ATTACHMENT C

Sediment Basin

Description

A sediment basin is a temporary settling pond that releases runoff at a controlled rate. It is designed to slowly release runoff, detaining it long enough to allow most of the sediment to settle. The outlet structure is a designed pipe riser and barrel. The entire structure is removed when construction is complete and the drainage area stabilized.

Conditions Where Practice Applies

Sediment basins are limited to sites where:

- Failure of the structure would not result in loss of life, damage to homes or buildings, or interruption of use or service of private utilities.
- The drainage area is 100 ac. or less.
- The height of the dam is 25 ft. or less, as measured from the natural streambed at center line of dam to the top of dam.
- The basin is to be removed within 36 months after its construction.

Sediment basins exceeding any of these limits shall conform to Ohio Dam Safety Laws, local requirements, or U.S.D.A Natural Resources Conservation Service Standards and Specifications No. 387 for ponds, whichever is more restrictive.

Ohio Dam Safety Laws may apply to basins larger than 15 ac.ft. (24,000 cy) as measured to the top of the dam. Information is available from the Ohio Department of Natural Resources, Division of Water, 1939 Fountain Square Ct., Columbus, Ohio 43224-1336; phone (614) 265-6731.

For temporary sediment control modifications to permanent ponds, see the standards and specifications of Permanent Ponds for Temporary Sediment Control.

PLANNING CONSIDERATIONS

Sediment basins along with sediment traps are generally the most reliable measures used for treating sediment-laden runoff. Sediment basins and traps are usually placed near the perimeter of construction-sites. Construction activity should be phased to allow them to remain functional for as long as possible, ideally until the area contributing runoff is stabilized. Sediment basins have relatively good sediment-trapping efficiencies and require little maintenance compared to other practices used to treat sediment-laden runoff. Settling ponds, both traps and basins, are generally recommended as the principal sediment-control practice for construction-sites.

Effectiveness--Sediment basins by no means trap all the sediment that washes into them. Sometimes more than half the sediment flows through. Therefore, sediment basins as with all sediment controls should be used in conjunction with erosion control practices such as temporary seeding to reduce the total amount of sediment washing to them.

While trapping efficiency varies widely for sediment basins, it is commonly between 60% and 80%. Trapping efficiency should be optimized within site constraints. This can be accomplished by: 1) incorporating design criteria which maximize trapping efficiency, 2) presenting this information clearly in construction documents, and 3) assuring construction is performed according to those documents.

Timing--Sediment basins, along with other sediment-control practices, must be constructed as a first step in any land disturbing activity and must be functional before upslope land disturbance takes place.

Location:

Construction Phases--Sediment basins should be placed so they function through all phases of the site's development, both before and after new drainage systems are constructed.

Diverting Runoff--Temporary diversions at the perimeter of sites often are used to direct runoff to sediment basins (see Temporary Diversion Specification).

Below Storm Drains--Sediment basins may be placed beyond the ends of proposed storm-drain systems. Postponing construction of the last sections of storm drain may be necessary to provide adequate area for the sediment basin between the outlet and receiving water course.

Storm-Drain Diversions--Storm drains may also be temporarily redirected through sediment basins during construction. After construction, the detours are removed and runoff is allowed to flow through the permanent storm drain.

Utilities--Give special consideration to sediment basin location and potential interference with construction of proposed drainageways, utilities and storm drains.

The design criteria includes 1) Pool Design, 2) Embankment Design, 3) Outlet Design, and 4) Emergency Spillway Design.

Design Procedures--In addition to the following design criteria, simple procedures are provided which may be used to meet these requirements. Other accepted engineering design procedures also may be used to meet the design criteria.

Runoff Calculations--Runoff computations must be based upon the worst soil-cover conditions expected to prevail in the contributing drainage area during the anticipated effective life of the structure. Runoff must be computed by accepted engineering methods such as the Rational Method, NRCS TR-55, or those outlined in Chapter 2, Estimating Runoff, "Engineering Field Handbook for Conservation Practices," NRCS.

POOL DESIGN CRITERIA:

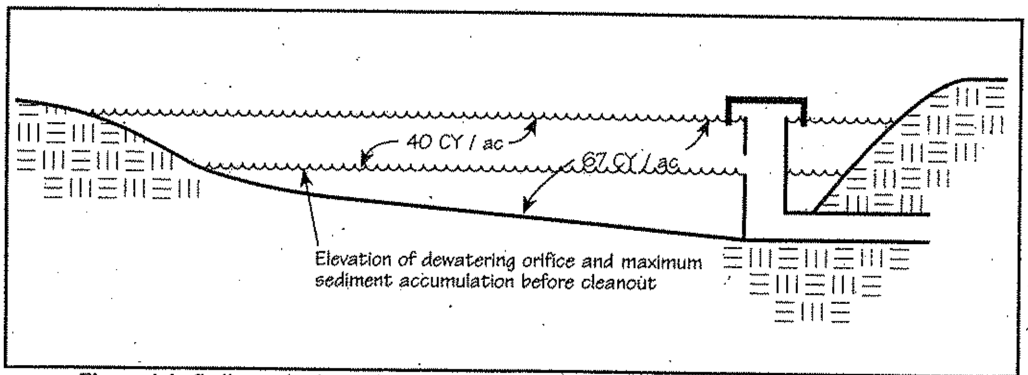


Figure 4-1 Sediment basin total volume made up of runoff storage and wet pool/sediment storage

1. **Plans**--Basin dimensions must be clearly shown (drawn to scale and labeled) on the plans to help in plan review and construction.

2. **Volume**--The minimum volume of sediment basins shall be 67 cy (0.04 ac.-ft.) for each acre of drainage area. This volume is measured below the top of the principal spillway's crest elevation. The drainage area includes the entire area contributing runoff to the sediment basin, off-site as well as on. Sediment basins will be cleaned out before sediment accumulation reduces the volume to 40 cy/ac. The cleanout elevation must be clearly marked on the riser. See maintenance section below.

3. **Increasing Trapping Efficiency**--It is recommended that the designer of a sediment basin strive to incorporate the following features to increase sediment trapping efficiencies. These are optimum criteria and will not be feasible for all sediment basins:

   Depth--The pool shall be configured to maximize the optimum depth of 3 ft. Depths over 5 ft. should be avoided. The depth shall be measured to the top of the principal outlet. Optimum depth is most important for basins that dewater or have temporary storage.

Length-to-Width Ratio--The length-to-width ratio shall be greater than 6:1 and less than 20:1 if feasible within the site's constraints. The width shall be calculated by dividing the surface area by the shortest flow path in the basin. Optimum length to width is most important for basins that do not dewater but remain full between rains.

Porous Baffles--If individual situations require greater trapping efficiency or if optimum depth and length-to-width ratios are not feasible, baffles may be incorporated into the design. Baffles shall be constructed to partition the basin into two or three cells. Baffles shall be porous, constructed of jute matting, rock, plastic safety fence, or other material that will dampen turbulent currents within the pool. Baffle height shall be greater than the principal spillway and less than the emergency spillway. Baffles that become submerged may cause flow just across the top layer of the pond. This allows little mixing with the water below and significantly lowers trapping efficiency.

4. **Safety**--Sediment basins are attractive to children and can be dangerous, particularly where slopes 2:1 or steeper lead directly into water 3 ft. or deeper. Danger is also increased where side slopes are not vegetated. The danger associated with sediment basins shall be minimized by avoiding the above pond configurations and/or by fencing and posting warning signs where appropriate.

EMBANKMENT DESIGN CRITERIA:

1. Embankments should have side slopes 2:1 or flatter. Note that if the basin will be developed into a permanent pond, remaining after construction, the combined side slopes must equal 5:1 or greater.

2. Seepage must be prevented from flowing along the foundation of the embankment. This requires stripping vegetation and topsoil. Cut-off trenches also are needed for all but the most stable conditions such as very low embankments and stable soils.

3. The height should include a 10% settling allowance. Note that the designed height of the embankment may need to be adjusted after designing the spillways.

4. Top Width:

Embankment Top Width	
Embankment Height (ft.)	Top Width (ft.)
< 15	8
15 - 20	10
> 20	12

PRINCIPAL SPILLWAY DESIGN CRITERIA:

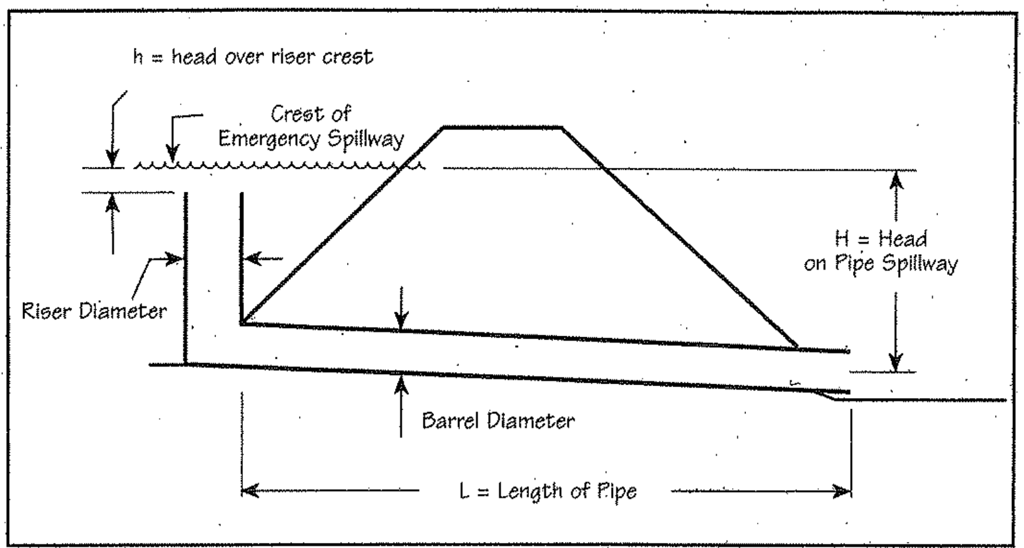


Figure 4-2 Sediment basin principal spillway design

1. **Capacity**--The principal spillway must pass at least 1 cfs/ac. of drainage area when the water surface is at the crest of the emergency spillway. The principal spillway will generally pass less than the 1-yr. frequency storm. Note the importance this places on the detention volume created by dewatering and the integrity of the emergency spillway.

2. **Crest Elevation**--The riser pipe's crest elevation must be a minimum of 1 ft. below the elevation of the emergency spillway.

3. **Sizing Procedure for Riser and Barrel:**
   - Determine Q from the capacity criteria above.
   - Determine h as the difference in elevation between the crests of the principal and the emergency spillway as shown in Figure 4-2.
   - Determine H as the difference in elevation between the barrel outlet and crest of the emergency spillway as shown in Figure 4-2.

   - With Q and h, refer to the following Riser Inflow Curves, Figure 4-3, and find the riser size required.
   - With Q and H, refer to the following Pipe Flow Table and find the barrel size required.

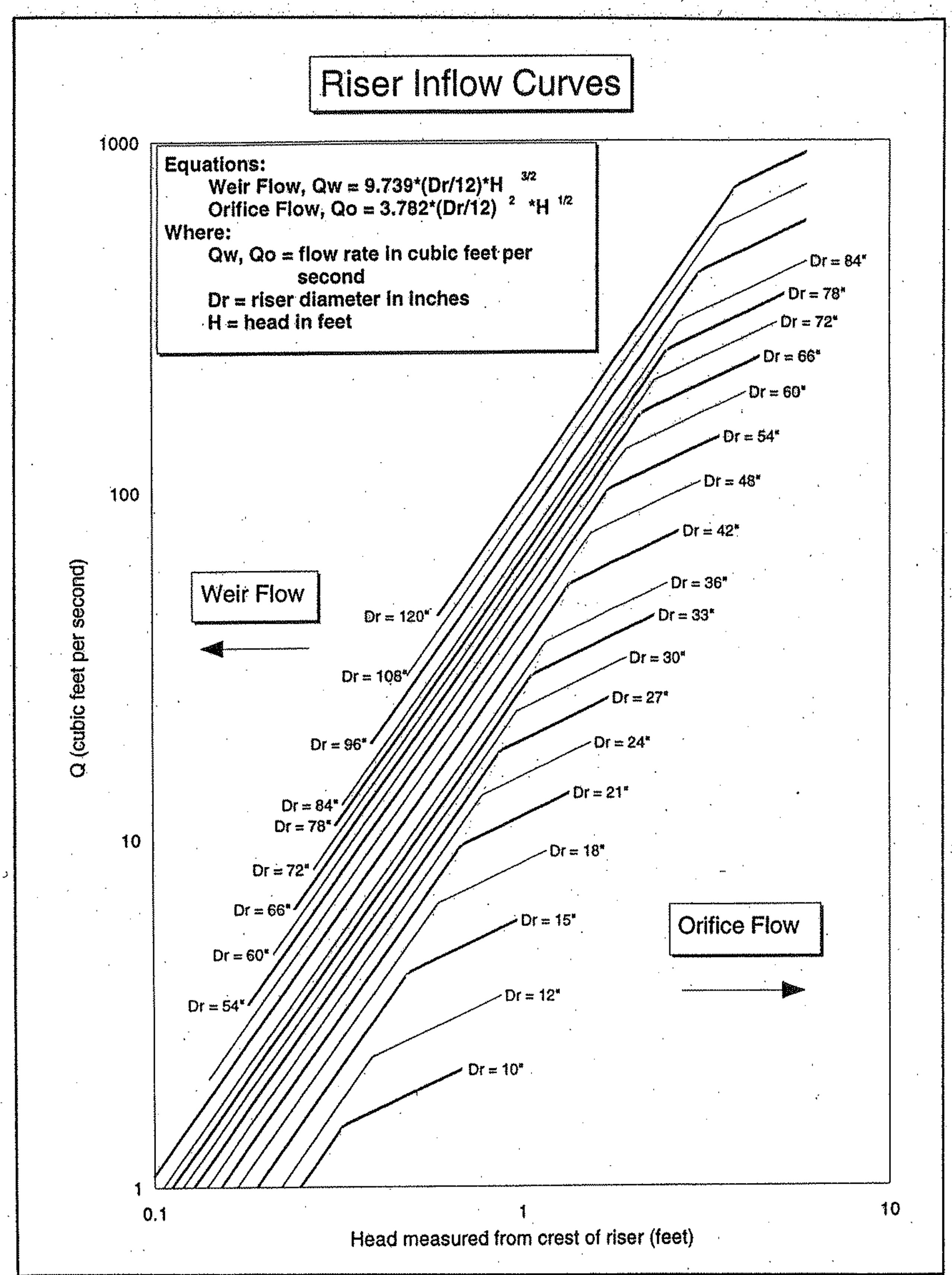


Figure 4-3 Sediment basin riser inflow curves

Barrel Size--For Corrugated Metal Pipe Principal Spillway
Based on flow rate (Q) and head (H)

Head, H (ft.)	Barrel Diameter (in.)													
	6	8	10	12	15	18	21	24	30	36	42	48	54	60
	Flow Rate, Q (cfs)													
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
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
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
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
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
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
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
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
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
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
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
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
13	1.20	2.53	4.49	7.15	12.6	19.7	28.8	39.8	67.8	104	148	201	262	331
14	1.25	2.63	4.66	7.42	13.0	20.5	29.9	41.3	70.4	108	154	208	272	343
15	1.29	2.72	4.83	7.68	13.5	21.2	30.9	42.8	72.8	112	159	216	281	355
16	1.33	2.81	4.99	7.93	13.9	21.9	32.0	44.2	75.2	115	165	223	290	367
17	1.37	2.90	5.14	8.18	14.3	22.6	32.9	45.5	77.5	119	170	230	299	378
18	1.41	2.98	5.29	8.41	14.8	23.2	33.9	46.8	79.8	120	174	236	308	389
Length L (ft.)	Correction Factors for 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
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
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
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
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
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
80	.94	.94	.95	.95	.95	.95	.96	.96	.96	.97	.97	.97	.98	.98
90	.89	.89	.90	.90	.91	.91	.92	.92	.93	.94	.94	.95	.95	.96
100	.85	.85	.86	.86	.87	.88	.89	.89	.90	.91	.92	.93	.93	.94

4. **Dewatering the Basin**--Automatic dewatering should be part of all sediment basins. While the top 60% of the pond's volume must dewater, the remaining sediment storage volume may remain as wet storage or be dewatered. Dewatering the sediment storage volume is often advantageous to the developer or contractor. Relatively dry material can be handled with on-site equipment rather than expensive draglines often needed to handle wet (un-dewatered) sediments. A standard design for each option is provided.

   Dewatering Option 1, 60% Drawdown--The riser shall have a dewatering orifice with trash guard located to dewater 60% of the pond's volume. This may be estimated as half the height of the riser. The orifice shall be sized to dewater 60% of the pond's volume in 48 to 72 hr. The following table may be used for sizing the dewatering orifice:

Sizing Dewatering Orifice	
Drainage Area to Sediment Basin (ac.)	Diameter of Orifice (in.)
5 - 10	1.5
10 - 20	2
20 - 35	2.5
35 - 55	3
55 - 75	3.5
75 - 100	4

   Dewatering Option 2, 100% Drawdown--The principal spillway riser or an additional riser shall be perforated with 1-in.-diameter holes on 4-in. horizontal and vertical spacing. The perforated riser shall be wrapped with wire mesh, then double wrapped with geotextile.

5. **Riser Base**--The principal spillway must be weighted to prevent flotation. The minimum factor of safety against flotation shall be 1.1. If concrete is used for the weighted riser base, the following formula may be used in calculating the required volume of concrete:

$$V = 0.62HD^2 - \frac{HW_R}{87.6}$$

Where:
H = Height Riser (ft.)
D = Diameter Riser (ft.)
W_R = Weight Riser (lb./ft.)
V = Volume of Concrete (ft.^{3})

6. **Trash Rack**--To prevent the riser from becoming clogged with straw or construction debris, a trash rack should be used. However, if conditions make clogging unlikely, a trash rack may not be necessary. Trash racks should be sized as follows:

Trash Rack Size (in.)		
Riser Diameter	Trash Rack Diameter	Trash Rack Height
15	21	7
18	27	8
21	30	11
24	36	13
27	42	15
36	54	17
42	60	19
48	72	21

7. **Anti-Seep Collars**--Anti-seep collars must be used on the barrel of the principal spillway.
   - Anti-seep collars must increase the seepage flow length by at least 15%.
   - Where more than one collar is used, they shall be spaced approximately 25 ft. apart.

   Anti-seep collars may not be needed if the embankment is less than 10 ft. and the barrel is 12 in. or smaller if made of corrugated metal pipe or 8 in. or smaller if made of smooth walled conduit.

8. **Outlet Protection**--The pipe barrel outlet must be stable and not cause erosion.

EMERGENCY SPILLWAY DESIGN CRITERIA

1. **Location**--Emergency spillways shall be constructed on undisturbed ground. It must not be constructed over the embankment.

2. **Capacity**--The emergency spillway shall have the capacity to pass at least 4 cfs/ac. of drainage area with a minimum freeboard of 1 ft. before overtopping the embankment. Accounting for the embankment settling 10%.

3. **Sizing Procedure**--Having determined the capacity Q, find the spillway width and stage required in the Capacity of Earth Spillways table. The stage is the difference between the pond surface and the crest of the emergency spillway.

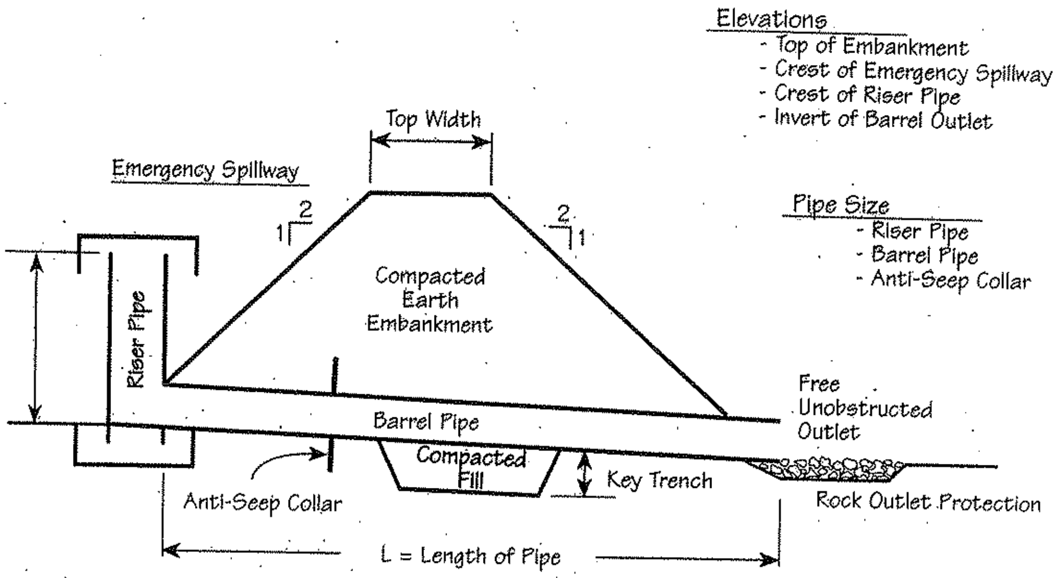
4. **Embankment Height**--Increase the height of the embankment if needed to maintain a minimum freeboard of 1 ft.

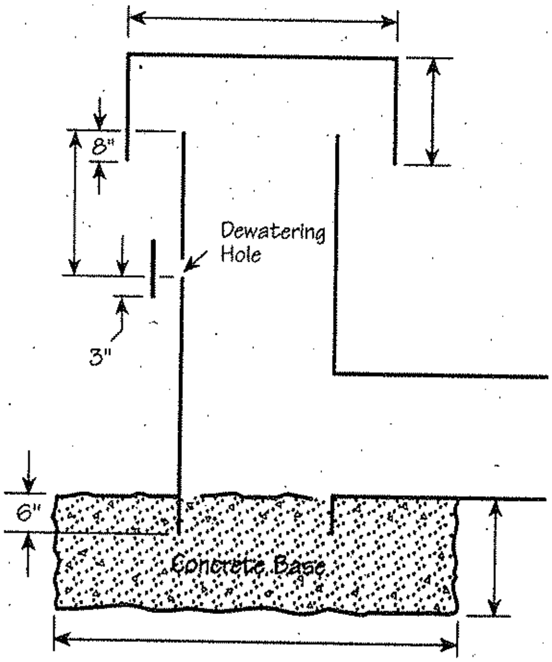
Capacity of Earth Spillways

Stage (ft.)	Bottom Width (ft.)																
	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
	Flow Rate Q (cfs)																
0.5	6	7	8	10	11	13	14	15	17	18	20	21	22	24	25	27	28
0.6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	35	37	39
0.7	11	13	16	18	20	23	25	28	30	33	35	38	41	43	44	46	48
0.8	13	16	19	22	26	29	32	35	38	42	45	46	48	51	54	57	60
0.9	17	20	24	28	32	35	39	43	47	51	53	57	60	64	68	71	75
1.0	20	24	29	33	38	42	47	51	56	61	63	68	72	77	81	86	90
1.1	23	28	34	39	44	49	54	60	65	70	74	79	84	89	95	100	105
1.2	28	33	40	45	51	58	64	69	76	80	86	92	98	104	110	116	122
1.3	32	38	46	53	58	65	73	80	86	91	99	106	112	119	125	133	140
1.4	37	44	51	59	66	74	82	90	96	103	111	119	127	134	142	150	158
1.5	41	50	58	66	75	85	92	101	108	116	125	133	142	150	160	169	178
1.6	46	56	65	75	84	94	104	112	122	132	142	149	158	168	178	187	197
1.7	52	62	72	83	94	105	115	126	135	145	156	167	175	187	196	206	217
1.8	58	69	81	93	104	116	127	138	150	160	171	182	194	204	214	226	233
1.9	64	76	88	102	114	127	140	152	164	175	188	201	213	225	235	248	260
2.0	71	83	97	111	125	138	153	164	178	193	204	218	232	245	256	269	283
2.1	77	91	107	122	135	149	162	177	192	207	220	234	250	267	276	291	305
2.2	84	100	116	131	146	163	177	194	210	224	238	253	269	288	301	314	330
2.3	90	108	124	140	158	175	193	208	226	243	258	275	292	306	323	341	354
2.4	99	116	136	152	170	189	206	224	241	260	275	294	312	327	346	364	378

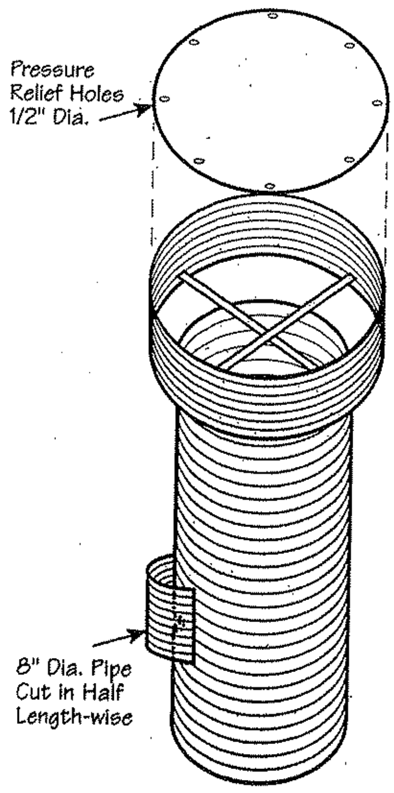
Note: The side slopes cut for the emergency spillway must be no steeper than 2:1.

Specifications
for
Sediment Basins

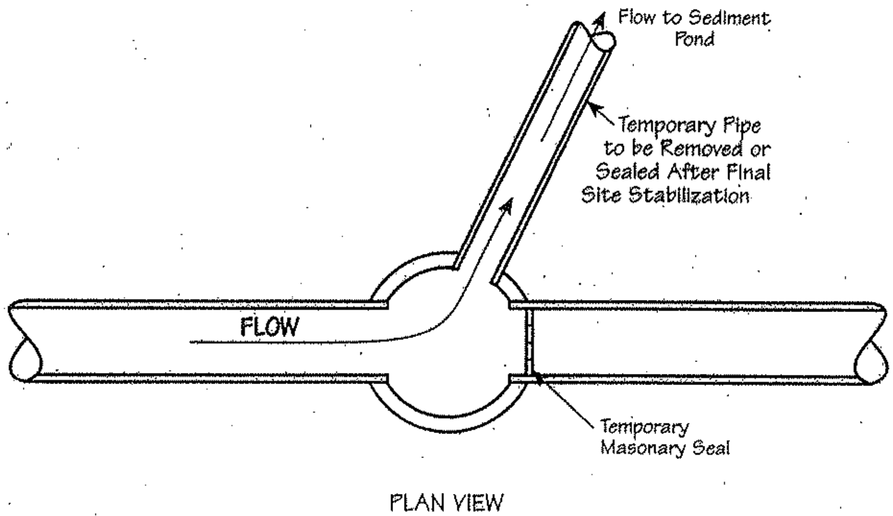




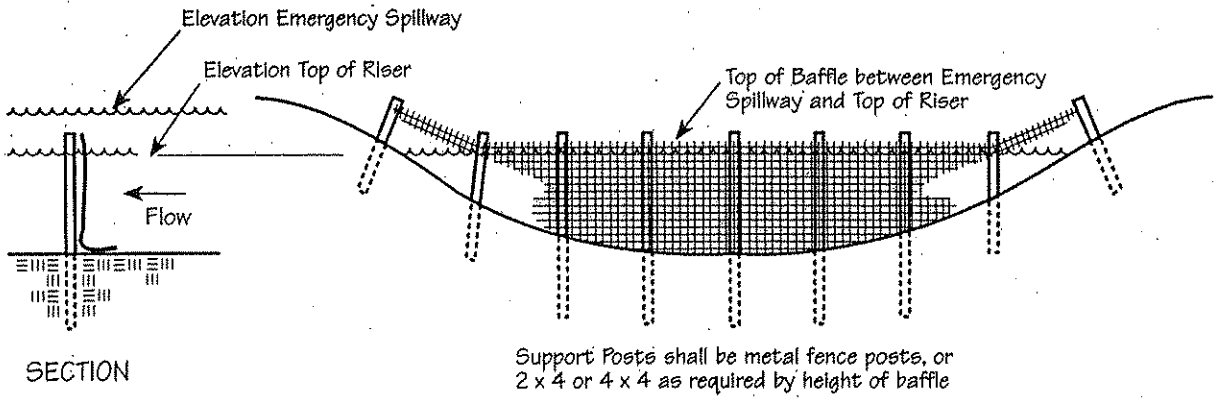
SECTION
Trash Racks & Base



ISOMETRIC



Temporary Storm Drain Diversion



Baffle

Specifications
for
Sediment Basins

1. Sediment basins shall be constructed and operational before upslope land disturbance begins.

2. Site Preparation--The area under the embankment shall be cleared, grubbed, and stripped of any vegetation and root mat. The pool area shall be cleared as needed to facilitate sediment cleanout. Gullies and sharp breaks shall be sloped to no steeper than 1:1. The surface of the foundation area will be thoroughly scarified before placement of the embankment material.

3. Cut-Off Trench--The cutoff trench shall be excavated along the centerline of the embankment. The minimum depth shall be 2 ft. unless specified deeper on the plans or as a result of site conditions. The minimum bottom width shall be 4 ft., but wide enough to permit operation of compaction equipment. The trench shall be kept free of standing water during backfill operations.

4. Embankment--The fill material shall be free of all sod, roots, frozen soil, stones over 6 in. in diameter, and other objectionable material. The placing and spreading of the fill material shall be started at the lowest point of the foundation and the fill shall be brought up in approximately 6-in. horizontal layers or of such thickness that the required compaction can be obtained with the equipment used. Construction equipment shall be operated over each layer in a way that will result in the required compaction. Special equipment shall be used when the required compaction cannot be obtained without it. The moisture content of fill material shall be such that the required degree of compaction can be obtained with the equipment used.

5. Pipe Spillway--The pipe conduit barrel shall be placed on a firm foundation to the lines and grades shown on the plans. Connections between the riser and barrel, the anti-seep collars and barrel and all pipe joints shall be watertight. Selected backfill material shall be placed around the conduit in layers and each layer shall be compacted to at least the same density as the adjacent embankment. All compaction within 2 ft. of the pipe spillway will be accomplished with hand-operated tamping equipment.

6. Riser Pipe Base--The riser pipe shall be set a minimum of 6 in. in the concrete base.

7. Trash Racks--Both the top of the riser and the dewatering orifice shall be fitted with trash racks firmly fastened to the riser pipe.

8. Emergency Spillway--The emergency spillway shall be cut in undisturbed ground. Accurate construction of the spillway elevation and width is critical and shall be within a tolerance of 0.2 ft.

9. Seed and Mulch--The sediment basin shall be stabilized immediately following its construction. In no case shall the embankment or emergency spillway remain bare for more than 7 days.

10. Sediment Cleanout--Sediment shall be removed and the sediment basin restored to its original dimensions when the sediment has filled one-half the pond's original depth or as indicated on the plans. Sediment removed from the basin shall be placed so that it will not erode.

11. Final removal - Sediment basins shall be removed after the upstream drainage area is stabilized or as indicated in the plans. Dewatering and removal shall NOT cause sediment to be discharged. The sediment basin site and sediment removed from the basin shall be stabilized.