G-2 SEDIMENT POND CONSTRUCTION

PURPOSE & APPLICATIONS

A sediment basin is a water impoundment constructed to collect and store sediment and/or debris made by constructing a dam or embankment or by excavating a pit or dugout pond for water storage. Its purpose is:

- Detain stormwater volume and slowly releasing it to the downstream waterways
- To prevent undesirable deposition on downstream drainage waterways
- To trap sediment originating from construction sites
- To provide a basin for deposition and storage of sediments and debris.

This specification applies if the following conditions exist:

- Failure of the dam will not result in loss of life; in damage to homes, commercial or industrial buildings, main highways, or railroads; or in interruption of the use or service of public utilities.
- A sediment basin must be more than 100 feet away from a Resource Protection Area as defined by the Maine DEP.

PLANNING CONSIDERATIONS

Water Quantity: By impounding water, ponds create a new surface and ground water regime. The peak discharge downstream may be reduced, and in dry weather the downstream flow may go to zero. Depending on the site, there may be an increased flow to the ground water. With some seepage the base flow may be extended over a longer period of time.

Water Quality: Ponds may trap nutrients and sediment, which wash into the basin, removing substances from downstream. Chemical concentrations in the pond may be higher during the summer months. By reducing the amount of water that flows in the channel downstream, the frequency of flushing of the stream is reduced and there is a temporary collection of substances held temporarily within the channel. A pond may cause more leachable substances to be carried into the ground water

CONSIDERATIONS

Sediment basins are a flow through type structure and are designed to retard the time it takes the runoff from reaching the downstream areas without long-term storage. There may be an increased recharge to ground water; but if the basin bottom is nearly impermeable, only a small amount of water may percolate beneath the basin.

- Ponds mostly trap coarse-grained sediments, which wash into the basin. Fine-grained sediments such as silts and clays will remain suspended in the water and will travel off-site unless the water is detained for an extended period of time.
- Water temperatures may be altered due to changes in shading of man-made channels and ponds.
- Ponds must not be constructed in or directly discharging to an existing stream channel as they cause thermal pollution - raising water temperatures high enough to damage Maine's cold water fisheries.
- Pond locations and construction activities may affect downstream water quality, wetlands and water-related wildlife habitats.
- Overall planning and design should be carefully considered to minimize the number of ponds required.

SPECIFICATIONS

Sediment ponds must be constructed and stabilized prior to disturbing the watershed above them. If sediment ponds will be stabilized with vegetation, they must be installed early in the growing season.

Design Criteria

Capacity: The capacity of the sediment basin shall equal to the stormwater volume to be detained plus the volume of sediment expected to be trapped. Periodic removal of sediment will be necessary to maintain the pond's capacity.

Temporary basins: Temporary basins having drainage areas of 5 acres or less and a total embankment height of 5 feet or less may be designed with less conservative criteria. The embankment shall have a minimum top width of 4 feet and side slopes of 2:1 or flatter. An outlet shall be provided of earth, pipe, stone, or other devices adequate to handle the 10-year frequency discharge without failure or significant erosion.

Site investigations: Test pits, dug prior to design preparation, are necessary to determine foundation conditions and to evaluate borrow sources for embankment pond construction. Soil auger information may be sufficient for excavated pond construction. In general soil information shall be gathered under the dam and principal spillway to a depth at least equal to the maximum dam height.

Site Conditions: Site conditions shall be such that runoff from the design storm can be safely, and in a non-erosive manner, passed through a natural or constructed emergency spillway and/or a principal spillway.

Number of ponds: Efforts should be made to minimize the number of ponds required.

Drainage area: The drainage area above the pond must be protected against erosion to the extent that expected sedimentation will not shorten the planned effective life of the structure. Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded at flood stage against the embankment at the emergency spillway elevation is 3 ft or more. Excavated ponds must be designed to be drained within a 10-day period.

Stabilization: All areas disturbed during construction shall be stabilized within 7 calendar days of that disturbance in accordance with the PERMANENT VEGETATION BMP, TEMPORARY MULCHING BMP, or other appropriate structural BMP. All construction of sediment basins must be completed and seeded by September 15th if vegetative measures will be used for final stabilization. Otherwise, erosion control blankets, erosion control mix will be required on side slopes as specified with the WINTER CONSTRUCTION AND STABILIZATION BMP. If structural measures such as riprap will be used for final stabilization, this time limit will not apply. Water shall not be channelized to the sediment basin until the basin is stabilized with vegetative or structural measures.

Removal of fine sediment particles: Sediment basins with pipe outlet structures shall be fitted with a temporary perforated riser surrounded by a gravel cone. This will serve to filter fine colloidal material. In sensitive watersheds where additional protection should be provided (lake watersheds, sensitive streams), a geotextile filter shall be installed around the riser as well. Additionally, the water shall be discharged to a well-vegetated receiving area to be filtered by natural or well-established vegetation.

Design Criteria for Embankment Ponds

Foundation cutoff: A cutoff of relatively impervious material shall be provided under the dam if necessary. The cutoff shall be located at or upstream from the centerline of the dam. It shall extend up the abutments as required and be deep enough to extend into a relatively impervious layer or provide for a stable dam when combined with seepage control. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Side slopes shall not be steeper than one horizontal to one vertical.

Earth embankment: The minimum top width for a dam is shown as follows. If the embankment top is to be used as a public road, the minimum width shall be 16 ft for one-way traffic. Guardrails

or other safety measures shall be used where necessary and shall meet the requirements of the responsible road authority.

Minimum top width for dams

Embankment	Top width
10 or less	6
10-15	8
15-20	10
20-25	12
25-35	14
35 or more	15

Embankment Slope: The combined upstream and downstream side slopes of the settled embankments shall not be less than five horizontal to one vertical, and neither slope shall be steeper than two horizontal to one vertical. All slopes must be designed to be stable, even if it requires flatter side slopes.

Slope Protection: If needed to protect the slopes of the dam, special measures, such as berms, rock riprap, sand-gravel, soil cement, or special vegetation, shall be provided.

Height requirements: The design height of the dam shall be increased by the amount needed to insure that after settlement the height of the dam equals or exceeds the design height. The minimum elevation of the top of the settled embankment shall be 1 ft above the water surface in the reservoir with the emergency spillway flowing at design depth. The minimum difference in elevation between the crest of the emergency spillway and the settled top of the dam shall be 2 ft for all dams having more than a 20-acre drainage area or more than 20 ft in effective height.

Excavated pond: Any excavated pond with a drainage area in excess of five acres, or spring flow in excess of 100 gallons per minute must be designed to accordance with embankment pond criteria.

Principal spillway: A pipe conduit, with needed appurtenances, shall be placed under or through the dam, except where rock, concrete, or other types of mechanical spillways are used, or where the rate and duration of flow can be safely handled by a vegetated or earth spillway. The spillway elevation shall be no less than 0.5 ft below the crest of the emergency spillway for dams having a drainage area or 20 acres or less, and no less than 1 ft for those having a drainage area of more than 20 acres.

When design discharge of the principal spillway is considered in calculating the peak outflow through the emergency spillway, the crest elevation of the inlet shall be such that the full flow will be generated in the conduit before there is discharge through the emergency spillway. The inlets and outlets shall be designed to function satisfactorily for the full range of flow and hydraulic head anticipated.

The capacity of the pipe conduit shall be adequate to discharge long-duration, continuous, or frequent flows without flow through the emergency spillways. The diameter of the pipe shall not be less than 4 in. If the pipe conduit diameter is 10 in. or greater, its design discharge may be considered when calculating the peak outflow rate through the emergency spillway.

The pipe shall be capable of withstanding external loading without yielding, buckling, or cracking. Flexible pipe strength shall not be less than that necessary to support the design load with a maximum of 5 percent deflection. The inlets and outlets shall be structurally sound and made of materials compatible with those of the pipe. All pipe joints shall be made watertight by the use of couplings, gaskets, caulking, or by welding.

The maximum height of fill over any principal spillway steel or aluminum pipe must not exceed 25 ft. The joints between sections of pipe shall be designed to remain watertight after joint elongation caused by foundation consolidation. Concrete pipe shall have concrete bedding or a concrete cradle, if required. Cantilever outlet sections, if used, shall be designed to withstand the cantilever load.

Cathodic protection is to be provided for coated welded steel and galvanized corrugated metal pipe where soil and resistivity studies indicate that the pipe needs a protective coating. If cathodic protection is not provided for in the original design and installation, electrical continuity in the form of joint bridging straps should be considered on pipes that have protective coatings. Cathodic protection should be added later if monitoring indicates the need.

Antiseep collar: Seepage control along an outlet pipe shall be provided if any of the following conditions exist:

- The effective height of dam is greater than 15 ft.
- The conduit is of smooth pipe larger than 8 in. in diameter.
- The conduit is of corrugated pipe larger than 12 in. in diameter.

When antiseep collars are used in lieu of a drainage diaphragm, they shall have a watertight connection to the pipe. Maximum spacing shall be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe. Collar material shall be compatible with pipe materials. The antiseep collar(s) shall increase by 15% the seepage path along the pipe.

Seepage control: Seepage along pipes extending through the embankment shall be controlled by use of a filter and drainage diaphragm, unless it is determined that antiseep collars will adequately serve the purpose.

The drain is to consist of sand, meeting fine concrete aggregate requirements (at least 15% passing the No. 40 sieve but no more than 10% passing the No. 100 sieve). If unusual soil conditions exist, a special design analysis shall be made. The drain shall be a minimum of 2 ft thick and extend vertically upward and horizontally at least three times the pipe diameter, and vertically downward at least 18 in beneath the conduit invert. The drain diaphragm shall be located immediately downstream of the cutoff trench, approximately parallel to the centerline of the dam.

The drain shall outlet at the embankment downstream toe, preferably using a drain backfill envelope continuously along the pipe to where it exits the embankment. Protecting drain fill from surface erosion will be necessary.

Antivortex devices: Closed conduit spillways designed for pressure flow must have adequate antivortex devices.

Trash guard: To prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser.

Pond drainage: A pipe with a suitable valve shall be provided to drain the pool area if needed for proper pond management. The principal spillway conduit may be used as a pond drain if it is located where it can perform this function.

Emergency spillways: An emergency spillway must be provided for each dam, unless the principal spillway is large enough to pass the peak discharge from the routed design hydrograph and the trash that comes to it without overtopping the dam. The following are minimum criteria for the acceptable use of closed conduit principal spillways without an emergency spillway: a conduit with a cross-sectional area of 3 sq.ft. or more, an inlet that will not clog, and an elbow designed to facilitate the passage of trash.

The minimum capacity of a natural or constructed emergency spillway shall require to pass the peak flow expected, less any reduction creditable to conduit discharge and detention storage. The emergency spillway shall safely pass the peak flow, or the storm runoff shall be routed through the reservoir. The routing shall start either with the water surface at the elevation of the crest of the principal spillway or at the water surface after 10 days' drawdown, whichever is higher. The 10-day drawdown shall be computed from the crest of the emergency spillway or from the elevation that would be attained if the entire design storm were impounded, whichever is lower. Emergency spillways shall provide for passing the design flow at a safe velocity to a point downstream where the dam will not be endangered.

Constructed emergency spillways are open channels that usually consist of an inlet channel, a control section, and an exit channel. They shall be trapezoidal and shall be located in undisturbed or compacted earth. The side slopes shall be stable for the material in which the spillway is to be constructed. For dams having an effective height exceeding 20 ft, the emergency spillway shall have a bottom width of not less than 10 ft.

Upstream from the control section, the inlet channel shall be level for the distance needed to protect and maintain the crest elevation of the spillway. The inlet channel may be curved to fit existing topography. The grade of the exit channel of a constructed emergency spillway shall fall within the range established by discharge requirements and permissible velocities.

Structural emergency spillways: If chutes or drops are used for principal spillways or principal emergency or emergency spillways, they shall be designed according to the principles set forth

by the USDA for chute spillway. The minimum capacity of a structural spillway shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in table 4, less any reduction creditable to conduit discharge and detention storage.
Vegetated emergency spillway: An embankment pond with a vegetated or earth emergency spillway and no principal spillway must satisfy all of the following conditions.

- The effective height of dam does not exceed 20 feet.
- The drainage area does not exceed 20 acres.
- The ratio of drainage area to pond surface area does not exceed 24.
- Surface runoff and/or ground water flow will not cause long duration, continuous or frequent flow.

Visual resource design: The visual design of ponds shall be carefully considered in areas of high public visibility and those associated with recreation. The underlying criterion for all visual design is appropriateness. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.
The embankment may be shaped to blend with the natural topography. The edge may be shaped so that it is generally curvilinear rather than rectangular. Excavated material can be shaped so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds. If feasible, islands may be added for visual interest and to attract wildlife.

Design Criteria for Excavated Ponds

Any excavated pond with a drainage area in excess of five acres, or spring flow in excess of 100 gallons per minute must be designed to accordance with embankment pond criteria.
Runoff: Provisions shall be made for a pipe and emergency spillway if necessary. Runoff flow patterns shall be considered when locating the pit and placing the spoil.
Side slopes: Side slopes of excavated ponds shall be stable and shall not be steeper than one horizontal to one vertical.
Perimeter form: If the structures are to be used for recreation or are highly visible to the public, the perimeter or edge should be curvilinear.
Inlet Protection: If surface water enters the pond in a natural or excavated channel, the side slope of the pond shall be protected against erosion.
Excavated material: The material excavated from the pond shall be placed so that its weight will not endanger the stability of the pond side slopes and so that it will not be washed back into the pond by rainfall. It shall be disposed of in one of the following ways:

- Uniformly spread to a height that does not exceed 3 ft, graded away from the pond.
- Uniformly placed and shaped with side slopes assuming a natural angle of repose. The excavated material will be placed at a distance equal to the depth of the pond but not less than 12 ft from the edge of the pond.
- Shaped to a designed form that blends visually with the landscape.

Construction Specifications

It is essential to use erosion control measures during the construction of a pond to protect downstream waterbodies from sedimentation. The following criteria for erosion and sediment control shall be considered when constructing a pond structure:
Site Location: Locate the permanent pond where there will be the least disturbance to the soils of the existing site. Ponds should not be located in stream or wetlands.
Timing: Whenever possible, install ponds during periods of low rainfall (generally late summer) to minimize downstream impacts from sedimentation.
Foundation preparation: The foundation area shall be cleared of trees, logs, stumps, roots, brush, boulders, sod, and rubbish. If needed to establish vegetation, the topsoil and sod shall be stockpiled and spread on the completed dam and spillways. Foundation surfaces shall be sloped no steeper than a ratio of one horizontal to one vertical. The foundation area shall be thoroughly scarified before placement of the fill material. The surface shall have moisture added, or it shall be compacted if necessary so that the first layer of fill material can be compacted and bonded to the foundation.

Cutoff Trench: The cutoff trench and any other required excavations shall be dug to the lines and grades shown on the plans or as staked in the field. If they are suitable, excavated materials may be used in the permanent fill. Existing stream channels in the foundation area shall be sloped no steeper than a ratio of one horizontal to one vertical. They shall be deepened and widened as necessary to remove all stones, gravel, sand, stumps, roots, and other objectionable material and to accommodate compaction equipment.

Fill Placement: The material placed in the fill shall be free of detrimental amounts of sod, roots, frozen soil, stones more than 6 in. in diameter (except for rockfills), and other objectionable material.

Drainfill: Drainfill shall be kept from being contaminated by adjacent soil materials during placement by either placing it in a cleanly excavated trench or by keeping the drain at least 1 ft above the adjacent earthfill. Selected drainfill and backfill material shall be placed around structures, pipe conduits, and antiseep collars at about the same rate on all sides to prevent damage from unequal loading.

Fill material shall be placed and spread beginning at the lowest point of the foundation and then bringing it up in horizontal layers thick enough that the required compaction can be obtained. The fill shall be constructed in continuous horizontal layers. If openings or sectionalized fills are required, the slope of the bonding surfaces between the embankment in place and the embankment to be placed shall not be steeper than a ratio of three horizontal to one vertical. The bonding surface shall be treated the same as that specified for the foundation to insure a good bond with the new fill.

The distribution and gradation of materials shall be such that no lenses, pockets, streaks, or layers of material shall differ substantially in texture or gradation from the surrounding material. If it is necessary to use materials of varying texture and gradation, the more impervious material shall be placed in the center and upstream parts of the fill. If zoned fills of substantially differing materials are specified; the zones shall be placed according to lines and grades shown on the drawings. The complete work shall conform to the lines, grades, and elevations shown on the drawings or as staked in the field.

S**tabilization:** All areas disturbed during installation shall be stabilized within 7 days of that disturbance in accordance with the PERMANENT VEGETATION BMP or other appropriate structural BMP. If vegetative stabilization is required, the project needs to be timed to use the growing season. All construction of ponds must be completed and seeded by September 15th if vegetative measures will be used for final stabilization. Final stabilization will include seeding, mulching and anchoring with netting or mats. If structural measures such as riprap will be used for final stabilization, this time limit will not apply. Water shall not be directed to the pond until the pond is stabilized with vegetative or structural measures.

Temporary Diversions: Where sedimentation is expected to cause major damage downstream, temporary diversions shall be installed to direct water around the pond construction area. Refer to the WATER DIVERSION BMP.

Culvert Inlets & Outlets: Reinforcement of culvert headwalls and outlets in pond structures is generally required to protect downstream areas from chronic erosion and sedimentation. Refer to the PIPE INLET PROTECTION BMP and the PIPE OUTLET PROTECTION BMP for information.

Riprap Outlet Sediment Trap and Energy Dissipator: A Riprap Outlet Sediment Trap consisting of a trap formed by an excavation and embankment. The outlet for this trap shall be through a partially excavated channel lined with riprap. This outlet channel shall discharge onto a stabilized area or to a watercourse. The riprap outlet sediment trap may be used for drainage areas of up to a maximum of 15 acres. Refer to PIPE OUTLET PROTECTION BMP.

Sequence of installation: Sediment basins must be installed and stabilized with either vegetation or structural measures prior to disturbing the land that will produce the sediment. Water shall not be channelized to the sediment basin until the basin is stabilized.

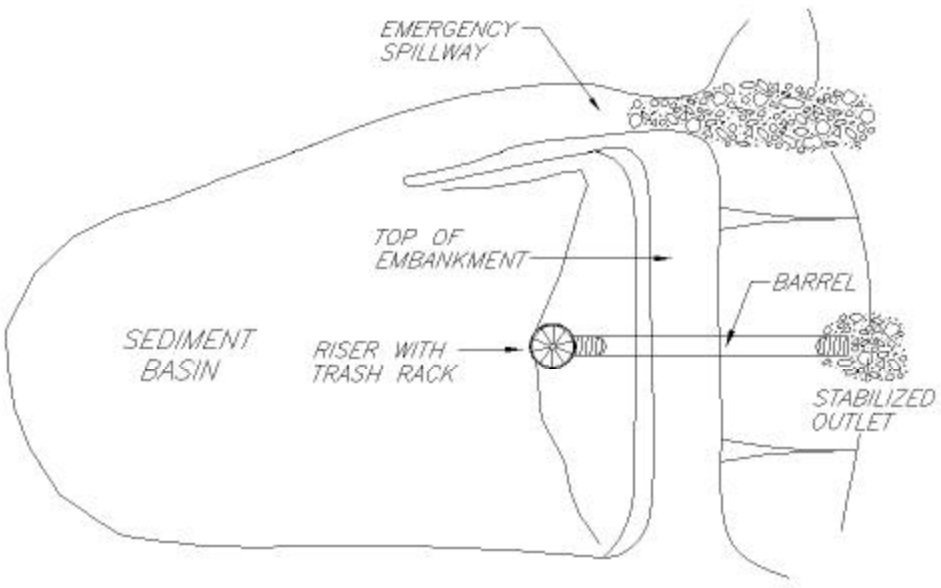
Moisture control: The moisture content of the fill material shall be adequate for obtaining the required compaction. Material that is too wet shall be dried to meet this requirement, and material that is too dry shall be wetted and mixed until the requirement is met.

Compaction: Construction equipment shall be operated over each layer of fill to maximize compaction. Special equipment shall be used if needed to reach the required compaction. If a minimum required density is specified, each layer of fill shall be compacted as necessary to

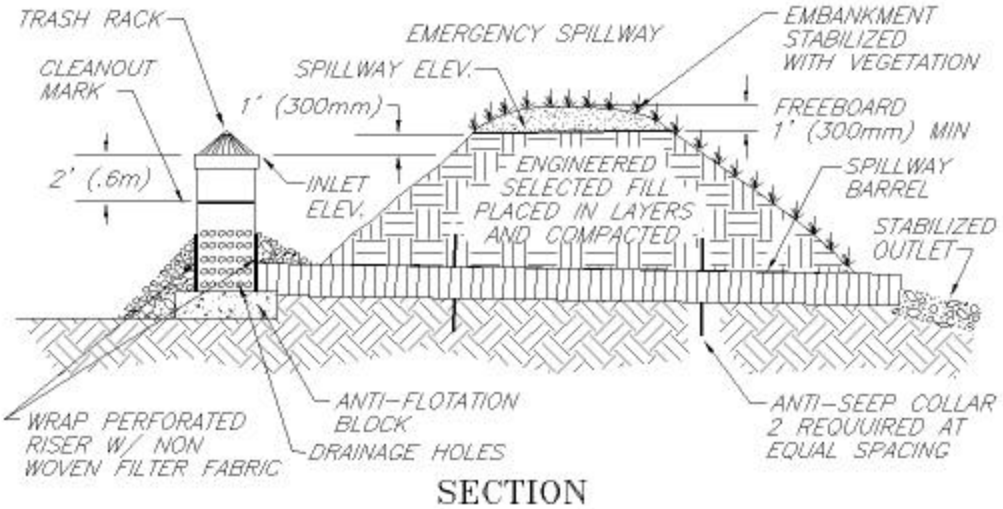
obtain that density.
Fill adjacent to structures, pipe conduits, and drainfill or antiseep collars shall be compacted to a density equivalent to that of the surrounding fill by hand tamping or by using manually directed power tampers or plate vibrators. Fill adjacent to concrete structures shall not be compacted until the concrete has had time to gain enough strength to support the load.
Protective Cover: A protective cover of vegetation shall be established on all exposed surfaces of the embankment, spillway, and borrow area if soil and climatic conditions permit. If soil or climatic conditions preclude the use of vegetation and protection is needed, nonvegetative cover such as mulches or gravel may be used. In some places, temporary vegetation may be used until permanent vegetation can be established. The embankment and spillway shall be fenced if necessary to protect the vegetation.
Principal spillway: Pipe materials shall conform to appropriate specifications. Antiseep collars shall be of materials compatible with that of the pipe and shall be installed so that they are watertight. The pipe shall be installed according to the manufacturer's instructions. It shall be firmly and uniformly bedded throughout its length and shall be installed to the line and grade shown on the drawings.
Concrete: The mix design and testing of concrete shall be consistent with the size and requirements of the job. Mix requirements or necessary strength shall be specified. The type of cement, air entrainment, slump, aggregate, or other properties shall be specified as necessary. All concrete is to consist of a workable mix that can be placed and finished in an acceptable manner. Necessary curing shall be specified. Reinforcing steel shall be placed as indicated on the plans and shall be held securely in place during concrete placement. Subgrades and forms shall be installed to line and grade, and the forms shall be mortartight and unyielding as the concrete is placed.
Foundation and embankment drains: Foundation and embankment drains, if required, shall be placed to the line and grade shown on the drawings. Detailed requirements of drain material and any required pipe shall be shown in the drawings and specifications for the job.
Excavated ponds: The completed excavation shall conform to the lines, grades, and elevations shown on the drawings or as staked in the field.
Embankment and excavated ponds: Construction operations shall be carried out so that erosion and air and water pollution are minimized and held within legal limits. All work shall be conducted in a skillful and workmanlike manner. The completed job shall present a workmanlike appearance.
Measures and construction methods that enhance fish and wildlife values shall be incorporated as needed and practical. Fencing and cover to control erosion and pollution shall be established as needed. Appropriate safety measures, such as warning signs, rescue facilities and fencing, shall be provided as needed.

MAINTENANCE

Pond installations need to be regularly inspected during their installation. If there is any evidence of siltation, corrective measures need to be installed to keep sediment from entering downstream areas.
The basin shall be maintained as needed to maintain its function. Clean out of sediment from the basin shall be determined based on the design criteria. The water discharged from sediment basins shall be monitored during storm events to determine how well they are functioning and if sedimentation is apparent, additional erosion control measures shall be applied to eliminate the source of sedimentation.



PLAN



SECTION

NOTES:

1. THE SEDIMENT BASIN WILL BE REMOVED WITHIN 3 YEARS.
2. EMERGENCY SPILLWAY CAPACITY DESIGNED FOR 25 YEAR STORM FLOW (INCLUDING STONE APRON).
3. POND CAPACITY DESIGNED FOR 25 YEAR STORM BEFORE ACTIVATING EMERGENCY SPILLWAY.

TYPICAL SEDIMENT BASIN

FILE: SEDBASIN