4.7 Sediment Traps and Basins

General Information

The purpose of a temporary trap or basin is to provide an area where muddy runoff is allowed to pond, so sediment will settle out. Sediment traps and basins should be installed in selected drainage areas before excavation or fill work begins. Do not depend on sediment traps and basins alone to control sediment loss from your construction site. Sediment basins and traps should fill with muddy runoff during and immediately after a rain storm and drain down slowly over the next 1–2 days.

Containment for the ponding area can be provided by an excavation or a dike made of earth or stone. Low-lying sites on the downhill side of bare soil areas are ideal places to install temporary sediment traps and basins. In general, sediment traps are designed to treat runoff from about 1 to 5 acres. Sediment basins are larger, and serve areas larger than 5 acres. Basins draining areas larger than 10 acres require an engineered design and are often designed to function as a permanent stormwater treatment pond after construction is complete.

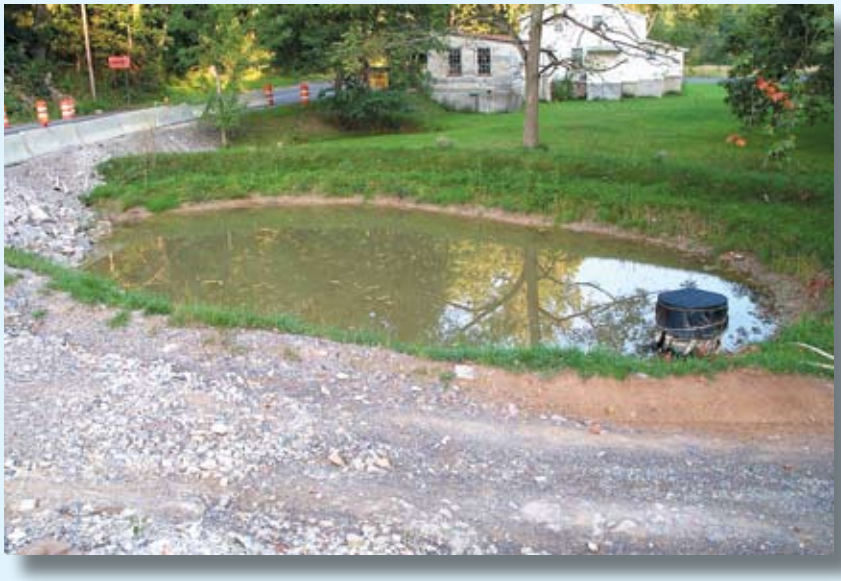
If feasible, do not put sediment traps or basins in or next to flowing streams or other waterways. Make sure pooled water does not flood buildings, roadways, utilities, or other structures. Construction of a permanent, stable outlet is key to long-term performance.

Temporary Sediment Traps

Any depression, swale, or low-lying place that receives muddy flows from exposed soil areas can serve as a sediment trap site. Installing several small traps at strategic locations is often better than building one large basin. The simplest approach is to dig a hole or build a dike (berm) of earth or stone where concentrated flows are present. This will help to detain runoff so sediment can settle out. The outlet can be a rock-lined depression in the containment berm.

Sediment Basins

Sediment basins are somewhat larger than traps, but the construction approach is similar. Sediment basins usually have more spillway protection because of their larger flows. Most have risers and outlet pipes rather than rock spillways to handle the larger flows. Sediment basins are often designed to serve later as stormwater treatment ponds. If this is the case, agreements might be required assigning responsibility for long-term sediment removal and general maintenance.



Small, temporary sediment traps intercept and detain construction site runoff so soil particles can settle out. Note how the outlet riser for this trap has been wrapped with filter fabric to increase detention time and trap suspended sediment. Designing traps and basins with long flow paths between the inlet and outlet also helps to increase sediment removal efficiency by extending the detention time. Where space restrictions prevent long basin designs, barriers placed in the basin can lengthen detention times by creating a serpentine flow path between the inlet and outlet.

4.7.1 Temporary Sediment (Silt) Traps

Simple traps or "checks" with rock berm containment structures can be installed as needed by field personnel with or without specific notations on plan documents. Standard notes on plans should call for installation of temporary traps in concentrated flow areas subject to rutting on an as-needed basis. Make sure containment berms are designed for overflow in the center of the berm, to prevent sidecutting and bypasses. Install traps in a series to control sediment from large upland areas.

Definition

A temporary sediment or silt trap is formed by excavation or by constructing a small embankment of stone, stone-filled bags, or other material to retain sediment. Sediment traps are considered temporary structures and often placed at the site on an *as needed* basis by field personnel. They should not be placed in flowing streams.

Purpose

Sediment traps pond and settle sediment from muddy runoff. Traps are used where physical site conditions or other restrictions prevent other erosion control measures from adequately controlling erosion and sedimentation. Sediment traps can be used downslope from construction operations that expose areas to erosion.

Design Criteria

Bermed sediment traps confined by rock, rock-filled fiber bags, or other material are preferred over excavated traps or those with soil berms. Traps are placed in converging flow areas (i.e., where ruts or washouts can form) or in ditches, where they are often called ditch checks or check dams. All traps are sized according to a design volume of 3,600 cubic feet per disturbed acre in the upstream drainage area. Multiple sediment traps constructed in a series are needed when the storage volume of each cannot meet this design requirement.

Sediment traps are generally used to treat a drainage area of 5 acres or less. When the total drainage area to a single structure exceeds 10 acres, an engineered sediment basin is necessary. Traps cannot be placed in blue-line streams or other regulated waters unless space limitations or design limitations provide no other feasible option. A USACE Clean Water Act (CWA) section 404 permit is required in these cases. Sediment traps must be cleaned out before they are half full of sediment.

KYTC Silt Trap Types A, B, and C

The KYTC specifies three types of temporary sediment or silt traps. Type A is an excavated basin with or without a soil berm constructed in a ditch or drainageway. Type B is one or more small berms of rock (KYTC No. 2 or shot rock) placed in a drainageway or ditch, with a geotextile underliner covered by 4 inches of KYTC No. 4 stone. A 12-inch overflow depression appears in the middle of the berm(s). Type C traps are berms constructed of porous fabric bags filled with crushed aggregate (e.g., KYTC No. 57), placed individually or in a series to create small ponding dams around drop inlets, curb inlets, or to form check dams in a drainageway or ditch.

General

- Construct traps of rock (KYTC No. 2 mixed with smaller stone), rock-filled fiber bags, or use approved commercial sediment trap products installed and spaced according to manufacturer's instructions.
- Site sediment traps in areas where they can be maintained (i.e., sediment removed).
- Set traps back from property lines or water bodies as much as possible.
- Do not site sediment traps at culvert or pipe outlets if possible.
- Minimum sediment storage capacity is 3600 cubic feet per acre of upland area drained by the trap. Where space restrictions exist, install multiple traps in a series at least 50 feet apart.
- Maximum drainage area is 5 acres.
- Basin flow length should be at least two times the flow width.
- Recommended trap depth for open areas is 2 feet at the inlet and 4 feet at the outlet.
- Trap height must be 1.5 feet minimum in ditches, 3–5 feet in open area drainageways.
- Trap berm width at base must be sufficient to support 2H:1V berm.
- Trap length must be sufficient to tie into upper banks in ditches or high enough to prevent side bypasses in drainageways. Overflows must be in the center of the berm.
- Construct the trap, seed and stabilize before clearing and grading work begins.

Embankment requirements

- Maximum height of 5 feet.
- Maximum inside and outside slopes of 2:1.
- Side slopes, containment berms, and inflowing ditches should be seeded and mulched or blanketed as soon as possible after construction.

Outlet requirements

- The outlet must consist of an overflow spillway wide made of stone (KYTC No. 2 minimum).

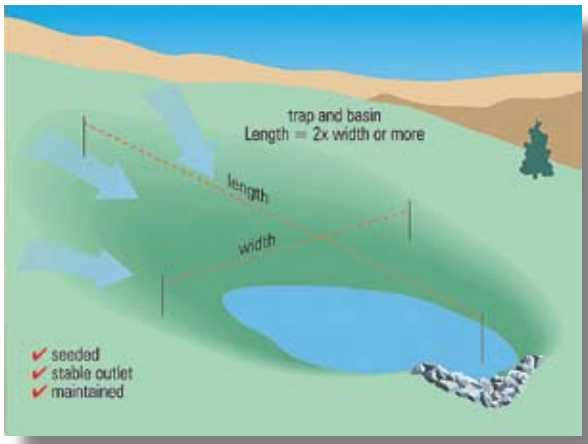
Construction Specifications

- Construct initial series of sediment traps before general site clearing and grading.
- The area to be excavated or ponded must be cleared of all trees, stumps, roots, brush, boulders, and debris. All topsoil containing excessive amounts of organic matter must be removed.
- Seeding, fertilizing, and mulching of the material taken from the excavation must comply with the applicable soil stabilization sections of this manual.
- Any material excavated from the trap must be uniformly spread to a depth not exceeding 3 feet and graded to a continuous slope away from the trap.
- Field-approved installations should be noted on weekly inspection reports and on plan documents within 7 days.

Inspection and Maintenance

The trap must be inspected weekly and after every rainfall greater than one-half inch. Sediment must be removed from the trap before the capacity is reduced to 50 percent of the design volume. Plans for the sediment trap must indicate the methods for disposing of sediment removed from the pond.

Temporary sediment traps are removed upon stabilization or cover of the upland drainage area with vegetation, pavement, and so on. The trap area should be graded, seeded, and mulched or blanketed. Excess sediment should be spread and stabilized where it will not enter the drainage system.



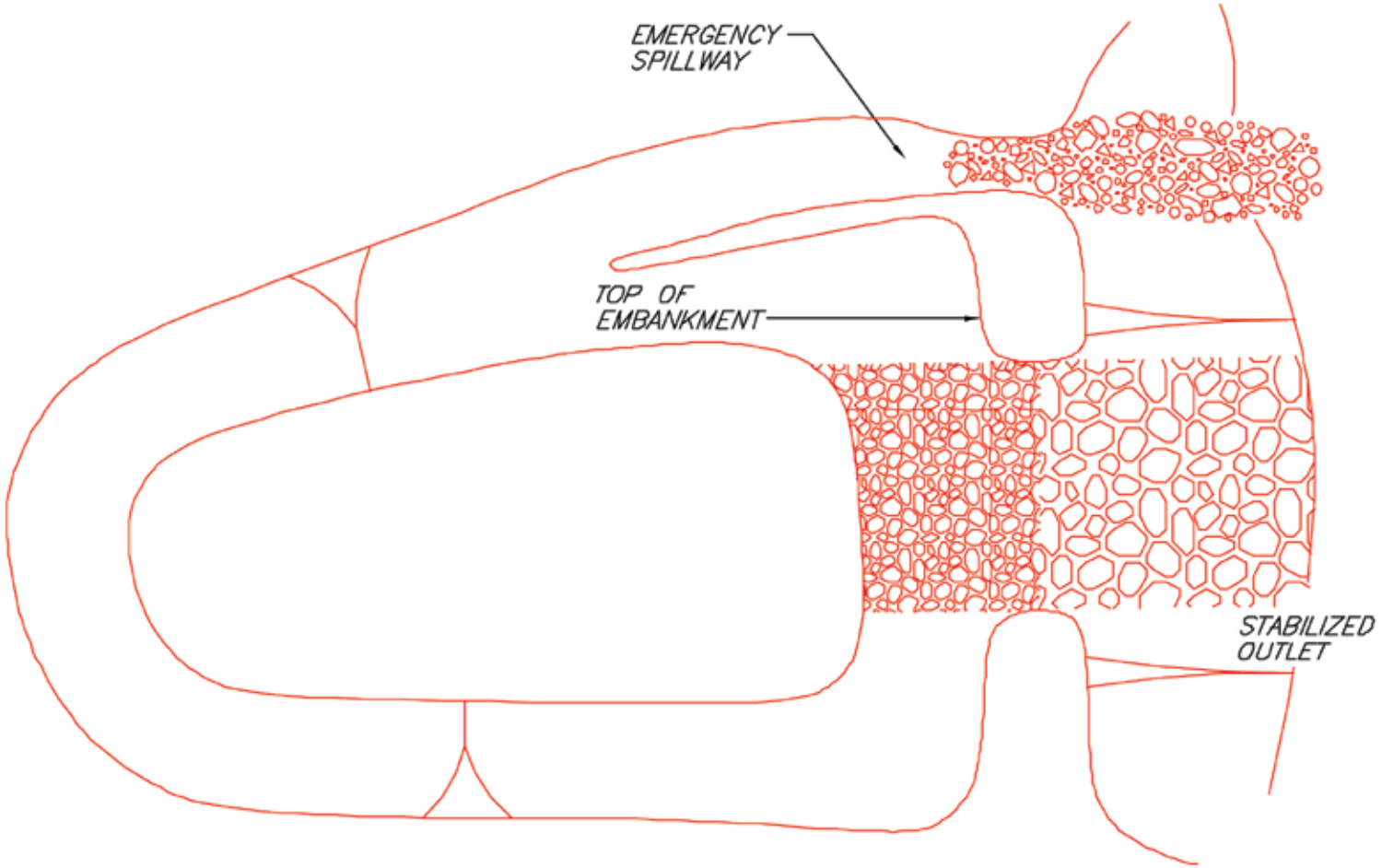
Design sediment traps with long flow paths if possible. Make sure overflow area is protected with rock or other armoring. For best results, seed trap and upland areas immediately after construction.

Make sure overflow outlet or riser is designed for maximum detention times. Note the rock berm around riser, which ensures maximum detention for muddy flows after small storms.

Good trap placement and performance; poor maintenance. Remove accumulated sediment before trap is half full. Spread material removed in a vegetated upland area or other site where it will not wash into nearby surface waters.

In areas where space is restricted, use multiple traps in a series to meet the design goal of 3600 cubic ft per acre of upland drainage. Get to final grade, seed and mulch as soon as possible to reduce trap maintenance and upkeep.

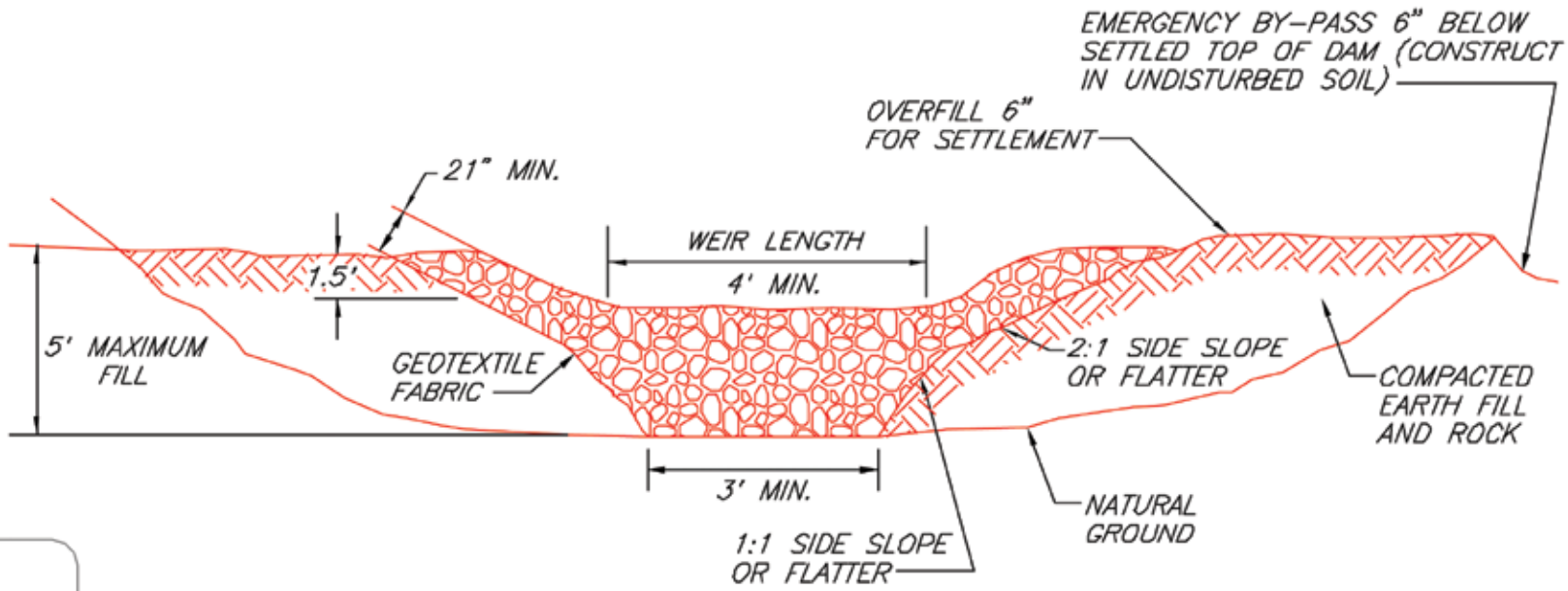
SEDIMENT TRAP



NOTE:
A SEDIMENT TRAP CAN BE USED FOR DISTURBED AREAS LESS THAN 5 ACRES.

PLAN

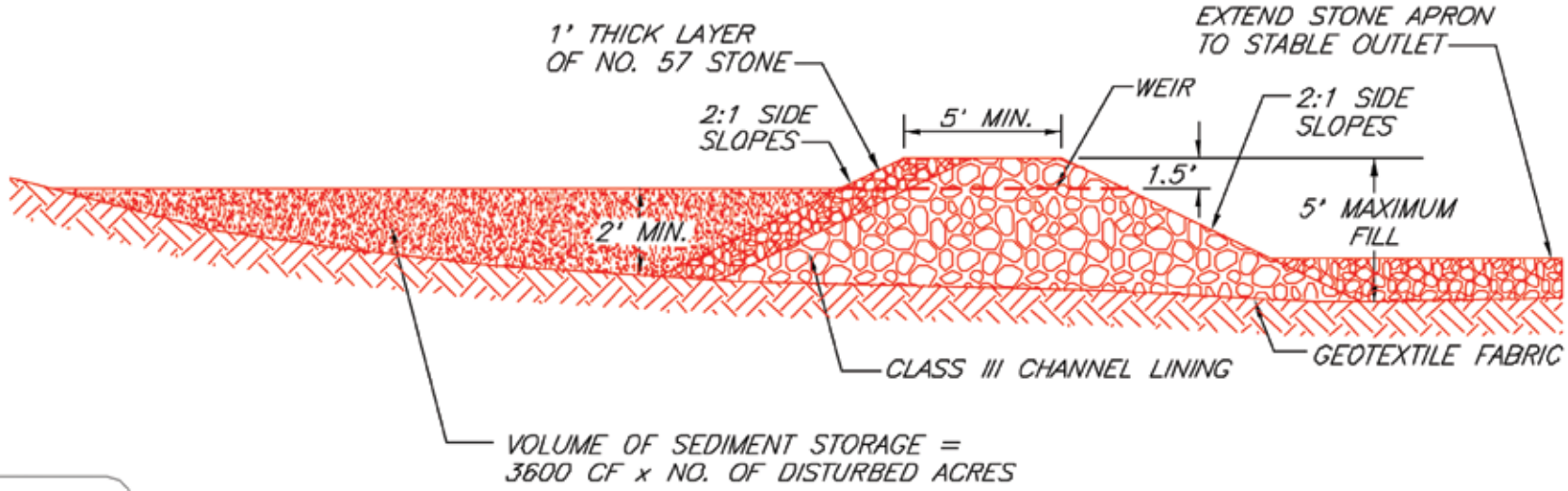
SEDIMENT TRAP



NOTE:
A SEDIMENT TRAP CAN BE USED FOR DISTURBED AREAS LESS THAN 5 ACRES.

EMBANKMENT AND SPILLWAY ELEVATION

SEDIMENT TRAP



NOTE:
A SEDIMENT TRAP CAN BE USED FOR DISTURBED AREAS LESS THAN 5 ACRES.

STONE SECTION

4.7.2 Sediment (Detention) Basins

Well-stabilized detention basin with erosion control blankets protecting sidewalls during grass seed germination. Note the temporary stone berming in front of outlet, which increases detention time and promotes maximum settling of soil particles. Design of this basin could be greatly improved by adding a temporary baffle or barrier between the inlet and outlet, which would force inflows from the culvert around the baffle. The longer flow path and settling time would improve soil removal.

Definition

A sediment basin is a pond created by excavation and construction of an embankment and designed to retain or detain runoff sufficiently to allow excess sediment to settle out.

Purpose

The sediment basin is intended to collect and store sediment from sites that are cleared or graded during construction or for extended periods of time before permanent vegetation is reestablished or before permanent drainage structures are completed. It is intended to intercept and trap sediment before it leaves the construction site. Some basins are temporary, with a design life of 12 to 18 months, and are to be maintained until the site area is permanently stabilized. Basins that will serve as permanent stormwater treatment ponds often require modified outlet risers during construction to ensure adequate ponding times and sediment removal.

Basins should be located at the stormwater outlet from the site, not in any natural or undisturbed stream. Use of temporary dikes, pipes or channels might be necessary to divert runoff from disturbed areas into the basin and to divert runoff originating from undisturbed areas around the basin.

Design Criteria

Sediment basins must be designed by a professional engineer licensed in Kentucky. The basin should be designed using SEDCAD or other computer program. The design criteria are listed below:

General

Site sediment basins where they will provide the best treatment (longest flow path between inlet and outlet, longest settling times) for the greatest area of the site. It is recommended that dams be located in a natural drainageway in a deep constriction that has a wide area upstream for ponding detained stormwater.

- Do not locate dams where a failure would result in severe property damage or danger to human life.
- Sediment basins should be designed or modified to drain down slowly for 2–4 days after a storm event. Modify the outlet if necessary to achieve the maximum detention time.

- Minimum design storage capacity is 3600 cubic feet per acre of upland area drained. The maximum capacity for the impoundment must not exceed 10 acre-feet. If more impoundment capacity is needed, install basins in a series or site them to intercept tributary drainage areas.
- Construction phase performance goal is to reduce the total suspended solids by 80 percent for the 10-year, 24-hour storm, or provide a detention time of 24 to 48 hours for the 10-year, 24-hour storm.
- Minimum drainage area is 5 acres; the maximum drainage area is 120 acres.
- Basin flow length should be at least two times the flow width; the longer, the better. Baffles constructed of filter fabric and metal posts can be used inside the basin to create a longer (e.g., serpentine) flow path between inlet(s) and the outlet.
- Construct the basin before clearing and grading work begins.
- Basins, side slopes, berms, inlets, and downstream outlet channels must be seeded and mulched or blanketed immediately after construction.
- Basins that drain more than 10 acres can be designed as retention (rather than detention) basins (i.e., *wet* ponds). Design outlet to drain top of the pool farthest away from muddy inflows. Incorporating a sediment collection forebay is recommended to aid in maintenance.

Embankment requirements

- Dam height should not exceed 20 feet
- Maximum inside and outside slopes of the dam must be 3H:1V
- Minimum 1 foot freeboard during the 100-year, 6-hour storm
- Antiseep collars around discharge pipe are required
- Minimum top width of the dam must be 12 feet

Principal spillway (riser and barrel) requirements

Use a subsurface drain, a solid riser pipe, or both, with sufficient dewatering holes to provide sufficient detention time. Risers with one-half inch holes every 3 to 6 inches apart are recommended.

- No large holes or slots should appear in the lower two-thirds of the riser. Risers with large openings can be modified as described below or wrapped with filter fabric to cover lower openings during the construction period.
- During construction, risers should be modified with an inlet protection dike, pile of stone at the riser base, or other structure to provide longer ponding times for small flow events.
- Operational design goal is to reduce the peak flow to predevelopment levels for the 2-year and 10-year, 24-hour storms.

KY Division of Water Dam Safety Requirements

The sediment basin might have to be designed in accordance with dam safety requirements of the KY Division of Water. A dam is defined as any impounding structure that is either 25 feet in height, measured from the downstream toe to the crest, or has a maximum impounding capacity of 50 acre-feet of water. Structures that do not meet these criteria but have the potential to cause significant property damage or pose a threat to loss of life in the downstream area are regulated in the same manner as dams.

- Minimum diameter of pipe outlet is 12 inches; anti-vortex baffle and trash rack are required
- Minimum one foot freeboard required from top of riser to crest of emergency spillway

Emergency spillway requirements

- Designed to pass the 100-year, 6-hour post development peak flow
- Crest elevation at least one foot above the tip of the riser pipe
- Minimum one foot freeboard during the 100-year, 6-hour storm to the top of the embankment
- Rock used for the emergency spillway must be KYTC No. 2 or larger, depending on flow volumes and spillway slope (see sections on rock-lined channels and outlet stabilization energy dissipator)
- Emergency spillway energy dissipator must be extended at least 4 feet beyond the toe of the dam

Construction Specifications

- Construct the basin by excavating or building an embankment dike before any clearing or grading work begins.
- Areas under the embankment and any structural works must be cleared, grubbed and stripped of any vegetation and rootmat as shown on the erosion and sediment control plan.
- To facilitate cleanout and restoration, the basin area must be cleared, grubbed and stripped of any vegetation.
- A cut-off trench must be excavated along the centerline of the earth fill embankments. The minimum depth must be 2 feet. The cut-off trench must extend up both abutments to the riser crest elevation.
- Fill material for the embankment must be clean, low-permeability, mineral soil free of roots, woody vegetation, oversized stones, rocks, or other objectionable material.
- Fill material must be placed in 6 inch lifts, continuous layers over the entire length of the fill. Compacting must be obtained by routing the hauling 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. Each layer must be compacted to 95 percent of maximum density and +/– 2 percent of optimum moisture content.
- The embankment should be constructed to an elevation of 10 percent higher than the design height to allow for settlement if compacting is achieved with hauling equipment. If compactors are used for compacting, the overbuild may be reduced to not less than 5 percent.
- The principle spillway riser must be securely attached to the discharge pipe by welding all around. All connections must be watertight.
- The pipe and riser must be placed on a firm, smooth soil foundation. The connection between the riser, and the riser base must be watertight. Pervious materials such as sand, gravel, or crushed stone must not be used as backfill around the pipe or anti-seep collars.

- The fill material around the pipe spillway must be placed in 4-inch layers and compacted under the shoulders and around the pipe to at least the same density as the adjacent embankment. A minimum of 2 feet of compacted backfill must be placed over the pipe spillway before crossing it with construction equipment.
- Risers might require a rock berm or other flow restrictor during the construction phase to ensure that muddy flows are detained sufficiently to promote settling of sediment.
- Steel base plates must have at least 2.5 feet of compacted earth, stone, or gravel over them to prevent flotation.
- An emergency spillway is required, and must not be installed in fill. Appropriate overflow channel lining and energy dissipator must be constructed.
- Baffles, if used, must be constructed of 4 inch by 4 inch posts and of 4 foot by 8 foot half-inch exterior plywood. The posts must be set at least 3 feet into the ground, no farther apart than 8 feet center to center, and must reach a height 6 inches below the riser crest elevation. Silt fencing with metal posts can also be used if flow velocities in the basin are low and ponding heights during the 2-year, 24-hour storm will not exceed 5 feet.
- The embankment, emergency spillway, incoming channels, and other site features must be stabilized with vegetation and mulched or blanketed immediately following construction.
- Construction operations must be carried out in such a manner that erosion and water pollution will be minimized.
- Local and state requirements must be met concerning fencing and signs warning the public of hazards of soft sediment and floodwater.

Inspection and Maintenance

Inspect the sediment basin weekly and after each rainfall greater than one-half inch. If incoming flows are exiting the basin quickly because of large holes in the outlet, modify the lower portion of the riser with a stone berm, filter fabric, or other flow restrictor that retains incoming flows for at least 12–24 hours.

- All damages caused by soil erosion or construction equipment must be repaired before the end of each working day.
- Remove sediment when the sediment storage zone is half full. This sediment must be placed in such a manner that it will not erode from the site. The sediment must not be deposited downstream from the embankment or in or adjacent to a stream or floodplain.
- When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposit must be leveled or otherwise disposed of according to the approved erosion and sediment control plan.
- If the sediment basin is designed to function as a permanent stormwater treatment pond, the basin and riser will be configured to that mode upon stabilization of the upland drainage area. Temporary flow restrictors on risers and other construction phase modifications must be removed.

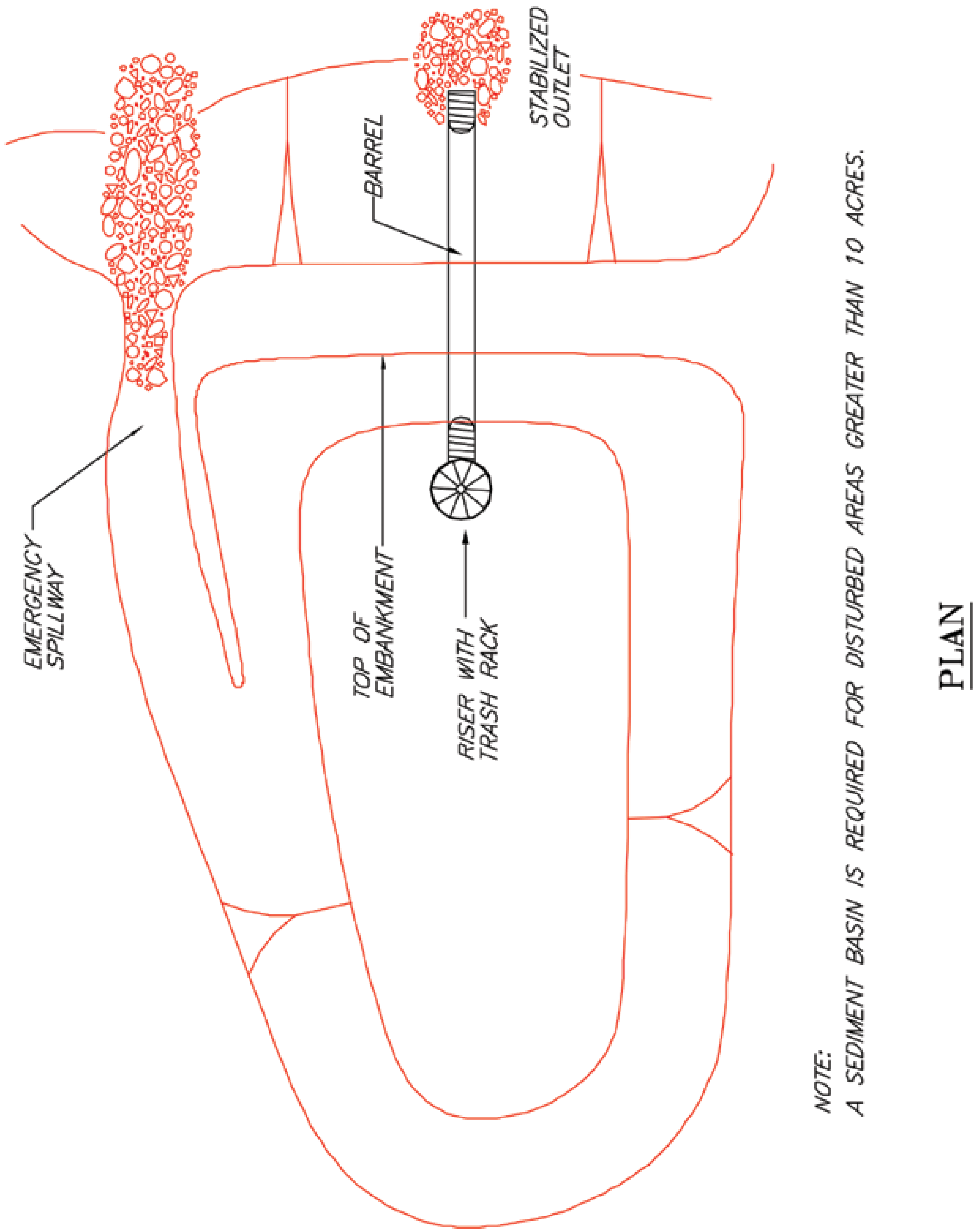
For best results, seed basin sidewalls and upland drainage areas as soon as possible. Make sure outlet structure does not allow rapid flow through the basin—use a rock berm, filter fabric, or other means to maximize ponding and detention time.

This is a well-constructed sediment basin. Note the rock flow restricter around outlet riser, which filters and detains inflows. Basin sidewalls should be seeded immediately after construction.

The flow path through this basin has been lengthened by using filter fabric baffles constructed to create a serpentine flow path. Note the rock pile around outlet riser to maximize detention and grass on sidewalls.

This outlet riser intake hole has been modified with a "half round" section of pipe with 1-inch holes on 6-inch centers and rock berm. This temporary dike provides additional detention during the construction phase, which improves soil removal.

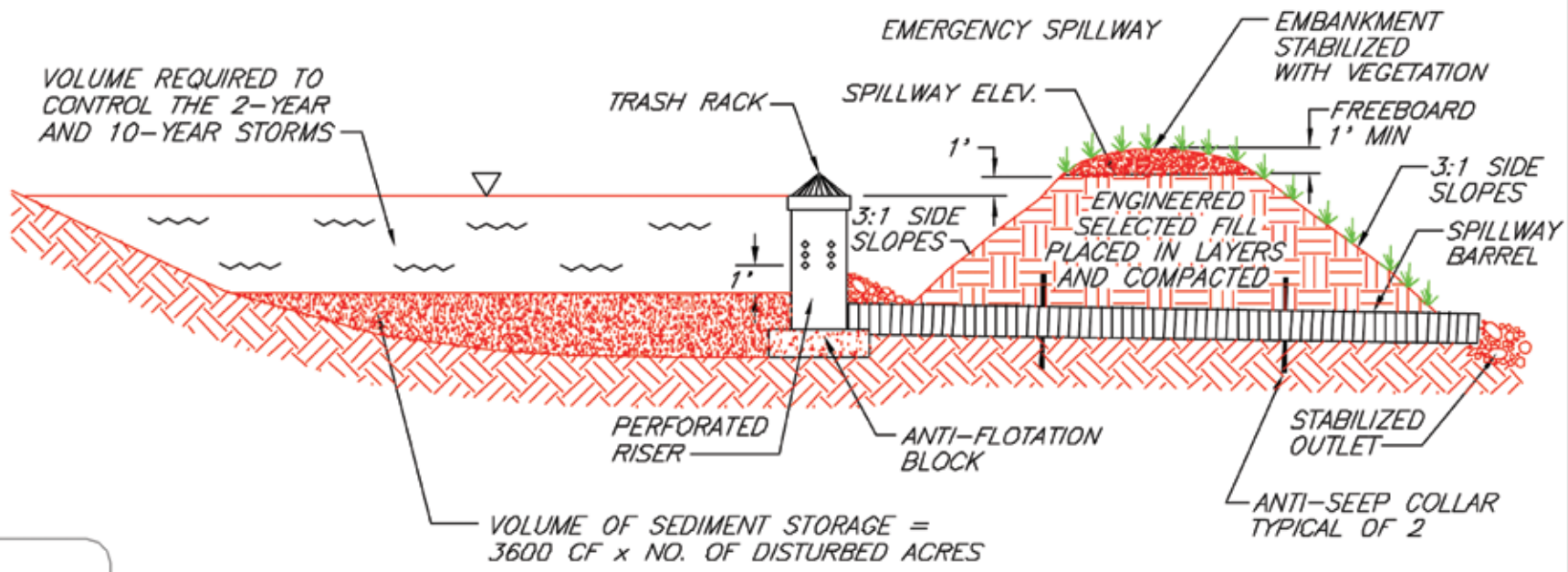
This shows a very well designed detention basin, featuring long flow path between inlet and outlet and V-notched outlet riser, which provides longer detention times for low flow events while still accommodating larger storms. Operation of this basin during the construction phase, however, is very poor. Note the lack of grass on sidewalls; no temporary dike in front of the outlet. This basin appears to be filling rapidly and requires sediment removal.



SEDIMENT BASIN

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

SEDIMENT BASIN



NOTE:
A SEDIMENT BASIN IS REQUIRED FOR DISTURBED AREAS GREATER THAN 10 ACRES.

SECTION

4.7.3 Dewatering Devices

This shows a dewatering sediment filter bag (center) in use at residential construction site. Muddy water pumped into the bag is physically filtered, with clear water passing through the bag fabric. Pumping muddy, unfiltered water directly into curb drains (center left) or surface streams constitutes a direct KPDES permit violation.

Definition

Dewatering is the pumping of stormwater or groundwater from excavation pits or trenches. The sediment-laden water must be pumped to a dewatering structure for sediment removal before it is discharged off-site.

Purpose

The purpose of a dewatering device is to remove sediment from the water before it is discharged off-site.

Design Criteria

Dewatering operations should not discharge to a ditch, pipe, or other conveyance that leads to a regulated water body (e.g., stream, river, wetland, lake) except as authorized by a KPDES permit.

There are several types of dewatering structures or devices that can be used. A flat, well-stabilized, vegetated area can serve as a filtering *structure* if it can withstand the velocity of the discharged water and infiltrate or assimilate it without erosion. The minimum filter radius or length must be at least 75 feet.

It is recommended that sediment basins or temporary sediment traps receive sediment-laden water from bore pits and trenches. This will ensure that the 80 percent trapping efficiency goal will be upheld. Take special care to ensure that pumping this water does not cause the sediment control structure to fail. Also take care at the outlet of the hose from the pump to ensure that erosion does not occur because of high concentrated flows.

Another option is to use an infiltration trench—a shallow, excavated trench back-filled with stone—to form a reservoir. This reservoir can contain subsurface drainage pipe or just stone. This trench allows water to filter through the stone and then be diverted to a suitable discharge point. The soils and the depth to the water table must be suitable for this sort of dewatering. Typical trench depths range from 2 to 8 feet. The stone fill material consists of washed aggregate 1.5 to 3 inches in diameter.

Other methods that can be used include a portable sediment tank, a silt fence pit, or a commercial sediment filter bag or *sock*. The structure must be sized to allow pumped water to flow through the structure without overtopping.

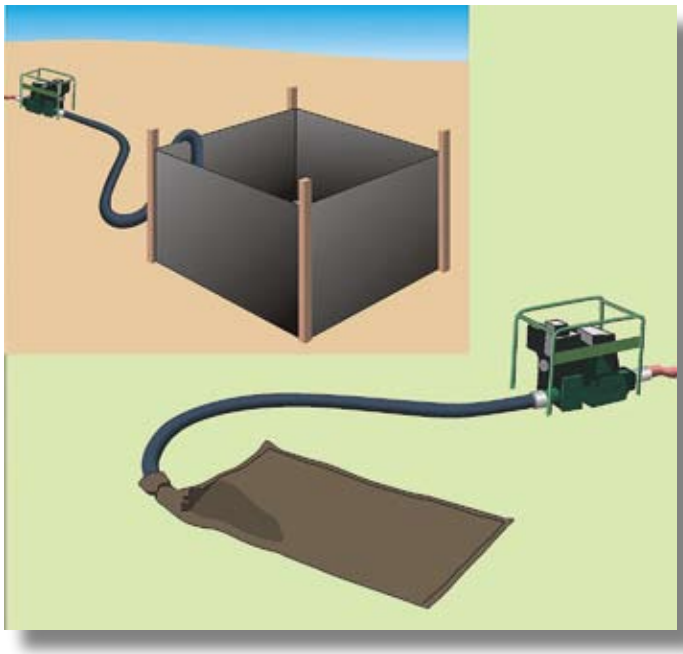
Construction Specifications

See the specifications in this manual for sediment traps and basins. Follow the manufacturer's recommendations for commercial products.

Inspection and Maintenance

Inspect the dewatering structure or device frequently to ensure that it is functioning properly and not overtopping. Accumulated sediment should be spread out on site and stabilized, or disposed of off-site.

Silt fence enclosures and commercial sediment filters will likely require cleaning to remove fine particles and restore performance. This can be done with a stiff brush when the filter is dry, or via other manufacturer's recommendations.



Containment structures for sediment-laden water can be made of rock or filter fabric. Standard notes should require monitoring to make sure the containment structure is not breached during dewatering operations.

Large bags or socks made of filter fabric provide excellent sediment removal and are extremely versatile. Site filtration structures away from surface waters if possible. Dispose of sediment collected in a flat vegetated area or other site where it will not wash into surface waters.

When dewatering sediment or other ponds, wait until several days after the last rain if possible to allow for settling of sediments. Pump from the upper portion of pond, where water is clearer.

Large sediment filter bag in operation. Note the row of straw bales around the bag providing additional treatment for clarified flow oozing out of the bag. A silt fence could also be used.