

USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

**POND SEALING OR LINING,
BENTONITE TREATMENT**

CODE 521C
(Reported by No.)

DEFINITION

A liner for a pond or waste impoundment consisting of a compacted soil bentonite mixture.

PURPOSE

To reduce seepage losses from ponds or waste impoundments for water conservation and environmental protection.

**CONDITIONS WHERE PRACTICE
APPLIES**

This practice applies where:

1. Water loss from a pond through leakage is or will be of such proportion as to prevent the pond from fulfilling its planned purpose, or where leakage will damage land and crops or cause waste of water or environmental problems;
2. Soils are suitable for treatment with bentonite;
3. Ponds or waste impoundments require treatment to reduce seepage rates and to impede the migration of contaminants to within acceptable limits.

CONSIDERATIONS

Venting should be considered if gas build up under the liner is anticipated.

If high water tables could adversely affect the proper functioning of the facility, interceptor or relief type drainage systems should be considered to control uplift pressures.

Effects upon components of the water budget, especially effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge should be considered.

Consider the potential need for water management, including the following:

1. Effects on the movement of silts, pathogens, and soluble materials carried by seepage toward the ground water;
2. Short-term and construction-related effects of this practice on the quality of the water resource;
3. Effects on wetlands or water-related wildlife habitats;
4. Effects on the visual quality of downstream water resources;
5. Effects on the use and management of nutrients and pesticides and their effect on surface and ground water quality.

CRITERIA

General Criteria

Ponds and waste impoundments to be sealed shall be constructed according to the Maryland conservation practice standards for Pond (Code 378), Waste Storage Facility (Code 313), Waste Treatment Lagoon (Code 359), or other conservation practices standards as appropriate.

Comply with all federal, state, and local laws, rules, and regulations.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Bentonite treated soil liners shall be filter compatible with the natural foundation materials on which they are compacted according to Chapter 26, Part 633, of the National Engineering Handbook.

Use a sodium bentonite with a free swell of at least 22 milliliters as measured by ASTM Standard Test Method D5890, unless laboratory tests using other bentonite types are used for design.

When laboratory permeability tests are required to determine application rates, perform tests using bentonite of the same quality and fineness as that proposed for use.

Compaction - Compact the treated layer to a minimum 90 percent of the maximum density as determined by the Standard Proctor Test, ASTM D-698.

Storage - Stored bentonite must be covered with a plastic sheet or tarpaulin until used. The work must be staged so that the contractor can complete subgrade preparation, scarification, soil moisture adjustment, spreading and mixing the bentonite, and compaction of the bentonite treated soil. Wet bentonite is difficult to work with.

Safety - For protection against bentonite dust, personnel on site during bentonite application and mixing shall wear a mask and goggles.

Vegetation - Shape and smooth the finished area and all disturbed areas and stabilize immediately after construction as required on the construction plans, and in accordance with the Maryland conservation practice standard for Critical Area Planting (Code 342).

Additional Criteria Applicable to Wastewater Impoundments

Design - Design bentonite treated soil liners for waste impoundments in accordance with National Engineering Handbook Series, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Appendix 10D and/or state regulatory requirements.

The minimum thickness of the finished compacted liner is 6 inches.

Liner Protection - Protect the liner against desiccation cracking, the effects of water surface fluctuations, wave action, surface erosion, erosion from pipe inlets, agitation equipment, animals, or items installed through the liner. Design protective measures into the system to protect the liner for these cases. Provide, at a minimum, 6 inches of compacted soil cover over the soil-bentonite liner.

Additional Criteria Applicable to Ponds

Application Rate - For ponds, in the absence of laboratory tests or field performance data on soils similar to those to be treated, the minimum application of finely ground bentonite per 1-inch thickness of constructed liner shall be:

Pervious Soil Description	Application Rate (lbs/ft²/in)
Silts (ML, CL-ML)	0.375
Silty Sands (SM, SC-SM, SP-SM)	0.5
Clean Sands (SP, SW)	0.625

Liner Thickness - In the absence of more detailed testing and analyses, liner thickness shall be according to the following table:

Water Depth (feet)	Liner Thickness (inches)
8 or less	6
8.1 – 16	12
16.1 – 24	18
24.1 – 30	24

A minimum thickness of 12 inches is recommended for all areas in the vertical range of water fluctuation. Provide a minimum 12-inch compacted layer of untreated soil over the treated liner where shoreline erosion or wetting and drying from fluctuating water levels exist.

SPECIFICATIONS

Plans and specifications for bentonite treated soil liners for ponds and waste impoundments shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. Include as part of the plans and specifications drawings, specifications, material requirements, quantities, construction requirements, and other documents as necessary to describe the work to be done.

The area to be treated shall be drained and dried.

Remove from the pool area all vegetation, stumps, trash, stones and other objects of a size sufficient to interfere (usually less than 1/3 of the treated soil depth) with the operation.

Fill and compact holes or crevices beneath the layer to be treated to a minimum density of 90 percent of Standard Proctor with soil at optimum moisture content. Cover areas of exposed gravel or fractured rock with a minimum of 12 inches of soil that has a minimum of 20 percent clay content and is compacted to the specified density.

Spread finely ground bentonite evenly over the subgrade surface at the specified rate. Use bentonite that is free flowing, high swelling, granular sodium bentonite. The bentonite shall be American Colloid Company, Volclay SG-40, Wyo-Ben, Envirogel-10, or equivalent.

Mix the material thoroughly to the specified depth with rotary tiller or similar equipment using multiple cross-direction passes. A disc is not recommended because of its poor mixing capabilities.

Compact treated layers a dry density of 90 percent or more of standard Proctor with soil at optimum moisture content.

At the interface between a previous day's work and the next day's work, re-mix and compact a transition zone that is a minimum of 3 feet wide.

Special attention must be given to sealing around pipes and structures. Compact 3 parts soil with 1 part bentonite near optimum moisture into a notch in the subgrade and hand compact.

Protect treated areas from damage by livestock. Protect areas near the water line and at points of concentrated surface flow against erosion.

OPERATION AND MAINTENANCE

Address in the Operation and Maintenance plan the operation and maintenance requirements for the conservation practice being lined.

Maintenance activities required for this practice consist of those operations necessary to prevent breaching of the treated soil layer. This includes, but is not limited to, excluding animals and equipment from the treated area; protection of the layer during initial filling, agitation, or pumping operations; and repair of disturbed or eroded areas.

SUPPORTING DATA AND DOCUMENTATION

Field Data and Survey Notes

The following is a list of the minimum data needed:

1. System plan sketch;
2. Topographic survey of the site showing elevations and control features;
3. Soils investigation showing seasonal high water table, location of test holes, and gradation and classification of soils to be sealed.

Design Data

Record on appropriate engineering paper. For guidance on the preparation of engineering plans, see Chapter 5 of the EFH, Part 650. The following is a list of the minimum required design data:

1. Statement concerning location and type of leaks or excessive permeability and description of foundation preparation to be made;
2. All required permits and documentation on file with the design information;
3. Plan view including, location map, all system components, material and construction specifications;
4. Rate of application and thickness of the treated blanket, method of mixing materials, method of compaction and protection, construction drawings, and component details;
5. Quantities estimate;
6. Job class on plan;
7. Details of foundation drainage, when required;
8. Planting plan. This must meet the criteria, specifications, and documentation requirements of the Maryland conservation practice standard for Critical Area Planting, Code 342.

Construction Check Data/As-built

Record on survey notepaper, SCS-ENG-28, or other appropriate engineering paper. Survey data will be plotted on plans in red. The following is a list of minimum data needed for As-builts:

1. Documentation of site visits on CPA-6. Include the date, who performed the inspection, specifics as to what was inspected, all alternatives discussed, and decisions made and by whom;
2. Actual dimensions of installed lining;
3. Verification of adequate foundation preparation;
4. Documentation of installation of foundation drainage;
5. Certification by the manufacturer that the liner material is suitable for the intended use, Certification statement from the contractor(s) that they have constructed the soil liner in accordance with the plans and specifications.
6. Statement on seeding and fencing;
7. Final quantities and documentation for quantity changes, and materials certification;
8. Sign and date checknotes and plans a person with appropriate approval authority. Include statement that practice meets or exceeds plans and NRCS practice standards.

REFERENCES

1. USDA, Natural Resources Conservation Service. *Engineering Field Manual, Chapter 4, "Elementary Soil Engineering" and Chapter 11, "Ponds and Reservoirs;"*
2. USDA, Natural Resources Conservation Service, *Maryland Field Office Technical Guide, Section IV, Standards and Specifications;*
3. USDA, Natural Resources Conservation Service. *National Engineering Handbook, Chapter 26, Part 633.*
4. USDA, Natural Resources Conservation Service. *National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Appendix 10D.*