Water for the World

Constructing Stabilization Ponds
Technical Note No. SAN. 2.C.5

A stabilization pond is a large shallow excavation that receives sewage from a sewer system, detains the sewage so that biological processes can destroy most of the disease-causing organisms, and discharges the effluent as treated sewage. Sometimes two or more ponds are constructed and connected by pipes. Constructing stabilization ponds requires the services of an experienced construction supervisor and surveyor. Construction involves assembling labor, materials, and tools; preparing the site; staking the pond, embankment, and pipe locations; excavating the pond; building embankments; laying pipes; and finishing embankments.

This technical note describes how to construct a stabilization pond. Read the entire technical note before beginning construction.

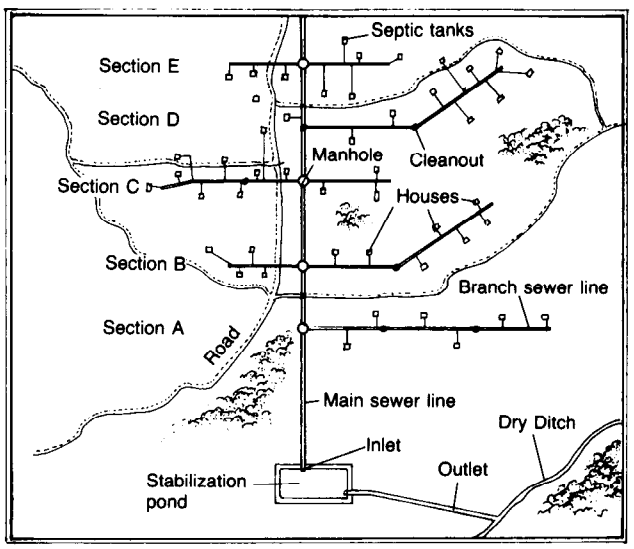

Figure 1. Master Sewer Map with Site of Stabilization Pond

Useful Definitions

EFFLUENT - Settled sewage.

TREATED SEWAGE - The liquid that flows out of a stabilization pond or series of ponds; treated sewage is safer than settled sewage and may be used to irrigate crops not intended for human consumption.

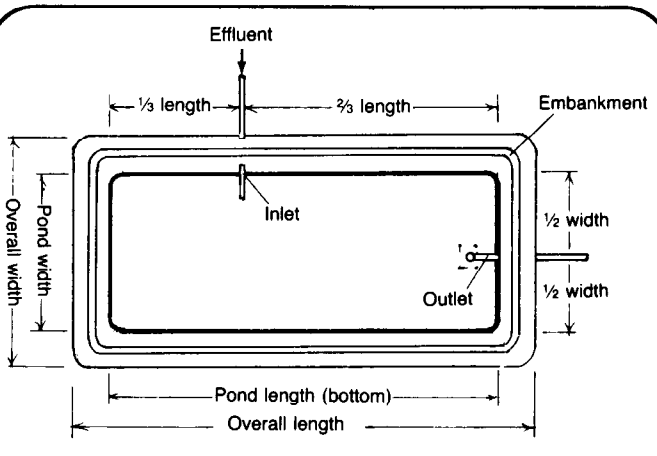

Figure 2. Pond Configuration

Materials Needed

Before construction can begin, the project designer must provide:

1. Location map, or master sewer map, similar to Figure 1;

2. Design drawing of the pond, similar to Figure 2;

3. Design drawing of the inlet, outlet, and embankment, similar to Figure 3;

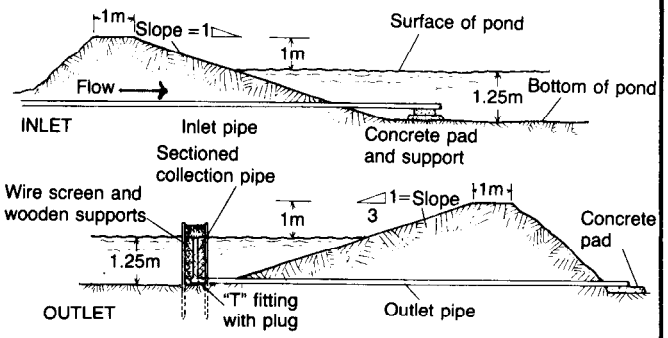

Figure 3. Detail of Inlet, Outlet and Embankments

4. Materials list similar to Table 1.

Table 1. Sample Materials List for a Stabilizaton Pond

Item	Description	Quantity	Estimated Cost
Labor	Construction foreman (experienced)	____	____
	Laborer (skilled with concrete)	____	____
	Laborer (skilled with heavy equipment)		____
	Laborers (unskilled)	____	____
Supplies	Sewer pipe (100mm diameter)	____m	____
	"T" fittings (100mm diameter)	____	____
	Valve	____	____
	Wire mesh (for outlet)	____m^2	____
	Cement	____m^3	____
	Sand (for concrete)	____m^3	____
	Gravel	____m^3	____
	Water	____liters	____
	Gravel (for embankment)	____m^3	____
	Grass seed (for embankment)	____	____
	Wood (for forms)	____	____
	Other	____	____
Tools and Equipment	Surveying equipment (transit, level, etc.)	____	____
	Tractor with front-end loader	____	____
	Shovels	____	____
	Rakes	____	____
	Trowel	____	____
	Mixing containers	____	____
	Hammer	____	____
	Saw	____	____
	Nails	____	____
	Other	____	____

Total Estimated Cost = ____

If more than one pond is being constructed, the project designer must also provide:

5. Design drawing of the pond system layout, similar to Figure 4 or 5;

6. Design drawings of all interpond piping, similar to Figure 6.

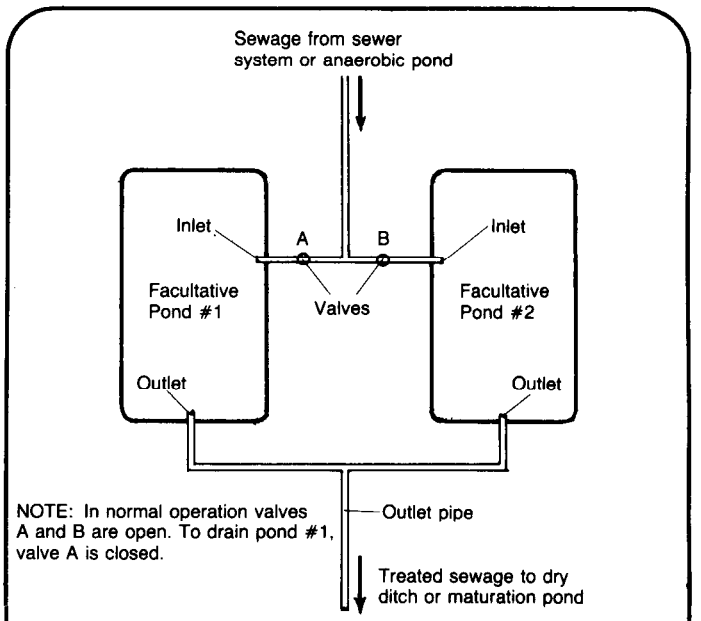

Figure 4. Parallel System Layout

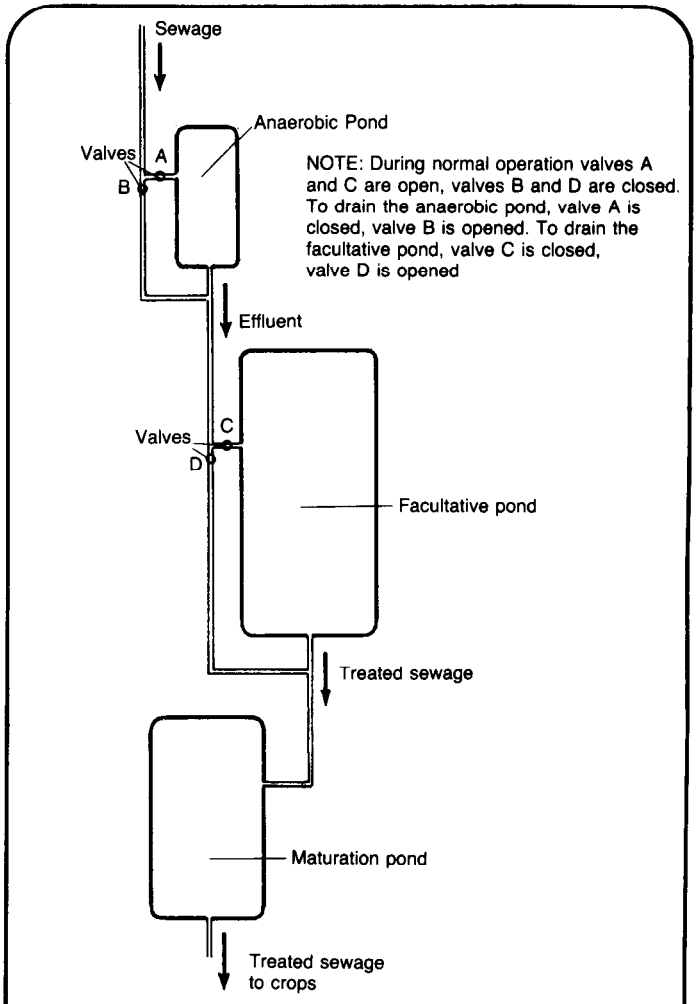

Figure 5. Series System Layout

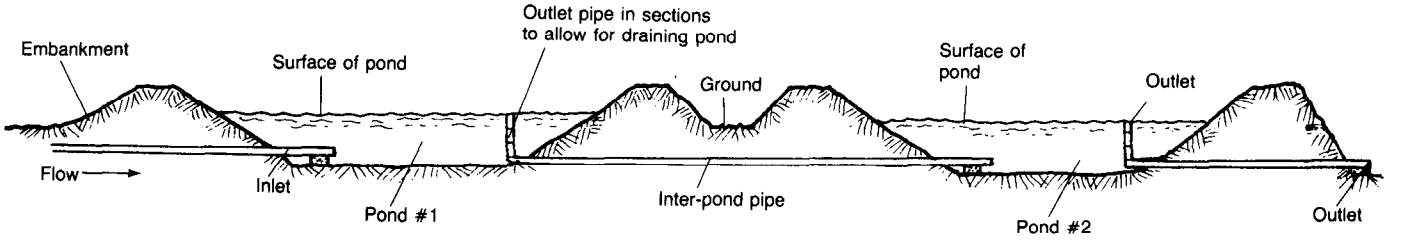

Figure 6. Inter-Pond Piping

7. Materials list attachment similar to Table 2.

You will also need:

8. All labor, materials, and tools described in the materials list and materials list attachment.

Table 2. Sample Materials List Attachment for Interpond Piping

Description	Quantity	Estimated Cost
Sewer pipe (100mm diameter)	____m	____
Sewer pipe (200mm diameter)	____m	____
Valves (100mm diameter)	____	____
Valves (200mm diameter)	____	____

Total Estimated Cost = ____

Construction Steps

Depending on local conditions, availability of materials, skills of workers, and so on, some construction steps will require only a few hours, while others may take a day or more. Read the construction steps and make a rough estimate of the time required for each step based on local conditions. You will then have an idea of when during the construction process specific workers, materials, and tools must be available. Draw up a work schedule similar to Table 3 showing construction steps.

Table 3. Sample Work Schedule for Constructing a Stabilization Pond

Time Estimate	Day	Task	Personnel	Materials/Tools
2 hours	1	Mark site	Foreman (always present), 2 workers	Maps, drawings, measuring tape
1½ days	1-2	Clean site of trees, brush, and debris	6 workers	Axes, machetes, cart
1 day	3	Scrape top soil and pile for finishing embankment	6 workers; 1 loader operator	Front-end loader, shovels
1 day	4	Stake site of pond embankment, pipes	1 surveyor, 3 workers	Transit, level, level rod, steel measuring tape, stakes
7 days	5-11	Excavate pond and build embankments	1 loader operator, 12 workers	Front-end loader, shovels picks, cart
4 hours	12	Dig pipe tenches	6 workers	Shovels, picks
2 hours	12	Build pipe base and slab	4 workers	Shovels, large flat stones
6 hours	13	Lay pipe	6 workers, 1 worker skilled with mortar	200mm diameter sewer pipe, mortar, "T" fitting
3 hours	13	Build vertical outlet and screen	6 workers, 1 worker skilled with mortar	Sleeved pipe sections, posts, creosote, wire screen
1 day	14	Fill in gaps in embankment	6 workers, 1 operator	Front-end loader, shovels
4 days	15-18	Finish embankment	1 loader operator, 12 workers	Loader, shovels, rocks topsoil, grass seed

Preparing the Site

1. Locate the site and temporarily mark it on the ground.

2. Assemble all labor, materials, and tools needed to begin construction.

3. Clear the pond and embankment site of all trees, bushes, stumps, brushwood, large rocks, and any other material not suitable for building the embankment. Haul this material to a landfill or other disposal site.

4. Remove any trees upwind from the site for a distance of 100-200m. This will create an unobstructed windpath, which will improve the efficiency of the pond after it is put into operation.

5. Remove topsoil or sod from the site and place it to one side. This will be used later to finish the embankment.

Staking Pond Site and Pipe Locations

1. Set reference stakes 5-10m apart indicating the boundaries of the bottom of the pond. Find the elevation of each stake using a surveyor's level and rod from the base point used in constructing the sewer. See "Constructing Sewer Systems," SAN.2.C.4.

2. Measuring the distance and elevation from the reference stakes, set slope stakes indicating the points at which to begin building the embankment and excavating the pond. See Figure 7.

3. Set stakes to indicate pipe locations. This will eliminate re-excavating portions of the embankment.

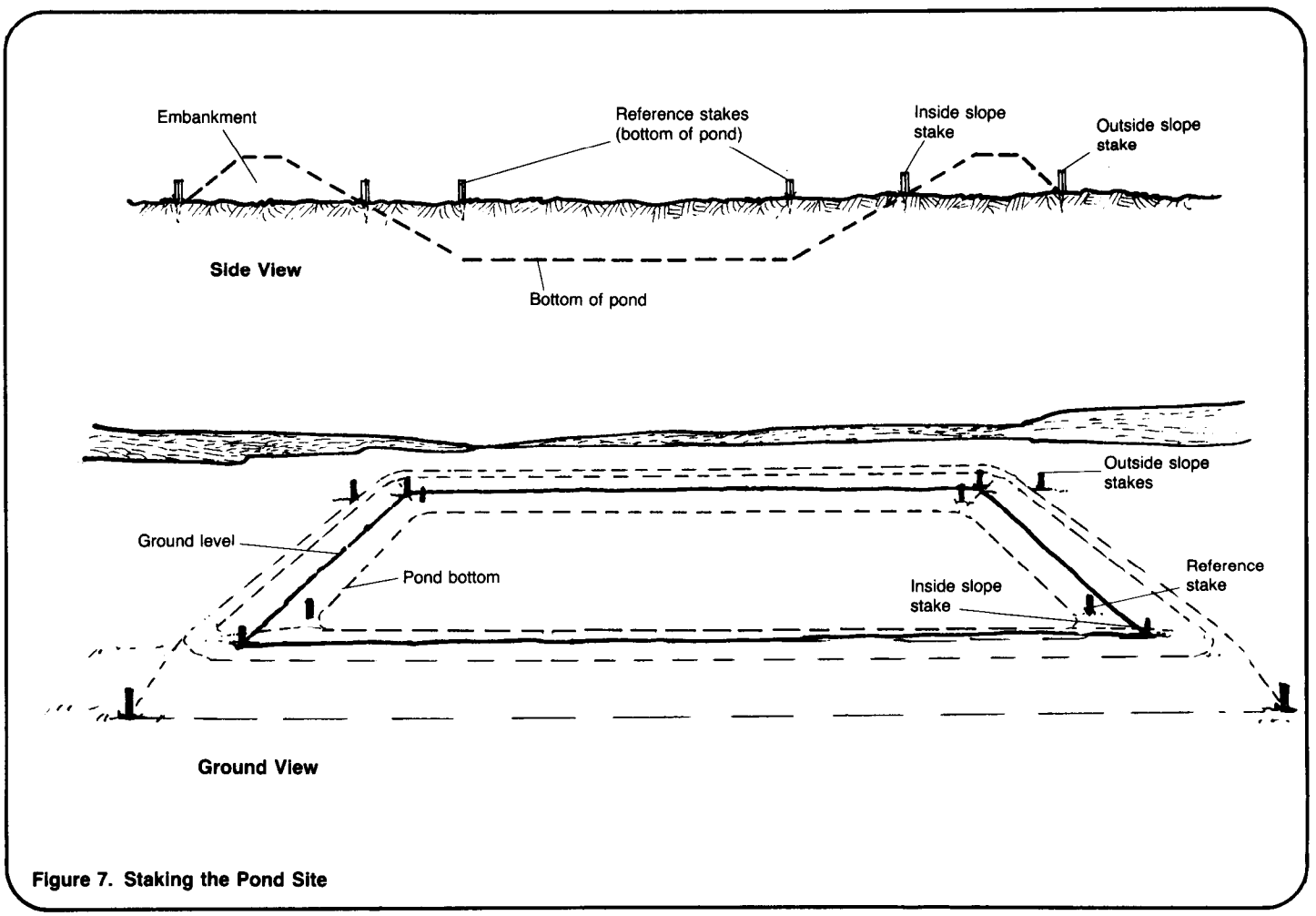

Figure 7. Staking the Pond Site

Excavating the Pond

1. Begin excavating at the inside slope stakes. Dig at the slope specified by the project designer until the bottom elevation is reached. Check this elevation with a surveyor's level and rod. See Figure 8.

2. Continue excavating along the bottom elevation of the pond. Use excavated soil to build up the embankments (see "Building Embankments").

3. Make the bottom of the pond as level and as uniformly compacted as possible. If there are soft spots or tree roots, dig them out, fill with moist soil, and compact.

4. Make the corners of the pond rounded.

5. Leave some excavated soil on the pond bottom if small dikes are to be built for the start of pond operation. See "Operating and Maintaining Stabilization Ponds," SAN.2.0.5.

Building Embankments

1. Begin building embankments as the pond is excavated. Embankments must be well tamped, with sides sloped according to design specifications.

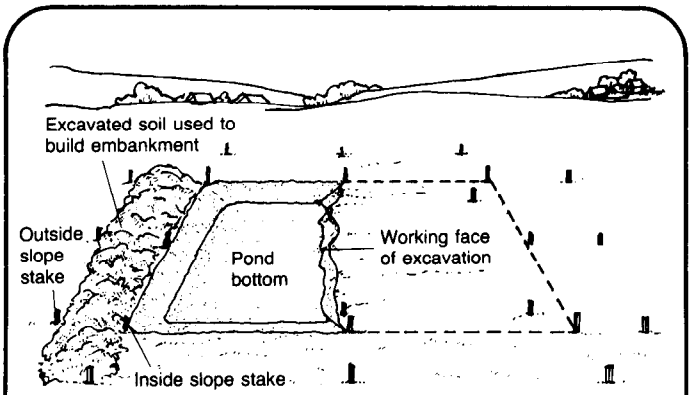

Figure 8. Pond Excavation

2. Leave gaps in the embankment at pipe locations as shown in Figure 9. It may also be convenient to leave one or more wide gaps for removal of excavated soil.

3. The top of the embankment must be level, well-tamped, and at least 1.0m wide. The horizontal distance from the top of the embankment to the bottom of the pond must equal the design depth of the pond plus 1.0m.

Laying Pipes

1. Excavate trenches for pipes at the design depth and locations. The bottoms of the trenches should be well-tamped.

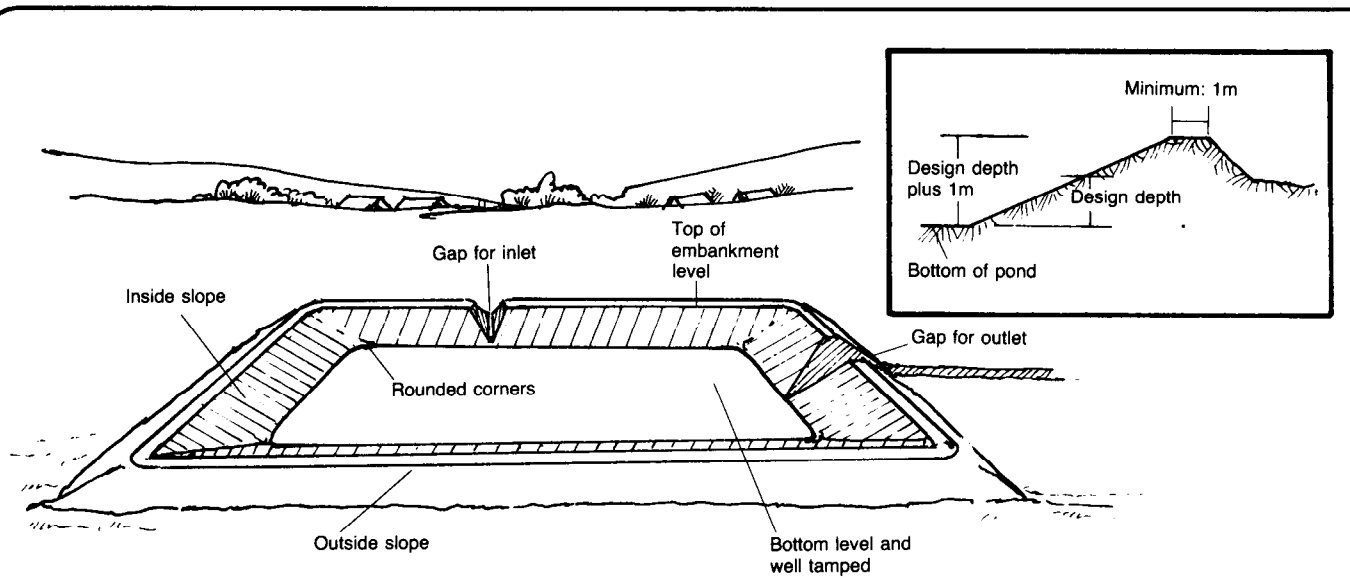

Figure 9. Excavated Pond and Embankments

2. Build bases about 0.5m high for the inlet pipes from concrete or stone. The purpose of the bases is to raise the inlet pipe above the bottom of the pond. See Figure 3.

3. Build slabs for the outlet pipes from concrete or stone. The purpose of the slab is to support the outlet pipe and to prevent erosion due to the discharge of treated sewage. Build support slabs under all valve locations.

4. Lay sewer pipe and mortar together sections. Install valves.

5. Build the vertical outlet from sleeved sections of pipe. The height of the vertical outlet determines the depth of the pond. It must be equal to the design depth calculated by the project designer. The sleeved sections will allow the pond to be drained when necessary. See Figure 3.

6. Build a protective screen around the vertical outlet with creosote-treated wood posts and rust-proof wire screen. The screen should extend at least 0.3m above and 0.3m below the vertical outlet. It will prevent floating debris from entering the outlet pipe after the pond is put into operation.

7. Carefully fill in pipe trenches with moist soil and tamp.

Finishing Embankments

1. Fill in any gaps in the embankment that were used for laying pipe or removing excavated soil. Thoroughly tamp the top and slopes and make them uniform with the existing embankment. See Figure 10.

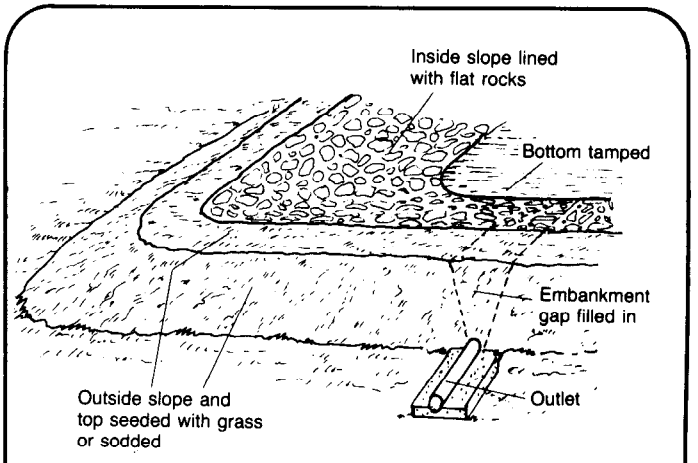

Figure 10. Finished Embankment

2. Line the entire inner face of the embankment slope with rocks and flat stones. This will prevent erosion due to wave action during pond operation. Rocks and stones should be smoothly graded to conform to the design slope of the embankment. Avoid using gravel and pebbles because this material tends to move downslope.

3. If topsoil or sod was initially removed from the site, use it now to cover the outside slope and top of the embankment. If no sod is available, plant grass seed. This will help prevent erosion of the embankment from wind and rain. See Figure 10.

4. Excess soil excavated from the pond can be used to build small dams to divert surface water away from the pond. If not, it should be graded level or hauled away from the pond site.