Section C - SEDIMENT TRAPPING DEVICES

9.0 STANDARDS AND SPECIFICATIONS

FOR

SEDIMENT TRAPS

Definition

A temporary sediment control device formed by excavation and/or an embankment with an approved outlet used to intercept sediment laden runoff and to retain the sediment.

Purpose

The purpose of a sediment trap is to intercept sediment laden runoff and trap the sediment in order to protect drainageways, properties, and rights-of-way downstream of the sediment trap from sedimentation.

Conditions Where Practice Applies

A sediment trap is installed at points of discharge from a disturbed area.

Wet and Dry Storage

The storage requirement for sediment traps I, II and IV and sediment basins is 3600 cubic feet per acre of contributory drainage area. The sediment traps and basins storage volume of 3600 cubic feet minimum per acre shall be divided equally into "dry" or dewatered storage and "wet" or retention storage. The basins and traps will be dewatered to the wet pool elevation corresponding to 1800 cubic feet of storage per acre of drainage. Sediment trap III consists of only "wet" storage and the volume required is 5400 cubic feet per acre of drainage area.

Design Criteria

1. The maximum drainage area for each type sediment trap shall be as follows:

Practice #	Practice Type	Max. Drainage Area
ST-I	Pipe Outlet	5.0 ac.
ST-II	Stone Outlet	5.0 ac.
ST-III	Rip-rap Outlet	10.0 ac.
ST-IV	Stone Outlet/Rip-rap Outlet	10.0 ac.

2. The volume of a natural sediment trap may be approximated by the equation:

Volume (ft^3) = 0.4 x surface area (ft^2) x maximum depth (ft).

3. Sediment traps shall be located so that they can be installed prior to grading or filling. Traps must not be located any closer than 20 feet from an existing building foundation. Care must be taken when placing sediment traps in structural fill areas (i.e. proposed roadways and building foundations). When these traps are removed the wet soil around the traps must also be removed to facilitate compaction. Trap bottoms shall be generally level. Plan view must indicate bottom dimensions. Showing contours/grading of traps may be required on plans to ensure constructability.

Locate traps to:

a. Obtain maximum storage benefit from the terrain with a 2:1 length to width ratio desired.
b. Facilitate cleanout.
c. Facilitate disposal of the trapped sediment.

4. Sediment shall be removed and the trap restored to the original dimensions when the sediment has accumulated to one half of the wet storage depth of the trap. Sediment removed from the trap shall be deposited in a protected area and in such a manner that it will not erode.

5. **All embankments for sediment traps shall not exceed 4' in height as measured at the low point of the original ground along the centerline of the embankment.** Embankments shall have a minimum 4' wide top and side slopes of 2:1 or flatter. The embankment shall be compacted by traversing with equipment while it is being constructed. Once constructed the top and outside face of the embankment shall be stabilized with seed and mulch. Points of concentrated inflow shall be protected in accordance with Grade Stabilization Structure criteria. The remainder of the interior slopes should be stabilized (one time) with seed and mulch upon trap completion and monitored and maintained erosion free during the life of the trap.

The elevation of the top of any dike directing water to any sediment trap will equal or exceed the maximum elevation of the embankment along the entire length of the trap.

6. All excavation operations shall be carried out in such a manner that erosion and water pollution shall be minimized. Sediment traps shall have 2:1 or flatter side slopes.

7. The outlet shall be designed, according to the standards set forth herein, constructed and maintained in such a manner that sediment does not leave the trap and that erosion at or below the outlet does not occur. Sediment traps must outlet onto stabilized (preferably undisturbed) ground, into a watercourse, stabilized channel, or into a storm drain system.

8. Following completion of all construction and stabilization at a site, all temporary sediment traps shall be removed and the areas occupied by the traps shall be graded and stabilized. Slope Silt Fence or other sediment control devices may be required during trap removal.

<u>If any of the design criteria presented here cannot be met, see Standard and Specifications for Sediment Basin.</u>

Trap details needed on Soil Erosion and Sediment Control Plans

There is no standard symbol for a sediment trap. Each trap shall be delineated on the plans in such a manner that it will not be confused with any other features. Each plan shall include all the information necessary to properly construct and maintain the trap. If tablular form is used to present the numbered information below, then each trap on the plan shall have a number and the numbers shall be consecutive. Please use caution in siting sediment traps, plot contours if necessary to ensure constructability. The following information, at a minimum, shall be shown for each trap on the plans:

1. Trap number.
2. Type of trap (ST-I, ST-II, etc.).
3. Drainage area (5 acres max. for ST-I and ST-II, 10 acres max. for ST-III and ST-IV).
4. Storage required (total).
5. Storage provided (total).
6. Weir length or pipe size, outfall length (for ST-IV) and channel depth (for ST-III).
7. Storage depth below outlet and cleanout elevation.
8. Embankment height and elevation (if applicable).
9. Typical detail of each trap used.
10. Trap bottom, wet storage limit and crest elevations.

9.1 Pipe Outlet Sediment Trap ST-I

This practice consists of a trap formed by an embankment or excavation. The outlet for the trap is through a perforated riser and a barrel pipe through the embankment. The barrel pipe and riser shall be made of corrugated metal or PVC pipe. All pipes shall be circular and watertight. The top of the embankment shall be at least 1 foot above the crest of the riser.

The riser shall be perforated above the wet pool elevation. Perforations shall be slits 1/2" wide by 6 inches in length or 1 inch diameter holes spaced six (6) inches both vertically and horizontally.

No perforations will be allowed within six (6) inches of the top of the horizontal barrel. All pipe connections shall be watertight. The riser shall be wrapped with 1/2" hardware cloth (wire) then wrapped with Geotextile Class E[10] and secured with strapping or connecting bands at the top and bottom of the cloth. The hardware cloth and geotextile shall cover an area at least six (6) inches above the highest perforation and six (6) inches below the lowest perforation. The top of the riser pipe shall have a trash rack/anti-vortex device that meets the requirements of Detail 16 and shall not be covered with geotextile fabric.

The riser shall have a base with sufficient weight to prevent flotation of the riser. Two approved bases are:

1. A concrete base twice the diameter of the riser, 12" thick with the riser embedded 9" into the concrete base (see Detail 15).

2. A 1/4" inch minimum thickness steel plate attached to the riser by a continuous weld around the circumference of the riser to form a watertight connection. The plate shall have 2' of stone, gravel, or recycled concrete placed on it to prevent flotation. In either case, each side of the square base measurement shall be the riser diameter plus 24 inches.

Note: Pipe outlet sediment traps shall be limited to five (5) acres maximum drainage area.

Table 7 Pipe Outlet Diameter Selection

Minimum Sizes Barrel Diam. (Inches)	Minimum Sizes Riser Diam. (Inches)	Minimum Sizes Trash Rack Diam. (Inches)	Maximum Drainage Area (Acres)
12"	15"	21"	1
15"	18"	27"	2
18"	21"	30"	3
21"	24"	36"	4
21"	27"	42"	5

[10] Refer to Table 27.

Construction Specifications

1. The area under the embankment shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared.

2. The fill material for the embankment shall be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed.

3. The total trap volume shall be 3600 cubic feet/acre of contributory drainage area (See Table 9). The top of the embankment must be $\geq$ 1'above the crest of the riser.

4. Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to one half of the wet storage depth of the trap (900 cf/ac). The sediment shall be deposited in a suitable area and in such a manner that it will not erode.

5. The structure shall be inspected periodically and after each rain and repairs made as needed.

6. Construction operations shall be carried out in such a manner that erosion and water pollution are abated. Once constructed, the top and outside face of the embankment shall be stabilized with seed and mulch. Points of concentrated inflow shall be protected in accordance with Grade Stabilization Structure criteria. The remainder of the interior slopes should be stabilized (one time) with seed and mulch upon trap completion and monitored and maintained erosion free during the life of the trap.

7. The structure shall be removed and area stabilized when the drainage area has been permanently stabilized.

8. All cut and fill slopes shall be 2:1 or flatter.

9. All pipe connections shall be watertight.

10. Above the wet storage elevation, the riser shall be perforated with 1/2" wide by 6" long slits or 1" diameter holes spaced 6" vertically and horizontally. No perforations will be allowed within 6" of the horizontal barrel.

11. The riser shall be wrapped with 1/2" hardware cloth (wire) then wrapped with Geotextile Class E[11]. The geotextile fabric shall extend 6" above the highest slit and six 6" below the lowest slit. Where ends of geotextile fabric come together, they shall be overlapped, folded and fastened to prevent bypass. Geotextile fabric shall be replaced as necessary to prevent clogging.

[11] Refer to Table 27.

12. Straps or connecting bands shall be used to hold the geotextile fabric and wire fabric in place and shall be placed at the top and bottom of the cloth.

13. Fill material around the pipe spillway shall be hand compacted in 4" layers. A minimum of 2' of hand-compacted backfill shall be placed over the pipe spillway before crossing it with construction equipment.

14. The riser shall be anchored with either a concrete base or steel plate base to prevent flotation. Concrete bases shall be at least twice the riser diameter and 12" thick with the riser embedded 9". Steel bases shall be at least twice the riser diameter, 1/4" minimum thickness plate, attached to the bottom of the riser with a continuous weld to form a watertight connection, and covered with 2' of stone, gravel, or tamped earth.

15. Anti seep collars shall be designed in accordance with Table 16 and Details 13 and 14.

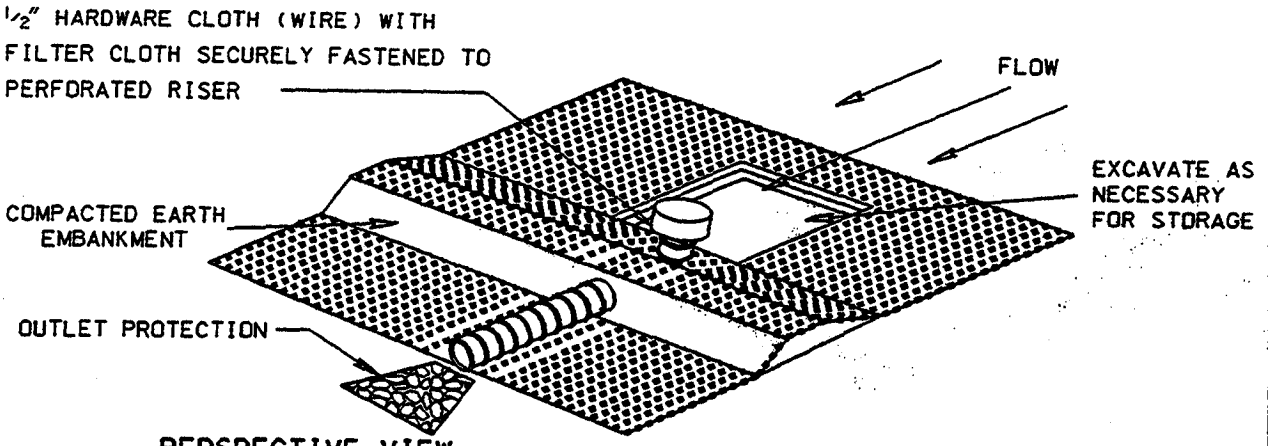
16. Concentric trash rack and anti-vortex device design details are on Detail 16.

17. Refer to Section D for dewatering requirements of sediment traps.

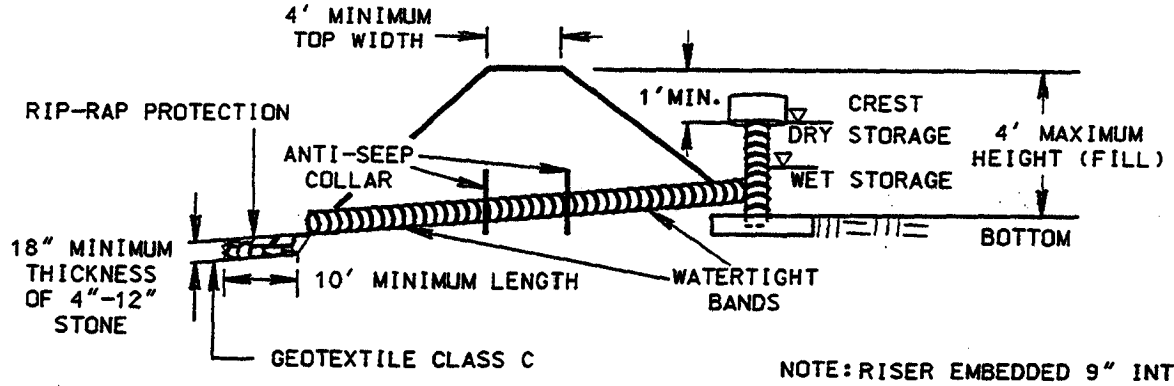
18. Outlet - An outlet shall be provided, including a means of conveying the discharge in an erosion free manner to an existing stable channel. Protection against scour at the discharge end of the pipe spillway shall be provided in accordance with the Standards and Specifications for Rock Outlet Protection or a practice from Section B - Grade Stabilization Structures.

19. Where discharge occurs at the property line, local ordinances and drainage easement requirements shall be met.

DETAIL 8 – PIPE OUTLET SEDIMENT TRAP – ST I



PERSPECTIVE VIEW



EMBANKMENT SECTION
THROUGH RISER

NOTE: RISER EMBEDDED 9" INTO CONCRETE OR ¼" STEEL PLATE ATTACHED TO RISER WITH A CONTINUOUS WELD ON BOTTOM AND 2' OF STONE PLACED ON STEEL PLATE TWICE THE RISER DIAMETER (MIN.)

Construction Specifications

1. The area under the embankment shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared.

2. The fill material for the embankment shall be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed.

3. The total trap volume as measured from the bottom to riser crest elevation shall be 3600 cubic feet per acre of drainage area (see Table 9). The top of embankment must be ≥1' above the riser crest elevation.

4. Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to one half of the wet storage depth of the trap (900cf/ac). The sediment shall be deposited in a suitable area and in such a manner that it will not erode.

5. The structure shall be inspected periodically and after each rain and repairs made as necessary.

PIPE OUTLET SEDIMENT TRAP - ST I

6. Construction operations shall be carried out in such a manner that erosion and water pollution are abated. Once constructed, the top and outside face of the embankment shall be stabilized with seed and mulch. Points of concentrated inflow shall be protected in accordance with Grade Stabilization Structure criteria. The remainder of the interior slopes should be stabilized (one time) with seed and mulch upon trap completion and monitored and maintained erosion free during the life of the trap.

7. The structure shall be removed and area stabilized when the drainage area has been properly stabilized.

8. All cut and fill slopes shall be 2:1 or flatter.

9. All pipe connections shall be watertight.

10. Above the wet storage elevation, the riser shall be perforated with ½" wide by 6" long slits or 1" diameter holes spaced 6" vertically and horizontally. No perforations will be allowed within 6" of the horizontal barrel.

11. The riser shall be wrapped with ½" hardware cloth (wire) then wrapped with Geotextile Class E. The filter cloth shall extend 6" above the highest slit and 6" below the lowest slit. Where ends of filter cloth come together, they shall be overlapped, folded and fastened to prevent bypass. Filter cloth shall be replaced as necessary to prevent clogging.

12. Straps or connecting bands shall be used to hold the filter cloth and wire fabric in place. They shall be placed at the top and bottom of the cloth.

13. Fill material around the pipe spillway shall be hand compacted in 4" layers. A minimum of 2' of hand-compacted backfill shall be placed over the pipe spillway before crossing it with construction equipment.

14. The riser shall be anchored with either a concrete base or steel plate base to prevent flotation. Concrete bases shall be at least twice the riser diameter and 12" deep with the riser embedded 9". Steel plate bases shall be at least twice the riser diameter. ¼" minimum thickness and attached to the bottom of the riser by a continuous weld to form a watertight connection. Then place 2' of stone, gravel or tamped earth on the plate.

15. Anti seep collars shall be constructed in accordance with plans (ref. table 16 and Details 13 and 14).

16. Concentric trash rack and anti-vortex device design details are on Detail 16.

17. Refer to Section D for dewatering requirements of sediment traps.

18. Outlet - An outlet shall be provided, which includes a means of conveying the discharge in an erosion free manner to an existing stable channel.

19. Where discharge occurs at the property line, local ordinances and drainage easement requirements shall be met.

9.2 Stone Outlet Sediment Trap ST-II

This practice consists of a trap formed by an embankment or excavation. The outlet of this trap is over a stone section placed on level ground. The minimum length weir (feet) of the outlet shall be equal to four (4) times the drainage area (acres).

The outlet crest (top of stone in weir section) shall be level, at least 1' foot below the top of the embankment and no more than 3' above ground beneath the outlet. 4" to 7" stone[12] or recycled concrete equivalent over Geotextile Class C[13] shall be used in the outlet. A 1' thick layer of 3/4" to 1 1/2" washed aggregate[14] shall be placed on the upstream face of the outlet. Geotextile Class C placed on the upstream face of the outlet may be substituted for the small stone.

Note: Stone outlet sediment traps shall be limited to a 5 acre maximum drainage area.

Construction Specifications

1. The area under the embankment shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared.

2. The fill material for the embankment shall be free of roots and other woody vegetation as well as over-sized stones, rocks, organic material or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed.

3. All cut and fill slopes shall be 2:1 or flatter.

4. The stone used in the outlet shall be 4" - 7" stone with a 1' thick layer of 3/4" to 1 1/2" washed aggregate placed on the upstream face of the outlet. Stone facing shall be maintained as necessary to prevent clogging. Geotextile Class C may be substituted for the stone facing by placing it on the inside face of the outlet.

5. Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to one half of the wet storage depth of the trap. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

6. The structure shall be inspected periodically and after each rain and repairs made as needed.

7. Construction of traps shall be carried out in such a manner that sediment pollution is abated. Once constructed, the top and outside face of the embankment shall be stabilized with seed and mulch. Points of concentrated inflow shall be protected in accordance with Grade Stabilization Structure criteria. The remainder of the interior slopes should be stabilized (one time) with seed and mulch upon trap completion and monitored and maintained erosion free during the life of the trap.

[12,14] Refer to Table 28

[13] Refer to Table 27

8. The structure shall be removed and the area stabilized when the drainage area has been properly stabilized.

9. Refer to Section D for specifications concerning trap dewatering.

10. Minimum trap depth shall be measured from the weir elevation.

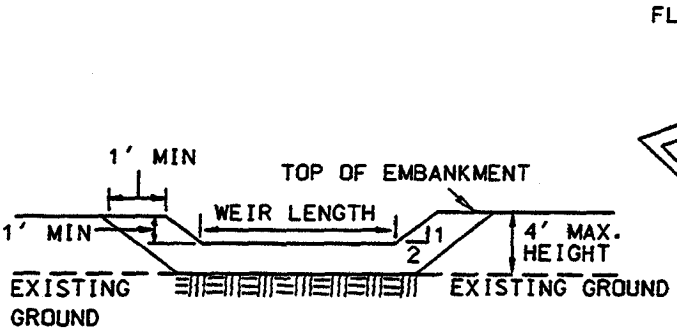
11. The elevation of the top of any dike directing water into the trap must equal or exceed the elevation of the trap embankment.

12. Geotextile Class C shall be placed over the bottom and sides of the outlet channel prior to the placement of stone. Sections of geotextile fabric must overlap at least 1' with the section nearest the entrance placed on top. The geotextile fabric shall be embedded at least 6" into existing ground at the entrance of the outlet channel.

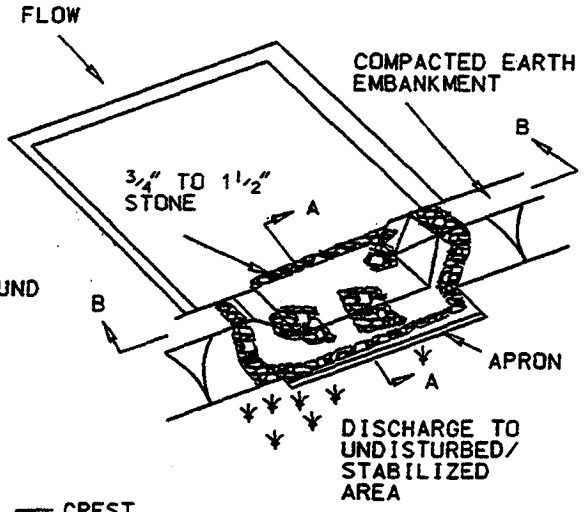
13. Outlet - An outlet shall be provided, including a means of conveying the discharge in an erosion free manner to an existing stable channel.

14. For storage requirements see Table 9.

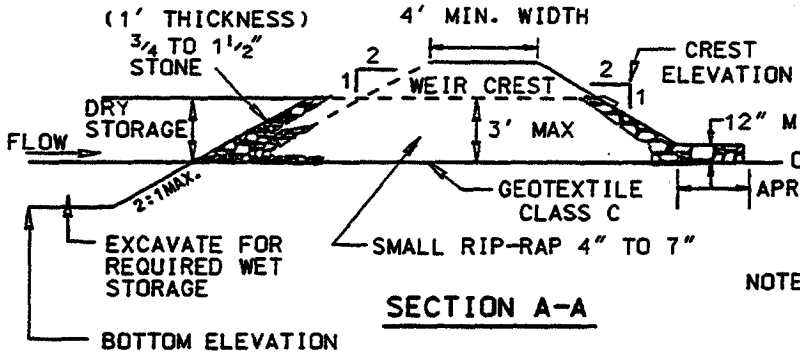
DETAIL 9 – STONE OUTLET SEDIMENT TRAP – ST II



SECTION B-B



PERSPECTIVE VIEW



SECTION A-A

NOTE: 5' MINIMUM LENGTH UP TO 5 ACRES. OVER 5 ACRES USE STONE/RIPRAP SEDIMENT TRAP ST-IV.

Construction Specifications

1. Area under embankment shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared.

2. The fill material for the embankment shall be free of roots and other woody vegetation as well as over-sized stones, rocks, organic material or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed.

3. All cut and fill slopes shall be 2:1 or flatter.

4. The stone used in the outlet shall be small rip-rap 4" to 7" in size with a 1' thick layer of 3/4" to 1 1/2" washed aggregate placed on the upstream face of the outlet. Stone facing shall be as necessary to prevent clogging. Geotextile Class C may be substituted for the stone facing by placing it on the inside face of the stone outlet.

5. Sediment shall be removed and trap restored to its original dimensions when the sediment has accumulated to one half of the wet storage depth of the trap. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

STONE OUTLET SEDIMENT TRAP - ST II

6. The structure shall be inspected periodically and after each rain and repairs made as needed.

7. Construction of traps shall be carried out in such a manner that sediment pollution is abated. Once constructed, the top and outside face of the embankment shall be stabilized with seed and mulch. Points of concentration inflow shall be protected in accordance with Grade Stabilization Structure criteria. The remainder of the interior slopes should be stabilized (one time) with seed and mulch upon trap completion and monitored and maintained erosion free during the life of the trap.

8. The structure shall be dewatered by approved methods, removed and the area stabilized when the drainage area has been properly stabilized.

9. Refer to Section D for specifications concerning trap dewatering.

10. Minimum trap depth shall be measured from the weir elevation.

11. The elevation of the top of any dike directing water into the trap must equal or exceed the elevation of the trap embankment.

12. Geotextile Class C shall be placed over the bottom and sides of the outlet channel prior to the placement of stone. Sections of filter cloth must overlap at least 1' with the section nearest the entrance placed on top. The filter cloth shall be embedded at least 6" into existing ground at the entrance of the outlet channel.

13. Outlet - An outlet shall be provided, including a means of conveying the discharge in an erosion free manner to an existing stable channel.

9.3 Rip-rap Outlet Sediment Trap ST-III

This practice consists of a trap formed by an excavation and embankment. The outlet for this trap shall be through a partially excavated channel lined with rip-rap or recycled concrete equivalent. The outlet channel shall discharge onto a stabilized area or to a stable watercourse. **The rip-rap outlet sediment trap may be used for drainage areas of up to a maximum of 10 acres.**

Dry storage is not required in the Rip-rap Outlet Sediment Trap, only excavation for wet storage. The storage required is 5400 cubic feet per acre of drainage area for Rip-rap Outlet Sediment Traps.

Construction Specifications

1. The area under the embankment shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared.

2. The fill material for the embankment shall be free of roots or other woody vegetation as well as over-sized stones, rocks, organic material or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed.

3. All cut and fill slopes shall be 2:1 or flatter.

4. Elevation of the top of any dike directing water into trap must equal or exceed the height of trap embankment.

5. Storage area provided shall be figured by computing the volume measured from top of excavation (For storage requirements see Table 10).

6. Geotextile Class C[15] shall be placed over the bottom and sides of the outlet channel prior to placement of stone. Sections of fabric must overlap at least 1' with section nearest the entrance placed on top. Fabric shall be embedded at least 6" into existing ground at entrance of outlet channel.

7. The outlet channel shall be constructed using 4"- 12" stone, placed 18" thick.

8. Outlet - An outlet shall include a means of conveying the discharge in an erosion free manner to a stable channel. Protection against scour at the discharge point shall be provided as necessary.

9. Outlet channel must have positive drainage from the trap.

10. Sediment shall be removed and trap restored to its original dimensions when the sediment has accumulated to 1/2 of the wet storage depth of the trap. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

11. The structure shall be inspected periodically after each rain and repaired as needed.

[15] Refer to Table 27.

12. Construction of traps shall be carried out in such a manner that sediment pollution is abated. Once constructed, the top and outside face of the embankment shall be stabilized with seed and mulch. Points of concentrated inflow shall be protected in accordance with Grade Stabilization Structure criteria. The remainder of the interior slopes should be stabilized (one time) with seed and mulch upon trap completion and monitored and maintained erosion free during the life of the trap.

13. The structure shall be dewatered by approved methods, removed and the area stabilized when the drainage area has been properly stabilized.

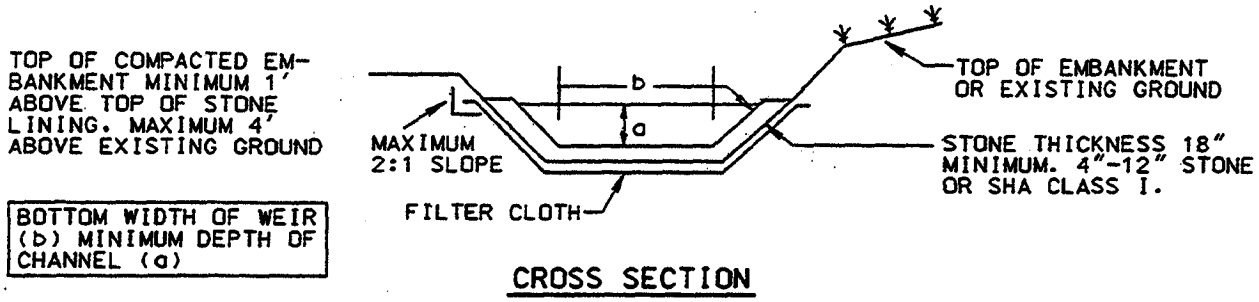
14. For storage requirements see Table 10.

Table 8 Riprap Outlet Sediment Trap

ST-III and IV (for Stone Lined Channel)

Contributing Drainage Area (Acres)	Depth of Channel (a) (Feet)	Width of Weir (b) (Feet)
1	1.5	4.0
2	1.5	5.0
3	1.5	6.0
4	1.5	10.0
5	1.5	12.0
6	1.5	14.0
7	1.5	16.0
8	2.0	10.0
9	2.0	10.0
10	2.0	12.0

DETAIL 10 – RIP-RAP OUTLET SEDIMENT TRAP – ST III



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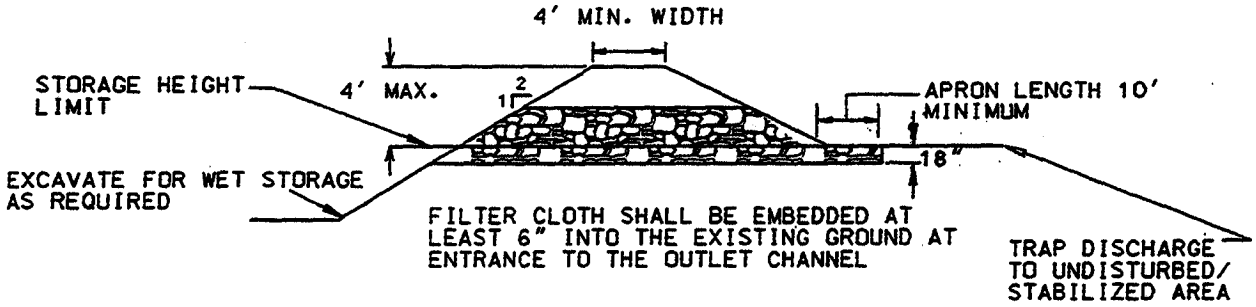

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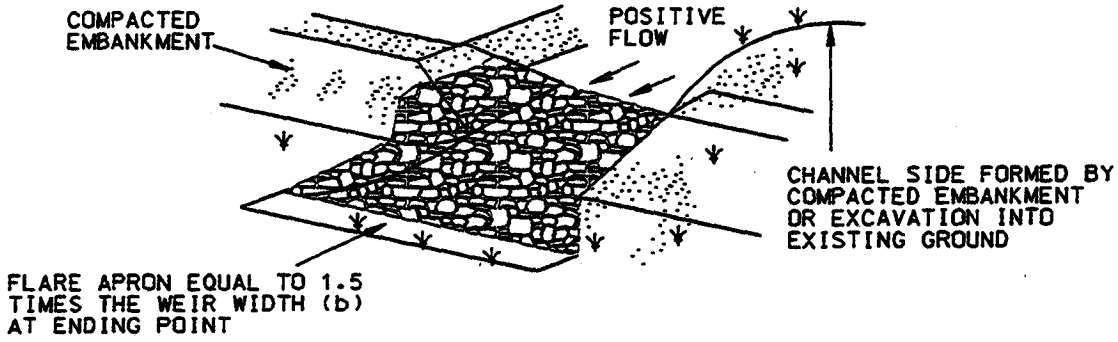

PERSPECTIVE VIEW

NOTE: MAXIMUM DRAINAGE AREA= 10 ac.

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RIP-RAP OUTLET SEDIMENT TRAP - ST III

Constuction Specifications

1. The area under embankment shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared.

2. The fill material for the embankment shall be free of roots or other woody vegetation as well as over-sized stones, rocks, organic material or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed. Maximum height of embankment shall be 4', measured at centerline of embankment.

3. All cut and fill slopes shall be 2:1 or flatter.

4. Elevation of the top of any dike directing water into trap must equal or exceed the height of trap embankment.

5. Storage area provided shall be figured by computing the volume measured from top of excavation. (For storage requirements see Table 10).

6. Filter cloth shall be placed over the bottom and sides of the outlet channel prior to placement of stone. Section of fabric must overlap at least 1' with section nearest the entrance placed on top. Fabric shall be embedded at least 6" into existing ground at entrance of outlet channel.

7. Stone used in the outlet channel shall be 4" - 7" placed 18" thick.

8. Outlet - An outlet shall be provided, which includes a means of conveying the discharge in an erosion free manner to an existing stable channel. Protection against scour at the discharge end shall be provided as necessary.

9. Outlet channel must have positive drainage from the trap.

10. Sediment shall be removed and trap restored to its original dimensions when the sediment has accumulated to $^1/_4$ of the wet storage depth of the trap (1350 cf/ac). Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

11. The structure shall be inspected periodically after each rain and repaired as needed.

12. Construction of traps shall be carried out in such a manner that sediment pollution is abated. Once constructed, the top and outside face of the embankment shall be stabilized with seed and mulch. Points of concentrated inflow shall be protected in accordance with Grade Stabilization Structure criteria. The remainder of the interior slopes should be stabilized (one time) with seed and mulch upon trap completion and monitored and maintained erosion free during the life of the trap.

13. The structure shall be dewatered by approved methods, removed and the area stabilized when the drainage area has been properly stabilized.

9.4 Stone/Rip-rap Outlet Sediment Trap ST-IV

This practice consists of a trap formed by an excavation and embankment. The outlet for this trap shall be through a partially excavated channel lined with rip-rap and containing a stone or recycled concrete equivalent outlet structure. The outlet shall discharge onto a stabilized area or to a stable watercourse. The stone outlet/rip-rap outlet sediment trap may be used for drainage areas up to a maximum of 10 acres. The outlet of this trap is over a stone section placed in the rip-rap channel. The minimum length weir (feet) of the stone section shall be equal to four (4) times the drainage area (acres). The Detail for ST-II shall be used on the plans for constructing ST-IV with the rip-rap apron length shown.

The outlet crest (top of stone in weir section) shall be level, at least 1' foot below top of embankment and no more than 3' above ground beneath the outlet. 4"- 7" stone shall be used in the weir and 4" - 12" or Class I rip-rap shall be used to construct the outlet. A 1' thick layer of 3/4" - 1 1/2" washed aggregate shall be placed on the upstream face of the outlet. Geotextile Class E or C[16] placed on the upstream face of the outlet may be substituted for the 3/4" - 1 1/2" stone.

Construction Specifications

1. The area under embankment shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared.

2. The fill material for the embankment shall be free of roots or other woody vegetation as well as over-sized stones, rocks, organic material or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed. Maximum height of embankment shall be four (4) feet, measured at centerline of embankment.

3. All cut and fill slopes shall be 2:1 or flatter.

4. Elevation of the top of any dike directing water into trap must equal or exceed the height of trap embankment.

5. Storage area provided shall be figured by computing the volume measured from top of weir. (For storage requirements see Table 9).

6. Geotextile Class C shall be placed over the bottom and sides of the outlet channel prior to placement of stone. Sections of fabric must overlap at least 1' with section nearest the entrance placed on top. Fabric shall be embedded at least 6" into existing ground at entrance of outlet channel.

7. 4"- 7" stone shall be used to construct the weir and 4" to 12" or Class I rip-rap shall be used to construct the outlet channel.

8. Outlet - An outlet shall include a means of conveying the discharge in an erosion free manner to an existing stable channel. Protection against scour at the discharge point shall be provided as necessary.

[16] Refer to Table 27.

9. Outlet channel must have positive drainage away from the trap.

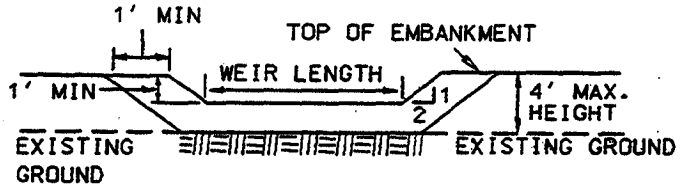
10. Sediment shall be removed and trap restored to its original dimensions when the sediment has accumulated to 1/2 of the wet storage depth of the trap. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

11. The structure shall be inspected periodically after each rain and repaired as needed.

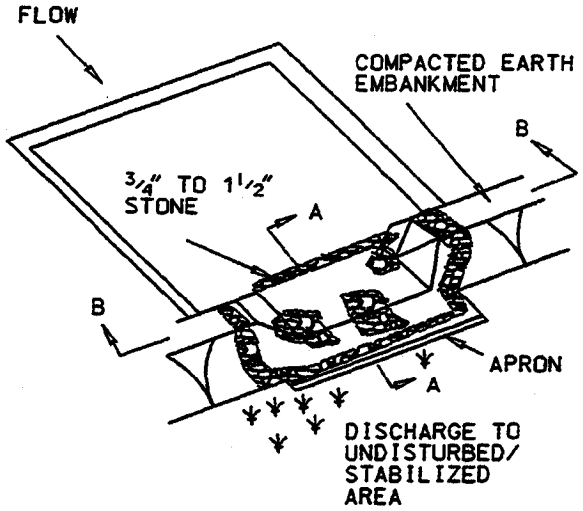
12. Construction of traps shall be carried out in such a manner that sediment pollution is abated. Once constructed, the top and outside face of the embankment shall be stabilized with seed and mulch. Points of concentrated inflow shall be protected in accordance with Grade Stabilization Structure criteria. The remainder of the interior slopes should be stabilized (one time) with seed and mulch upon trap completion and monitored and maintained erosion free during the life of the trap.

13. The structure shall be removed and the area stabilized when the drainage area has been properly stabilized.

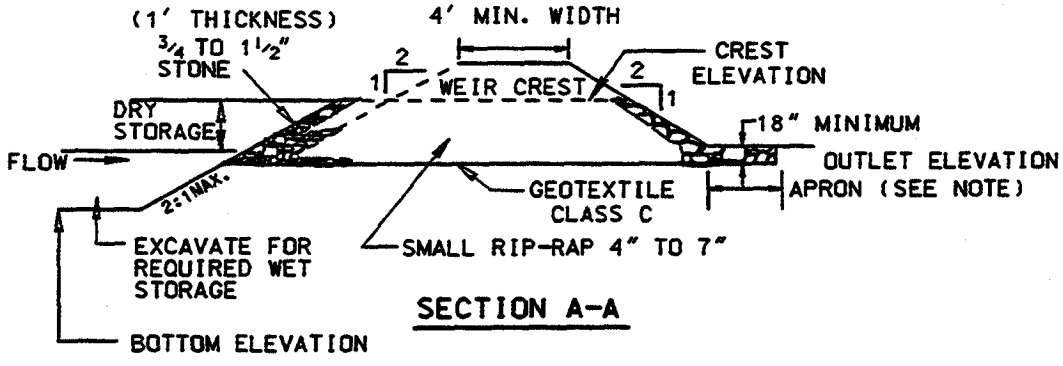
DETAIL 10A - STONE / RIP-RAP OUTLET SEDIMENT TRAP - ST IV



SECTION B-B



PERSPECTIVE VIEW



SECTION A-A

NOTE: 5' MIN LENGTH UP TO 5 ACRES. OVER 5 ACRES USE 10' MIN

STONE / RIP-RAP OUTLET SEDIMENT TRAP - ST IV

Constuction Specifications

1. The area under embankment shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared.

2. The fill material for the embankment shall be free of roots or other woody vegetation as well as over-sized stones, rocks, organic material or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed. Maximum height of embankment shall be 4', measured at centerline of embankment.

3. All cut and fill slopes shall be 2:1 or flatter.

4. Elevation of the top of any dike directing water into trap must equal or exceed the height of trap embankment.

5. Storage area provided shall be figured by computing the volume measured from top of excavation. (For storage requirements see Table 9).

6. Geotextile Class C shall be placed over the bottom and sides of the outlet channelprior to placement of stone. Section of fabric must overlap at least 1' with section nearest the entrance placed on top. Fabric shall be embedded at least 6" into existing ground at entrance of outlet channel.

7. 4" - 7" stone shall be used to construct the weir and 4" - 12" or Class I rip-rap shall be used to construct the outlet channel.

8. Outlet - An outlet shall include a means of conveying the discharge in an erosion free manner to an existing stable channel. Protection against scour at the discharge point shall be provided as necessary.

9. Outlet channel must have positive drainage from the trap.

10. Sediment shall be removed and trap restored to its original dimensions when the sediment has accumulated to $^1/_2$ of the wet storage depth of the trap (900 cf/ac). Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

11. The structure shall be inspected periodically after each rain and repaired as needed.

12. Construction of traps shall be carried out in such a manner that sediment pollution is abated. Once constructed, the top and outside face of the embankment shall be stabilized with seed and mulch. Points of concentrated inflow shall be protected in accordance with Grade Stabilization Structure criteria. The remainder of the interior slopes should be stabilized (one time) with seed and mulch upon trap completion and monitored and maintained erosion free during the life of the trap.

13. The structure shall be dewatered by approved methods, removed and the area stabilized when the drainage area has been properly stabilized.

Table 9 Sediment Trap Design Criteria
ST-I, ST-II, ST-IV

DRAINAGE AREA (AC.)	TRAP TYPE*	TOTAL VOLUME (CF)	WET VOLUME (CF)	DRY VOLUME (CF)	MINIMUM DEPTH (FT)	MINIMUM LENGTH (FT)	MINIMUM WIDTH (FT)
1	I/II	3600	1800	1800	2.5	46	23
2	I/II	7200	3600	3600	2.5	68	34
3	I/II	10800	5400	5400	2.5	86	42
4	I/II	14400	7200	7200	3.0	90	43
5	I/II	18000	9000	9000	3.0	101	50
6	IV	21600	10800	10800	4.0	90	46
7	IV	25200	12600	12600	4.0	100	50
8	IV	28800	14400	14400	4.0	105	55
9	IV	32400	16200	16200	4.0	110	60
10	IV	36000	18000	18000	4.0	123	60

*I - PIPE OUTLET (POST), II - STONE OUTLET (SOST), IV - STONE/RIPRAP OUTLET (SROST)

1. The length to width ratio should be 2:1.

2. Minimum length and width dimensions apply to the bottom of the traps.

3. The side slopes will be 2:1 or flatter.

4. If the stone outlet is used in conjunction with rip-rap channel protection then the storage requirement will be 3600 cubic feet per acre. If the stone outlet and rip-rap apron are used, the length of the apron will be a minimum of 10'.

Table 10 Sediment Trap Design Criteria ST-III

DRAINAGE AREA (AC.)	TRAP TYPE*	TOTAL VOLUME (CF)	WET VOLUME (CF)	MINIMUM DEPTH (FT)	MINIMUM LENGTH (FT)	MINIMUM WIDTH (FT)
1	III	5400	5400	2.5	58	29
2	III	10800	10800	2.5	85	42
3	III	16200	16200	2.5	107	53
4	III	21600	21600	3	111	55
5	III	27000	27000	3	125	62
6	III	32400	32400	4	115	57
7	III	37800	37800	4	125	62
8	III	43200	43200	4	135	67
9	III	48600	48600	4	143	72
10	III	54000	54000	4	152	76

* III - RIP-RAP OUTLET (ROST)

1. The length to width ratio should be 2:1.

2. Minimum length and width dimensions apply to the bottom of the traps.

3. The side slopes shall be 2:1 or flatter.

4. See Table 8 for minimum apron length for rip-rap outlet sediment traps.

10.0 STANDARD AND SPECIFICATIONS

FOR

SEDIMENT BASINS

Definition

A temporary barrier or dam constructed across a drainage way or at other suitable locations to intercept sediment laden runoff. This barrier may be combined with excavation to achieve the required storage.

Purpose

Sediment basins protect downstream properties and drainageways by trapping sediment and controlling the release of stormwater runoff.

Wet and Dry Storage

The minimum storage volume requirement for sediment basins is 3600 cubic feet per acre of contributory drainage area. The basin storage volume of 3600 cubic feet per acre shall be divided equally into "dry" or dewatered storage and "wet" or retention storage. Basins shall be dewatered to the wet pool elevation corresponding to 1800 cubic feet of storage per acre of drainage area.

Conditions Where Practice Applies

A sediment basin is required to control runoff and sediment from large areas where sediment traps are not appropriate. Stormwater management ponds may be used as sediment basins provided that they meet the requirements of this section and that the construction sequence addresses converting the sediment basin to the permanent stormwater management pond.

Conditions of Use

This standard applies to the installation of temporary sediment basins on sites where: (a) failure of the structure would not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities; (b) the drainage area does not exceed 100 acres; (c) the maximum embankment height does not exceed 15 feet measured from the natural ground to the embankment top along the centerline of embankment; and (d) the basin is to be removed within 36 months after the beginning of construction of the basin. Where these criteria cannot be met, the structure shall be designed to conform with the Natural Resources Article, Title 8, Subtitle 8, Annotated Code of Maryland or Maryland SCS Standards and Specifications No. 378 for Ponds. The total volume of permanent sediment basins shall equal or exceed the capacity requirements for temporary basins contained herein.

Design Criteria

Design and construction shall comply with state and local laws, ordinances, rules and regulations.

1. Location The sediment basin should be located to obtain the maximum storage benefit from the terrain and for ease of cleanout of the trapped sediment. It should be located to minimize interference with construction activities and construction of utilities. Whenever possible, sediment basins should be located so that storm drains may outfall or be diverted into the basin.

2. Volume of the Basin The volume of the sediment basin, as measured from the bottom of the basin to the elevation of the principal spillway crest shall be at least 3600 cubic feet per acre of total drainage area (134 cubic yards). This 3600 cubic feet of storage is approximately equal to 1 inch of runoff per acre of drainage area. The sediment basin storage volume of 3600 cubic feet minimum per acre shall be divided equally into "dry" or dewatered storage and "wet" or retention storage. See Basin Draw-Down for dewatering criteria.

Sediment basins shall be cleaned out when the basin is filled with sediment to 900 cf/acre of total drainage area. Cleanout shall be performed to restore the original design volume to the basin. The elevation corresponding to the maximum allowable sediment level shall be determined and shall be stated in the design data as a distance below the top of the riser. The distance between the top of the riser and the cleanout elevation shall be clearly shown on the riser, above the pool elevation.

3. Surface Area Basins shall be designed so that the ratio of acres of surface area to cubic feet/second of discharge (from a 10 year storm) is greater than or equal to 0.0035. The surface area shall be measured at the design high water elevation.

4. Shape of the Basin It is recommended that the designer of a sediment basin strive to incorporate the following features:

a. Length to width ratio greater than 2:1, where length is the distance between the inlet and outlet.

b. A wedge shape with the inlet located at the narrow end.
c. In situations where the above conditions cannot be met, baffles designed to maximize detention time may be required.
d. The dimensions necessary to obtain the required basin volume and surface area shall be clearly shown on the plans to facilitate plan review, construction and inspection.

5. Inflow Protection Whenever the inflow to the basin is not stabilized refer to the inflow protection specifications. Inflow protection provides safe conveyance of concentrated runoff into temporary sediment basins to prevent erosion. Inflow protection shall meet or exceed the practices found in Section B of these Standards and Specifications. Points of runoff entry should be located as far away from the riser as possible, to maximize travel time in conjunction with dikes, swales or other water control devices as warranted by site conditions.

6. Embankment The embankment plans shall include elevations at the top of earth fill at constructed and settled height.

7. Side Slopes The combined upstream and downstream side slopes of the settled embankment shall not be less than five horizontal to one vertical (5:1) with neither slope steeper than 2:1. Slopes must be designed to be stable in all cases.

8. Top Width For dam embankments up to ten (10) feet, the top will be level and a minimum of eight (8) feet in width. For embankments between ten (10) feet and fifteen (15) feet, the top width will be ten (10) feet.

9. Spillway Design Runoff shall be computed by the method outlined in Chapter 2, Estimating Runoff, "Engineering Field Manual for Conservation Practices" available in the Soil Conservation Service offices, or by TR-55, Urban Hydrology. Runoff computations shall be based upon the worst soil-cover conditions expected to prevail in the contributing drainage area during the anticipated effective life of the structure. The combined capacities of the principal and emergency spillways shall be sufficient to pass the "routed" peak rate of runoff from a 10-year frequency storm.

10. Principal Spillway A spillway shall be provided which consists of a vertical pipe or box type riser joined (watertight connection) to a pipe (barrel) which shall extend through the embankment and outlet beyond the downstream toe of the fill . The storage volume required shall be measured from the riser crest elevation to the bottom of the basin. The minimum size of the barrel shall be what is required to pass 10% of the 10 year storm or 8 inches in diameter whichever is larger.

a. Crest elevation The crest elevation of the riser shall be a minimum of one foot below the elevation of the control section of the emergency spillway.

b. Watertight Riser and Barrel Assembly The riser and all pipe connections shall be completely watertight except for the inlet opening at the top or dewatering openings and shall not have any other holes, leaks, rips or perforations.

c. Basin Draw-down The water in the basin from the riser crest to the permanent pool shall be drawn down over a 10 hour period through an internal orifice in a draw-down device. A draw-down device shall be included in the sediment basin plans submitted for approval and shall be installed during construction of the basin. Design of a draw-down device shall be required if an orifice size other than those provided in Table 11 is to be used. Design of perforations in the horizontal or vertical dewatering device is required. Draw-down shall be done in such a manner as to remove the clean water without removing sediment that has settled out or floating debris. This shall be done by constructing a perforated horizontal or vertical draw-down device with an internal orifice to control discharge. If perforating the riser is desired as a draw-down device, the minimum detention time shall be 10 hours, however, the riser must be wrapped with 1/2" hardware cloth and Geotextile Class E or C[17]. Other methods may be used as long as detailed drawings are provided on the approved sediment control plans.

[17] Refer to Table 27.

NOTE: If the basin is to be converted to a stormwater management pond the riser should not be perforated. If PVC pipe is used for the principle spillway then the concrete pipe chart will be used for hydraulic design. Use manufacturer's specification for loading.

d. Anti-vortex Device and Trash Rack An anti-vortex device and trash rack shall be securely installed on top of the riser and shall be the concentric type meeting these specifications for corrugated metal pipe risers and shall meet MD 378 for all others.

e. Base The riser shall have a base attached with a watertight connection and shall have sufficient weight to prevent flotation of the riser. Steel base plates of at least 1/4" thickness shall be twice the diameter of the riser and shall have at least 2' of compacted earth, stone or gravel placed over it to prevent flotation. Concrete riser bases shall be twice the diameter of the riser, a minimum of 18" thick, contain steel reinforcement as shown in Detail 15, and shall have the riser embedded 9" minimum. Risers over 10 feet in height require that anti-floatation calculations be performed and shall be based on the following:

1. The riser shall be analyzed for floatation assuming all orifices and pipes are plugged.

2. The factor of safety against floatation shall be 1.2 or greater.

f. Anti-seep Collars Anti-seep collars shall be installed around all conduits through earth fills of impoundment structures according to the following criteria:

1. Collars shall be placed to increase the seepage length along the conduit by a minimum of 15 percent of the pipe length located within the saturation zone.

2. Collar spacing shall be between 5 and 14 times the vertical projection of each collar.

3. Collars should be placed within the saturation zone. In cases where spacing limit will not allow this, at least one collar shall be placed in the saturation zone.

4. All anti-seep collars and their connections shall be watertight.

5. Anti-seep collars shall be placed a minimum of two feet from pipe joints.

6. Anti-seep collars must have 2' minimum projection.

g. Outlet - An outlet shall be provided, including a means of conveying the discharge in an erosion free manner to an existing stable channel. Where discharge occurs at the property line, drainage easements will be obtained in accordance with local ordinances. Adequate notes and references concerning the easements will be shown on the erosion and sediment control plan. Protection against scour at the discharge end of the pipe spillway shall be provided. See Section 18.0 Standard and Specifications for Rock Outlet Protection.

11. Emergency Spillways The entire flow area of the emergency spillway shall be constructed in undisturbed ground (not fill). The emergency spillway cross-section shall be trapezoidal with a minimum bottom width of eight feet. This spillway channel shall have a straight, level control section of at least 25 feet in length. The exit channel section shall have sufficient slope such that the discharge capacity of the spillway is not hindered in any way and allows the discharge to be released at a non-erosive velocity.

a. Capacity - The minimum capacity of the emergency spillway shall be that required to pass the peak rate of runoff from the 10-year 24-hour duration storm, less any reduction due to flow in the principal spillway. Emergency spillway dimensions may be determined by using the method in Detail 12 and Table 14.

b. Velocities - The velocity of flow in the exit channel shall not exceed 5 feet per second for vegetated channels. For channels with erosion protection other than vegetation, velocities shall be within the non-erosive range for the type of protection used.

c. Freeboard - Freeboard is the difference between the design high water elevation in the emergency spillway and the top of the settled embankment. Freeboard shall be at least one foot.

12. Sediment Disposal The sediment basin plans shall indicate the method(s) of disposing of the sediment removed from the basin. The sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the basin or adjacent to a stream or floodplain. **Disposal sites must be considered in an approved sediment control plan.** The sediment basin plans shall show the method of disposal of the sediment basin after the drainage area is stabilized, and shall include the stabilization of the sediment basin site. **Sediment shall not be allowed to flush into a stream or drainage way.** For dewatering methods see Section D.

Construction Specifications

1. Site Preparation: Perimeter sediment control devices must be installed prior to clearing and grubbing. Areas where the embankment is to be placed shall be cleared, grubbed, and stripped of topsoil to remove trees, vegetation, roots or other objectionable material. The pool area shall not be cleared until completion of the dam embankment unless the pool area is to be used for borrow. In order to facilitate clean-out and restoration, the pool area (measured at the top of the pipe spillway) shall be cleared of all brush, trees, and other objectionable materials.

2. Cut-off Trench: A cut-off trench shall be excavated along the centerline of earth fill embankments. The minimum depth shall be four feet. The cut-off trench shall extend up both abutments to the riser crest elevation. The minimum bottom width shall be two feet, but wide enough to permit operation of excavation and compaction equipment. The side slopes shall be no steeper than 1:1. Compaction requirements shall be the same as those for the embankment. The trench shall be dewatered during the backfilling-compaction operations. For dewatering see Section D.

3. Embankment: The fill material shall be taken from approved areas shown on the plans. It shall be clean mineral soil free of roots, woody vegetation, oversized stones, rocks, or other objectionable material. Relatively pervious materials such as sand or gravel (Unified Soil Classes GW, GP, SW & SP) or organic materials (Unified Soil Classes OL and OH) shall not be placed in the embankment. Areas on which fill is to be placed shall be scarified prior to placement of fill. The fill material shall contain sufficient moisture so that it can be formed by hand into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compaction. Fill material shall be placed in six-inch to eight-inch thick continuous lifts over the entire length of the fill. Compaction shall be obtained by routing and hauling the construction equipment over the fill so that the entire surface of each layer of the fill is traversed by at least one wheel or tread track of the equipment or by the use of a compactor. **The embankment shall be constructed to an elevation 10 percent higher than the design height to allow for settlement.**

4. Principal Spillway: Steel risers shall be securely attached to the barrel or barrel stub by welding the full circumference making a watertight structural connection. Concrete risers shall be poured with the principal spillway in place or precast with voids around the principal spillway filled with concrete or shrink proof grout for watertight connection. The barrel stub must be attached to the riser at the same percent (angle) of grade as the outlet conduit. The connection between the riser and the riser base shall be watertight. All connections between barrel sections must be achieved by approved watertight band assemblies. The barrel and riser shall be placed on a firm, smooth foundation of impervious soil as the embankment is constructed. **Breaching the embankment to install the barrel is unacceptable.** Pervious materials such as sand, gravel, or crushed stone shall not be used as backfill around the pipe or anti-seep collars. The fill material around the pipe spillway shall be placed in four inch lifts and hand compacted under and around the pipe to at least the same density as the adjacent embankment. A depth of 1.5 times the pipe diameter (min.) shall be backfilled over the principal spillway and hand compacted before crossing it with construction equipment.

5. Emergency Spillway: **The emergency spillway shall be installed in undisturbed ground.** The achievement of planned elevations, grades, design width, entrance and exit channel slopes are critical to the successful operation of the emergency spillway and must be constructed within a tolerance of $\pm$ 0.2 feet.

6. Vegetative Treatment: Stabilize the embankment in accordance with the appropriate vegetative Standard and Specifications immediately following construction. In no case shall the embankment remain unstabilized for more than seven (7) days. Once constructed, the top and outside face of the embankment shall be stabilized with seed and mulch. The remainder of the interior slopes should be stabilized (one time) with seed and mulch upon basin completion and monitored and maintained erosion free during the life of the basin.

7. Safety: **Local requirements concerning fencing and signs shall be met, warning the public of hazards of soft sediment and floodwater.**

8. Maintenance: Repair all damage caused by soil erosion and construction equipment at or before the end of each working day. Sediment shall be removed from the basin when it reaches the specified distance below the top of the riser as shown on the riser. This sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the embankment, adjacent to a stream or floodplain. Disposal areas must be stabilized.

9. Final Disposal: When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposits are to be leveled or otherwise disposed of in accordance with the approved sediment control plan. The proposed use of a sediment basin site will often dictate final disposition of the basin and any sediment contained therein. If the site is scheduled for future construction, then the basin material and trapped sediments must be removed and safely disposed of and the basin shall be backfilled with a structural fill. When the basin area is to remain open space, the pond may be pumped dry (using methods in Section D - Dewatering), graded, and back filled.

10. Conversion to Stormwater Management Structure: After permanent stabilization of all disturbed contributory drainage areas, temporary sediment basins, if initially built and certified to meet permanent standards, may be converted to permanent stormwater management structures. To convert the basin from temporary to permanent use, the outlet structure must be modified in accordance with approved stormwater management design plans. Additional grading may also be necessary to provide the required storage volume in the basin. **Conversion can only take place after all disturbed areas have been permanently stabilized to the satisfaction of the inspection authority and storm drains have been flushed.**

INFORMATION TO BE SUBMITTED

Sediment basin designs and construction plans submitted for review to the Soil Conservation District or other agencies shall include the following:

1. Sediment controls necessary for the installation of the basin.

2. Specific location of the basin.

3. Plan view of the basin and emergency spillway showing existing and proposed contours.

4. Cross section of dam, including elevations at the top of earth fill at constructed and settled height, principal spillway and emergency spillway; profile of emergency spillway.

5. Details of pipe connections, riser to pipe connections, riser base, anti-seep collars, trash rack, cleanout elevation, and anti-vortex device.

6. Runoff calculations for the 10-year frequency storm assuming worst soil conditions.

7. Storage Computation

   a. Total volume required including volumes of "wet" and "dry" storage.

   b. Total volume provided including volumes of "wet" and "dry" storage.

   c. Level of sediment at which cleanout shall be required, stated as a distance from the riser crest to the sediment surface.

8. Calculations showing design of pipe and emergency spillways.

9. Maintenance equipment access points.

10. Dewatering method (sump pit, etc.).

11. Bottom dimensions of basins.

12. Drainage Area Map clearly showing the maximum contributory drainage area to reach the basin.

13. Other information as required by the approval agency.

Bibliography

Hoan, CT., Tapp, J.S. "Design of Sedimentation Basins," NCHRP Synthesis of Highway Practices (1980) Ware, A.D.,

Institute of Mining and Minerals Research, The Deposits Sedimentation Pond Design Manual, Lexington 1979, University of Kentucky.

Barfield, Billy J. and Clar, Michael L., Development of New Design Criteria for Sediment Traps and Basins. 1985.

Figure 2 Temporary Sediment Basin Design Data Sheet

Computed by:_____ Date: _____ Checked by: ____ Date: _____

Project name:_____ Basin #: _____

Location:_____

_____

Total area draining to basin: _____ acres (ac)

Basin Volume Design

Note: 1. Also see Surface Area Design #30, this form.

2. To convert ft^3 to yd^3, divide ft^3 by 27. To convert ft^2 to yd^2, divide ft^2 by 9.

1. Min. required vol. = 3600 ft^3/ac x _____ ac. drainage = _____ ft^3
2. Actual Volume of basin =_____ft^3
3. Excavate _____ft^3 (_____yd^3) to obtain required capacity.
4. Vol. at dewatering elev. = 1800 ft^3/ac x _____ ac. = _____ ft^3
5. Vol. of basin at cleanout = 900 ft^3/ac x _____ ac. = _____ ft^3
6. Elevation corresponding to min. required volume of basin (riser crest elevation) _____ ft.
7. Permanent pool elevation _____ ft.
8. Distance from riser crest elevation to permanent pool elevation _____ ft.
9. Basin cleanout elevation _____ ft.
10. Distance from riser crest elevation to cleanout elevation_____ ft.

Spillway Design

11. Q_{10} = _____cfs (peak discharge from 10-yr, 24-hr storm event, attach computations)

Principal Spillway (Qps) (See Detail 11)

12. Design Principal Spillway (Barrel) discharge, Design Q_{ps} = _____ cfs (min. 10% of 10 year peak or 8" Diameter Pipe)
13. H = _____ ft.; Barrel length = _____ ft.
14. Barrel Diam. _____ in. Note: Q_{ps} must equal or exceed Design Q_{ps}
    Q_{ps} = Q (from Table 13 or 14) _____ x (length correction factor) _____ = _____ cfs.
15. Riser Diameter _____ in.; Riser Height _____ ft.; Riser Head (h) = _____ ft.
16. Trash Rack Diam. _____ in.; Trash Rack Height = _____ in.

NOTE: A table showing design data shall be included on the plan for each basin.

Emergency Spillway (Qes)

17. Emergency spillway cap., $Q_{es} = Q_{10} - Q_{ps}$ =_____ -_____ =_____cfs
18. Width _____ ft; Hp _____ft
19. Entrance channel slope _____%.
20. Exit channel slope _____%.

Anti-Seep Collar Design (If Required)

21. y = _____ ft.; z =_____:1; pipe slope = _____ %; Ls = _____ ft
22. Use _____ collars, _____ ft. - _____ in. square; projection = _____ ft.

Design Elevations

23. Riser Crest	=_____ ft.	24. Design High Water	=_____ft.
25. Emergency Spillway Crest	=_____ ft.	26. Min. settled top of dam	=_____ ft.
27. Permanent pool	=_____ ft.	28. Bottom of Basin	=_____ ft.
29. Draw-down orifice invert	=_____ ft.		

Surface Area Design

30. Min.basin surface area; SA $\geq$ 0.0035 x Q_{10} = 0.0035 x _____ cfs $\leq$ _____ac.

Draw-down Device

31. Draw-down device orifice diameter = _____ in. (From Table 11)
32. A_t = Total area of perforations $\geq 4A_o$

A_t= (# of perforation/foot)(perforation area ft^2)(perforated section length ft.)

A_t= _____ft^2

A_o = Internal orifice area (from Table 11 or computed)

Table 11 Draw-down Device
Orifice Area and Diameter

Drainage Area (acres)	Maximum Orifice Diameter (d_o)	Maximum Orifice Area (A_o)
5-10	4"	0.087 ft^2
10-20	6"	0.20 ft^2
20-40	8"	0.34 ft^2
40-60	10"	0.55 ft^2
60-80	12"	0.79 ft^2
80-100	14"	1.07 ft^2

Draw-down Device Equations

$$Q_{d\text{-}d}\ (cfs) = \frac{(1800\ cf/acre)(number\ of\ acres)}{(10\ hours)(3600\ seconds/hour)}$$

$$A_o = \frac{Q_{d\text{-}d}}{C\sqrt{2gh_{d\text{-}d}}} \qquad d_o = \sqrt{\frac{4A_o}{\pi}}$$

$h_{d\text{-}d}$ = 2/3 (Riser Crest Elevation - Wet Storage Elevation)
C = Constant = 0.6
A_o = Internal Orifice Area ($ft.^2$)
π = Constant = 3.142
d_o = Maximum Orifice Diameter
g = Gravitational Constant = 32.166 ft/s^2

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET
INSTRUCTIONS FOR USE OF FORM

1. The minimum required volume of storage is 3600 cubic feet per acre (ft^3/ac) of drainage area. Compute the volume of basin storage using the *entire* drainage area. Do not estimate storage based only on disturbed area.

2. The volume of a naturally shaped basin (no excavation) may be approximated by the formula Volume = 0.4 Ad, where Volume is in ft^3, A is the surface area of the basin in square feet (ft^2), and d is the maximum depth of the basin in feet (ft.). Volume may be computed from contour information or other suitable methods.

3. If the volume of the basin is not adequate for the required storage, excavate to obtain the required volume.

4. The volume of the basin for a permanent pool is 1800 ft^3/ac from each acre of drainage area. The basin is dewatered to this permanent pool elevation and volume through the draw-down device.

5. The volume of the basin for cleanout of settled sediment is 900 ft^3/ac for each acre of drainage area. As the basin fills with sediment to this volume, the sediment shall be removed to restore the original design volume.

6. Determine the design elevation for the minimum required storage volume of the basin. The design elevation is set at the riser crest to provide the required 3600 ft^3/ac of drainage area.

7. Determine the design elevation of the permanent pool level. The basin shall be dewatered to this elevation using a draw-down device or perforations in the riser. The design elevation of the permanent pool corresponds to 1800 ft^3/ac of volume. The size of the internal orifice governs the discharges between the riser crest and permanent pool elevations, with the draw-down time being 10 hours (minimum).

8. Subtract the permanent pool elevation from the riser crest elevation.

9. Determine the elevation of basin cleanout, storage corresponding to 900 ft^3/ac.

10. Subtract the cleanout elevation from the riser crest elevation. The distance (ft.) between the riser crest elevation and cleanout elevation shall be clearly shown on the riser.

11. The peak discharge rate is computed for a 10-year, 24-hour storm event using approved SCS methods (Q_{10}) assuming worst soil cover conditions.

12. The minimum principal spillway discharge capacity (Q_{ps}) under H(ft) head shall be the discharge through an 8" pipe or 10 percent of Q_{10}, whichever is greater.

NOTE: If there is no emergency spillway then $Q_{ps} = Q_{10}$.

13. "H" is the distance in feet between the centerline of the outlet pipe and the emergency spillway crest. Determine the length of the barrel.

14. Determine the barrel diameter for Q_{ps} using the Pipe Spillway Design Charts.

15. Determine the riser diameter, length, and "h" to release the principal spillway discharge using the solid lines on Table 15. The riser crest should be set (minimum) 1 foot below the emergency spillway (See Detail 11).

16. Determine the trash rack and anti-vortex device size using Detail 16.

17. Compute the capacity required for the emergency spillway capacity (Q_{es}) by subtracting the actual flow carried by the principal spillway from Q_{10}.

18. Using Table 14 and Detail 12, determine values of Hp and bottom width for the emergency spillway.

19. Determine the entrance channel slope.

20. Determine the exit channel slope.

21. Determine the anti-seep collar design. (See Table 16 and Detail 13).

22. Determine the number of anti-seep collars to use.

23. Determine the design elevation of the riser crest.

24. Design high water is the elevation of the emergency spillway crest plus the value of Hp.

25. Determine the design elevation of the emergency spillway.

26. The minimum settled top of dam elevation requires 1.0 ft. of freeboard above design high water. The minimum constructed top of dam elevation shall include a 10% increase in height to allow for settlement.

27. Determine the elevation where 1/2 of the total storage volume is attained. This elevation, known as the permanent pool elevation, is also the invert elevation of the basin draw-down device.

28. Fill in the basin bottom elevation.

29. Fill in the draw-down orifice invert. For a horizontal draw-down device this elevation should be the same as the permanent pool elevation.

30. Compute the minimum basin surface area using the equation given on the Sediment Basin Design Data Sheet and Q_{10}.

31. Choose a basin draw-down orifice size from the Table 11 or design one using the parameters given.

32. Using orifice area from Table 11, or calculations, and a maximum perforation diameter of 1" (0.0055 ft^2 area), determine the length of pipe required to provide sufficient perforations so that the area of perforations (total) is greater than or equal to four times the internal orifice area.

Table 12 Corrugated Metal Pipe Inlet Flow Chart

70 Feet of Corrugated Metal Pipe Conduit $K_m = K_e + K_b = 1.00$

(Full Flow Assumed, n=0.025, Diameter of Pipe in Inches, H in Feet)

H	6"	8"	10"	12"	15"	18"	21"	24"	30"	36"	42"	48"	54"	60"	66"	72"
1'	0.33	0.70	1.25	1.98	3.48	5.47	7.99	11.0	18.8	28.8	41.1	55.7	72.6	91.8	113	137
2'	0.47	0.99	1.76	2.80	4.92	7.74	11.3	15.6	26.6	40.8	58.2	78.8	103	130	160	194
3'	0.58	1.22	2.16	3.43	6.02	9.48	13.8	19.1	32.6	49.9	71.2	96.5	126	159	196	237
4'	0.67	1.40	2.49	3.97	6.96	10.9	16.0	22.1	37.6	57.7	82.3	111	145	184	226	274
5'	0.74	1.57	2.79	4.43	7.78	12.2	17.9	24.7	42.1	64.5	92.0	125	162	205	253	306
6'	0.82	1.72	3.05	4.86	8.52	13.4	19.6	27.0	46.1	70.6	101	136	178	225	277	336
7'	0.88	1.86	3.30	5.25	9.20	14.5	21.1	29.2	49.8	76.3	109	147	192	243	300	362
8'	0.94	1.99	3.53	5.61	9.84	15.5	22.6	31.2	53.2	81.5	116	158	205	260	320	388
9'	1.00	2.11	3.74	5.95	10.4	16.4	24.0	33.1	56.4	86.5	123	167	218	275	340	411
10'	1.05	2.22	3.94	6.27	11.0	17.3	25.3	34.9	59.5	91.2	130	176	230	290	358	433
11'	1.10	2.33	4.13	6.58	11.5	18.2	26.5	36.6	62.4	95.6	136	185	241	304	376	454
12'	1.15	2.43	4.32	6.87	12.1	19.0	27.7	38.2	65.2	99.9	142	193	252	318	392	475
13'	1.20	2.53	4.49	7.15	12.6	19.7	28.8	39.8	67.8	104	148	201	262	331	408	494
14'	1.25	2.63	4.66	7.42	13.0	20.5	29.9	41.3	70.4	108	154	208	272	343	424	513
15'	1.29	2.72	4.83	7.68	13.5	21.2	30.9	42.8	72.8	112	159	216	281	355	439	531

L (ft) — Correction Factors for Other Pipe Lengths

20	1.69	1.63	1.58	1.53	1.47	1.42	1.37	1.34	1.28	1.24	1.20	1.18	1.16	1.14	1.13	1.11
30	1.44	1.41	1.39	1.36	1.32	1.29	1.27	1.24	1.21	1.18	1.15	1.13	1.12	1.11	1.10	1.09
40	1.28	1.27	1.25	1.23	1.21	1.20	1.18	1.17	1.14	1.12	1.11	1.10	1.09	1.08	1.07	1.06
50	1.16	1.16	1.15	1.14	1.13	1.12	1.11	1.10	1.09	1.08	1.07	1.06	1.06	1.05	1.05	1.04
60	1.07	1.07	1.07	1.06	1.06	1.05	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.02	1.02	1.02
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	.94	.94	.95	.95	.95	.95	.96	.96	.96	.97	.97	.97	.98	.98	.98	.98
90	.89	.89	.90	.90	.91	.91	.92	.92	.93	.94	.94	.95	.95	.96	.96	.96
100	.85	.85	.86	.86	.87	.88	.89	.89	.90	.91	.92	.93	.93	.94	.94	.95
120	.78	.79	.79	.80	.81	.82	.83	.83	.85	.86	.87	.89	.89	.90	.91	.92
140	.72	.73	.74	.75	.76	.77	.78	.79	.81	.82	.84	.85	.86	.87	.88	.89
160	.68	.69	.69	.70	.71	.73	.74	.75	.77	.79	.80	.82	.83	.84	.85	.86

Table 13 Reinforced Concrete Pipe Inlet Flow Chart

70 Feet of Reinforced Concrete Pipe Conduit $K_m = K_e + K_b = 1.00$

(Full Flow Assumed, n=0.013, Diameter of Pipe in Inches, H in Feet)

HD	12"	15"	18"	21"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	90"	96"	102"
1'	3.08	5.17	7.83	11.1	14.9	24.2	35.8	49.7	65.8	84.2	105	128	153	180	210	242	276	312
2'	4.35	7.31	11.1	15.7	21.0	34.2	50.6	70.3	93.1	119	148	181	216	255	297	342	390	441
3'	5.33	8.95	13.6	19.2	25.8	41.9	62.0	86.1	114	146	182	221	265	312	363	419	478	541
4'	6.15	10.3	15.7	22.1	29.8	48.4	71.6	99.4	132	168	210	255	306	360	420	483	552	624
5'	6.88	11.6	17.5	24.7	33.3	54.1	80.1	111	147	188	234	286	342	403	469	540	617	698
6'	7.54	12.7	19.2	27.1	36.4	59.3	87.7	122	161	206	257	313	374	441	514	592	676	765
7'	8.14	13.7	20.7	29.3	39.4	64.0	94.8	131	174	223	277	338	404	477	555	640	730	826
8'	8.70	14.6	22.2	31.3	42.1	68.5	101	141	186	238	297	361	432	510	594	684	780	883
9'	9.23	15.5	23.5	33.2	44.6	72.6	107	149	197	253	315	383	459	541	630	725	827	936
10'	9.73	16.3	24.8	35.0	47.0	76.5	113	157	208	266	332	404	483	570	664	764	872	987
11'	10.2	17.1	26.0	36.7	49.3	80.3	119	165	218	279	348	424	507	598	696	802	9151	1035
12'	10.7	17.9	27.1	38.3	51.5	83.9	124	172	228	292	363	442	530	624	727	837	9555	1081
13'	11.1	18.6	28.2	39.9	53.6	87.3	129	179	237	304	378	461	551	650	757	872	9948	1125
14'	11.5	19.3	29.3	41.4	55.7	90.6	134	186	246	315	392	478	572	674	785	904	1032	1168
15'	11.9	20.0	30.3	42.9	57.6	93.8	139	192	255	326	406	495	592	698	813	9364	1068	1209

L (ft) — Correction Factors for Other Pipe Lengths

20	1.30	1.24	1.21	1.18	1.15	1.12	1.10	1.08	1.07	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.03
30	1.22	1.18	1.15	1.13	1.12	1.09	1.08	1.07	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.02	1.02	1.02
40	1.15	1.13	1.11	1.10	1.08	1.07	1.05	1.05	1.04	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02
50	1.09	1.08	1.07	1.06	1.05	1.04	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01
60	1.04	1.04	1.03	1.03	1.03	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.001	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	.96	.97	.97	.97	.98	.98	.98	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99
90	.93	.94	.94	.95	.95	.96	.97	.97	.98	.98	.98	.98	.98	.99	.99	.99	.99	.99
100	.90	.91	.92	.93	.93	.95	.95	.96	.97	.97	.97	.98	.98	.98	.98	.98	.98	.99
120	.84	.86	.87	.89	.90	.91	.93	.94	.94	.95	.96	.96	.96	.97	.97	.97	.97	.98
140	.80	.82	.83	.85	.86	.88	.90	.91	.92	.93	.94	.94	.95	.95	.96	.96	.96	.97
160	.76	.78	.80	.82	.83	.86	.88	.89	.90	.91	.92	.93	.94	.94	.95	.95	.95	.96

Table 14

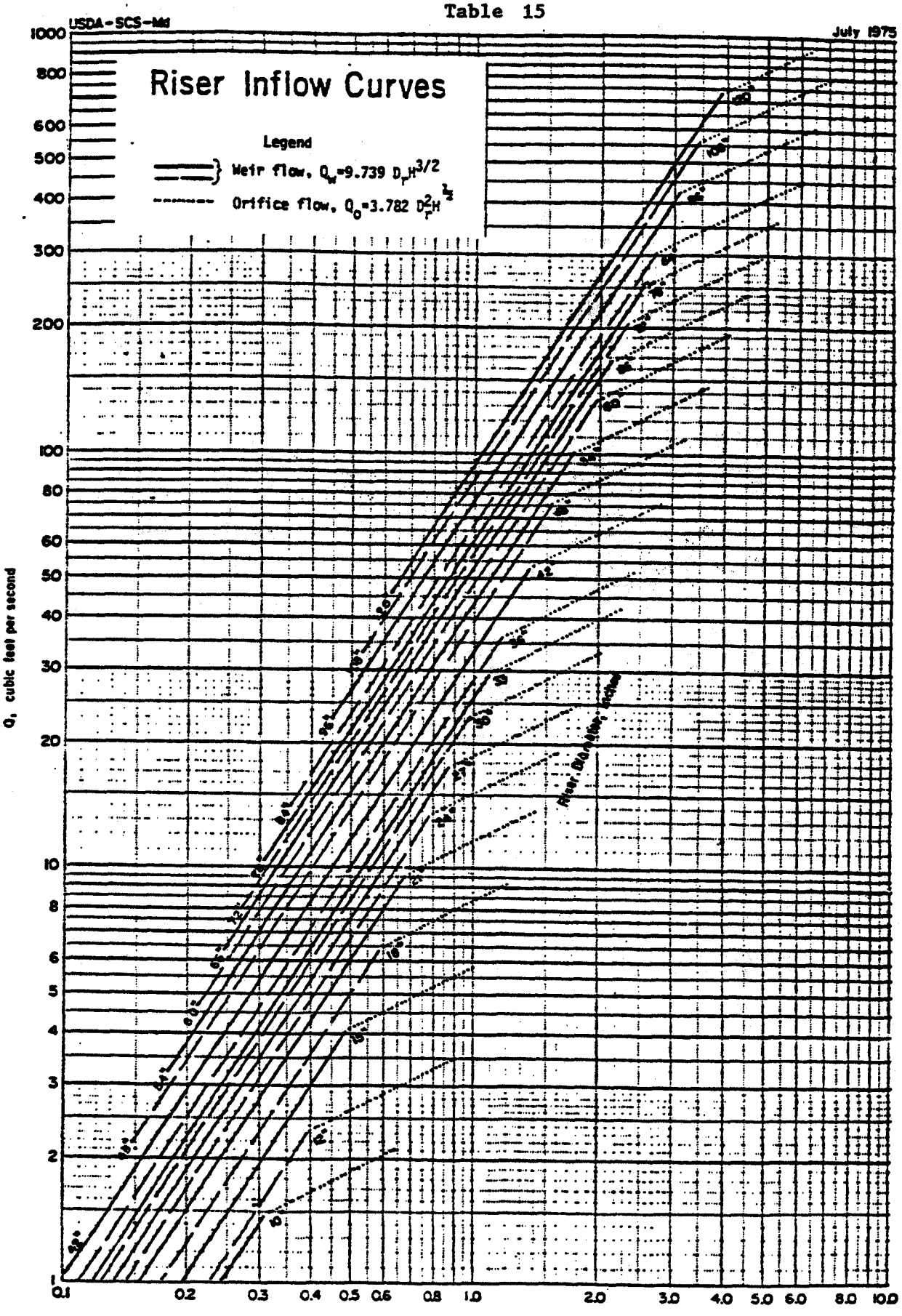
DESIGN DATA FOR EARTH SPILLWAYS

STAGE (Hp) IN FEET	SPILLWAY VARIABLES	BOTTOM WIDTH (b) IN FEET																
		8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
0.5	Q	6	7	8	10	11	13	14	15	17	18	20	21	22	24	25	27	28
	V	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	S	3.9	3.9	3.9	3.9	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
0.6	Q	8	10	12	14	16	18	20	22	24	26	28	30	32	34	35	37	39
	V	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	S	3.7	3.7	3.7	3.7	3.6	3.7	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
0.7	Q	11	13	16	18	20	23	25	28	30	33	35	38	41	43	44	46	48
	V	3.2	3.2	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
	S	3.5	3.5	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
0.8	Q	13	16	19	22	26	29	32	35	38	42	45	46	48	51	54	57	60
	V	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
	S	3.3	3.3	3.3	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
0.9	Q	17	20	24	28	32	35	39	43	47	51	53	57	60	64	68	71	75
	V	3.7	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
	S	3.2	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
1.0	Q	20	24	29	33	38	42	47	51	56	61	63	68	72	77	81	86	90
	V	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	S	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
1.1	Q	23	28	34	39	44	49	54	60	65	70	74	79	84	89	95	100	105
	V	4.2	4.2	4.2	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
	S	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
1.2	Q	28	35	40	45	51	58	64	69	76	80	86	92	98	104	110	116	122
	V	4.4	4.4	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
	S	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
1.3	Q	32	38	46	53	58	65	73	80	86	91	99	106	112	119	125	133	140
	V	4.5	4.6	4.6	4.6	4.6	4.6	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
	S	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
1.4	Q	37	44	51	59	66	74	82	90	96	103	111	119	127	134	142	150	158
	V	4.7	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
	S	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.6	2.8	2.6	2.6	2.8	2.6	2.6	2.8	2.6	2.6
1.5	Q	41	50	58	66	75	85	93	101	108	116	125	133	142	150	160	169	178
	V	4.8	4.9	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.1	5.1	5.1
	S	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.5
1.6	Q	46	56	65	75	84	94	104	112	122	132	142	149	158	168	178	187	197
	V	5.0	5.1	5.1	5.1	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
	S	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
1.7	Q	52	62	72	83	94	105	115	126	135	146	156	167	175	187	196	206	217
	V	5.2	5.2	5.2	5.3	5.3	5.3	5.3	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
	S	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
1.8	Q	58	69	81	93	104	116	127	138	150	160	171	182	194	204	214	226	233
	V	5.3	5.4	5.4	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.6	5.6	5.6	5.6	5.6	5.6
	S	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
1.9	Q	64	76	88	102	114	127	140	152	164	175	188	201	213	225	235	248	260
	V	5.5	5.5	5.5	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
	S	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
2.0	Q	71	85	97	111	125	138	153	164	178	193	204	218	232	245	256	269	283
	V	5.6	5.7	5.7	5.7	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9
	S	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
2.1	Q	77	91	107	122	135	149	162	177	192	207	220	234	250	267	276	291	305
	V	5.7	5.8	5.9	5.9	5.9	5.9	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	S	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3

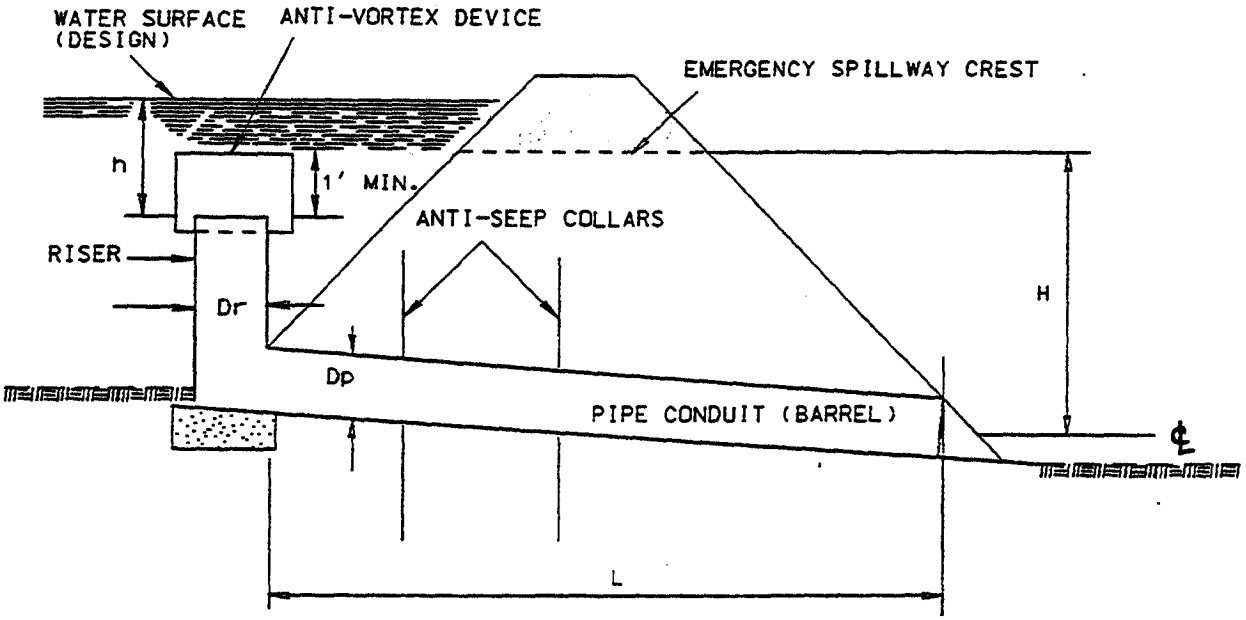
DATA TO RIGHT OF HEAVY VERTICAL LINES SHOULD BE USED WITH CAUTION, AS THE RESULTING SECTIONS WILL BE EITHER POORLY PROPORTIONED, OR HAVE VELOCITIES IN EXCESS OF 6 FEET PER SECOND.

Source: USDA-SCS

Table 15


USDA-SCS-Md
July 1975
Riser Inflow Curves
Legend
Weir flow, $Q_w = 9.739\ D_r H^{3/2}$
Orifice flow, $Q_o = 3.782\ D_r^2 H^{1/2}$
Riser Diameter, inches
Q, cubic feet per second
Head in feet, measured from crest of riser
1000
800
600
500
400
300
200
100
80
60
50
40
30
20
10
8
6
5
4
3
2
1
0.1
0.2
0.3
0.4
0.5
0.6
0.8
1.0
2.0
3.0
4.0
5.0
6.0
8.0
10.0

DETAIL 11 – PIPE SPILLWAY DESIGN



H= Head on pipe spillway (pipe flow), feet (centerline of outlet to emergency spillway crest or to design high water if no emergency spillway).
h= Head over riser crest, in feet.
L= Length of pipe in feet.
Dp= Diameter of pipe conduit (barrel).
Dr= Diameter of riser.

CHART USE INSTRUCTIONS

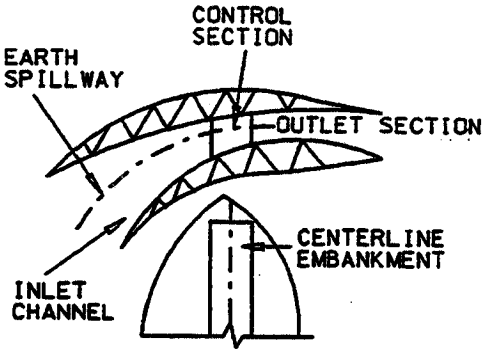
1. Enter chart, Table 13 or Table 14 with H and required discharge.
2. Find the diameter of the pipe conduit that provides equal or greater discharge.
3. Enter chart, Table 12, with actual pipe discharge.
4. Read across chart to select the smallest riser that provides discharge within the weir flow portion of the rating curve.
5. Read down the chart to find the corresponding h required.

EXAMPLE

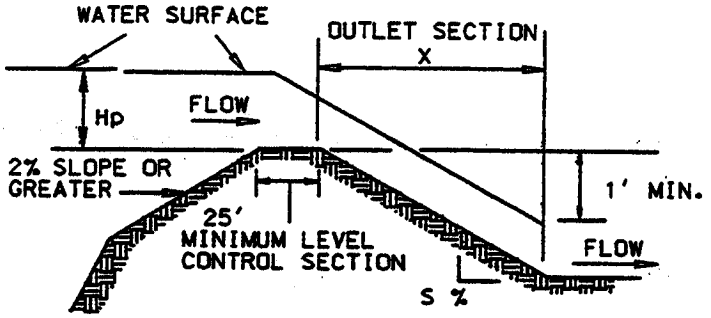
Given: Q (required) = 5.8 cfs
L= 60'
H= 9' to centerline of pipe= Free outlet

Find: Pipe size, actual Q and size of riser.
Q of 12" pipe= 6.0 cfs. x (correction factor) 1.07= 6.4 cfs.
from the Pipe Flow Chart.
From Riser Inflow Curves, smallest riser= 18" (@ H= 0.6)

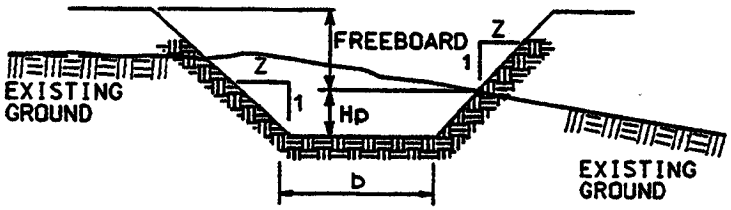
DETAIL 12 – EMERGENCY SPILLWAY



PLAN VIEW OF EMERGENCY SPILLWAY



PROFILE ALONG CENTERLINE OF EMERGENCY SPILLWAY



CROSS SECTION OF EMERGENCY SPILLWAY AT CONTROL SECTION

LEGEND

n= manning's Coefficient of Roughness.
Hp= Difference in elevation between the crest of the emergency spillway and the control section and water surface of the reservoir. in feet.
b= Bottom width of emergency spillway at the control section. in feet. (8' Minimum)
Q= Total discharge. in cfs.
V= Velocity. in feet per second. that will exist in the channel below the control section. at design Q. if constructed to slope (S) that is shown. (Vmax = 5 fps.)
S= Flattest slope (S). in %. allowable for the channel below the control section.
X= Minimum length of the channel below the control section. in feet.
Z= Side slope ratio.

Minimum Z = 2

NOTES

1. For a given Hp a decrease in the exit slope from S as given in the table decreases the spillway discharge but increasing the exit slope from S does not increase the discharge. If an exit slope (Se) steeper than S is used. then the velocity (Ve) in the exit channel will increase according to the following relationship:

$$Ve = V \left(\frac{Se}{S}\right)^{0.3}$$

2. Data to the right of the heavy vertical lines on Table 14 should be used with caution. as the resulting sections will be either poorly proportioned or have velocities in excess of 5 ft./sec.

Designing Anti-Seep Collars (Refer to Detail 13)

1. Determine the length of pipe within the saturation zone of the embankment (L_s) either graphically or by using the following equation, assuming that the upstream slope of the embankment intersects the invert of the pipe at its upstream end and that the slope of the pipe (S_o) is constant.

$$L_s = \frac{Y(Z+4)}{(1-4\ S_o)}$$

2. Determine the vertical projection (P_1) required to increase L_s by 15% either graphically as shown on C-10-22 or by using the equation:

$$P_1 = 0.075\ L_s$$

3. Choose the actual vertical projection (2' minimum) of each anti-seep collar (P) by rounding up P_1 or rounding down P_1 and using multiple collars.

4. Determine the number of anti-seep collars (N) required of the chosen vertical projection (P) using equation:

$$\frac{P_1}{P} = N$$

5. Either round up N or repeat steps 3 and 4 to determine optimum P/N relationship.

6. Provide construction specifications relative to the materials to be used and method for anchoring the anti-seep collar(s) to the pipe in a water tight manner.

7. Anti-seep collar spacing shall be between 5 and 14 times the vertical projection of each collar.

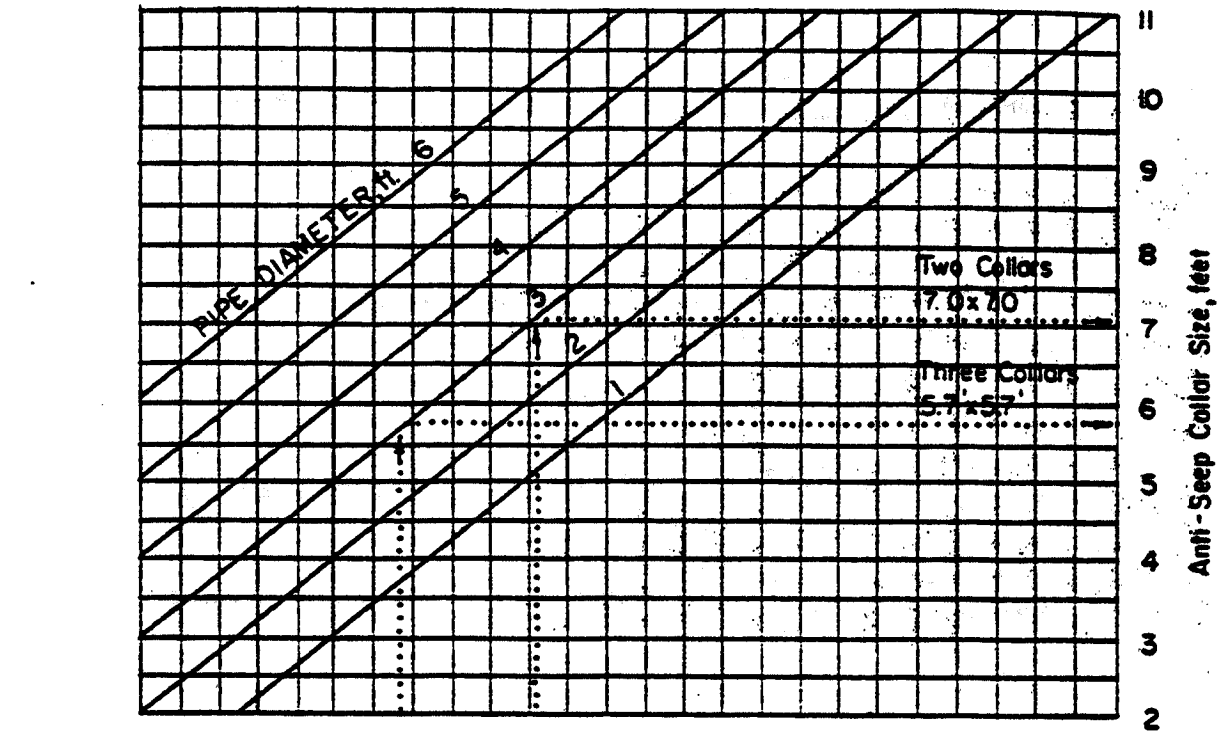
8. Anti-seep collar dimensions shall extend a minimum of 2 feet in all directions around the pipe.

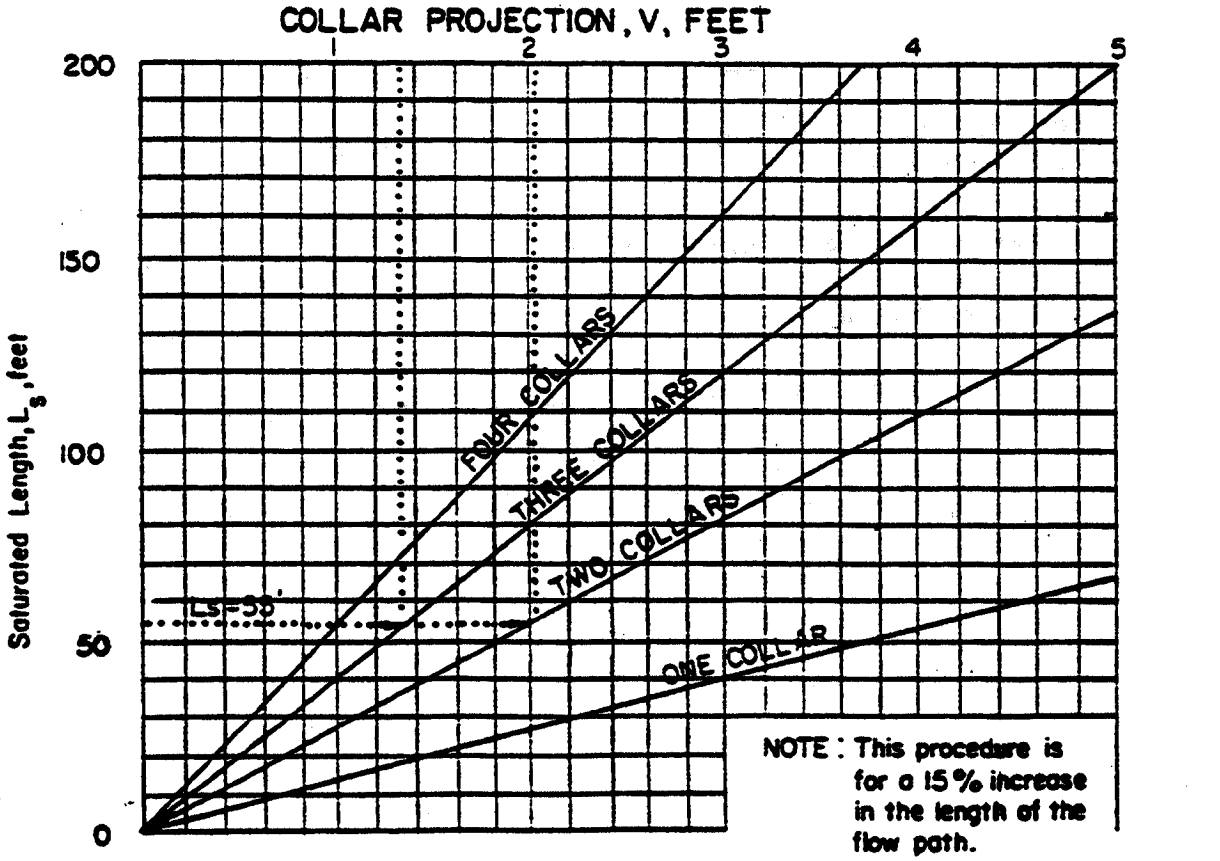
9. Anti-seep collars shall be placed a minimum of two feet from pipe joints.

10. Anti-seep collars should be placed within the saturation zone. In cases where the spacing limit will not allow this, at least one collar shall be placed in the saturation zone.

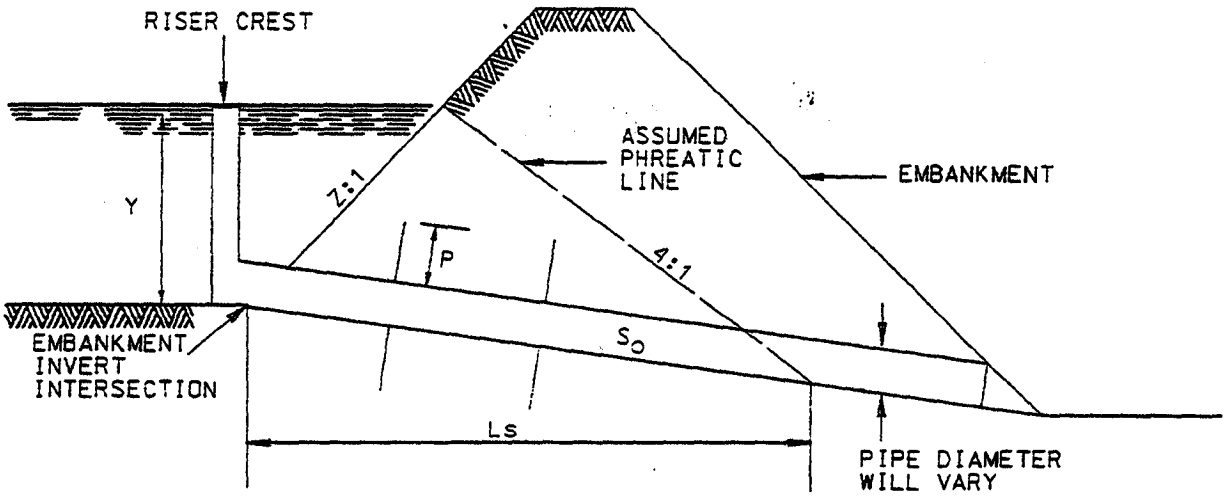
Table 16

ANTI-SEEP COLLAR DESIGN





DETAIL 13 – ANTI-SEEP COLLAR DESIGN



ANTI-SEEP COLLAR DESIGN

where: p= vertical projection of anti-seep collar(ft).

Ls = length of pipe in the saturated zone (ft.)

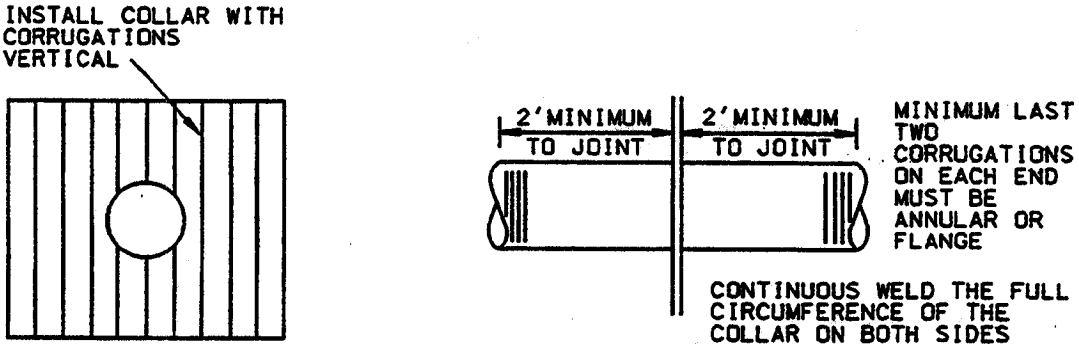
y= distance in feet from upstream invert of pipe to highest normal water level expected to occur during the life of the structure. usually the top of the riser.

z= slope of upstream embankment as a ratio of z ft. horizontal to one ft. vertical.

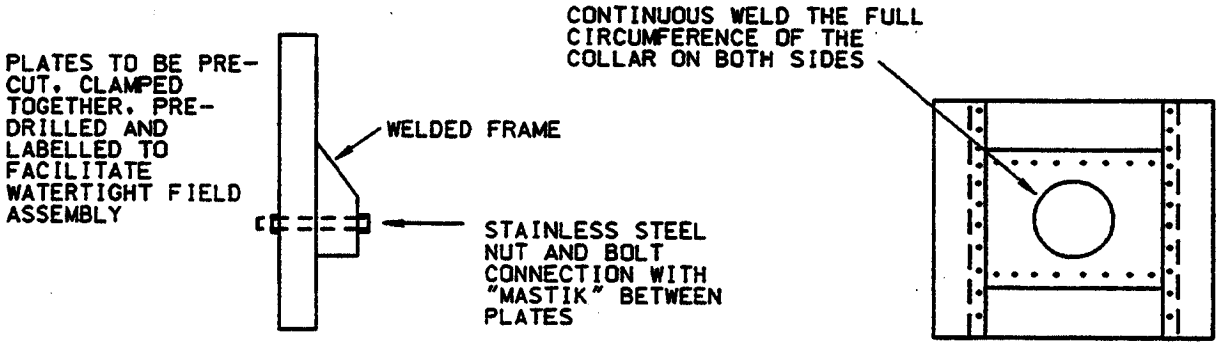
s_o= slope of pipe in feet per foot.

This procedure is based on the phreatic line as shown in the drawing above:

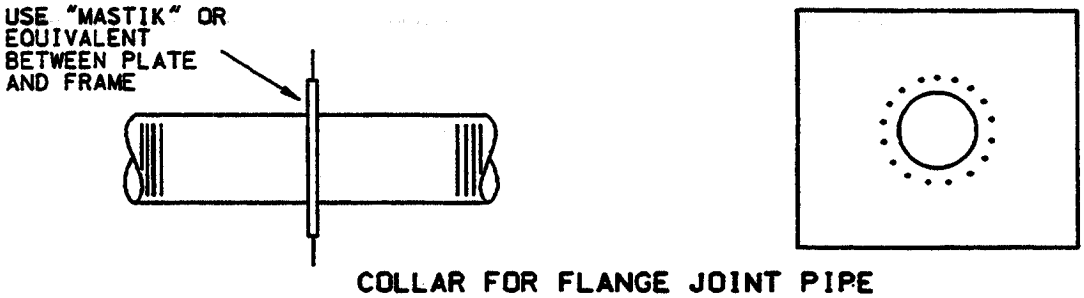
DETAIL 14 – TYPICAL ANTI-SEEP COLLARS



COLLAR WELDED IN PLACE ON BARREL SECTION



ANTI-SEEP COLLAR DESIGN



COLLAR FOR FLANGE JOINT PIPE

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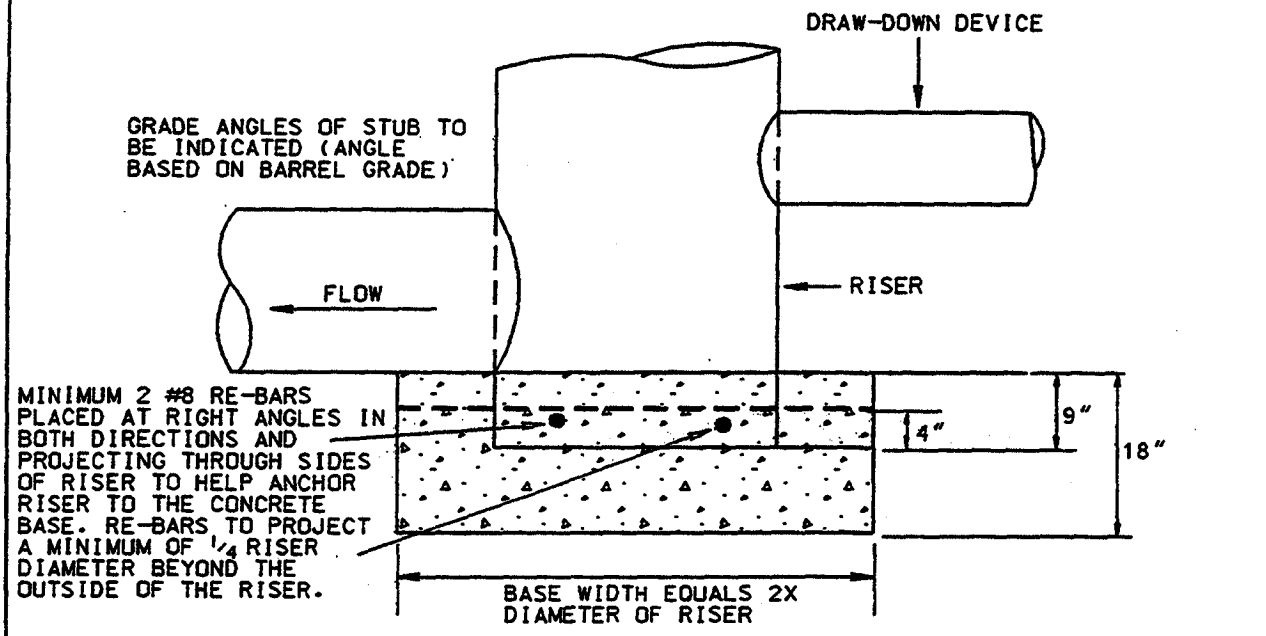
DETAIL 15 – RISER BASE DETAIL



NOTE: ANCHORING BARS SHOULD PROJECT 1/4 DIAMETER BEYOND OUTSIDE OF THE RISER.

Construction Specifications

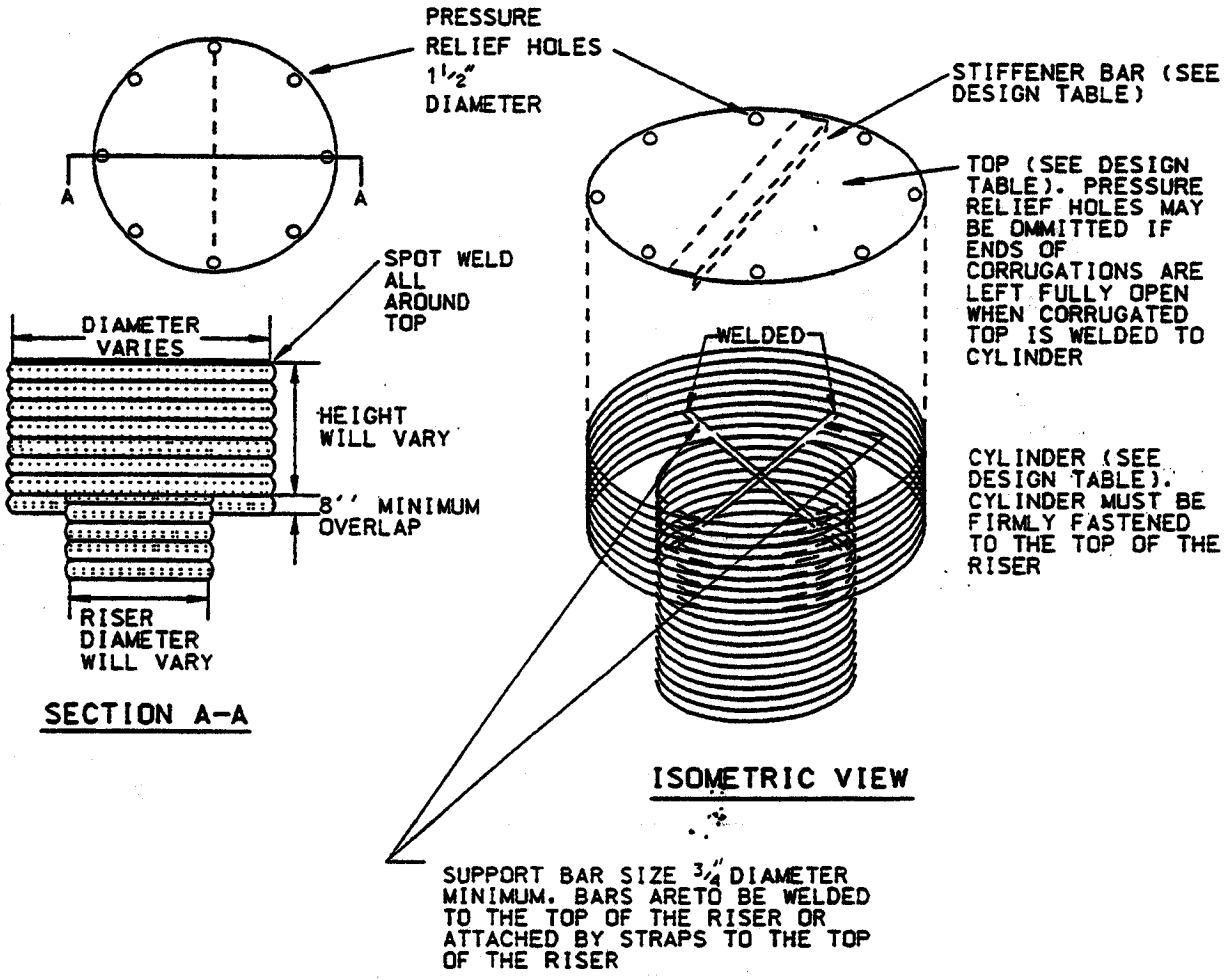
The riser shall have a base attached with a watertight connection and shall have sufficient weight to prevent flotation of the riser. Two approved bases for risers 10" or less in height are:

1. A concrete base 18" thick with the riser embedded 9" in the base.

2. A 1/4" minimum thickness steel plate attached to the riser by a continuous weld around the circumference of the riser to form a watertight connection. The plate shall have 2' of stone, gravel, or compacted earth placed on it to prevent flotation. In either case, each side of the square base shall be twice the riser diameter.

Note: For risers greater than ten feet high computations shall be made to design a base which will prevent floatation. The minimum factor of safety shall be 1.20 (downward forces = 1.20 x upward forces).

DETAIL 16 – CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE



DETAIL 16 CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE (continued)

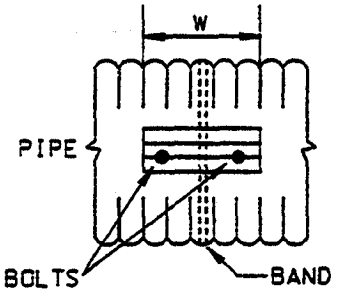
Riser Diam., in.	Trash Rack Cylinder Diam. in.	Thick., gage	H. in.	Minimum Size Support Bar	Minimum Top Thickness	Stiffener
12	18	16	6	#6 Rebar	16 ga.	—
15	21	16	7	"	"	—
18	27	16	8	"	"	—
21	30	16	11	"	"	—
24	36	16	13	"	14 ga.	—
27	42	16	15	"	14 ga.	—
36	54	14	17	#8 Rebar	12 ga.	—
42	60	14	19	"	"	—
48	72	12	21	1-1/4" pipe or 1-1/4 x 1-1/4 x 1/4 angle	10 ga.	—
54	78	12	25	"	"	—
60	90	12	29	1-1/2" pipe or 1-1/2 x 1-1/2 x 1/4 angle	8 ga.	—
66	96	10	33	2" pipe or 2x2x3/16 angle	8 ga., w/stiffener	2x2x1/4 angle
72	102	10	36	"	"	2-1/2x2-1/2x1/4 angle
78	114	10	39	2-1/2" pipe or 2x2x1/4 angle	"	"
84	120	10	42	2-1/2" pipe or 2-1/2x2-1/2x1/4 angle	"	2-1/2 x2-1/2x 5/16 angle

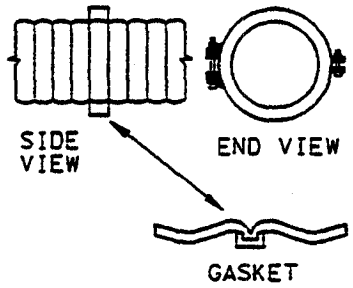
Note: The above trash rack and anti-vortex device information is only for corrugated metal pipe. Concrete risers must meet the requirements of MD 378.

DETAIL 17 TYPES OF COUPLERS FOR CORRUGATED STEEL PIPE

(ALL CONNECTOR BANDS REQUIRE NEOPRENE GASKETS)

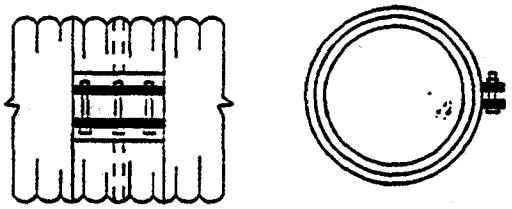
SIDE VIEW ANNULAR COUPLING BAND



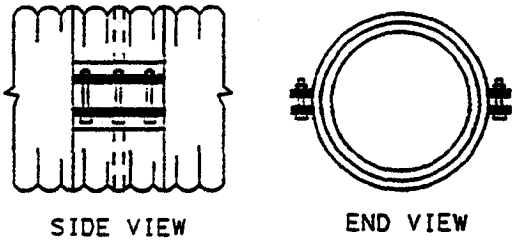


BAR AND STRAP CONNECTOR CHANNEL COUPLING BAND FOR FLANGED END CORRUGATED STEEL PIPE

STANDARD LAP-TYPE COUPLING BANDS FOR ANNULAR OR HELICAL CORRUGATED STEEL PIPE

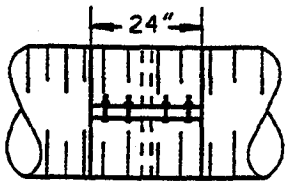


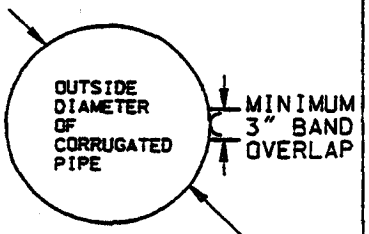
ONE PIECE LAP-TYPE COUPLING FOR ANNULAR OR HELICAL PIPE 12" TO 24" IN DIAMETER



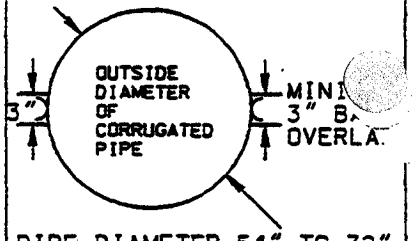
TWO PIECE LAP-TYPE COUPLING FOR ANNULAR OR HELICAL PIPE 12" TO 24" IN DIAMETER

ROD AND LUG TYPE COUPLING BAND 9 CORRUGATIONS 24" WIDE



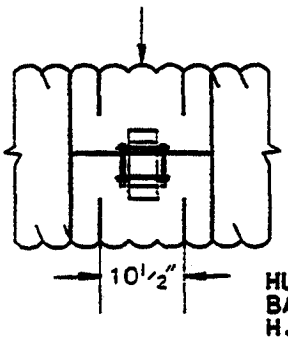


PIPE DIAMETER 15" TO 48"

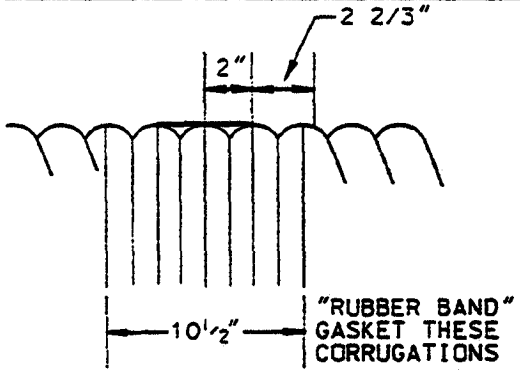


PIPE DIAMETER 54" TO 72"

BAR AND STRIP CONNECTOR



HUGGER TYPE COUPLING BAND FOR REFORMED END H.C.S.P. OR ANNULAR C.S.P.

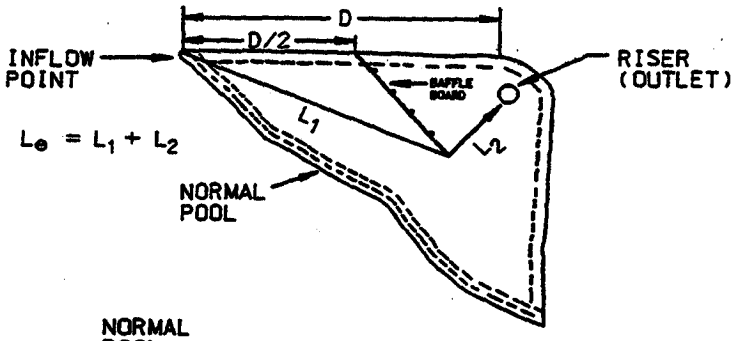


CONTINUOUS CORRUGATION ANNULAR BAND

UNDER NO CIRCUMSTANCES. WILL THE DIMPLE (UNIVERSAL) CONNECTOR BAND BE ACCEPTABLE FOR USE IN ANY SEDIMENT CONTROL OR STORMWATER MANAGEMENT STRUCTURE

DETAIL 18 – SEDIMENT BASIN BAFFLES

PLAN VIEWS



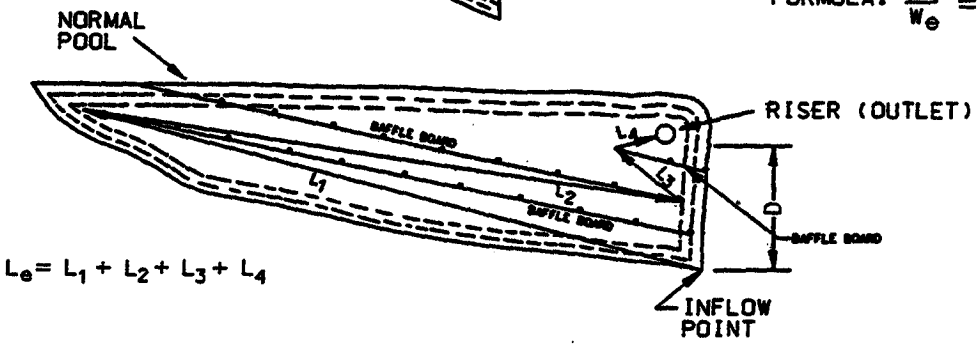
D = DISTANCE BETWEEN INFLOW AND OUTFLOW

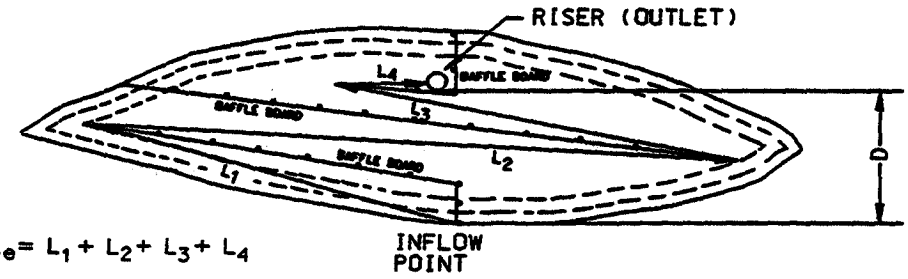
A = AREA OF NORMAL POOL

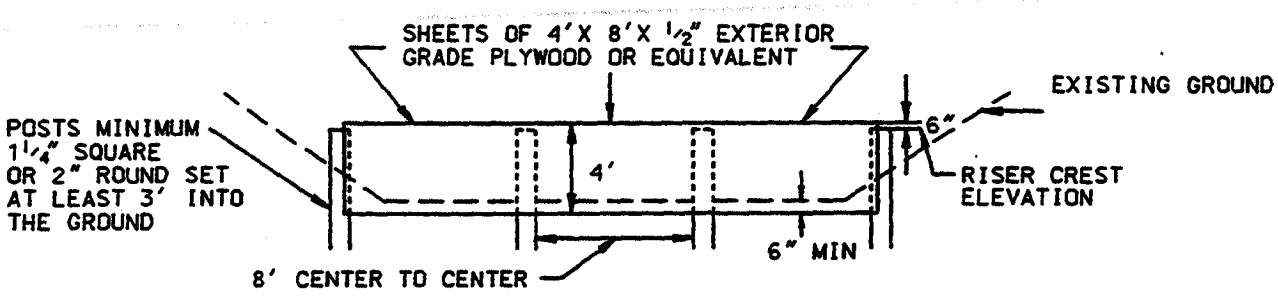
W_e = EFFECTIVE WIDTH = A/D

L_e = TOTAL DISTANCE FROM THE INFLOW POINT AROUND THE BAFFLES TO THE RISER

FORMULA: $\frac{L_e}{W_e} \geq 2$







BAFFLE DETAIL

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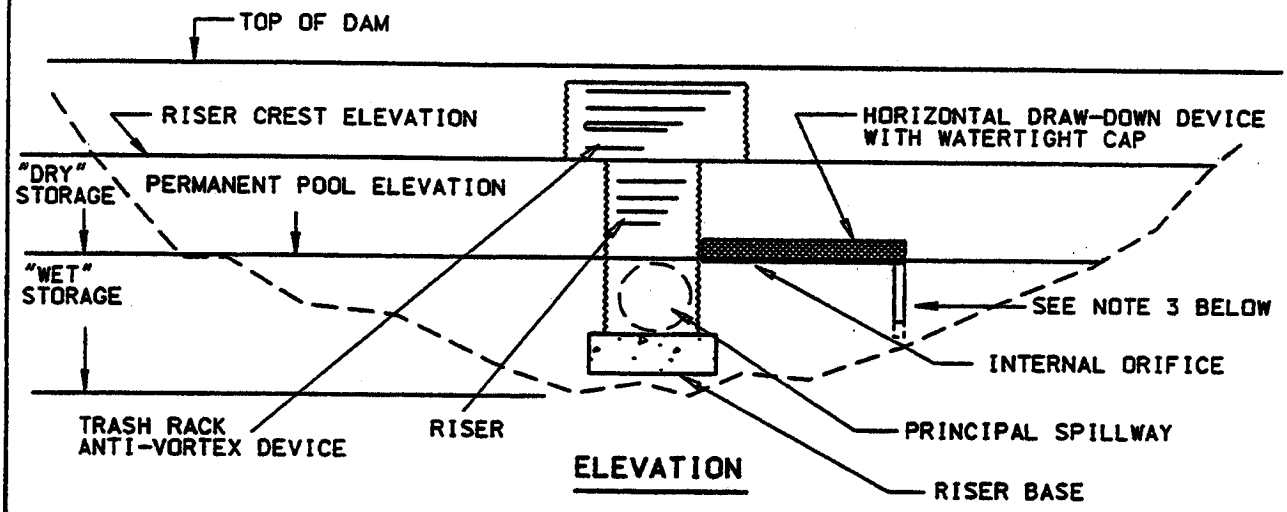
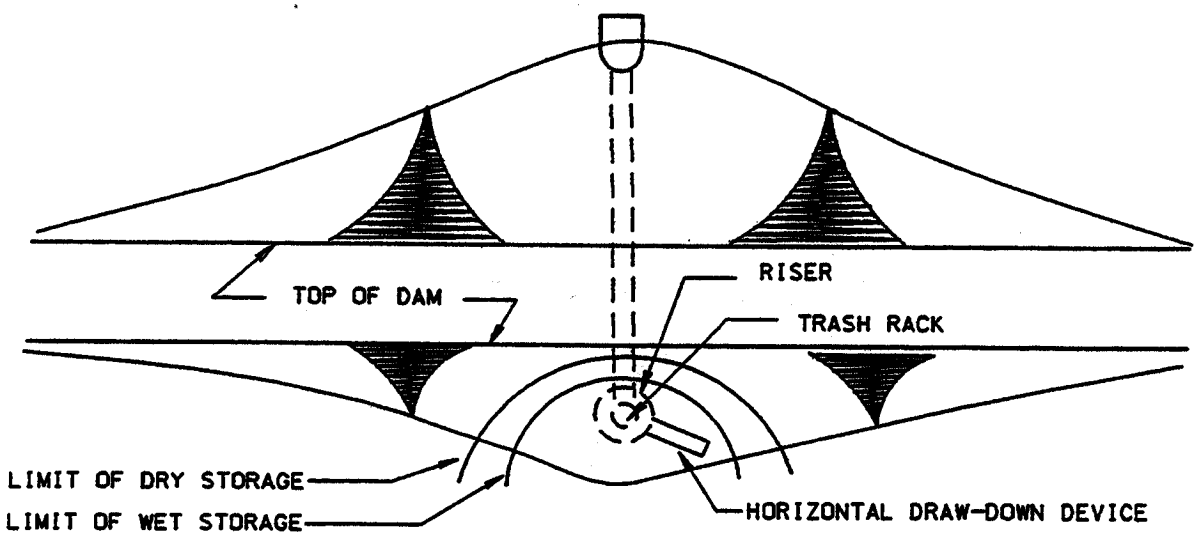
BASIN DRAWDOWN SCHEMATIC
HORIZONTAL DRAW-DOWN DEVICE



ELEVATION



PLAN VIEW

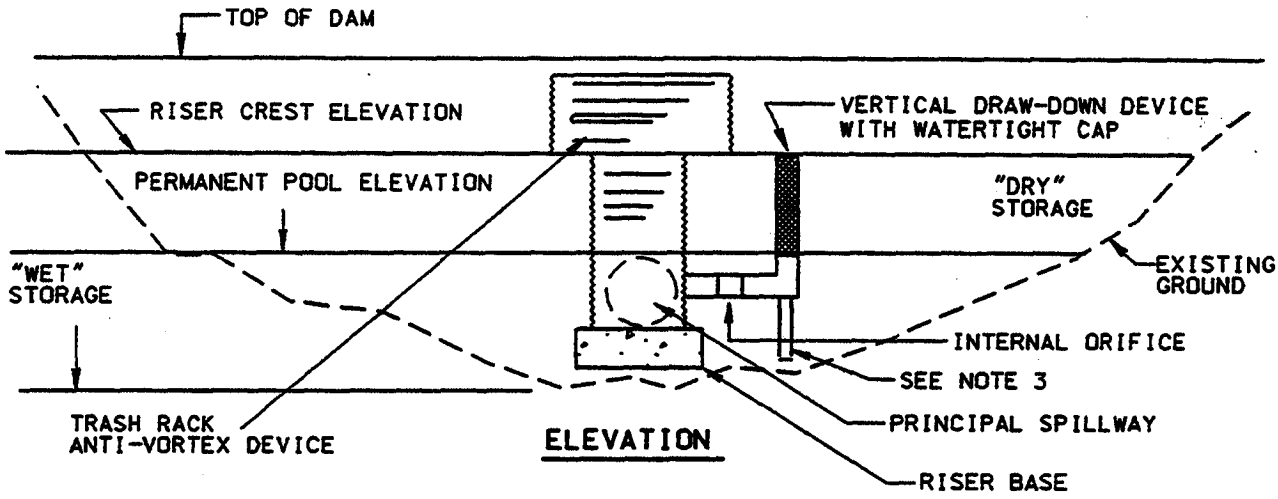
Construction Specifications

1. The total area of the perforations must be greater than 2 times the area of the internal orifice.

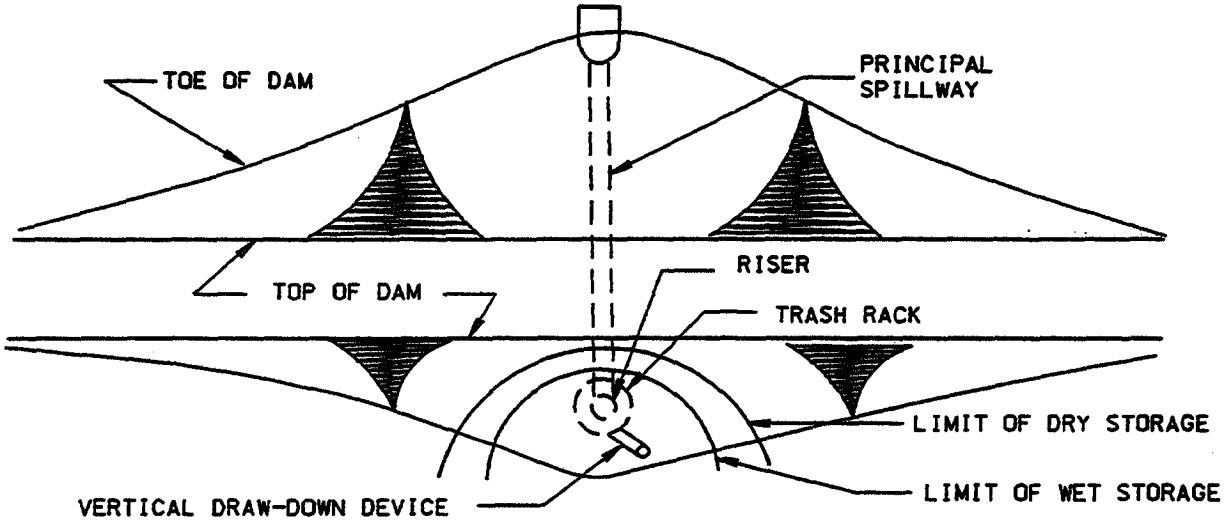
2. The perforated portion of the draw-down device shall be wrapped with ½" hardware cloth and geotextile fabric. The geotextile fabric shall meet the specifications for Geotextile Class E.

3. Provide support of draw-down device to prevent sagging and floatation. An acceptable preventative measure is to stake both sides of draw-down device with 1" steel angle, or 1' by 4" square or 2" round wooden posts set 3' minimum into the ground then joining them to the device by wrapping with 12 gauge minimum wire.

BASIN DRAWDOWN SCHEMATIC
VERTICAL DRAW-DOWN DEVICE



ELEVATION



PLAN VIEW

Construction Specifications

1. Perforations in the draw-down device may not extend into the wet storage.

2. The total area of the perforations must be greater than 2 times the area of the internal orifice.

3. The perforated portion of the draw-down device shall be wrapped with ½" hardware cloth and geotextile fabric. The geotextile fabric shall meet the specifications for Geotextile Class E.

4. Provide support of draw-down device to prevent sagging and floatation. An acceptable preventative measure is to stake both sides of draw-down device with 1" steel angle, or 1' by 4" square or 2" round wooden posts set 3' minimum into the ground then joining them to the device by wrapping with 12 guage minimum wire.

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11.0 STANDARDS AND SPECIFICATIONS

FOR

STONE OUTLET STRUCTURES

Definition

A temporary stone dike installed in conjunction with and as a part of an earth dike.

Purpose

The purpose of the Stone Outlet Structure is to filter sediment laden runoff, provide a protected outlet for an earth dike, provide for diffusion of concentrated flow, and allow the area behind the dike to dewater.

Conditions Where Practice Applies

Stone outlet structures apply to any point of discharge where there is need to dispose of runoff at a protected outlet or to diffuse concentrated flow for the duration of the period of construction. **The drainage area to this practice shall be 1/2 acre or less.**

Outlet

The stone outlet structure shall be located so as to discharge onto an already stabilized area or into a stable watercourse. Stabilization shall consist of complete vegetative cover, paving, etc., sufficiently established to be erosion resistant.

Construction Specifications

1. 2" to 3" stone[18] or recycled concrete equivalent is preferred but clean gravel may be used if stone is not available.

2. The crest of the stone dike shall be at least 6" lower than the lowest elevation of the top of the earth dike and shall be level.

3. The stone outlet structure shall be embedded into the soil a minimum of 4".

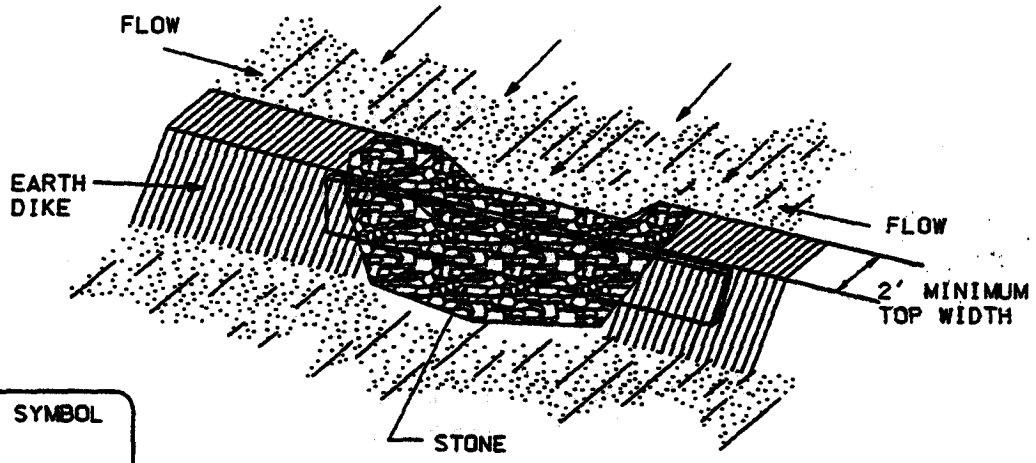
4. The minimum length of the crest of the stone outlet structure shall be 6'.

5. The baffle board shall extend 1' into the dike and 4" into the ground and be staked in place.

6. The drainage area to this structure shall be less than 1/2 acre.

[18] Refer to Table 28

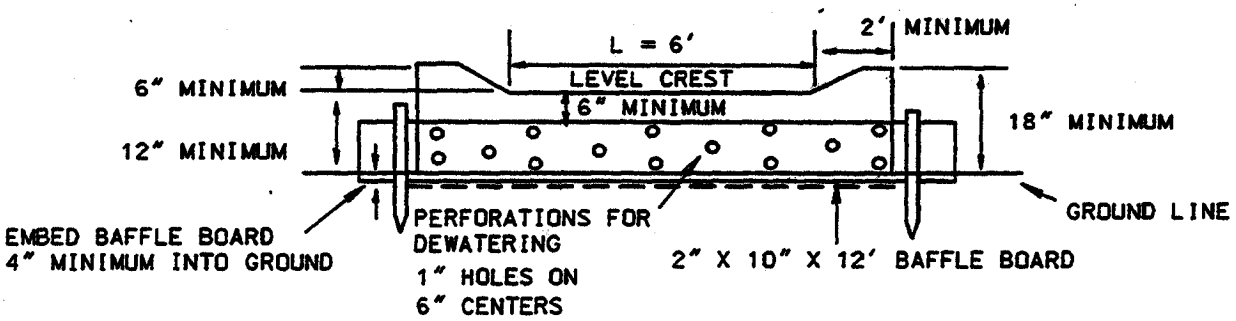
DETAIL 19 – STONE OUTLET STRUCTURE



STANDARD SYMBOL

TSDS

PERSPECTIVE VIEW



CROSS SECTION

Construction Specifications

1. Crushed stone shall be used. Gravel may be used if crushed stone is not available. The stone shall be 2"-3" in size.

2. The crest of the stone dike shall be at least 6" lower than the lowest elevation of the top of the earth dike and shall be level.

3. The stone outlet structure shall be embedded into the soil a minimum of 4".

4. The minimum length of the crest of the stone outlet structure shall be 6'.

5. The stone outlet structure shall be inspected after each rain. Stone shall be replaced when the structure ceases to function and ponding results.

6. The baffle board shall be extended one foot into the dike, staked and embedded 4" into the existing ground.

7. The drainage area to this structure shall be less than ½ acre.