

**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, wetlands, 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, wetlands, or waste impoundments require treatment to reduce seepage rates and to impede the migration of water and 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 Natural Resources Conservation Service (NRCS) standards.

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

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 American Society for Testing and Materials (ASTM) Standard Test Method D 5890 unless laboratory tests using other bentonite types are used for design.

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.

**Criteria Applicable to Ponds and Wetlands**

**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 6-inch thickness of constructed liner shall be as follows:

Pervious Soil Description	Application Rate (lb./ft. <sup>2</sup> )
Clays (CL)	2.3
Silts (ML, CL-ML)	2.5
Clayey sands (SC)	2.8
Silty sands (SM, SC-SM, SP-SM)	3.0
Clean sands (SP, SW)	3.8
Fractured rock or gravels (GW, GP)	4.5

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service or download it from the electronic Field Office Technical Guide (eFOTG).

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**Liner thickness.** In the absence of more detailed testing and analyses, liner thickness shall be according to the following:

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

### **Criteria Applicable to Waste Impoundments**

**Design.** Design of the bentonite-treated soil liners for waste impoundments shall be in accordance with [Appendix 10D in Chapter 10 of National Engineering Handbook Part 651 \(NEH 651\)](#), [Agricultural Waste Management Field Handbook](#), and/or state regulatory requirements. Use the tables above for application rate and liner thickness in the absence of detailed testing and analyses.

**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 inches of compacted soil cover shall be placed over the soil-bentonite liner.

### **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 in Chapter 10 of NEH 651](#) 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.

Consider using coarser grades of bentonite material to reduce problems with dust and drifting.

### **PLANS AND SPECIFICATIONS**

Plans and specifications for bentonite-treated soil liners for ponds, wetlands, 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.

### **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) exclusion of 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.