NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

POND SEALING OR LINING
SOIL DISPERSANT TREATMENT

(No.)

CODE 521B

DEFINITION

A liner for a pond or waste storage impoundment consisting of a compacted soil-dispersant 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 dispersants.
- Ponds or waste storage 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

Ponds to be sealed shall be constructed to meet NRCS standards for ponds (378), waste treatment facilities (313), waste treatment lagoons (359), or wildlife watering facilities (648), as appropriate.

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

Dispersant treated soil liners shall be filter-compatible with the sub-grade on which they are compacted to prevent loss of the liner soil into larger openings in the sub-grade material. The National Engineering Handbook, Part 633, Chapter 26-Gradation Design of Sand and Gravel Filters, provides criteria on filter compatibility.

The dispersant shall be tetrasodium pyrophosphate (TSPP), sodium tripolyphosphate (STPP), or soda ash unless laboratory tests using other dispersant types are used in the design.

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

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

Criteria Applicable to Ponds

Design. Dispersant treated soil liners for ponds not storing animal waste shall be designed to reduce seepage to rates that will allow the pond to function suitably as intended.

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 dispersant per 6-inch thickness of constructed liner shall be:

Dispersant Type	Application rate (lb./ 100 ft^2)
Polyphosphates	7.5
Soda Ash	20

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	6
8.1 – 16	12
16.1 – 24	18
24.1 - 30	24

Criteria Applicable To Waste Impoundments

Design. Design of dispersant treated soil liners for waste storage impoundments shall be designed to reduce specific discharge (unit seepage) to rates recommended in the National Engineering Handbook Series, Part 651, Agricultural Waste Management Field Handbook (AWMFH), Chapter 10, Appendix 10D or rates mandated in state regulations if they are more restrictive. Lower specific discharge rates may be used at the discretion of the Designer.

Liner Thickness. The minimum thickness of the finished compacted liner shall be the greater of:

1. that required to achieve a specific discharge (unit seepage) design value selected by the designer,
2. that required by state regulations, or
3. that given in the following table. The water depth to be used in the table is the normal full pool storage depth in the impoundment.

Water Depth (feet)	Liner Thickness (inches)
≤ 16	12
16.1 – 24	18
> 24	24

Other Criteria

Liner Construction. Use methods described in Appendix 10D to the AWMFH for liner construction.

Liner Protection. Dispersant treated soil liners shall be protected against damage caused by the effects of water surface fluctuations, desiccation and cracking, wave action, rainfall during periods when the liner is exposed, water falling onto the liner from pipe outlets, agitation equipment, solids and sludge removal activity, animal activity, penetrations through the liner, and any other activity capable of causing physical damage to the liner.

Design should include measures to protect against damage to the dispersant treated soil liner due to uplift water pressures if a seasonal high water table occurs at a level above that of the lowest potential level of liquid in the impoundment. Examples of protective design measures are the use of perimeter drains to lower the water table, maintaining minimum liquid depth in the impoundment, and using liners thick enough to resist uplift water pressures.

Protection of the finished liner from the effects of desiccation during periods when the pond or impoundment is low or empty is advisable. A protective soil cover may be considered. The soil cover shall be of a soil type, thickness, and density that is resistant to erosion and desiccation.

Side Slopes. The side slopes of ponds or waste storage impoundments should be 3H: 1V or flatter to facilitate mixing of the dispersant when the bathtub method of construction as described in Appendix 10D, AWMFH, is used. Slopes as steep as 2H: 1V can be considered if the stair-step method of construction as described in Appendix 10D to the AWMFH is used. Maintenance requirements should also be considered when selecting a side slope.

CONSIDERATIONS

Experience with soil permeability lab tests indicates some glacial soils in Ohio benefit from the addition of soil dispersants. Figure 1 shows the general location of benefitted regions and should be used as a planning guide. Lab tests are to be used to confirm applicability and the rate of application is to be according to test results.

If soda ash is used, it should be dense grade soda ash.

If soda ash is applied without lab testing, the application rate should be .2 pounds per square foot of six inch lift.

Soil dispersants shall be spread and incorporated into six inch clay lifts and compacted with a sheeps foot roller during construction.

A protective soil cover should be added. The soil cover should be a six inch compacted layer of cohesive soil found at the site that will adequately protect the liner form desiccation and erosion.

Dispersant treated soil liners for waste storage impoundments shall be designed to reduce specific discharge (unit seepage) to 10^{-6} cm^3 per cm^2 per second.

Consider using a flexible geomembrane or geosynthetic clay liner for sites that have water depths greater than 24 feet.

Alternatives to compacted soil dispersant treated liners should be considered for poor foundation conditions such as karstic bedrock, joints or other discontinuities of the underlying bedrock.

PLANS AND SPECIFICATIONS

Plans and specifications for dispersant 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 necessary to describe the work to be done.

OPERATION AND MAINTENANCE

Maintenance activities required for this practice consist of those operations necessary to prevent and/or repair damage to the dispersant treated soil liner. This includes, but is not limited to; excluding animals and equipment from the treated area; repairing damage to the liner occurring from erosion during initial filling; erosion resulting from wave action after the impoundment fills, and erosion caused by agitation, pumping operations, as well as activities involved in removal of solids and sludge. Damage that might be caused by roots from trees and large shrubs should be prevented by removing such vegetation at first appearance. If the liner is damaged, any disturbed or eroded areas should be repaired to restore the liner to its original thickness and condition

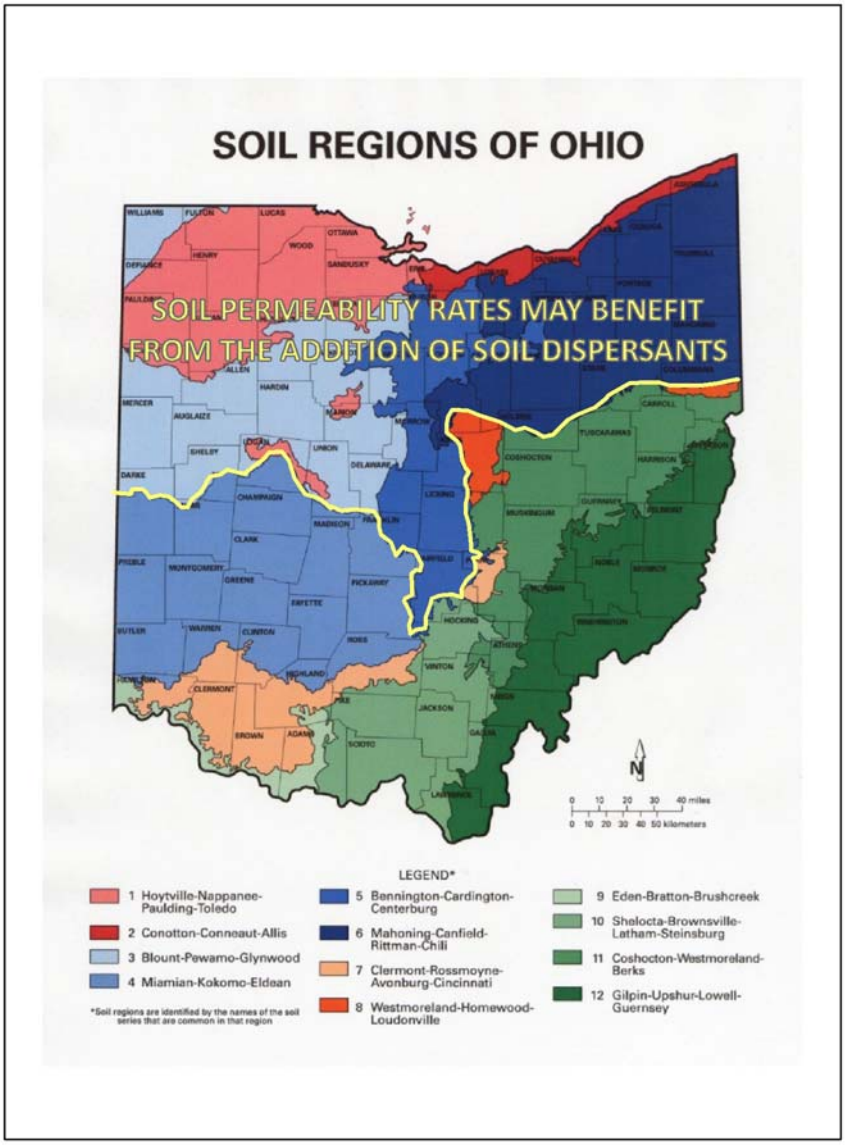

Figure 1

NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION
POND SEALING OR LINING SOIL DISPERSANT TREATMENT

POND SEALING OR LINING
SOIL DISPERSANT TREATMENT
CODE 521B
Construction Specification

Soil Properties

For liner-type sealing, soils shall have from 15 to 30 percent clay and be classified as CL or SC. The remaining portion of the liner material should have a wide range of soil particles in the silt, fine sand, and coarse sand range. For questionable materials, hydraulic conductivity tests should be performed on the proposed lining material.

Construction

The area to be treated shall be cleared of all vegetation and trash and all stones or other objects of a size to interfere with the operation of compaction equipment.

The area to be treated shall be drained. The moisture content of the soil should be near optimum for compaction. Water shall be added or additional drying by soil manipulation shall be done as the situation demands.

Holes shall be filled and fill material compacted.

Scarify or loosen the soil in the reservoir area to a depth of 4-in. Remove rocks and tree roots which are exposed.

The earth material shall be spread to a uniform depth of 6-8 in. over the surface to be sealed. All clods or lumps are to be broken down to a fine state by disking, dragging, or preferably by roto-tilling. Soil dispersants are then be uniformly spread at the specified rate and incorporated into the soil with roto-tilling or disking.

Each layer of soil shall be compacted to a dry density of 90 percent or more of the maximum dry density (based on the “Standard Proctor Test”) with the water content above optimum moisture.

A sheepsfoot roller shall be used to compact each layer.

Treated areas should be protected from puncture by livestock trampling. Areas near the normal water line and points of concentrated surface flow into the pond should be protected against erosion.

Procedure for lining or compacting the bottom and sides of a manure storage pond or Lagoon

The purpose of this procedure is to produce a compacted liner treated with soil dispersant to blanket the bottom of a holding pond or lagoon. The liner is to be designed using the procedure in Appendix 10-Dof the AWMFH. Use the following procedure to construct the liner:

- Excavate the pond or lagoon to its finished grade, and then remove an additional amount of soil from the bottom and the sideslopes equal to the thickness of the planned liner.

- Scarify the bottom of the excavation for a minimum depth of 4-inches with ripper, disk, or chisel plow going in both directions perpendicular to each other.
- Spread and incorporate soil dispersant into the loose soil
- Add water to the scarified soil to raise the moisture content above optimum moisture content.
- Compact the scarified soil with a minimum of 6 passes of a 200 psi sheepsfoot roller
- Place another lift of loose soil at the proper moisture content in a 9-inch thickness, add and incorporate soil dispersant, and compact each lift with a sheepsfoot roller. This will result in a compacted lift that is 6-inches thick.
- Cover the structure with a final lift of untreated compacted soil the final thickness of the liner will be 18 inches including the untreated six inch compacted cohesive layer to protect the treated liner
- Roll the top surface of the final lift with loaded rubber tired equipment or a loaded smooth drum roller

Soil compaction

The following are minimum requirements for compacting CL or SC soils used for embankments and liners when laboratory data is not available. (Restated from practice standards 313 & 359)

- *Precompacted Lift thickness:* The lift thickness shall be equivalent to the length of the feet of the sheepsfoot roller plus 3 inches; not to exceed 9 inches in total thickness.
- *Maximum rock diameter:* 3 inches.
- *Minimum Moisture content:* - The soil material shall be of sufficient moisture to easily form it into a moist, somewhat soft, ball by hand and not develop any cracks. This moisture content approximates optimum plus 2%.
- *Compaction equipment:* Sheepsfoot roller with a minimum 200-psi foot contact pressure,
  and feet a minimum of 7” in length.
- *Compaction effort:* a minimum of 6 passes of the roller over all points of each lift. When the moisture content is adequate, the sheepsfoot roller will penetrate the soil and ride on the drum. The soil is too dry if the sheepsfoot roller does not fully penetrate the soil.
- Any additional water needed for proper compaction shall be thoroughly mixed in with a disk prior to compaction.

The surface of a compacted lift must be sufficiently moist to allow bonding with the next lift, otherwise the surface needs to be scarified, wetted to the minimum moisture content, and recompacted prior to placement of the next lift