at the dam crest elevation is not capable of passing the 100-year frequency storm (Q_{100}) then the dam face must be designed for the overtopping flow (Q_{over}). The design overtopping storm frequency shall be a 100-year frequency storm (Q_{100}).

Design method:

- 1) Determine Overflow by the following equation:

$$Q_{over} = Q_{100} - Q_{ps} - Q_{es}$$

Where:

Q_{over} = Overtopping Flow cfs (***cms***)

Q_{100} = 100-year Frequency Storm (cfs) (***cms***)

Q_{ps} = Principal Spillway Flow (cfs) (***cms***)

Q_{es} = Emergency Spillway Flow (cfs) (***cms***)

- 2) Find the cubic foot per second per foot of dam width (q) at the base of the dam. It may be required to calculate the rock size at higher elevations in the dam face when large D_{50} rock sizes are calculated. This would allow the D_{50} rock size to decrease as it reaches the top of the structure.

$$(q) = Q_{over} / \text{Flow width}$$

- 3) See Fig. 20.3.4.3.5A&B to determine the required D_{50} size at that elevation.

Flow width is the width of the dam at the elevation on the dam face being analyzed.

Example:

Dam has a 2.5:1 face slope, Base width of 10 feet, Total dam height is 10 feet, $Q_{100} = 200\text{cfs}$, $Q_{ps} = 40\text{cfs}$, $Q_{es} = 60\text{cfs}$

$$Q_{\text{over}} = 200\text{cfs} - 40\text{cfs} - 60\text{cfs}$$

$$Q_{\text{over}} = 100\text{cfs}$$

Base width is 10 feet

$$q_0 = 100\text{cfs} / 10\text{ft}$$

$$q_0 = 10\text{cfs/ft}$$

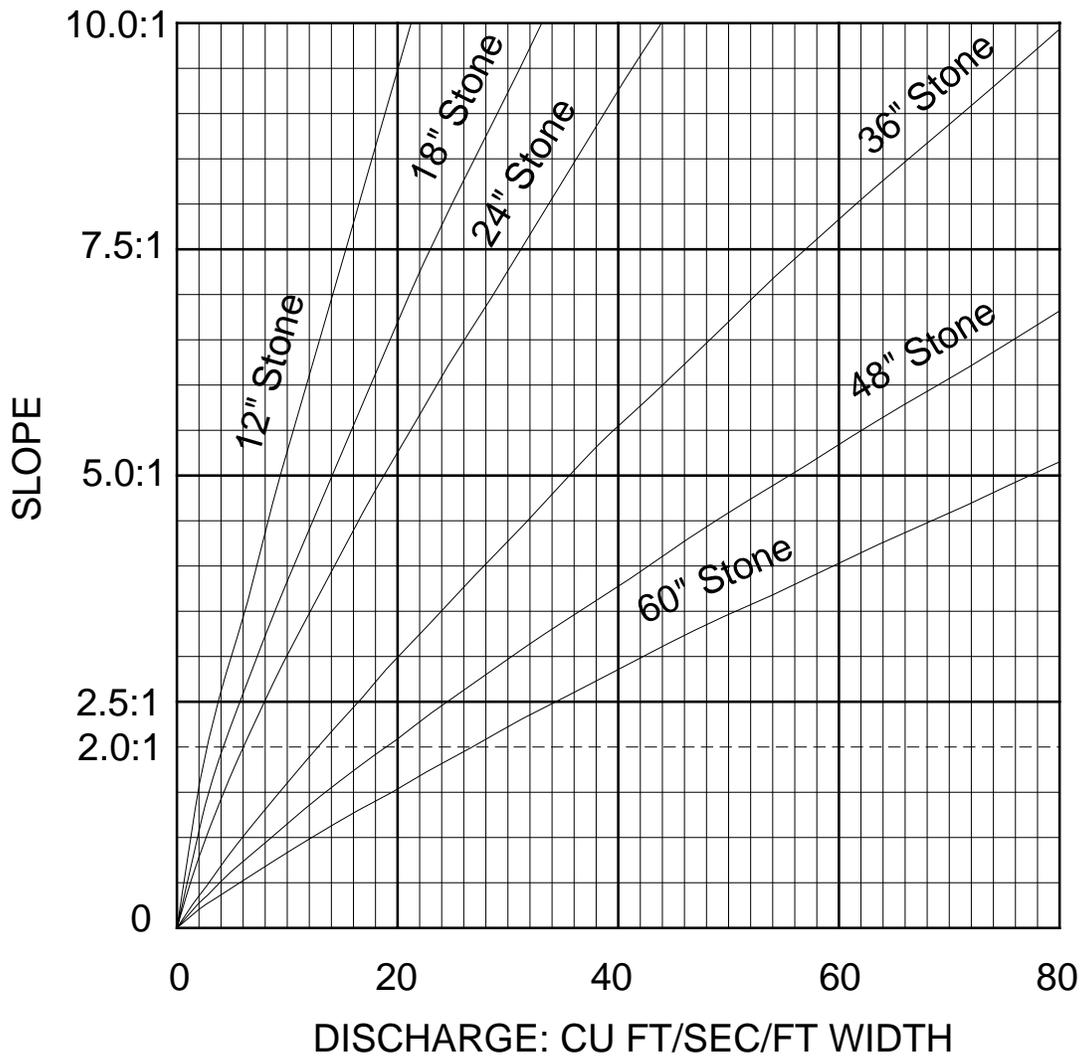
Using Fig. 20.3.4.3.5A and the 2.5:1 Slope the required D_{50} is 30" rock.

The dam width 5 feet higher in the dam is 20 feet.

$$q_5 = 100\text{cfs} / 20\text{ft}$$

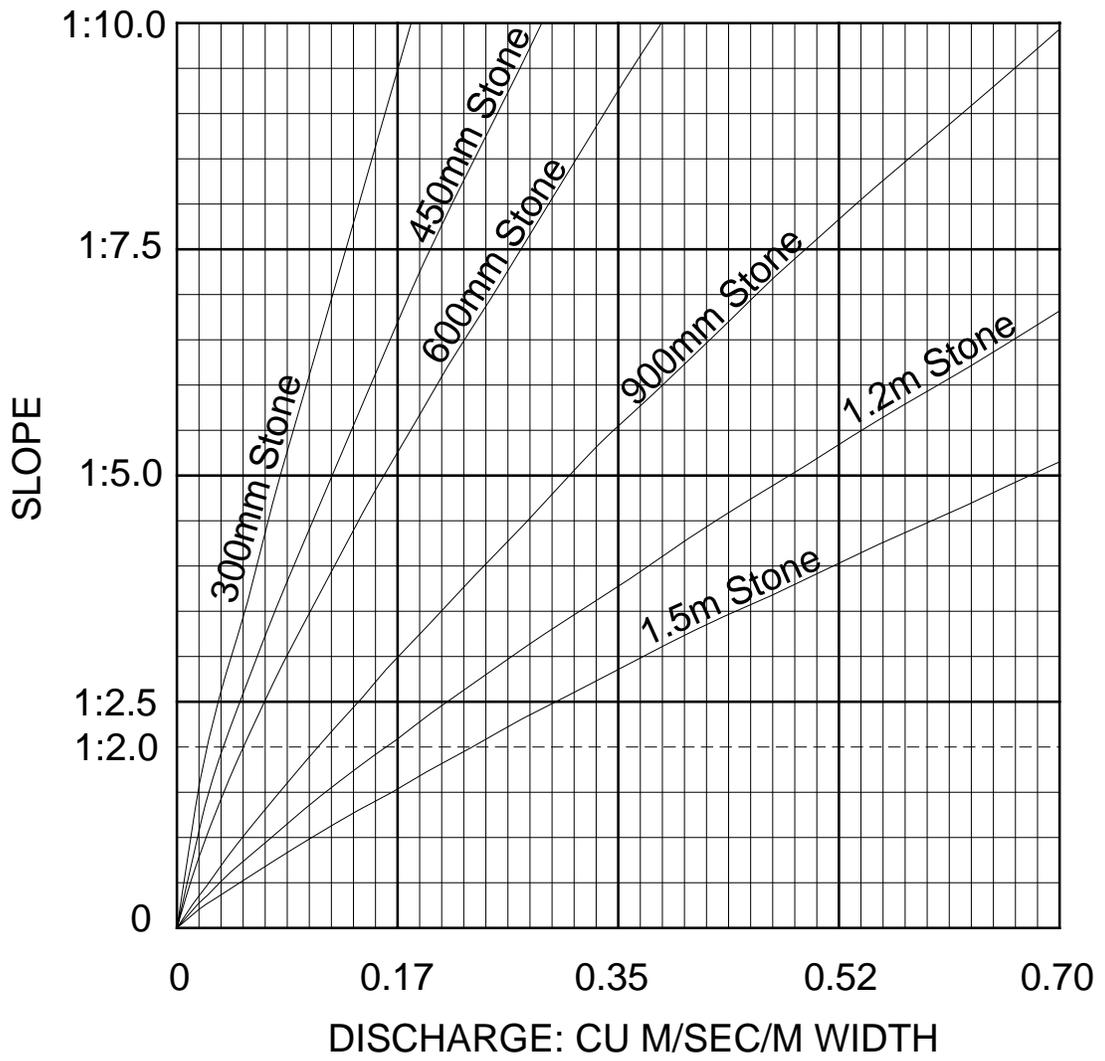
$$q_5 = 5\text{cfs/ft}$$

Using Fig. 20.3.4.3.5A and the 2.5:1 Slope the required D_{50} is 18" rock.



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MANUAL
FIGURE 20.3.4.3.5A



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EROSION CONTROL
 MANUAL
 FIGURE 20.3.4.3.5B

20.3.5 - Construction Methods: Sediment basins should be located outside the normal slope limits so that they can be built prior to the start of construction and remain in service throughout the construction period. Low areas adjacent to the highway should be utilized where possible so that water pollution during construction of these basins can be minimized. In order to gain the maximum benefits from sediment basins, they shall be constructed as the first order of work, even before clearing and grubbing operations begin.

The area where a sediment dam will be constructed will be cleared of vegetation to allow the dam to be keyed into the existing ground. Likewise, the area behind the dam to be flooded will be cleared to facilitate future sediment removal. The key shall be a minimum of 3 foot **(900 mm)** wide and 2 foot **(600 mm)** deep and shall extend the full width of the dam. It will be required on all dams over 5 feet **(1.5 m)** in height.

The material utilized for construction of the sediment dam may be obtained from the unclassified excavation if available without creating significant disturbance. If the material is not available, an item and quantity for rock borrow excavation will be established in the contract.

The material will be placed in 6-8 inch **(50-200 mm)** lifts and compacted by the hauling and spreading equipment tracks covering the entire surface or by the use of a roller.

When the principal spillway is a conduit, it will be sized as described in Section 20.3.4 of this manual.

The inlets of sediment basins should be constructed with a wide cross-section and a minimum grade to prevent turbulence.

Basins that remain in place are to be fenced in accordance with Section 608 of the Specifications. If additional right-of-way is required to construct basins that remain in place, the additional taking **shall be right-of-way** and not a temporary construction or drainage easement.

The accumulated sediment in a basin shall be removed once the wet storage volume has been reduced by 50 percent. Removed accumulated sediment shall be disposed of in such location that the sediment will not erode into construction areas, natural waterways or streams, or wetlands. This is also applicable for excavated material removed during construction and/or removal of the sediment basin.

Prior to removing sediment from the ponds and/or dams as described above, the basin must be dewatered. A "Dewatering Device" as specified in Section 642 of the Specifications, shall be utilized.

When removing a sediment basin all sediment accumulation may be required to be removed, all excavations backfilled and properly compacted, all dam structures removed and the existing ground restored to its natural or intended condition unless otherwise noted.

SECTION

30

DESIGN

30 – DESIGN:

The designer will evaluate the land disturbing activities for a particular project to determine what erosion and sediment control features are necessary and appropriate to be included in the project plans.

For projects such as resurfacing and latex modified concrete bridge deck overlays, erosion and sediment control features will not be required.

All projects with land disturbing activities, individual bid items as per Section 642 of the Specifications will be established. Plan quantities will be developed utilizing criteria set forth in this manual and/or any appropriate Design Directive. Sediment basins will be designed and shown on the plans as they may require additional right-of-way or temporary easement.

In accordance with the December 5, 2002 National Pollutant Discharge Elimination System (NPDES) General Permit all land disturbing activities of 1 acre (**0.4 ha**) and greater are required to be registered with the West Virginia Department of Environmental Protection. Registration under the new permit is divided into two types. Those projects involving disturbed areas of 1 to 3 acres (**0.4 to 1.2 ha**) will require the submission of a "Notice of Intent" (NOI) form. A "Site Registration Application Form" (SRA) is to be submitted for those projects involving greater than 3 acres (**1.2 ha**) of disturbance. The WVDOH method of calculating disturbed area is to utilize the Clearing and Grubbing (C&G) quantity.

General guidelines as to which form are to be completed and submitted will be as follows:

1. Any project with 1 to 3 acres (**0.4 to 1.2 ha**) of C&G activities will require a completed NOI form.
2. Any project with less than 1 acre (**0.4 ha**) of C&G activities and an undefined waste site, borrow site or undefined construction access area will require a completed NOI form.
3. Any projects without C&G, which may involve significant disturbed areas for waste sites, borrow sites or any other construction activities will require a completed NOI form.
4. Any project with C&G of 1¹/₂ acres (**0.6 ha**) and a substantial amount of waste or borrow that cannot be placed in the remaining 1¹/₂ acres (**0.6 ha**) will require a completed SRA form.
5. Any project with a construction phase of 1 calendar year or greater, regardless of C&G or other land disturbance activities, will require a completed SRA form.

The designer shall complete and submit the appropriate NPDES registration form to the Technical Section of the Engineering Division during the final phases of design. The

Engineering Division will submit the permit registration to the WVDEP in the name of the West Virginia Department of Transportation, Division of Highways.

The WVDOH will register all projects with any land disturbing activities. Projects such as resurfacing, bridge deck overlays, traffic signal installation, guardrail placement, ditch pulling, etc. will not require and NPDES registration. However, the use of ***BMP's*** is strongly encouraged.

All designers are cautioned to pay particular attention to Section 20 and all the necessary requirements and criteria for the sizing of sediment basins. The tentative locations of sediment basins are to be indicated on the Preliminary Field Review plan submission. All sediment basins are to be completely designed and shown on the Final Field Review plan submission. Concurrence/approval (of the sediment basins) in writing from the appropriate WVDEP personnel is to be obtained at the conclusion of the review. If the concurrence/approval cannot be given subject to comments made at the review, then corrections are to be made promptly and resubmitted for approval.

If the required size of a sediment basin cannot be accomplished, written justification explaining in detail the reasons for not meeting the necessary criteria is to be available at the Final Field Review. ***Right of way constraints are not justification for downsizing a basin*** unless the taking of an occupied building, encroaching on a cultural/natural resource or the disturbance to constructing the basin is greater than the area being protected. The designer shall establish right-of-way limits that allow for the full development of a properly designed sediment basin.

The designer is to provide all the necessary bid items and quantities that will allow the Contractor to develop an Erosion and Sediment Control plan for submittal to the WVDOH as outlined in Section 40 of this manual.

The quantities are to be calculated using the following guidelines:

Item 642001-*, Temporary Berms, per linear foot (***meter***) – For estimating purposes, use length of the embankment in profile times 2.5.

Item 642002-*, Slope Drain, per linear foot (***meter***) – Use the embankment length divided by 250 +1, multiplied by the average slope of the embankment.

[(Embankment Length/250) + 1] x (Average of the finished slope of the embankment)

This calculation is for one side of the embankment.

Item 642004-*, Seed Mix, "Type", per pound (***kilogram***) – See current specifications for rate of seed per acre (***hectare***) and schedule of seeding operations. For estimating purposes, assume the entire project will be seeded twice per construction season.

Item 642005-*, Mulch, "Type", per ton (***megagram***) – See current specifications for rate of mulch per acre (***hectare***) of area to be seeded and mulched. For estimating purposes, assume the entire project will be mulch twice per construction season.

Item 642006-*, Fertilizer, per ton (**megagram**) – Fertilizer shall be applied at the rate of 800 lb. per acre (**900 kilogram per hectare**) of area to be seed and mulched. For estimating purposes, assume the entire project will be fertilized twice per construction season.

Item 642007-*, Fiber Matting, per square yard (**square meter**) – Use when contour ditch velocities exceed that allowable as set forth in the Drainage Manual.

Item 642008-*, Temporary Pipe, per linear foot (**meter**) – Use as outlined in Section 20 of the Erosion and Sediment Control Manual.

Item 642009-*, Contour Ditch, per linear foot (**meter**) – For estimating purposes, use three times the project length rounded to the nearest 100 foot (**30 meters**).

Item 642010-*, Agricultural Limestone, per ton (**megagram**) – Use 1.5 ton per acre (**3.4 megagram per hectare**) of area to be seeded and mulched unless the pH tests indicate otherwise.

Item 642011-*, Hay or Straw Bales, per each – Use 0.25 times the project length. For estimating purposes, a hay or straw bale is 3 feet (**1 meter**) in length.

Item 642012-*, Silt Fence, per linear foot (**meter**) – Use 2 times the project length.

Item 642015-*, Super Silt Fence, per linear foot (**meter**) – When sediment basins have been downsized, the design may include a bid quantity for Super Silt Fence and shall indicate on the plans where it is to be used.

Item 642031-*, Ditch Checks, per each - Use as outlined in Section 20 of the Erosion and Sediment Control Manual.

Item 642033-*, Sediment Trap, per cubic yard (**cubic meter**) - For estimating purposes, use 100 cubic yards (**77 cubic meters**) per 1000 foot (**300 meters**) of project length. When sediment basins have been downsized, the quantity for sediment trap shall be increased.

Item 642035-*, Riser, per each – A riser is to be used for all sediment basins except as noted in Section 20.3. The outlet pipe is to be bid as a regular pipe item.

Item 642036-*, Sediment Removal, per cubic yard (**cubic meter**) – For estimating purposes, use 100 cubic yards (**77 cubic meters**) per 1000 feet (**300 meters**) of project length or 50% of the total sediment basin (ponds and dams) volume, which ever is greater, per construction season.

Item 642042-*, Flocculant Block, per each – For estimating purposes, use 2 flocculant block per sediment basin per construction season and 1 flocculant block per 50 cubic yards of Sediment Trap bid per construction season.

Item 642043-*, Premanufactured Ditch Checks, per each – When sediment basins have been downsized, the designer may include a bid quantity for Premanufactured ditch checks and shall indicate on the plans where they are to be used. Such areas could include upstream of inlet or culverts prior to a gutter or a slope drain.

Item 642050-*, Dewatering Device, per each – For estimating purposes, use 1 dewatering device per sediment basin and 1 dewatering device per excavated pier or abutment when the excavation is anticipated to be wet.

Sediment Basins are to be site specific designs as outlined in Section 20 and shown on the construction plans. Each sediment basin is to be considered as its own project and earthwork cannot be considered from any other part of the project. Quantities for each basin are to be calculated for the bid items as indicated on the “Sediment Basin” Table shown below and itemized in the Summary of Quantities under its own category.

SEDIMENT BASIN SUMMARY																
STATION	LEFT / RIGHT	BASIN NUMBER	207001	207034	211001	211002	211017	606030	642035	642036	201001	(NOTE 3)				REMARKS
			UNCLASSIFIED EXCAVATION	FABRIC FOR SEPARATION	UNCLASSIFIED BORROW EXCAVATION (NOTE 1)	ROCK BORROW EXCAVATION	IMPERVIOUS CORE	OUTLET PIPE	RISER	SEDIMENT REMOVAL	CLEARING AND GRUBBING	SEED MIX	MULCH	FERTILIZER	AGRICULTURAL LIMESTONE	
			CY	SY	CY	TON	SF	LF	EA	CY	ACRE	LB	TON	TON	TON	
TOTALS																

- NOTE 1 – UNCLASSIFIED BORROW EXCAVATION QUANTITY FOR EACH BASIN ON THE TOTAL REQUIRED EXCAVATION FOR EACH BASIN.
- NOTE 2 – COST AND QUANTITY INCLUDED IN THE UNIT PRICE BID FOR ITEM 201001, CLEARING AND GRUBBING, PER LS – QUANTITY IS FOR INFORMATION ONLY.
- NOTE 3 – COST TO BE INCLUDED IN UNIT BID PRICE FOR ITEM 207001, UNCLASSIFIED EXCAVATION, PER CY. MATERIAL CERTIFICATION REQUIREMENTS FOR THESE ITEMS SHALL BE WAIVED. QUANTITIES FOR INFORMATION ONLY.
- NOTE 4 – SHRINK AND SWELL FACTORS AS WELL AS UNSUITABLE MATERIAL FOR SEDIMENT BASINS HAVE NOT BEEN CONSIDERED IN THE EARTHWORK CALCULATIONS.

All Sediment Basins are to be removed unless approved per Section 20 and a site specific restoration plan should be shown on the construction plans. Each sediment basin restoration is to be considered as its own project and earthwork cannot be considered from any other part of the project. Quantities for each basin restoration is to be calculated for the bid items as indicated on the “Sediment Basin Restoration” Table shown below and itemized in the Summary of Quantities under its own category. Sediment basins that are approved to be left in place upon completion of construction they are to be fenced in accordance with Section 608 of the specifications.

SEDIMENT BASIN RESTORATION											
STATION	LEFT / RIGHT	BASIN NUMBER	207001	633003	(NOTE 2)		(NOTE 3)			REMARKS	
			UNCLASSIFIED EXCAVATION (NOTE 1)	DUMP ROCK GUTTER	STOCKPILING ROCK	STOCKPILING UNCLASSIFIED MATERIAL	SEED MIX	MULCH	FERTILIZER		AGRICULTURAL LIMESTONE
			CY	CY	CY	CY	LB	TON	TON		TON
TOTAL											

NOTE 1 – UNCLASSIFIED EXCAVATION QUANTITY FOR EACH BASIN ON THE TOTAL REQUIRED EXCAVATION FOR EACH BASIN RESTORATION. SHRINK AND SWELL FACTORS AS WELL AS UNSUITABLE MATERIAL HAVE NOT BEEN CONSIDERED IN THE EARTHWORK CALCULATIONS. PLACING THE STOCKPILED MATERIAL EXCEPT FOR THE DUMP ROCK GUTTER HAS BEEN INCLUDED IN THE UNCLASSIFIED EXCAVATION QUANTITY.

NOTE 2– COST TO BE INCLUDED IN UNIT BID PRICE FOR ITEM 207001, UNCLASSIFIED EXCAVATION, PER CY. STOCKPILING OF MATERIAL IS TO BE PERFORMED DURING THE EXCAVATION OF THE CONSTRUCTION PROJECT. QUANTITIES FOR INFORMATION ONLY.

NOTE 2– COST TO BE INCLUDED IN UNIT BID PRICE FOR ITEM 207001, UNCLASSIFIED EXCAVATION, PER CY. MATERIAL CERTIFICATION REQUIREMENTS FOR THESE ITEMS SHALL BE WAIVED. QUANTITIES FOR INFORMATION ONLY.

The method of calculating the quantities for pay items shown in this section is to be used as a guide. Conditions of individual projects may dictate the need for adjustment of these methods.

SECTION
40
CONSTRUCTION

40 – CONSTRUCTION:

40.1 - CONTRACTOR'S EROSION AND SEDIMENT CONTROL PLAN:

The Contractor shall exercise every reasonable precaution throughout the life of the project to control water pollution. Construction of permanent drainage facilities as well as performance of other contract work, which will contribute to the control of siltation shall be accomplished at the earliest practicable time during the life of the Contract. Pollutants such as chemicals, fuels, lubricants, bitumen's, raw sewage, and other harmful waste shall not be discharged into or alongside of rivers, streams, wetlands, lakes, reservoirs, etc. or into natural or manmade water courses leading thereto.

The Contractor shall prepare a temporary erosion and sediment control plan as outlined below and submit three (3) copies at the pre-construction conference.

The plan may be submitted in phases or in its entirety at the discretion of the Contractor. If it is done in phases, Phase I will consider that portion of the project prior to the clearing and grubbing operations occurring. Phase II will include all other work. Since highway construction is continually changing, the time of construction between the clearing and grubbing phase and the final stages of work will have to be written in lieu of using the plans to depict the final product. In either case, work shall not proceed on a particular phase until the Erosion and Sediment Control Plan (Plan) for that phase is approved and implemented.

The plan will have the following minimum requirements:

1. A plan view of the project showing the location of the Contractor's proposed erosion and sediment control facilities, roadway centerline, right-of-way limits, haul roads, waste sites, borrow sites, and erosion and sediment control facilities as established on the contract plans. The project plan sheets may be utilized for this purpose.
2. A detailed written description of the Contractor's Plan referenced to the plan sheets as mentioned above. For each facility shown, the following information will be required unless previously indicated on the construction plans.
 - a. Size of facility-storage computations.
 - b. Runoff calculations.
 - c. Calculations for design of principal and/or emergency spillways (sediment dams only).
 - d. Plan and profile of each structure.
 - e. Time schedule of when the facility will be constructed in relation to the phase of the project (e.g. sediment pond to be constructed prior to embankment operations, sediment trap excavated after pipe placement).
3. Time schedule for the erosion and sediment control contract items not readily shown on plan views (i.e. seeding and mulching).

4. The quantity of erodible soil which shall be exposed is limited to 750,000 SF **(7 ha)** by Section 642 of the Specifications as a result of (1) clearing and grubbing and (2) excavation, embankment, borrow or waste for a maximum cumulative total of 1,500,000 SF **(14 ha)**. The amount of exposed erodible soil may be limited to less if an area will not be worked for an extended period of time. **Clearing and grubbing of the entire project will not be permitted.** If the Contractor anticipates exceeding these limits, permission must be requested from the Engineer accompanied by a letter justifying the request.
5. The Contractor will also be required to prepare and submit a Groundwater Protection Plan (GPP). The areas of concern will be equipment maintenance yards, including fueling and refueling areas, and product storage areas. The GPP should address groundwater protection and maintenance. A generic GPP for construction related activities has been included in Section 80 of this manual.

A checklist of the items, which should be included in the Contractor's Plan is contained in Section 60 of this Manual.

40.2 - WVDOH REVIEW/APPROVAL OF THE CONTRACTOR'S EROSION & SEDIMENT CONTROL PLAN:

The Assistant District Engineer-Construction (ADEC) will be responsible for providing a quick review and reply to the Contractor concerning Phase I of the Plan in order to expedite the project. If additional information is needed, the Contractor shall be so advised by the ADEC.

Phase II of the plan will be reviewed by the Project Engineer/Supervisor, the ADEC, and the Regional Engineer from the Contract Administration Division. Outside agencies such as the West Virginia Department of Environmental Protection (WVDEP), the West Virginia Division of Natural Resources (WVDNR), the West Virginia Conservation Agency (WVCA), and/or the local Soil Conservation District may also be involved in the review process if the project contains or is adjacent to highly sensitive environmental areas.

Approval of the Plan is the responsibility of the Contract Administration Division unless otherwise specified. The Contract Administration Division will notify the ADEC who will notify the Contractor concerning the adequacy of the Plan or the need for additional information.

40.3 - FIELD IMPLEMENTATION:

Once the Plan is approved, the Contractor will begin implementation in the field. The Project Engineer/Supervisor or ADEC can approve minor changes approved Plan; however, the Contract Administration Division and WVDEP must approve major changes.

The first order of work for the Contractor is to establish erosion and sediment control.

Both the WVDOH and the Contractor will appoint key project personnel to continually review erosion and sediment control on the project. At a minimum, reviews shall occur weekly and after every significant rainfall. The "Erosion and Sediment Control Inspection Form," included in this Section is to be used to conduct these reviews.

Additions and adjustments to the project erosion and sediment control features should be implemented as needed.

The terms of the NPDES General Permit (See Section 70 of this Manual) must be followed. Major flaws in the plan quantities and designed sediment basins should be reported to the designer to aid in preventing future occurrences on other projects.


WEST VIRGINIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
EROSION AND SEDIMENT CONTROL INSPECTION FORM

State Project:	Federal Project:
Date:	Time:
Weather:	

Best Management Practices Review					
Silt Fence		Perm. Seed & Mulch		Areas @ Final Grade >7 Days	
Diversions		Vigor of Grass		Areas Unstabilized > 14 Days	
Sediment Traps		Ditch Checks		Clearing & Grubbing	
Sediment Basins		Stable Const Entrance		Perm Waterways Stabilized	
Maintenance		Slope Drains/Berms		Waste Site	
Water Bars		Down Slope Areas Protected		Borrow Site	
Topsoil Stockpile		Timely Installation		Other	
Temp. Seed & Mulch		Other		Other	

S-Satisfactory **U**-Unsatisfactory **N/A**-Not Applicable **N/O**-Not Observed **M**-Marginal

Receiving Stream(s) Evaluation: Muddy? Yes No Sediment Deposits? Yes No

Additional Comments:

_____ Reviewer

40.4 - EROSION & SEDIMENT CONTROL PLAN FOR WASTE & BORROW SITES:

1. The Contractor shall submit four (4) copies of the Erosion & Sediment Control Plan (E&S) to the ADEC.
2. The ADEC or his designee shall review the E&S with the Project Engineer/Supervisor.
3. If the E&S does not include all necessary information (erosion & sediment control features, good location map, etc.) then the ADEC shall return the E&S to the Contractor with a list of deficiencies.
4. If the E&S includes all necessary information, then the ADEC shall send the E&S to the appropriate WVDEP via **overnight** mail or carrier.
5. The WVDEP has **30 days** to review the plan.
6. If the WVDEP returns the E&S to the ADEC due to insufficient information, the ADEC shall request the necessary information from the Contractor.
7. When the ADEC receives an E&S approval from the WVDEP, he shall forward the approved E&S to Contract Administration via **overnight** mail or carrier.
8. Contract Administration shall review the E&S and provide comments and/or approval to the ADEC.
9. Once the ADEC receives the approval from Contract Administration, the ADEC shall provide copies of the approved E&S to the Project Engineer/Supervisor and notify the Contractor of said approval.
10. Once the E&S features are in place as set forth in the Contractor's approved E&S, then the Waste or Borrow Site may be used.

NOTES:

Waste and borrow site submissions should be complete including Save Harmless, West Virginia State Historic Preservation Office (SHPO) approval, and cross-sections.

In addition, the Contractor shall submit a completed WVDOH Form HL-445. A copy is included within this section.

The E&S along with a good location map must be submitted and approved by the WVDEP before it can be considered part of the NPDES permit and/or site registration obtained by the WVDOH.

WEST VIRGINIA DEPARTMENT OF HIGHWAYS

REQUEST FOR APPROVAL OF WASTE OR BORROW SITE

Form HL-445 (T) 4-20-70

Project No.		County	Contractor
Waste Site No.	Borrow Site No.	Waste or Borrow Site on the Property of	

1. (a) Are precautions necessary to prevent stream pollution? Yes ___ No ___
 (b) If the answer is "yes", will the Contractor comply? Yes ___ No ___
 Outline precautions necessary on an attached sheet.
2. (a) Are precautions necessary to prevent blocking drainage on new highways or existing roadways? Yes ___ No ___
 (b) If the answer is "yes", will the Contractor comply? Yes ___ No ___
 Outline precautions necessary on an attached sheet.
3. Has Contractor, in his Agreement with the Property owner, explained the waste or borrow site will be seeded and mulched? Yes ___ No ___
4. (a) Will the use of this borrow or waste site location involve the need for flagging traffic or present any other maintenance of traffic problems. Yes ___ No ___
 (b) If the answer is "yes", has the Contractor agreed to accept the cost as his responsibility? Yes ___ No ___
5. Representative of district who review the location in the field _____
6. Has Base Line for waste or borrow site been permanently referenced to permit re-establishment? Yes ___ No ___
7. Have original cross sections been taken at sufficient intervals and with the necessary precision to allow accurate computation of material borrowed or wasted? Yes ___ No ___
8. Has Contractor included computations of amount of material to be wasted or borrowed from sites? Yes ___ No ___
9. Attachments included with submission:

___ Drainage precaution attachment	___ Contractor's written request for approval
___ Drawing indicating position relative to center line of highway and establishment of base line	___ Stream pollution attachment
___ Cross sections indicating original and proposed elevations	___ Written agreement between Contractor and property owner
	___ Map indicating location

REVIEWED AND ACCEPTED BY		SUBMITTED BY	
Contractor	Date	Assistant District Engineer	Date
RECOMMENDED FOR APPROVAL		APPROVED BY	
District Engineer	Date	Construction Division Director	Date
FOR REGIONAL ENGINEER USE ONLY			Regional Engineer
Reviewed in the Field	Yes ___ No ___	Date	
Recommended for Approval	Yes ___ No ___	Date	
Concurrence of Design Obtained (For Interstate Projects Only)	Yes ___ No ___	Date	

SECTION
50
MAINTENANCE

50 – MAINTENANCE:

Maintenance operations such as ditch pulling and slide removal also encounter erosion and sediment.

Materials obtained from ditch pulling operations shall be treated the same as sediment removed from sediment basins. It should be disposed of in locations where it will not readily erode back into the ditch or natural drain way. It shall not be placed in streams, on stream banks, or in wetlands. The remaining ditch is to be seeded and mulched. Temporary features such as ditch checks and sediment traps as described and detailed in Section 20 of this Manual are to be installed to aid in minimizing erosion and sediment.

Slide removal operations can be treated in the same manner as excavation and embankment operations. The excavated material and the newly exposed land areas are to be treated as mentioned above.

SECTION

60

CHECKLIST FOR

EROSION AND SEDIMENT

CONTROL PLAN

60 - CHECKLIST FOR EROSION & SEDIMENT CONTROL PLAN:

A. Clearing and Grubbing (Phase I):

- 1. Indicate the proposed number of acres (**ha**) to be cleared at the start of operations.
- 2. Clearing and grubbing locations.
- 3. The disposition of cleared material - burned, wasted, chipped, etc.
- 4. The clearing method to be followed - cleared but not grubbed, cleared and grubbed, timber sawn with high stumps, etc.
- 5. The type of protection given to the cleared areas and to control erosion such as:
 - a. Clearing and grubbing limited to specification requirements in the fall due to difficulty in getting ground cover established.
 - b. Clear but not grub with disturbed areas not immediately needed seeded and mulched at the Contractor's expense.
 - c. Clear and grub with seeding and mulching those areas not immediately needed at the Contractor's expense.
 - d. Indicate the erosion control features to be used during this phase of the project such as sediment basins, hay or straw diversions, and/or contour ditching concurrent with clearing operations (show location on plans).

60.2. Excavation and Embankment (Phase II):

- 1. Excavation erosion controls - discuss the controls to be exercised such as:
 - a. Installation of sediment basins or other structures below excavation areas. Submit calculations for sediment basin design.
 - b. Specify temporary and permanent seeding methods and frequency.
 - c. Install contour ditches as appropriate.
- 2. Embankment erosion controls - discuss those to be employed during this phase such as:
 - a. Maintain temporary berms and temporary slope drains as

embankment is constructed (show location on plans).

- b. Install sediment traps at inlets and/or outlets of temporary slope drains and at the outer outlets of the temporary berms such as gutters, etc. (Show location and size on plans).
- c. Install sediment basins where appropriate below embankment areas if not already constructed during clearing and/or excavation operations. Submit calculations for sediment basin design.
- d. Indicate location of access routes for maintenance of sediment control structures on the plans.
- e. Specify temporary and permanent seeding methods and frequency.
- f. The gutter and channel linings are to be constructed concurrent with the embankment construction.
- g. Install hay or straw diversions or silt fence at toe of fills.

3. Haul Roads

- a. Indicate the location of haul roads and sediment and erosion control features on the plan that are known at the time.
- b. Describe the typical treatment of haul roads such as temporary berms on the outside edge with temporary slope drains to outlet the water in a controlled manner.
- c. Indicate the location of all known stream crossings on the plan and discuss the construction details intended (construction of non-erodible material, size of pipe, etc.).

4. Suspension of Work

- a. Include a narrative of the actions to be taken whenever work is to be suspended for a period of time greater than three (3) weeks, such as berm construction, method of maintaining erosion control features, etc.

5. Borrow and Waste Pits

- a. Show the location of the pit and associated haul roads (if known) on the plans and discuss the anticipated erosion and sediment control features to be installed.

- b. Specify temporary and permanent seeding methods and frequency.

6. Channel Changes

- a. Describe the construction methods to be followed in constructing all channel changes on the project to minimize siltation such as cut in dry, install permanent channel lining as soon as the excavation has been completed, etc.

7. Completion of Embankment Phase

- a. Describe the controls to be followed from the time the embankment has been brought to rough grade until the paving is completed such as:
 - 1) Install sediment traps upstream of median inlets and in the ditches at the end of cuts.
 - 2) Install Type "B" temporary berms on all fills tying into the previously placed temporary slope drains.
 - 3) Complete the installation of permanent gutters.

SECTION

70

NPDES GENERAL WATER

POLLUTION CONTROL PERMIT



WEST VIRGINIA
Department of Environmental Protection
Division of Water Resources

**WEST VIRGINIA/NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
GENERAL WATER POLLUTION CONTROL PERMIT**

Permit No. WV0115924

Issue Date: November 5, 2002

Effective Date: December 5, 2002

Expiration Date: December 4, 2007

Subject: Storm Water Associated
With Construction Activities

To whom it may concern:

This is to certify that any establishment with discharges composed entirely of storm water associated with construction activities disturbing one (1) acre or greater of land area (construction activities are earth disturbing operations such as clearing and grubbing, grading, filling and excavation operations during site development for residential, commercial or industrial purposes) and agreeing to be regulated under the terms of this general permit, except for;

1. Operations that result in the disturbance of less than one acre of total land area, which are not part of a larger common plan of development or sale.
2. Storm water discharges associated with earth disturbing activities that the Director has shown to be or may reasonably be expected to be contributing to a violation of a water quality standard.
3. Earth disturbing activities governed by other NPDES permits issued by the Department of Environmental Protection. This includes Division of Mining and Reclamation Permits for coal mining and non-metallic quarries.
4. Landfills, except in the preparation of a new landfill and/or clay borrow areas.
5. Other activities exempt from NPDES permitting requirements as set forth in 40 CFR 122.3 and 47 CSR 10.3.2.b.

is hereby granted coverage under this General WV/NPDES Water Pollution Control Permit to allow storm water discharges into the waters of the State. This General Permit is subject to the following terms and conditions:

The information submitted on and with the site registration application form will hereby be made terms and conditions of the General Permit with like effect as if all such information were set forth herein, and other pertinent conditions set forth in Sections A, B, C, D, E, F and G.

Sites registered under the 1997 General Storm Water Permit WV0115100 will automatically be provided coverage under General Storm Water Permit WV0115924. Any newly proposed or expanded construction activity on those sites will require new registration under General Storm Water Permit WV0115924.

Sites disturbing 1 to less than 3 acres that were under construction prior to the effective date of this permit, will be required to apply for and receive permit coverage if not completed by March 1, 2003.

SECTION A. TERMS OF PERMIT

Discharges from sites covered under the General Permit will not cause a violation of 46CSR1 and 46CSR 12 of the West Virginia Legislative Rules pursuant to Chapter 22, Article 11 and Article 12.

SECTION B. SCHEDULE OF COMPLIANCE

Compliance with this General Permit and the approved Storm Water Pollution Prevention Plan is required upon the beginning of the construction project.

SECTION C. MANAGEMENT CONDITIONS

C.1 Duty to Comply

C.1.a. The permittee must comply with all conditions of this Permit. Permit noncompliance constitutes a violation of the federal Clean Water Act (CWA) and State Act (Chapter 22, Article 11 and Article 12) and is grounds for enforcement action; for permit modification, relocation and reissuance, suspension or revocation; or for denial of a permit renewal application.

C.1.b. The permittee shall comply with all effluent standards or prohibitions established under Section 307(a) of the CWA for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

C.2 Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for a new permit as detailed in permit re-issuance. The construction activities permitted by this General Permit have 365 days past the expiration of the permit to complete the activity. Sites not completely stabilized will be required to reapply.

C.3 Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit, which has a reasonable likelihood of adversely affecting human health or the environment.

C.4 Permit Actions

This permit may be modified, revoked and reissued, suspended, or revoked for cause. The filing of a request by the permittee for permit modification, revocation and reissuance, or revocation, or a notification of a planned change or anticipated noncompliance, does not stay any permit condition.

C.5 Property Rights

This permit does not convey any property rights of any sort or any exclusive privilege.

C.6 Signatory Requirements

All applications, reports, or information submitted to the Director shall be signed and certified as required in 47 CSR 10.4.6 of the West Virginia Legislative Rules. If an authorization becomes inaccurate because a different individual or position has responsibility for the overall operation of the project, a new authorization must be submitted to the Director prior to, or together with any reports, information, or applications to be signed by an authorized representative.

C.7 Transferability

This permit is not transferable to any person, except after notice to the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary.

C.8. Duty to Provide Information

The permittee shall furnish to the Director, within a reasonable specified time, any information, including water quality monitoring if necessary which the Director may request to determine whether cause exists for modifying, revoking and reissuing, suspending, or revoking this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

C.9. Other Information

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information.

C.10. Inspections and Entry

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

C.10.a. Enter upon the permittee's premises in which an effluent source or activity is located, or where records must be kept under the conditions of this permit;

C.10.b. Have access to and copy at reasonable times, any records that must be kept under the conditions of this permit;

C.10.c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit.

C.11. Permit Modification

This permit may be modified, suspended, or revoked in whole or in part during its term in accordance with the provisions of Chapter 22-11 and 47CSR10 of the Code of West Virginia. Any permittee wishing to modify their coverage under this permit shall submit such request at least 30 days prior to the commencement of the proposed action.

C.12. Water Quality

The effluent or effluents covered by this permit are to be of such quality so as to not cause violations of applicable water quality standards adopted by the State Environmental Quality Board.

C.13. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under section 311 of the CWA.

C.14. Liabilities

C.14.a.

Any person who violates a permit condition implementing sections 301, 302, 306, 307, 308, 318 or 405 of the Clean Water Act is subject to a civil penalty not to exceed \$25,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing section 301, 302, 306, 307, or 308 of the Clean Water Act is subject to a fine of not less than \$2,500 nor more than \$25,000 per day of violation, or by imprisonment for not more than 1 year, or both.

C.14.b.

Any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

C.14.c.

Nothing in C.14.a), and b) shall be construed to limit or prohibit any other authority the Director may have under the State Water Pollution Control Act, Chapter 22, Article 11 and State Groundwater Protection Act, Chapter 22, Article 12.

C.15 Outlet Markers

An outlet marker shall be posted during the term of General Permit coverage in accordance with Title 47, Series 11, Section 9 of the West Virginia Legislative Rules.

SECTION D. OPERATION AND MAINTENANCE

D.1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of the permit.

D.2. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D.3. Bypass

D.3.a. Definitions

D.3.a.1.

“Bypass” means the intentional diversion of waste streams from any portion of a treatment facility; and

D.3.a.2.

“Severe property damage” means substantial physical damage to property, damage to the treatment facility which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

D.3.b.

Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of D.3.c) and D.3.d) of this permit.

D.3.c. Notification of bypass

D.3.c.1.

If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten (10) days before the date of the bypass.

D.3.c.2

If the permittee does not know in advance of the need for bypass, notice shall be submitted as requires in F.2.a) of this permit.

D.3.d. Prohibition of bypass

D.3.d.1.

Bypass is permitted only under the following conditions, and the Director may take enforcement action against a permittee for bypass, unless;

D.3.d.1.A.

Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

D.3.d.1.B

There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated sediment, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventive maintenance. This condition is not satisfied if the sediment and erosion control structures were not installed in the proper sequence; and

D.3.d.1.C.

The permittee submitted notices as required under D.3.c) of this permit.

D.3.d.2.

The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed in D.3.d)(1) of this permit.

D4 Upset

D.4.a. Definition “Upset” means an exceptional incident in which there is unintentional and temporary noncompliance with the terms and conditions of the permit and the Storm Water Pollution Prevention Plan because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

D.4.b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of D.4.c) are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

D.4.c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

D.4.c.1.

An upset occurred and that the permittee can identify the cause(s) of the upset:

D.4.c.2.

The permitted project was at the time being properly operated.

D.4.c.3.

The permittee submitted notice of the upset as required in F.2.a) of this permit.

D.4.c.4

The permittee complied with any remedial measures required under C.3. of this permit.

D.4.d. Burden of proof. In any enforcement proceedings the permittee seeking to establish the occurrence of an upset has the burden of proof.

D.5. Removed Substances

Where removed substances are not otherwise covered by the terms and conditions of this permit or other existing permits by the Director, any solids, sludge, filter backwash or other pollutants (removed in the course of treatment or control of wastewater) and which are intended for disposal within the State, shall be

disposed of only in a manner and at a site subject to the approval by the Director. If such substances are intended for disposal outside the State or for reuse, i.e., as a material used for making another product, which in turn has another use, the permittee shall notify the Director in writing of the proposed disposal or use of such substances, the identity of the prospective disposer or users, and the intended place of disposal or use, as appropriate.

SECTION E. MONITORING AND REPORTING

Monitoring of discharges is not required for construction activities unless directed by the Director.

E.1. Definitions

“As-built drawing” means a certified drawing of conditions as they were actually constructed.

“Best Management Practices” (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, other management practices and various structural practices such as but not limited to silt fence, sediment traps, seeding and mulching, and rip-rap used to prevent or reduce erosion and sediment runoff and the pollution of waters of the State. BMPs also include treatment requirements, operating procedures and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

“Clearing” means cutting and removing vegetation with chain saws, brush axes, brush hogs and other mechanical means where there is little or no soil disturbance.

“Common Plan of Development” is a contiguous construction project where multiple separate and distinct construction activities may be taking place at different times on different schedules but under one plan. The “plan” is broadly defined as any announcement or piece of documentation or physical demarcation indicating construction activities may occur on a specific plot; included in this definition are most subdivisions.

“Control” is a Best Management Practice such as erosion control or sediment control that used on a construction project will reduce sedimentation

“Construction Activity” means earth disturbance operations such as clearing and grubbing, grading, filling and excavation during site development for residential, commercial or industrial purposes. This includes but is not limited to access roads, off-site borrow and spoil areas and house lots in subdivisions.

“CWA” means Clean Water Act or the Federal Water Pollution Control Act.

“Director” means the Director of the Division of Water Resources, Department of Environmental Protection, or their designated representative.

“Disturbed area” is the total area of earth disturbing activity that will take place during all phases of a construction project, including but not limited to all waste and borrow sites, utility installation, road building, mass grading, and site development. For the purposes of the General Permit, subdivisions will consider a minimum of ¼ acre disturbance per lot, unless the lot is less than ¼ acre in size, in which the entire lot will be considered as disturbed area.

“Establishment” is an operation or facility as defined in West Virginia Code 22-11-3.

“Secretary” means the Secretary of the Department of Environmental Protection, or their designated representative.

“Estimate” means to be based on a technical evaluation of the sources contributing to the discharge.

“Excavating” means large scale grading accomplished usually with heavy machinery.

“Final Stabilization” means disturbed areas shall be covered by some sort of permanent protection. “Final Stabilization” includes; pavement, buildings, stable waterways (rip-rap, concrete, grass or pipe), a healthy, vigorous stand of perennial grass that uniformly covers at least 70 percent of the ground, stable outlet channels with velocity dissipation which directs site runoff to a natural watercourse, and any other approved structure or material.

“Grading” means changing surface contours by removing soil and stone from one place and building it up in another.

“Groundwater” means the water occurring in the zone of saturation beneath the seasonal high water table or any perched water zones.

“Groundwater Protection Plan” means groundwater protection practices developed and implemented in accordance with WV Legislative Rules, 47CSR58.

“Grubbing” means physically removing vegetative stumps and roots from the ground and disturbing the earth, usually by heavy machinery.

“Impervious surface” means a surface composed of any material that significantly impedes or prevents natural infiltration of water into soil. Impervious surfaces include, but are not limited to, roofs, building, streets, parking areas, and any concrete, asphalt, or compacted gravel surface.

“Intermittent stream” means a stream which has no flow during sustained periods of no precipitation and which do not support aquatic life whose life history requires residence in flowing waters for a continuous period of at least six (6) months.

“Karst” means a type of topography formed over limestone, dolomite, or gypsum resulting in dissolving or solution of the underlying calcareous rock.

“Minor construction activity” means an activity which disturbs one acre or more area, but less than a three acre area.

“Notice of Intent” is the form to be submitted by the applicant to register a small construction project (one that disturbs 1 to less than 3 acres) under the Construction Storm Water General Permit. (NOI)

“Notice of Termination” is the form to be submitted by the applicant to terminate coverage under the Construction General Storm Water Permit, after final stabilization has been completed. See Final Stabilization. (NOT)

“Pre-development” means the condition of the land, the amount and health of the ground cover and vegetation, prior to development. A “good” condition should be assumed for the pre-development condition.

“Point Source” is any discernible, confined and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, and container from which pollutants are or may be discharged to surface waters of the state.

Conveyances of pollution formed both as a result of natural erosion or by material means, and which constitutes a component of a drainage system, may fit the statutory definition and thereby subject the operators to liability under the Act.

“Post-development” means the anticipated final conditions of the project, including rooftops, parking lots, streets, drainage systems, vegetation, and any other structure planned. For subdivisions and speculative developments, it will be assumed that all lots are developed.

“Runoff coefficient” means the fraction of total rainfall that is not infiltrated into the ground that will appear at the point of discharge as runoff.

“Run off curve number” is the numeric value reflecting the runoff coefficient and is based on soils, slopes, and type and health of the ground cover.

“Sinkhole” means a depression in the land surface formed by solution or collapse that directs surface runoff into subsurface or to an underground drainage flow.

“Site Registration Application Forms” means the forms designed by the Director for the purpose of registering for coverage under a general permit. Under the General Permit WV0115924 there will be two separate forms, one for 1 to less than 3 acres (Notice of Intent) and the Site Registration Application Form for projects that disturb 3 acres and greater.

“Storm Water” means storm water runoff, snowmelt runoff, and surface runoff and drainage.

“Storm Water Management Facilities” means structures such as ponds, basins, outlets, ditches, velocity dissipaters, infiltration trenches and basins, extended detention basins and ponds, and any other structure used to control the quality and quantity of storm water from a development project.

“Storm Water Pollution Prevention Plan” means the Erosion and Sediment Control Plan submitted as part of the Site Registration Application Form.

“Tier 2.5 Waters” means Waters of Special Concern as identified in 46 CSR 1-4F.1.

“Tier 3 Waters” means waters as otherwise identified in 46CSR 1-4G.1.

“1-year, 24-hour precipitation event” means the maximum 24-hour precipitation event with a probable recurrence interval of once in 1 year. This information is available from the National Climatic Center of the Environmental Data Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, or the Natural Resources Conservation Service’s Erosion Control Handbook for Developing Areas.

“25-year, 24-hour precipitation” means the maximum 24-hour precipitation event with a probable recurrence interval of one in 25 years.

SECTION F. OTHER REPORTING

F1. Reporting Spill and Accidental Discharges

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to Series 11, Section 2, of the West Virginia Legislative Rules promulgated pursuant to Chapter 22, Article 11.

F2. Immediate Reporting

F2.a. The permittee shall report any noncompliance which may endanger health, property or the environment immediately after becoming aware of the circumstances by using the Department’s designated spill alert telephone number (1-800-642-3074). A written submission shall be provided within five (5) days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and time, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

SECTION G. OTHER REQUIREMENTS

G1. Requiring an individual permit or an alternative general permit.

G1.a. The Director may require any person authorized by this permit to apply for and obtain either an individual NPDES permit or an alternative NPDES general permit. Any interested person may petition the Director to take action under this paragraph. The Director may require any owner or operator authorized to discharge under this permit to apply for an individual NPDES permit only if the owner or operator has been notified in writing that a permit application is required. This notice shall include a brief statement of the reasons for this decision, an application form, a statement setting a deadline for the owner or operator to file the application, and a statement that on the effective date of the individual NPDES permit or the alternative general permit as it applies to the individual permittee, coverage under this general permit shall automatically terminate. The Director may grant additional time to submit the application upon request of the applicant. If an owner or operator fails to submit in a timely manner an individual NPDES permit application required by the Director under this paragraph, then the applicability of this permit to the individual NPDES permittee is automatically terminated at the end of the day specified for application submittal.

G1.b. Storm water discharges associated with construction activities for operations regulated pursuant to West Virginia Code Chapter 22, Article 6 (Oil and Gas Operations) are covered by this General Permit. However, the permittee shall comply with the provisions of the site Construction and Reclamation Plan (Chapter 35-4-16) in lieu of the provisions of Section G.4 of this General Permit. Separate application to the Division of Water

Resources for coverage under this General Permit is not required. Other provisions of this General Permit are applicable to these operations and failure to comply with the approved Construction and Reclamation Plan shall constitute a failure to comply with Section G.4 of this General Permit.

G2. Prohibition of non-storm water discharges

Except as provided below, all discharges covered by this permit shall be composed entirely of storm water. Discharges of material other than storm water must be in compliance with an NPDES permit (other than this permit) issued for the discharge.

The following non-storm water discharges are authorized by this permit: discharges from fire fighting activities, fire hydrant flushing; waters used to wash vehicles or control dust; potable water sources, including waterline flushing; lawn watering; routine external building washdown which does not use detergents; pavement washwater where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used; air conditioning condensate; springs; uncontaminated groundwater; and foundation or footing drains where flows are not contaminated with process materials such as solvents that are combined with storm water discharges associated with industrial activity.

This permit does not authorize the conveyance, diversion, channeling, directing or otherwise allowing the discharge of storm water into a sinkhole without an Underground Injection Control Permit.”

G3. Releases in excess of Reportable Quantities

This permit does not relieve the permittee of the reporting requirements of 40 CFR 117 and 40 CFR 302. The discharge of hazardous substances in the storm water discharge(s) from a project is not authorized by this General Permit, and in no case shall the discharge(s) contain a hazardous substance equal to or in excess of reporting quantities.

G4. Storm Water Pollution Prevention Plans (SWPPP)/Groundwater Protection Plans (GPP)

A Storm Water Pollution Plan and a Groundwater Protection Plan shall be developed for each project covered by this permit. These two plans may be combined into one plan so long as all of the requirements for both plans are met. Alternatively, they may be developed and maintained as separate stand-alone documents.

Storm Water Pollution Prevention Plans shall be prepared in accordance with good engineering practices. The plan shall identify potential sources of pollution that may reasonably be expected to affect the quality of storm water discharges associated with construction activity. In addition, the plan shall describe and ensure the implementation of practices that are to be used to reduce the pollutants in storm water discharges associated with construction activity and to assure compliance with the terms and conditions of this permit.

Groundwater Protection Plans (GPP) shall be prepared in accordance with Section G4.e.2.c.iv. of this permit and the requirements of Title 47, Series 58, Section 4.11. et seq (Groundwater Protection Regulations). The GPP shall identify all operations that may reasonably be expected to contaminate the groundwater resources with an indication of the potential for soil and groundwater contamination from those operations. In addition the GPP shall provide a thorough and detailed description of procedures designed to protect groundwater from the identified potential contamination sources. Guidance in the completion of a GPP is available from the Division of Water Resources. A generic GPP will be provided as part of the instructions.

G4.a. The SWPPP and the GPP shall be signed in accordance with Section C.6. and retained on site.

G4.b. The application and SWPPP shall be submitted to the Division of Water Resources at least 45 days before construction is to begin, except as noted in G4.b.3., G4.b.4, and G4.b.5. Developers should submit applications for review prior to accepting bids on the project. As the plans are evaluated by the Director or authorized representative, the Director or authorized representative may notify the permittee during the 45-day review period that the plan(s) do not meet one or more of the minimum requirements of this section. After such notification from the Director or authorized representative, the permittee shall make changes to the plan in accordance with the time frames established below, and shall submit to the Director, a written certification that the requested changes have been made.

- G4.b.1. Except as provided below in paragraph (2), the permittee shall have 30 days after such notification to make the changes necessary.
- G4.b.2. The permittee of a storm water discharge associated with industrial activity composed in part or in whole of runoff from construction activities shall have 24 hours after such notification to make changes relating to sediment and erosion controls to prevent loss of sediment from an active site, unless additional time is provided by the Director or an authorized representative.
- G4.b.3. Projects disturbing less than 3 acres and that do not discharge to or upstream of a Tier 2.5 or Tier 3 waters shall submit only the Notice of Intent Form (NOI) 10 days prior to initiating construction.
- G4.b.4. Projects that will discharge to or upstream of Tier 2.5 or Tier 3 waters and disturb 3 acres or more, or that will disturb 100 or more acres, or that the grading phase of construction will last for more than one year, shall submit the application and SWPPP at least 90 days prior to construction to allow for the public notice procedure.
- G4.b.5. Projects proposing permanent storm water basins or ponds shall submit the GPP with the application.
- G4.c. The permittee shall modify, using forms provided by DWR, the SWPPP whenever there is a change in design, construction, scope of operation, or maintenance, which has a significant effect on the potential for the discharge of pollutants to the waters of the State, or if the SWPPP proves to be ineffective in achieving the general objectives of controlling pollutants in storm water discharges associated with construction activity. Should conditions warrant, the Director may request changes to the SWPPP during a field inspection. The Director may review changes or modifications to the SWPPP in the same manner as above.

The permittee shall amend the GPP whenever there is a change in design, construction, operation, or maintenance which could reasonably be expected to have an impact on the potential contamination of groundwater. The Director may review amendments to the GPP in the same manner as above.

- G4.d. In addition to the requirements of G4.e, the SWPPP shall also include, at a minimum, the following items:

- G4.d.1 General Management Controls

- G4.d.1.A Preventive Maintenance – A preventive maintenance program shall involve inspection and maintenance of sediment and erosion control devices and storm water management structures to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to surface waters.

- G4.d.1.B Good Housekeeping – Good housekeeping requires the maintenance of a clean and orderly project.

- G4.d.1.C Spill Prevention and Response Procedures – Areas where potential spills can occur, and their accompanying drainage points shall be identified clearly in the storm water pollution prevention plan. Where appropriate, specifying material handling procedures and storage requirements in the plan should be considered. Procedures for cleaning up spills shall be identified in the plan and made available to the appropriate personnel. The necessary equipment to implement a clean up should be available to personnel.

- G4.d.1.D Employee Training – Employees training programs shall inform personnel at all levels of responsibility of the components and goals of the storm water pollution prevention plan. Training should address topics such as spill response, good housekeeping and routine inspection. A pollution prevention plan shall identify time frames for such training.

- G4.d.1.E Visual Inspection – Qualified company personnel shall be identified to inspect as set forth under Maintenance G4.e)(2)(E). A tracking or follow-up procedure should be used to ensure that adequate response and corrective actions have been taken in response to the inspection. Records of inspections shall be maintained for review by the Director.

- G4.d.1.F Record keeping and Internal Reporting Procedures – Incidents such as spills, leaks and improper dumping, along with other information describing the quality and quantity of storm water discharges should be included in the records. Inspections and maintenance activities such as cleaning sediment basins or traps and other sediment trapping structures or catch basins and reseeding should be documented and recorded.

- G4.d.2. Consistency with other plans-Spill Prevention Control and Countermeasure (SPCC) plans under Section 311 of the CWA or any BMP's or GPP pursuant to 47 CSR 58 may be incorporated into a storm water prevention plan by reference.
- G4.e. Requirements for Construction Activities – Operations that discharge storm water associated with construction activity disturbing one or more acres are not only subject to the requirements of Section G.4.d) of this permit, but are also subject to the following requirements. The storm water pollution prevention plans shall include, as a minimum, the following items.
- G4.e.1. Site Description – Each plan shall, at a minimum, provide a description of the following:
- G4.e.1.A A description of the nature of the construction activity, including a proposed timetable for major activities;
- G4.e.1.B. Estimates of the total area of the site and the part of the site that is expected to undergo excavation or grading, the increase in impervious area by acreage and percentage, and the total amount of excavation by cut and fill;
- G4.e.1.C. For each discharge design point an estimate of the pre-construction peak discharge from 1 year, 24 hour storm in cubic feet per second and an estimate of the post-development peak discharge from a 1 year, 24 hour storm in cubic feet per second using the Natural Resource Conservation Service's TR-55 or TR-20 or other approved methodology. Provide a description of the nature of fill material to be used, and data describing the soil from the Natural Resource Conservation Service's county soil survey and any known water quality data of any discharge from the site.
- G4.e.1.D. A site map indicating, with a minimum of 5 foot contours, drainage patterns and slopes prior to construction and anticipated conditions after grading activities, topsoil stockpiles, waste areas, borrow sites, locations of sediment control structures identified in the narrative, the location of impervious areas after construction is completed, final storm water routing including all ditches and pipe systems, property boundaries and easements, nearest receiving stream, access roads, legend and springs, surface waters and any other information necessary to describe the project in detail.
- G4.e.2. Controls – Each construction operation covered by this permit shall develop a description of controls appropriate for the project, and implement such controls. The description of these controls shall address the following minimum components, including a schedule for implementing such controls.
- G4.e.2.A. Erosion and Sediment Controls
- G4.e.2.A.i. Vegetative Practices – A description of interim and permanent stabilization practices, including site-specific scheduling of the implementation of the practices shall be provided. Site plans should ensure that existing vegetation is preserved where attainable and that disturbed portions of the site are stabilized as rapidly as possible. Stabilization practices may include: temporary seeding, permanent seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, preservation of mature vegetation, and other appropriate measures. Also include in the plan seedbed preparation requirements and the type and amount of soil amendments necessary to establish a healthy stand of vegetation. A record of the dates when major grading activities will occur, and when construction activities temporarily or permanently cease on a portion of the site, and when stabilization measures will be initiated shall be included in the plan. Except as noted below, stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 7 days after the construction activity in that portion of the site has temporarily or permanently ceased.
- G4.e.2.A.i.a. Where the initiation of stabilization measures by the 7th day after construction activity temporary or permanently ceases is precluded by snow cover, stabilization measures shall be initiated as soon as conditions allow.
- G4.e.2.A.i.b. Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g., The total time period that construction activity is temporarily halted is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 7th day after construction activities have temporarily ceased.

G.4.e.2.A.i.c. Temporary diversions, both upslope and diversions to trapping structures, must be seeded and stabilized immediately and prior to becoming functional.

G.4.e.2.A.ii Structural Practices – A description of the structural practices to be used to divert flows around exposed soils, store flows or otherwise limit runoff from exposed areas and eliminate sediment laden runoff from the site. Such practices may include but are not limited to silt fences, earth dikes and berms, land grading, diversions, brush barriers, drainage swales, check dams subsurface drains, pipe slope drains, storm drain inlet protection, rock outlet protection, reinforced soil retention systems and geotextiles, gabions and riprap, and permanent and temporary sediment traps/basins.

For locations on a site that have a drainage area of 5 acres or less, a sediment trap which provides a storage volume equal to 3600 cubic feet per acre of drainage area shall be installed. Half of the volume of the trap will be in a permanent pool and half will be dry storage.

For drainage areas of greater than five acres, a sediment basin providing 3600 cubic feet per drainage acre shall be installed. Half of the volume of the basin will be in a permanent pool and half will be dry storage. Sediment basins must be able to dewater the wet storage volume in 48 to 72 hours. A sediment basin must be able to pass through the spillway(s) a twenty-five-year, 24-hour storm event with one foot of freeboard. The inlet(s) to a sediment trapping structure must be protected against erosion by the appropriate material such a riprap.

If necessary, diversions will be used to direct runoff to the trapping structure. Diversions must be stabilized immediately and prior to becoming functional.

For locations served by a common drainage where a detention basin providing 3600 cubic feet of storage is not attainable, silt fences, rock check dams, sediment traps in series or equivalent or additional sediment and erosion controls within the project area are required in lieu of the required sized sediment basin. Justification and a narrative description of the additional measures must be provided for use of any practice(s) other than sediment basins or traps.

Fill slopes must be protected by measures used to divert runoff away from fill slopes to conveyance measures such as pipe slope drains or stable channels.

Sediment trapping structures will be eliminated, and the area properly reclaimed and stabilized, when the contributing drainage area is stabilized and the structures are no longer needed, unless the structure is converted into a permanent storm water detention/retention structure. All trapped sediments will be disposed on in an upland area where there is no chance of entering nearby streams. Breaching the embankment to dewater the structure is not permitted. Dewatering and removal of the structure should not cause a violation of water quality standards. Provide a description of the procedures that will be used in removing these structures and the time frame.

No sediment-laden water will be allowed to leave the site without going through an appropriate device.

G.4.e.2.A.iii Presumptive Conditions for Discharges to Tier 2.5 Waters

Construction activities discharging to Tier 2.5 waters will be deemed not to cause significant degradation if, in addition to the standard General Permit conditions, the following presumptive conditions are met. Projects that do not meet the presumptive conditions will be required to seek coverage under an individual permit.

- a. An undisturbed buffer zone shall be maintained between the construction activity and the stream of at least 100 feet. Certain limited construction activities may be allowed within the buffer zone and considered consistent with these criteria, if it is demonstrated that such construction is necessary and unavoidable. Examples would include road construction necessary to access the site, installation of water quality protective measures that could not otherwise be constructed, or the construction of linear projects such as utility lines or highways, whose alignment cannot avoid the stream. In those circumstances, any buffer waiver would apply only to the area needed to construct that portion of the facility. Any temporary structures allowed within the buffer zone must be removed upon completion of construction and the area re-vegetated, preferably with native or non-invasive plants.

- b. Permanent structural measures shall be provided to attenuate storm water runoff such that the pre-construction peak discharge rate is not exceeded for the 1 year, 24 hour storm. The storm water management plan shall also discuss BMP's to be implemented to reduce potential storm water pollutants from the site.
- c. All disturbed areas shall be seeded and mulched immediately upon reaching final grade. In the event the construction activity stops for 2 weeks or more in an area, that area will be immediately seeded and mulched with a temporary vegetative cover.

G4.e.2.B Storm Water Management Plan

A description of measures that will be installed during construction to control storm water discharges after the project is completed shall be included in the storm water pollution prevention plan. The completed project shall convey storm water runoff in a manner that will protect both the site and the receiving stream from post-construction erosion. All waterways and other runoff conveyance structures shall be permanently stabilized as appropriate for expected flows. In developing structural practices for storm water control, the operator shall consider the use of, but not limited to: infiltration of runoff onsite; flow attenuation by use of open vegetated swales and natural depressions; storm water retention structures and storm water detention structures. A combination of practices may be utilized. Low impact development technology is encouraged to minimize alteration of the pre-construction site hydrology. Velocity dissipation devices shall be placed at the outlet of all detention or retention structures and along the length of any outlet channel as necessary to provide a non-erosive velocity flow from the structure to a natural water course. Projects that increase the impervious surface on the project area by fifteen percent (15%) or more shall demonstrate that existing channel characteristics in the natural watercourse will not be altered by the storm water discharge. This provision may be complied with by:

- i. providing structural measures to attenuate the storm water runoff so that the pre-construction peak discharge rate is not exceeded; or
- ii. providing a hydrologic and/or geomorphic assessment that demonstrates that the increased peak discharge rate can be accommodated by the receiving stream without altering the existing channel characteristics (increased bank erosion or channel instability).

Projects located in areas that have local government requirements and/or criteria for post construction storm water management may address Item (i) by meeting those requirements. If local storm water management criteria have not been established, the design shall address maintenance of pre-construction flows for the 1 year, 24-hour storm. Alternative design measures will be considered with technical justification provided by the applicant. All designs for this provision should consider reduction of both the frequency and duration of peak flow rates. Item (ii) should be addressed by demonstration that the receiving natural channel can convey the developed condition 1 year, 24-hour storm within the channel banks and at a non-erosive velocity. A detailed assessment will not be required for Item (ii) if the proposed discharge rate is one (1) percent or less of the expected flow rate for the receiving stream at the point of discharge (for the 1 year, 24 hour storm) or the project is less than (3) acres in size (unless required by local government).

Projects that are expected to significantly increase peak storm water discharge rates should also consider control of storm water discharges for flood protection purposes (out of bank flooding). Flood protection would be considered at a minimum as control of the post-construction peak discharge rate for a 10-year, 24-hour storm to the pre-construction peak discharge rate. However, the level of protection should be based on the hazard involved to downstream life and property. The permittee shall be required to meet any local government or other agency requirements for storm water management and provide verification thereof (See Section D below).

The permittee shall submit all calculations, watershed mapping, design drawings, and any other information necessary to explain the technical basis for the storm water management plan. Since development site conditions vary widely, plan preparer's will have significant latitude in designing practices to comply with this provision of the permit. However, design procedures shall follow professionally accepted engineering and hydrologic methodologies. Permanent storm water management structures that will impound water (detention/retention basins or similar structures) shall be designed and certified by a Registered Profes-

sional Engineer. These structures shall also have a certified as-built drawing submitted with the Notice of Termination at the completion of the project. Permittees are only responsible for the installation and maintenance of storm water management facilities prior to final stabilization of the site and termination of General Permit coverage, however the entity responsible for post-construction maintenance shall be identified.

G4.e.3.C Other Controls

G4.e.2.C.i Waste Disposal –All solid waste and construction/demolition material must be disposed of in accordance with the Code of West Virginia and Legislative Rule Title 33 Series 1, “Solid Waste Management Rule”.

G4.e.2.C. ii Each site shall have stone access entrance and exit drives and parking areas to reduce the tracking of sediment onto public or private roads. Except for haul roads, all unpaved roads on the site carrying more than 25 vehicles per day shall be graveled.

G4.e.2.C.iii The plan shall ensure and demonstrate compliance with applicable State, local sanitary sewer or septic system regulations.

G4.e.2.C.iv Groundwater Protection Plan (GPP) – The applicant shall prepare a GPP that will satisfy the State’s Groundwater Protection Act. Projects proposing permanent storm water ponds or basins will submit the GPP for review.

G4.e.2.D Approved State or Local Plans

Facilities which discharge storm water associated with industrial activity from construction activities must include in their storm water pollution prevention plan procedures and requirements specified in applicable sediment and erosion site plans or storm water management plans approved by State or local officials. Sediment and erosion control or storm water management plans approved by other state or local programs and that are either incorporated by reference in the General Permit or a part of an approved SWPPP, may be enforced under this permit. Certification of compliance with the state or local ordinances must be included in the application.

G4.e.2.E Maintenance

A description of procedures to maintain in good and effective condition and promptly repair or restore all grade surfaces, walls, dams and structures, vegetation, erosion and sediment control measures and other protective devices identified in the site plan. At a minimum, procedures in a plan shall provide that all erosion controls on the site are inspected at least once every seven calendar days and within 24 hours after any storm event of greater than 0.5 inches of rain per 24 hour period.

G4.f All Storm Water Pollution Prevention Plans and Groundwater Protection Plans required under this permit are considered reports that shall be available to the public under Section 308(b) of the CWA. The owner or operator of a project with storm water discharges covered by this permit shall make plans available to members of the public upon request by the public. However, the permittee may claim any portion of a Storm Water Pollution Plan or Groundwater Plan as confidential in accordance with 47 CSR 10-12.7.

G4.g No condition of this permit shall release the permittee from any responsibility or requirements under other environmental statutes or regulations.

G4.h Permanent ponds and basins and ponds and basins that will remain in use for more than one year must be designed and certified by a Registered Professional Engineer.

G5. Discharges to Impaired Waters

This permit does not authorize new sources or new discharges of constituents of concern to impaired waters unless consistent with the approved Total Maximum Daily Load (TMDL) and applicable state law. Impaired waters are those that do not meet applicable water quality standards and are listed on the Clean Water Act Section 303(d) list. Pollutants of concern are those constituents for which the water body is listed as

impaired. Discharges of pollutants of concern to impaired water bodies for which there is an approved total maximum daily load (TMDL) are not eligible for coverage under this permit unless they are consistent with the approved TMDL. Within six months of the TMDL approval, permittees must incorporate any limitations, conditions, or requirements applicable to their discharges necessary for compliance with the TMDL, including any monitoring or reporting required by DWR rules, into their storm water pollution prevention plan in order to be eligible for coverage under this general permit.

Sites that discharge into a receiving water which has been listed on the Clean Water Act 303(d) list of impaired waters, and with discharges that contain the pollutant(s) for which the water body is impaired, must document in the SWPPP how the BMP's will control the discharge of the pollutant(s) of concern.

G6. Endangered and Threatened Species

If a site discharges to a stream where a Federally endangered or threatened species or its habitat are present, the applicant should contact the US Fish and Wildlife Service to insure that requirements of the Federal Endangered Species Act are met.

H. Reopener Clause

If there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with industrial activity covered by this permit, the owner or operator of such discharge may be required to obtain an individual permit or alternative general permit in accordance with Section G.1. of this permit or the permit may be modified to include different limitations and/or requirements.

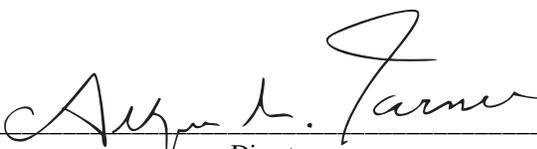
I. The conditions, standards, and limitations of this General Permit will be reviewed at the time of reissuance for possible revisions that may lead to more or less stringent conditions, standards, and limitations.

J. Permit coverage for construction activities encompassed by this permit expires upon satisfactory stabilization of the site. Satisfactory stabilization means **ALL** disturbed areas shall be covered by some sort of permanent protection. "Stabilize" includes; pavement, buildings, waterways (rip-rap, concrete, grass, or pipe), a healthy, vigorous stand of grass that uniformly covers more than 70 percent of the ground, stable outlet channels with velocity dissipation which directs site runoff to a natural watercourse, and any other approved structure or material. The permittee will request a final inspection by sending in the "Notice of Termination". The "Notice of Termination" shall also include as-built drawings, certified by a Registered Professional Engineer, for any permanent ponds or basins. Sites not stabilized will continue to have coverage under this permit and will be assessed an annual permit fee as promulgated by the West Virginia Legislature. Sites will be assessed a pro-rated annual fee based upon the completion date and proper stabilization.

The herein-described activity is to be constructed or installed and operated, used and maintained strictly in accordance with the terms and conditions of this permit; with any plans, specifications, and information submitted with the individual site registration application form, with any plan of maintenance and method of operation thereof submitted and with any applicable rules and regulations promulgated by the State Environmental Quality Board.

Failure to comply with the terms and conditions of this permit, with any plans, specifications and information submitted, and with any plan of maintenance and method of operation thereof submitted shall constitute grounds for the revocation or suspension of this permit to any individual establishment or other person and for the invocation of all the enforcement procedures set forth in Chapter 22, Articles 11 and 12 of the Code of West Virginia.

This permit is issued in accordance with the provisions of Article 11, Chapter 22 of the Code of West Virginia.

By: 
Director

SECTION

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GENERIC GROUND WATER

PROTECTION PLAN

GENERIC GROUNDWATER PROTECTION PLAN FOR CONSTRUCTION SITES

To be considered a Groundwater Protection Plan (GPP) which can be implemented; this document must be completed in full. If a portion of this plan does not apply to your facility, it should be marked "Not Applicable" or "NA". If more space is needed for any section, attach additional sheets to this document. Number any additions with the appropriate section number (For example: 47 CSR 58.4.11.1).

This GPP must be available on site for review at all times. The Director may require modification of a GPP to assure adequate protection of ground water.

If a facility does not have adequate ground water protection practices in place they may submit a compliance schedule for implementation of the necessary practices. This compliance schedule would allow them time (no longer than thirty days) to implement the necessary practices.

FACILITY / SITE INFORMATION	
Facility Name:	
Facility Location:	County:
Latitude: ° ' "	Longitude: ° ' "
Contact Person:	Telephone:
Company Name:	
Mailing Address:	
City, State, Zip:	
Date Construction To Begin:	
Date Construction To End:	

<p>I certify that I have personally examined and approved this Groundwater Protection Plan (GPP). This GPP will be implemented and adhered to during the period construction is in progress at this site.</p>	
Designated Representative:	Title:
Signature:	Date:

**INVENTORY WORK SHEET FOR POTENTIAL CONTAMINANTS
(47 CSR 58.4.11.1)**

Complete the following table providing the storage location, quantity and potential to contaminate soil or ground water. If the potential contaminate listed is not kept on site, then enter "NA" in all three columns. If this site maintains additional items with the potential to contaminate ground water, list the additional items in the spaces provided at the end of this list. The storage location should be indicated on a site map.

Potential Contaminant	Storage Locations	Quantity	Potential to Contaminate Soil or Ground Water
Pesticides			
Herbicides			
Fertilizers			
Batteries			
Battery Acid			
Fuels			
Lubricants (Oil/Grease)			
Paint			
Paint Thinner			
Parts Cleaners			
Tanks			
Drums			
Sumps			
Chemical for Snow Control			
Storage Area for Raw Materials, Product, or Waste			

**PROCEDURES DESIGN TO PROTECT GROUND WATER
AT CONSTRUCTION SITES
(47 CSR 58.4.11.2)**

Complete the following table providing the practices and procedures which will be in place at the construction site to prevent contamination of ground water by the potential contaminants. Equipment cleaning, maintenance activities, pipelines, and sumps and tanks which contain potential contaminants must be addressed. Examples of Ground Water Protection Practices can be found in 47 CSR 58.4. et seq.

Potential Contaminant	Procedures to Prevent Contamination of Ground Water
Pesticides	
Herbicides	
Fertilizers	
Batteries	
Battery Acid	
Fuels	
Lubricants (Oil/Grease)	
Paint	
Paint Thinner	
Parts Cleaners	
Tanks	
Drums	
Impoundments Containing Contaminants	
Ditches Containing or Transporting Contaminants	
Sumps Containing Contaminants	
Chemicals for Snow Control	
Storage Area for Raw Materials, Product, or Wastes	

47 CSR 58.4.11.3

Include a list of procedures to be employed in the design of any new equipment or operations. This section does not apply to sites covered under a General Storm Water Permit for Construction Activities.

47 CSR 58.4.11.4

A summary of all activities carried out under other regulatory programs that have relevance to ground water protection. Indicate below all permits, required plans and regulatory agencies that have any control over the facility and how the facility could impact ground water.

PERMIT NUMBER	PERMIT
	WV/National Pollutant Discharge Elimination System (NPDES)
	WV/DEP/OWM Solid Waste Facility Permit
	WV/DEP/OWM Hazardous Waster Facility Permit
	WV/DEP/OWM Underground Storage Tank Program
	Resource Conservation Recovery Act (RCRA)
	Comprehensive Environmental Response, Compensation, & Liability Act (CERLA)
	Toxic Substance Control Act
	Hazardous Waster Operations and Emergency Response Requirements (HAZWOPER)
	Underground Injection Control Permit
	Federal Insecticide and Fertilizer Registration Act (FIFRA)
	WV Department of Health (Septic Tanks and Sewage Systems)

47 CSR 58.4.11.5

Discuss all available information reasonably available to the facility/activity regarding existing ground water quality at, or which may be affected by the site. Complete the following table as much as possible and attach a brief description of readily available information such as soil type, type of underlying geologic formations, the results of any percolation tests conducted by the county health department for septic tanks, and the results of any sampling activity at the facility from monitoring wells, drinking water wells, springs, or seeps. The location of the sampling points should be identified on the site sketch. Monitoring wells and sampling are not requirements of a GPP. However, if the information is available it should be included. Prior spills, remediation efforts, and known contamination, both on site and at adjacent or nearby sites, should be included.

Closest Surface Water Body:	
Distance to Closest Surface Water Body:	
Depth to Ground Water (If Known):	
Known Ground Water Monitoring Wells Within 2000 Feet:	
Known Public or Private Drinking Water Wells Within 2000 Feet:	
Closest Well Head Protection Area:	
Closest Source Water Protection Area:	

47 CSR 58.4.11.6

No wastes will be used for deicing, ice control, structural fills, road base or other uses unless provided for in existing regulations.

47 CSR 58.4.11.7

All employees will be trained on their responsibility to ensure ground water protection. Current job procedures provide direction on how to prevent ground water contamination through proper work practices.

47 CSR 58.4.11.8

Every three months during the life of the construction activity, the site will be inspected to ensure that all elements and equipment of the sites ground water protection program are in place, properly functioning, and appropriately managed.

SECTION

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BIBLIOGRAPHY

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1. United States Department of Agriculture, Soil Conservation Service, West Virginia Erosion and Sediment Control Handbook for Developing Areas, May 1993 Revised.
2. Goldman, Steven J., Erosion & Sediment Control Handbook, 1986, McGraw-Hill, Inc.
3. AASHTO, Volume III AASHTO Guidelines For Erosion and Sediment Control In Highway Construction, Task Force on Hydrology and Hydraulics, 1992.
4. West Virginia Department of Transportation, Division of Highways, Standard Specifications, Roads and Bridges, adopted 2000.
5. West Virginia Department of Highways, Roadway Design Division, Drainage Manual, 1984.
6. West Virginia Department of Transportation, Division of Highways, Plan Metrication Guide, November 1993.
7. United States Environmental Protection Agency, Office of Water (WH-547), Storm Water Management For Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92-005, September 1992.
8. West Virginia Division of Environmental Protection, Office of Water Resources, West Virginia Pollutant Discharge Elimination System General Water Pollution Control Permit, December 5, 2002.