

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

**POND SEALING OR LINING
BENTONITE TREATMENT**

(No.)

CODE 521C

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:

- Soils are suitable for treatment with bentonite.
- Ponds or waste impoundments require treatment to reduce seepage rates and to impede the migration of contaminants to within acceptable limits.

CRITERIA

General Criteria Applicable To All Purposes

Bentonite treated soil liners shall comply with all federal, state, and local laws, rules, and regulations.

Lined structures shall meet all applicable NRCS standards.

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.

The minimum thickness of the finished compacted liner shall be 6 inches.

The bentonite shall be 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.

At a minimum, soil shall have a significant clay fraction, which will seal when the natural structure is broken by the dispersant. For chemical sealing, soils shall have properties approximating the following:

- 1. At least 50 percent finer than #200 sieve (the #200 sieve is about the smallest particle visible to the naked eye or 0.074 mm diameter).***

If soil has properties outside the above limit, chemical sealing should not be attempted unless tested and laboratory verified. When laboratory permeability tests are required to determine application rates, the tests shall be performed using bentonite of the same quality and fineness as that proposed for use.

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

NRCS, NHCP

September 2001

NRCS, WV

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Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service [State Office](#) or visit the [electronic Field Office Technical Guide \(e-FOTG\)](#) located on our web site. **Note: Bold italics is information added or changes made to the National Conservation Standard by WV.**

Criteria Applicable To Waste Impoundments

Design. Design of the bentonite treated soil liners for waste impoundments shall be in accordance with National Engineering Handbook Series, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Appendix 10D and/or state regulatory requirements ***which ever is more restricted.***

Liner Protection. The liner shall be protected 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. Protective measures shall be designed into the system to protect the liner for these cases. At least 6" of compacted soil cover shall be placed over the soil-bentonite.

Liners shall be protected from livestock hoof action, heavy rolling equipment and/or agitation equipment by a concrete pad or other suitable means.

There shall be a minim of 2.0 feet of fine grained soil compacted over fractured rock outcrops or other highly permeable materials. The treated blanket shall be in addition to the 2.0 feet of cover.

Criteria Applicable To Ponds

Application Rate. For ponds, ***with a course grained soils***, 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 (lb/ft ²)
Silts (ML, CL-ML)	1.0
Silty Sands (SM, SC-SM, SP-SM)	1.5
Clean Sands (SP, SW)	2.0
Open Rock* or Gravel with Clay or sand mixed 6" layer	2.5
<i>A minimum of 2.0 feet of fine-grained soil compacted over cavernous limestone. The top 6 inches of the 2.0 feet shall be treated with Bentonite.</i>	

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 (<i>two-6" lifts</i>)
16.1 – 24	18 (<i>3-6" lifts</i>)
24.1 - 30	24 (<i>4-6" lifts</i>)

****Additional liner thickness shall be provided for greater water depths, for pond areas exposed to drying, rock or gravel outcrops and for areas subject to wave action.***

For areas with livestock traffic, the liner shall be a minimum of 8" thick and be protected from hoof action.

CONSIDERATIONS

Flattening the slopes of ponds or waste impoundments to facilitate compactive efforts during construction should be considered. The stair-step method of construction as outlined in Appendix 10D may be considered in lieu of slope flattening.

A protective compacted soil cover should be considered for protecting the soil-bentonite liner for ponds.

Consider using a flexible membrane liner for sites that have water depths greater than 24 feet.

PLANS AND 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. Plans and specifications shall include such drawings, specifications, material requirements, quantities, construction requirements, equipment requirements, and other documents as are necessary to describe the work to be done.

At a minimum, the plans and specifications shall provide the following:

1. ***Layout of the containment structure, collection points, waste transfer locations or pipelines, pumping plant and topography of the site***
2. ***Documentation of soil properties and testing and geotechnical investigation as required.***
3. ***Required liner properties, cushion materials, and pipeline materials***
4. ***Subgrade details, including tolerances on smoothness of the finished grade***
5. ***Details of liner installation, seaming requirements, and requirements for attachments and appurtenances***
6. ***Quality control testing***
7. ***Fence and signage requirements, as required.***
8. ***Refer to 210-VI-EFH Amend. 45, WV5 Preparation of Engineering Plans for additional guidance.***

OPERATION AND MAINTENANCE

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

The plan shall contain requirements including but not limited to:

1. ***Design capacity and liquid level of the structure.***
2. ***A description of the normal operation, safety concerns and maintenance requirements.***
3. ***Repair procedures.***
4. ***Periodic inspection of the following:***
 - ***Visible portions of the sealer and liner for signs of leakage or other damage;***
 - ***Liner interface with inlets, outlets, ramps, or other appurtenances for damage;***
 - ***Liquid level in the structure;***
5. ***Safety Issues and Warnings Signs***
6. ***Copy of manufacturer, material, warranty and design criteria associated with sealing of the structure.***

REFERENCES

Quality Assurance and Quality Control for Waste Containment Facilities, EPA/1600/R-93/182, September 1993.

210-VI-EFH Amend. 45, WV5 Preparation of Engineering Plans

210-V-NEM Part 505 – Non-NRCS Engineering Services

WV NRCS Engineering Field Handbook