WASTE STORAGE FACILITY

(No.)

Code 313

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A waste storage *impoundment*[1] made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a *structure*.

II. Purpose

To temporarily store wastes such as manure, *manure processing derivatives*, *leachate*, *wastewater*, and *contaminated runoff* from agricultural sources in a manner which safeguards the environment.

This standard does not preclude the addition of other off farm organic materials, pending approval by the appropriate regulatory authority.

III. Conditions Where Practice Applies

This standard applies to:

- waste storage impoundments or structures up to 30 million gallons in size;
- construction of a storage facility in areas where the soils, geography, and topography are suitable and where the construction, operation, and maintenance will protect the soil and water resources;
- facilities that are part of a planned agriculture waste management system intended to meet the facility management goals, regulatory requirements, or *nutrient management plans* by providing storage of waste;
- waste storage facilities utilizing embankments with a maximum *effective height* of 25 feet and where damage resulting from failure would be limited.

This standard does not apply to the storage of human waste or the unstacked waste that accumulates in animal housing units.

IV. Federal, Tribal, State and Local Laws

Waste storage facilities shall comply with all federal, tribal, state, and local laws, rules or regulations. The operator is responsible for securing required permits. This standard does not contain the text of the federal, tribal, state, or local laws governing waste storage facilities.

V. Criteria

The following criteria establish **minimum** allowable limits for design parameters, acceptable installation processes, or performance requirements.

A. General Criteria

The following general criteria apply to this practice.

1. Management Assessment

A management assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed with the owner/operator to explore options and to determine the purpose of storage components, available resources, manure disposal schemes, sand and manure solids separation methods, and waste characteristics.

When the intent of the owner/operator is to process and/or treat the various waste streams within the *animal production area*, the designer shall provide a narrative describing the system. The description will include the intent and purpose of the treatment or processing strategies relative to land spreading or waste distribution strategies, stabilization of organic by-products, separation of sand bedding, reducing pollutant loads, nutrient concentration, waste consistencies, odor control, energy production, and volume reduction.

The management assessment shall address the following as appropriate to the system being designed:

a. Waste Characterization.

1) Sources, volumes and consistency of manure, contaminated runoff, manure processing derivatives, leachate,

[1]Words in the standard that are shown in italics are described in VIII. Definitions. The words are italicized the first time they are used in the text.


HOW WILL THEY EMPTY IT?
MANURE CONSISTANCY?
ACCESS?
SPREADABLE ACRES?

wastewater, and other inputs to the waste storage facility.

2) Animal types.

3) Bedding types and quantity.

b. Land base available for utilization of waste.

c. Planned storage period.

d. Waste handling and transfer methods from the waste source to the storage facility.

e. Facility waste removal methods.

f. Storage facility liner possibilities and preferences.

g. Access needs and limitations.

h. Safety needs, including those to address the hazards of manure gases.

i. Labor and equipment needs.

j. Potential odor concerns.

k. Provisions for facility expansion.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste storage facility and transfer components. The assessment shall include input from the owner/operator. The site assessment shall include:

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, *cultural resources*, and wetlands.

b. Test pit or soil boring logs, soil test results, a soil survey photo, and a narrative describing the design parameters that have been derived from the soils data. Test pit soil or boring criteria include:

1) The number and distribution needed to characterize the subsurface (soils, saturation, and *bedrock*). Test pits or borings shall be added if there is inconsistency within or between test pits or borings.

2) Based on the facility *footprint* there shall be a minimum of one test pit or boring per 15,000 square feet of footprint, with a minimum of two per facility. Test pits and borings used to meet these criteria shall be located in the footprint or no more than 100 feet from the footprint. These test pits/soil borings shall extend to bedrock, a free water surface, or to a minimum depth to ensure subsurface saturation and bedrock separation distances required in this standard are achieved.

3) Soil layers shall be described with respect to thickness, texture using the Unified Soil Classification System (USCS), Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

4) The elevation of bedrock and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.

5) The upper elevation of all saturated layers encountered.

c. Locations of *sinkholes* and other *karst* features and direct conduits to groundwater within 1,000 feet of the facility.

d. Locations, dimensions and elevations, soil volumes, soil samples, testing results, and reclamation plans of any borrow areas. Characterize borrow areas according to Section V.A.2.b.(1)), V.A.2.b.(3), and V.A.2.b.(4). Test pits for clay borrow source evaluation shall be completed on a maximum 100-foot grid.

e. Identification of potential impacts from failure of the embankments, liners, or structures.

3. Flood Prone Areas

Waste storage facilities located in *flood prone areas* shall be protected from inundation, structural damage, and instability. These facilities shall be designed to accommodate any additional loading resulting from static water

wastewater, and other inputs to the waste storage facility.

2) Animal types.

3) Bedding types and quantity.

b. Land base available for utilization of waste.

c. Planned storage period.

d. Waste handling and transfer methods from the waste source to the storage facility.

e. Facility waste removal methods.

f. Storage facility liner possibilities and preferences.

g. Access needs and limitations.

h. Safety needs, including those to address the hazards of manure gases.

i. Labor and equipment needs.

j. Potential odor concerns.

k. Provisions for facility expansion.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste storage facility and transfer components. The assessment shall include input from the owner/operator. The site assessment shall include:

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, *cultural resources*, and wetlands.

b. Test pit or soil boring logs, soil test results, a soil survey photo, and a narrative describing the design parameters that have been derived from the soils data. Test pit soil or boring criteria include:

1) The number and distribution needed to characterize the subsurface (soils, saturation, and *bedrock*). Test pits or borings shall be added if there is inconsistency within or between test pits or borings.

2) Based on the facility *footprint* there shall be a minimum of one test pit or boring per 15,000 square feet of footprint, with a minimum of two per facility. Test pits and borings used to meet these criteria shall be located in the footprint or no more than 100 feet from the footprint. These test pits/soil borings shall extend to bedrock, a free water surface, or to a minimum depth to ensure subsurface saturation and bedrock separation distances required in this standard are achieved.

3) Soil layers shall be described with respect to thickness, texture using the Unified Soil Classification System (USCS), Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

4) The elevation of bedrock and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.

5) The upper elevation of all saturated layers encountered.

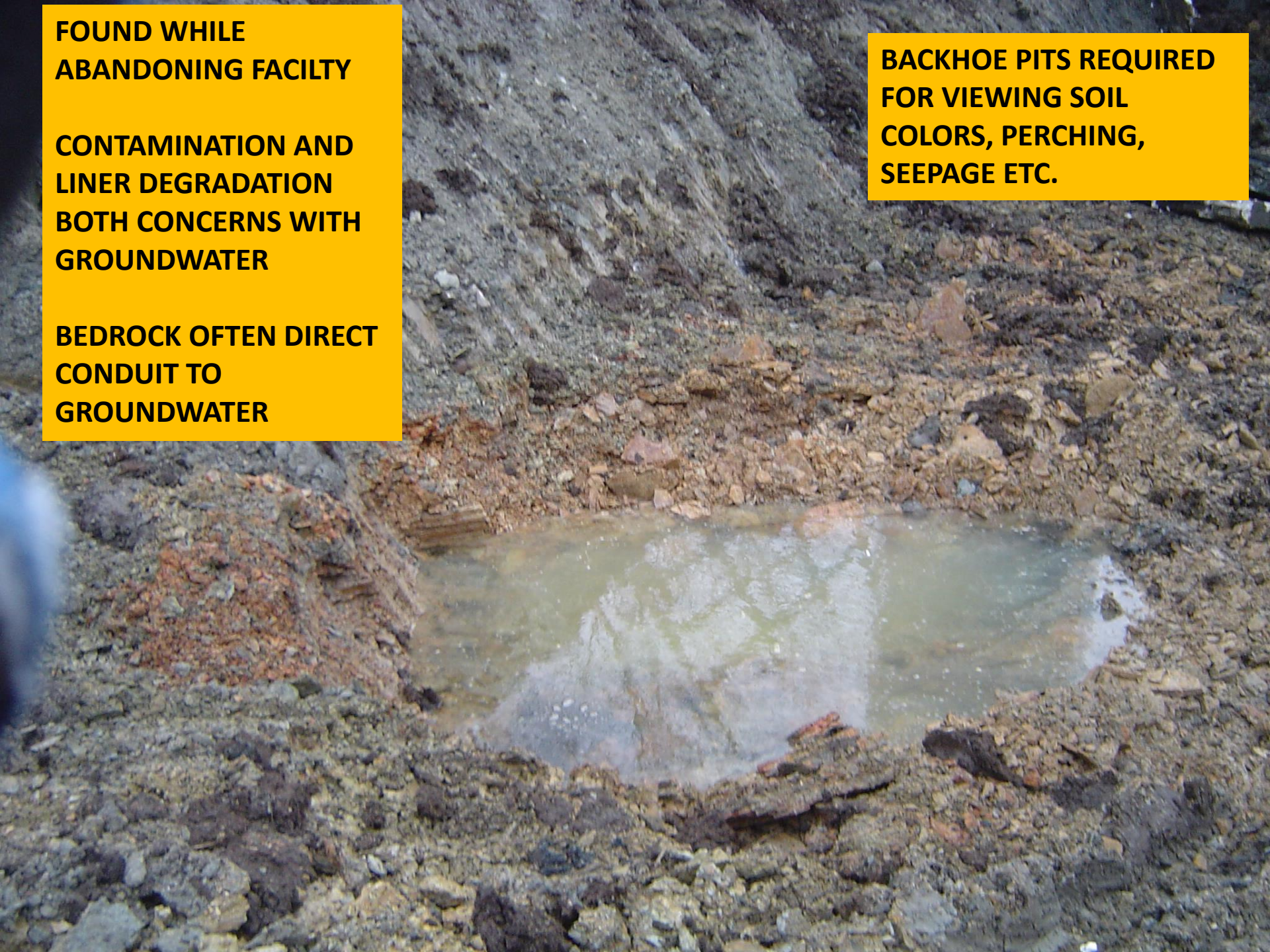
c. Locations of *sinkholes* and other *karst* features and direct conduits to groundwater within 1,000 feet of the facility.

d. Locations, dimensions and elevations, soil volumes, soil samples, testing results, and reclamation plans of any borrow areas. Characterize borrow areas according to Section V.A.2.b.(1)), V.A.2.b.(3), and V.A.2.b.(4). Test pits for clay borrow source evaluation shall be completed on a maximum 100-foot grid.

e. Identification of potential impacts from failure of the embankments, liners, or structures.

3. Flood Prone Areas

Waste storage facilities located in *flood prone areas* shall be protected from inundation, structural damage, and instability. These facilities shall be designed to accommodate any additional loading resulting from static water


FOUND WHILE ABANDONING FACILTY
CONTAMINATION AND LINER DEGRADATION BOTH CONCERNS WITH GROUNDWATER
BEDROCK OFTEN DIRECT CONDUIT TO GROUNDWATER
BACKHOE PITS REQUIRED FOR VIEWING SOIL COLORS, PERCHING, SEEPAGE ETC.


LANDOWNER NEVER EMPTIED FACILTY BUT ALLOWED MANURE TO OVERFLOW FOR 20 YEARS

wastewater, and other inputs to the waste storage facility.

2) Animal types.

3) Bedding types and quantity.

b. Land base available for utilization of waste.

c. Planned storage period.

d. Waste handling and transfer methods from the waste source to the storage facility.

e. Facility waste removal methods.

f. Storage facility liner possibilities and preferences.

g. Access needs and limitations.

h. Safety needs, including those to address the hazards of manure gases.

i. Labor and equipment needs.

j. Potential odor concerns.

k. Provisions for facility expansion.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste storage facility and transfer components. The assessment shall include input from the owner/operator. The site assessment shall include:

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, *cultural resources*, and wetlands.

b. Test pit or soil boring logs, soil test results, a soil survey photo, and a narrative describing the design parameters that have been derived from the soils data. Test pit soil or boring criteria include:

1) The number and distribution needed to characterize the subsurface (soils, saturation, and *bedrock*). Test pits or borings shall be added if there is inconsistency within or between test pits or borings.

2) Based on the facility *footprint* there shall be a minimum of one test pit or boring per 15,000 square feet of footprint, with a minimum of two per facility. Test pits and borings used to meet these criteria shall be located in the footprint or no more than 100 feet from the footprint. These test pits/soil borings shall extend to bedrock, a free water surface, or to a minimum depth to ensure subsurface saturation and bedrock separation distances required in this standard are achieved.

3) Soil layers shall be described with respect to thickness, texture using the Unified Soil Classification System (USCS), Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

4) The elevation of bedrock and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.

5) The upper elevation of all saturated layers encountered.

c. Locations of *sinkholes* and other *karst* features and direct conduits to groundwater within 1,000 feet of the facility.

d. Locations, dimensions and elevations, soil volumes, soil samples, testing results, and reclamation plans of any borrow areas. Characterize borrow areas according to Section V.A.2.b.(1)), V.A.2.b.(3), and V.A.2.b.(4). Test pits for clay borrow source evaluation shall be completed on a maximum 100-foot grid.

e. Identification of potential impacts from failure of the embankments, liners, or structures.

3. Flood Prone Areas

Waste storage facilities located in *flood prone areas* shall be protected from inundation, structural damage, and instability. These facilities shall be designed to accommodate any additional loading resulting from static water

HIGH VALUE LOW CHROMA REDUCED CONDITION DUE TO PROLONGED SATURATION

REDDISH MOTTLES INDICATE OXIDATION GRAY MOTTLES LONG TERM SATURATION AND REDUCTION

wastewater, and other inputs to the waste storage facility.

2) Animal types.

3) Bedding types and quantity.

b. Land base available for utilization of waste.

c. Planned storage period.

d. Waste handling and transfer methods from the waste source to the storage facility.

e. Facility waste removal methods.

f. Storage facility liner possibilities and preferences.

g. Access needs and limitations.

h. Safety needs, including those to address the hazards of manure gases.

i. Labor and equipment needs.

j. Potential odor concerns.

k. Provisions for facility expansion.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste storage facility and transfer components. The assessment shall include input from the owner/operator. The site assessment shall include:

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, *cultural resources*, and wetlands.

b. Test pit or soil boring logs, soil test results, a soil survey photo, and a narrative describing the design parameters that have been derived from the soils data. Test pit soil or boring criteria include:

1) The number and distribution needed to characterize the subsurface (soils, saturation, and *bedrock*). Test pits or borings shall be added if there is inconsistency within or between test pits or borings.

2) Based on the facility *footprint* there shall be a minimum of one test pit or boring per 15,000 square feet of footprint, with a minimum of two per facility. Test pits and borings used to meet these criteria shall be located in the footprint or no more than 100 feet from the footprint. These test pits/soil borings shall extend to bedrock, a free water surface, or to a minimum depth to ensure subsurface saturation and bedrock separation distances required in this standard are achieved.

3) Soil layers shall be described with respect to thickness, texture using the Unified Soil Classification System (USCS), Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

4) The elevation of bedrock and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.

5) The upper elevation of all saturated layers encountered.

c. Locations of *sinkholes* and other *karst* features and direct conduits to groundwater within 1,000 feet of the facility.

d. Locations, dimensions and elevations, soil volumes, soil samples, testing results, and reclamation plans of any borrow areas. Characterize borrow areas according to Section V.A.2.b.(1)), V.A.2.b.(3), and V.A.2.b.(4). Test pits for clay borrow source evaluation shall be completed on a maximum 100-foot grid.

e. Identification of potential impacts from failure of the embankments, liners, or structures.

3. Flood Prone Areas

Waste storage facilities located in *flood prone areas* shall be protected from inundation, structural damage, and instability. These facilities shall be designed to accommodate any additional loading resulting from static water

OFTEN A DIRECT CONDUIT TO GROUNDWATER

CAN BE ECXAVATED TO ACHIEVE VERTICAL SEPARATION

SOILS WITH OVER 20% FINES REQUIRED FOR BACKFILL

POSITIVE DRAINAGE ON BEDROCK FACE UNDER FACILTY

VERTICAL SEPARATION REQUIREMENT VARIES WITH LINER TYPE

wastewater, and other inputs to the waste storage facility.

2) Animal types.

3) Bedding types and quantity.

b. Land base available for utilization of waste.

c. Planned storage period.

d. Waste handling and transfer methods from the waste source to the storage facility.

e. Facility waste removal methods.

f. Storage facility liner possibilities and preferences.

g. Access needs and limitations.

h. Safety needs, including those to address the hazards of manure gases.

i. Labor and equipment needs.

j. Potential odor concerns.

k. Provisions for facility expansion.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste storage facility and transfer components. The assessment shall include input from the owner/operator. The site assessment shall include:

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, *cultural resources*, and wetlands.

b. Test pit or soil boring logs, soil test results, a soil survey photo, and a narrative describing the design parameters that have been derived from the soils data. Test pit soil or boring criteria include:

1) The number and distribution needed to characterize the subsurface (soils, saturation, and *bedrock*). Test pits or borings shall be added if there is inconsistency within or between test pits or borings.

2) Based on the facility *footprint* there shall be a minimum of one test pit or boring per 15,000 square feet of footprint, with a minimum of two per facility. Test pits and borings used to meet these criteria shall be located in the footprint or no more than 100 feet from the footprint. These test pits/soil borings shall extend to bedrock, a free water surface, or to a minimum depth to ensure subsurface saturation and bedrock separation distances required in this standard are achieved.

3) Soil layers shall be described with respect to thickness, texture using the Unified Soil Classification System (USCS), Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

4) The elevation of bedrock and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.

5) The upper elevation of all saturated layers encountered.

c. Locations of *sinkholes* and other *karst* features and direct conduits to groundwater within 1,000 feet of the facility.

d. Locations, dimensions and elevations, soil volumes, soil samples, testing results, and reclamation plans of any borrow areas. Characterize borrow areas according to Section V.A.2.b.(1)), V.A.2.b.(3), and V.A.2.b.(4). Test pits for clay borrow source evaluation shall be completed on a maximum 100-foot grid.

e. Identification of potential impacts from failure of the embankments, liners, or structures.

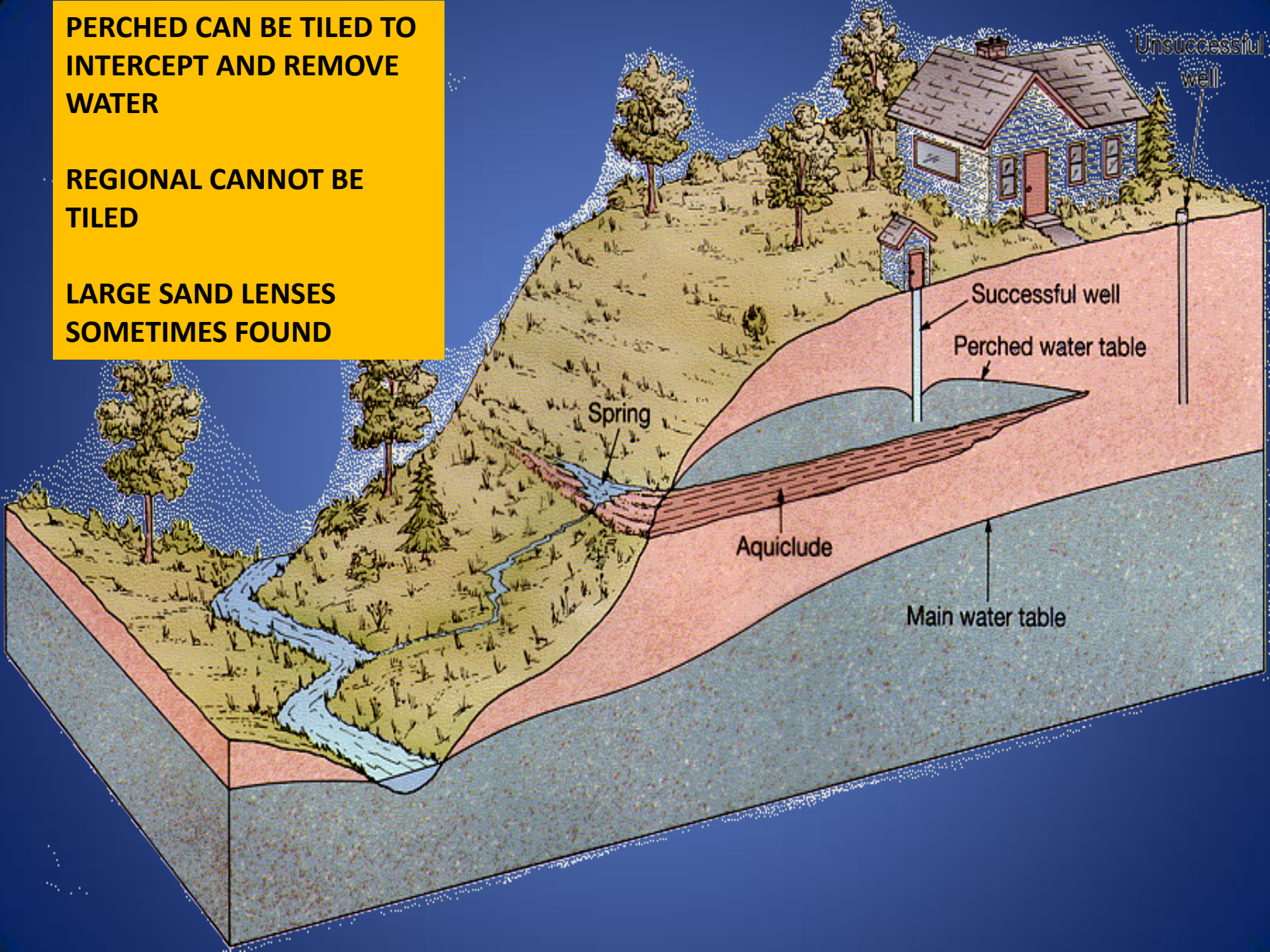
3. Flood Prone Areas

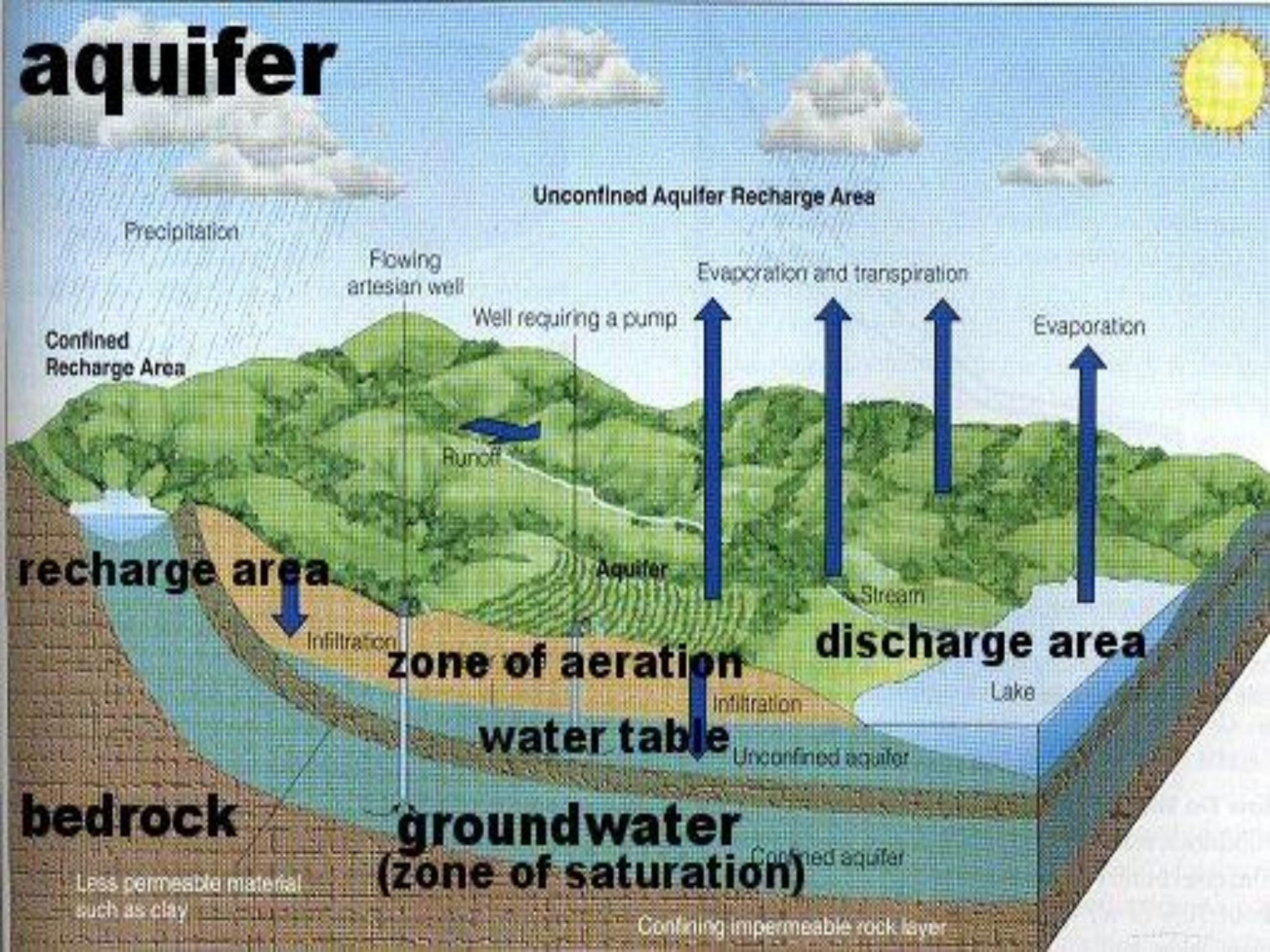
Waste storage facilities located in *flood prone areas* shall be protected from inundation, structural damage, and instability. These facilities shall be designed to accommodate any additional loading resulting from static water

PERCHED CAN BE TILED TO INTERCEPT AND REMOVE WATER

REGIONAL CANNOT BE TILED

LARGE SAND LENSES SOMETIMES FOUND




aquifer
Unconfined Aquifer Recharge Area
Precipitation
Flowing artesian well
Well requiring a pump
Evaporation and transpiration
Evaporation
Confined Recharge Area
Runoff
recharge area
Aquifer
Stream
Infiltration
zone of aeration
discharge area
Lake
Infiltration
water table
Unconfined aquifer
bedrock
groundwater
(zone of saturation)
Confined aquifer
Less permeable material such as clay
Confining impermeable rock layer

wastewater, and other inputs to the waste storage facility.

2) Animal types.

3) Bedding types and quantity.

b. Land base available for utilization of waste.

c. Planned storage period.

d. Waste handling and transfer methods from the waste source to the storage facility.

e. Facility waste removal methods.

f. Storage facility liner possibilities and preferences.

g. Access needs and limitations.

h. Safety needs, including those to address the hazards of manure gases.

i. Labor and equipment needs.

j. Potential odor concerns.

k. Provisions for facility expansion.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste storage facility and transfer components. The assessment shall include input from the owner/operator. The site assessment shall include:

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, *cultural resources*, and wetlands.

b. Test pit or soil boring logs, soil test results, a soil survey photo, and a narrative describing the design parameters that have been derived from the soils data. Test pit soil or boring criteria include:

1) The number and distribution needed to characterize the subsurface (soils, saturation, and *bedrock*). Test pits or borings shall be added if there is inconsistency within or between test pits or borings.

2) Based on the facility *footprint* there shall be a minimum of one test pit or boring per 15,000 square feet of footprint, with a minimum of two per facility. Test pits and borings used to meet these criteria shall be located in the footprint or no more than 100 feet from the footprint. These test pits/soil borings shall extend to bedrock, a free water surface, or to a minimum depth to ensure subsurface saturation and bedrock separation distances required in this standard are achieved.

3) Soil layers shall be described with respect to thickness, texture using the Unified Soil Classification System (USCS), Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

4) The elevation of bedrock and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.

5) The upper elevation of all saturated layers encountered.

c. Locations of *sinkholes* and other *karst* features and direct conduits to groundwater within 1,000 feet of the facility.

d. Locations, dimensions and elevations, soil volumes, soil samples, testing results, and reclamation plans of any borrow areas. Characterize borrow areas according to Section V.A.2.b.(1)), V.A.2.b.(3), and V.A.2.b.(4). Test pits for clay borrow source evaluation shall be completed on a maximum 100-foot grid.

e. Identification of potential impacts from failure of the embankments, liners, or structures.

3. Flood Prone Areas

Waste storage facilities located in *flood prone areas* shall be protected from inundation, structural damage, and instability. These facilities shall be designed to accommodate any additional loading resulting from static water


STRICT HORIZONTAL
SEPARATION REQUIRED


BEDROCK NOT ALWAYS FOUND
SOME OUTLETS ON SIDE HILLS OTHERS TO REGIONAL OR PERCHED WATERTABLES

wastewater, and other inputs to the waste storage facility.

2) Animal types.

3) Bedding types and quantity.

b. Land base available for utilization of waste.

c. Planned storage period.

d. Waste handling and transfer methods from the waste source to the storage facility.

e. Facility waste removal methods.

f. Storage facility liner possibilities and preferences.

g. Access needs and limitations.

h. Safety needs, including those to address the hazards of manure gases.

i. Labor and equipment needs.

j. Potential odor concerns.

k. Provisions for facility expansion.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste storage facility and transfer components. The assessment shall include input from the owner/operator. The site assessment shall include:

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, *cultural resources*, and wetlands.

b. Test pit or soil boring logs, soil test results, a soil survey photo, and a narrative describing the design parameters that have been derived from the soils data. Test pit soil or boring criteria include:

1) The number and distribution needed to characterize the subsurface (soils, saturation, and *bedrock*). Test pits or borings shall be added if there is inconsistency within or between test pits or borings.

2) Based on the facility *footprint* there shall be a minimum of one test pit or boring per 15,000 square feet of footprint, with a minimum of two per facility. Test pits and borings used to meet these criteria shall be located in the footprint or no more than 100 feet from the footprint. These test pits/soil borings shall extend to bedrock, a free water surface, or to a minimum depth to ensure subsurface saturation and bedrock separation distances required in this standard are achieved.

3) Soil layers shall be described with respect to thickness, texture using the Unified Soil Classification System (USCS), Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

4) The elevation of bedrock and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.

5) The upper elevation of all saturated layers encountered.

c. Locations of *sinkholes* and other *karst* features and direct conduits to groundwater within 1,000 feet of the facility.

d. Locations, dimensions and elevations, soil volumes, soil samples, testing results, and reclamation plans of any borrow areas. Characterize borrow areas according to Section V.A.2.b.(1)), V.A.2.b.(3), and V.A.2.b.(4). Test pits for clay borrow source evaluation shall be completed on a maximum 100-foot grid.

e. Identification of potential impacts from failure of the embankments, liners, or structures.

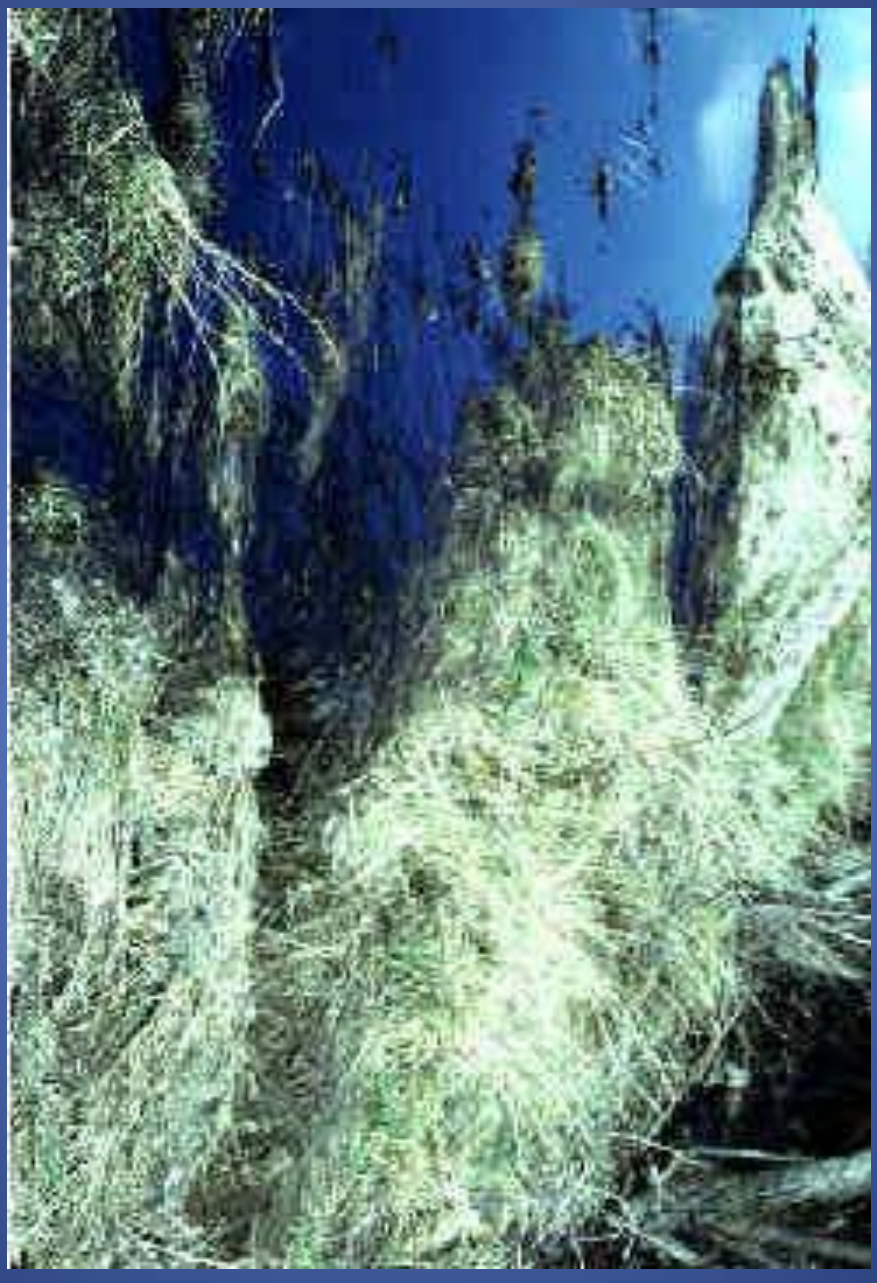
3. Flood Prone Areas

Waste storage facilities located in *flood prone areas* shall be protected from inundation, structural damage, and instability. These facilities shall be designed to accommodate any additional loading resulting from static water


CATISTROPHIC FAILURES ARE POSSIBLE
SUBTLE FAILURES MORE COMMON CAUSED BY LINER DAMAGE FROM AGITATION, POOR CONSTRUCTION OR WATER DAMAGE
2013. 5. 7 8:07


2013. 5. 7 8:11


EMBANKMENT TOP WIDTH, SIDESLOPES FILL PLACEMENT AND CORE TRENCHEDS SPECIFIED IN STANDARD



wastewater, and other inputs to the waste storage facility.

2) Animal types.

3) Bedding types and quantity.

b. Land base available for utilization of waste.

c. Planned storage period.

d. Waste handling and transfer methods from the waste source to the storage facility.

e. Facility waste removal methods.

f. Storage facility liner possibilities and preferences.

g. Access needs and limitations.

h. Safety needs, including those to address the hazards of manure gases.

i. Labor and equipment needs.

j. Potential odor concerns.

k. Provisions for facility expansion.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste storage facility and transfer components. The assessment shall include input from the owner/operator. The site assessment shall include:

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, *cultural resources*, and wetlands.

b. Test pit or soil boring logs, soil test results, a soil survey photo, and a narrative describing the design parameters that have been derived from the soils data. Test pit soil or boring criteria include:

1) The number and distribution needed to characterize the subsurface (soils, saturation, and *bedrock*). Test pits or borings shall be added if there is inconsistency within or between test pits or borings.

2) Based on the facility *footprint* there shall be a minimum of one test pit or boring per 15,000 square feet of footprint, with a minimum of two per facility. Test pits and borings used to meet these criteria shall be located in the footprint or no more than 100 feet from the footprint. These test pits/soil borings shall extend to bedrock, a free water surface, or to a minimum depth to ensure subsurface saturation and bedrock separation distances required in this standard are achieved.

3) Soil layers shall be described with respect to thickness, texture using the Unified Soil Classification System (USCS), Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

4) The elevation of bedrock and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.

5) The upper elevation of all saturated layers encountered.

c. Locations of *sinkholes* and other *karst* features and direct conduits to groundwater within 1,000 feet of the facility.

d. Locations, dimensions and elevations, soil volumes, soil samples, testing results, and reclamation plans of any borrow areas. Characterize borrow areas according to Section V.A.2.b.(1)), V.A.2.b.(3), and V.A.2.b.(4). Test pits for clay borrow source evaluation shall be completed on a maximum 100-foot grid.

e. Identification of potential impacts from failure of the embankments, liners, or structures.

3. Flood Prone Areas

Waste storage facilities located in *flood prone areas* shall be protected from inundation, structural damage, and instability. These facilities shall be designed to accommodate any additional loading resulting from static water

levels or saturated soils. The lowest point at which floodwater could enter the waste storage facility shall be 2 feet above the maximum elevation of flow resulting from a 100-year, 24-hour rainfall event.

4. **Location**

Waste storage facilities shall be located so the potential impacts from breach of embankment, accidental release, and liner failure are minimized. Potential failures and environmental impacts identified in the site assessment shall be addressed in the design phase, the operation and maintenance plan, and/or the emergency action plan.

5. **Design Storage Volume**

Design storage volumes shall be calculated with the procedures and default values found in the Wisconsin supplement to Chapter 10 of the NRCS Agricultural Waste Management Field Handbook (AWMFH) or site-specific estimates and measurements documented in the plan. The design storage duration and volume shall be consistent with the nutrient management plan and emptying schedule. Design volume shall include the sum of the following during the storage period:

- Manure, bedding and other wastes.
- The volume of wastewater from all sources that is anticipated to enter the storage facility. The wastewater volume shall be based on default values or estimates and measurements documented in the plan.
- Normal precipitation less evaporation on the surface of the facility.
- Runoff volumes from the drainage area for design storage duration.
- 25-year, 24-hour precipitation on the surface of the facility.
- 25-year, 24-hour runoff volume from the drainage area.

6. **Maximum Operating Level**

The maximum operating level for liquid or slurry waste storage facilities shall be the storage level that provides for the design storage volume listed in Section V.A.5 less the volume of precipitation and runoff from the 25-year, 24-hour storm event. See Figure 1.

A permanent marker or indicator that does not compromise the integrity of the liner shall be installed at the maximum operating level. The stored waste shall be managed such that it remains below the maximum operating level during normal operating conditions. State or local codes may require additional markers.

A contingency plan shall be implemented when the maximum operating level is reached.

7. **Extra Depth for Safety**

A minimum of one foot of depth shall be added to the design storage volume to reduce the risk of overtopping. This depth is not intended to add storage capacity. See Figure 1.

8. **Remaining Waste and Sumps**

An additional depth shall be added to the facility to accommodate the waste that cannot be routinely removed during emptying. A minimum of two feet shall be added to storage depth for facilities with side slopes and one foot for vertical walled facilities. The additional storage depth can be reduced if a sump is installed or other provisions to empty the facility have been made.

9. **Separation from Subsurface Saturation or Bedrock**

The separation is determined to be the closest distance from any point on the inside surface (bottom and sides) of the storage facility to the feature from which separation is required.

The definition of subsurface saturation is not intended for application in any context other than to protect structures installed from hydrostatic loadings.

a. For the purposes of this standard, factors used to identify subsurface saturation shall include observed saturation, gleyed soil, gray mottles, and soil color in conjunction with nearby surface water features. The highest subsurface saturation elevation in a test pit/soil boring will be identified by any of the following soil properties.

   1) Free water or wet soil identified by glistening, due to the slow release of water.


EMBANKMENTS
DOWNSTREAM
SOMETIMES USED

levels or saturated soils. The lowest point at which floodwater could enter the waste storage facility shall be 2 feet above the maximum elevation of flow resulting from a 100-year, 24-hour rainfall event.

4. **Location**

Waste storage facilities shall be located so the potential impacts from breach of embankment, accidental release, and liner failure are minimized. Potential failures and environmental impacts identified in the site assessment shall be addressed in the design phase, the operation and maintenance plan, and/or the emergency action plan.

5. **Design Storage Volume**

Design storage volumes shall be calculated with the procedures and default values found in the Wisconsin supplement to Chapter 10 of the NRCS Agricultural Waste Management Field Handbook (AWMFH) or site-specific estimates and measurements documented in the plan. The design storage duration and volume shall be consistent with the nutrient management plan and emptying schedule. Design volume shall include the sum of the following during the storage period:

- Manure, bedding and other wastes.
- The volume of wastewater from all sources that is anticipated to enter the storage facility. The wastewater volume shall be based on default values or estimates and measurements documented in the plan.
- Normal precipitation less evaporation on the surface of the facility.
- Runoff volumes from the drainage area for design storage duration.
- 25-year, 24-hour precipitation on the surface of the facility.
- 25-year, 24-hour runoff volume from the drainage area.

6. **Maximum Operating Level**

The maximum operating level for liquid or slurry waste storage facilities shall be the storage level that provides for the design storage volume listed in Section V.A.5 less the volume of precipitation and runoff from the 25-year, 24-hour storm event. See Figure 1.

A permanent marker or indicator that does not compromise the integrity of the liner shall be installed at the maximum operating level. The stored waste shall be managed such that it remains below the maximum operating level during normal operating conditions. State or local codes may require additional markers.

A contingency plan shall be implemented when the maximum operating level is reached.

7. **Extra Depth for Safety**

A minimum of one foot of depth shall be added to the design storage volume to reduce the risk of overtopping. This depth is not intended to add storage capacity. See Figure 1.

8. **Remaining Waste and Sumps**

An additional depth shall be added to the facility to accommodate the waste that cannot be routinely removed during emptying. A minimum of two feet shall be added to storage depth for facilities with side slopes and one foot for vertical walled facilities. The additional storage depth can be reduced if a sump is installed or other provisions to empty the facility have been made.

9. **Separation from Subsurface Saturation or Bedrock**

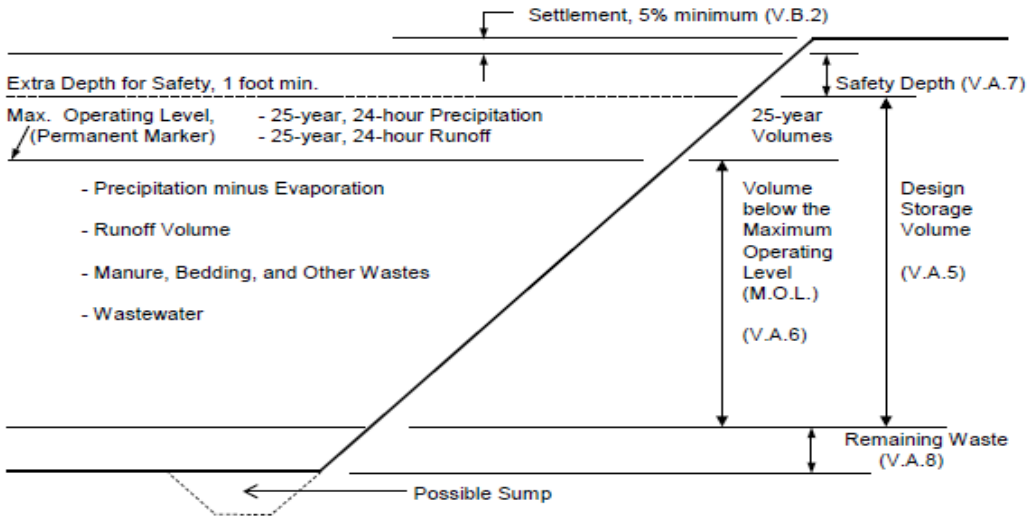
The separation is determined to be the closest distance from any point on the inside surface (bottom and sides) of the storage facility to the feature from which separation is required.

The definition of subsurface saturation is not intended for application in any context other than to protect structures installed from hydrostatic loadings.

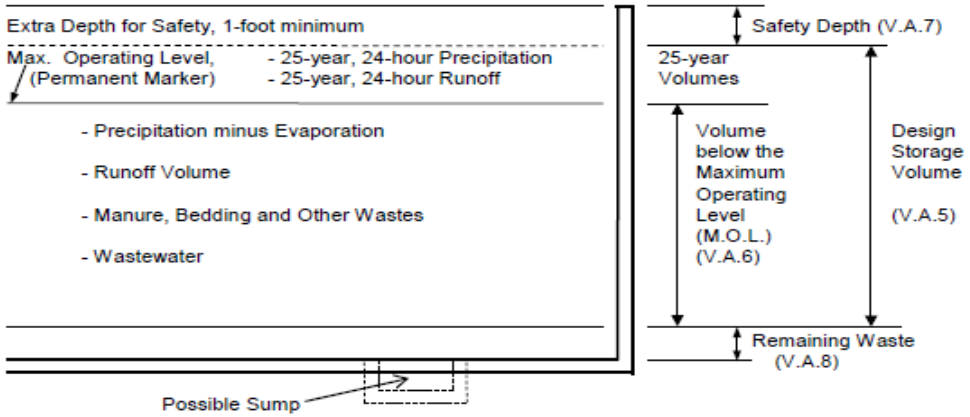
a. For the purposes of this standard, factors used to identify subsurface saturation shall include observed saturation, gleyed soil, gray mottles, and soil color in conjunction with nearby surface water features. The highest subsurface saturation elevation in a test pit/soil boring will be identified by any of the following soil properties.

   1) Free water or wet soil identified by glistening, due to the slow release of water.

Figure 1
Design Storage Volume



IMPOUNDMENT



STRUCTURE

levels or saturated soils. The lowest point at which floodwater could enter the waste storage facility shall be 2 feet above the maximum elevation of flow resulting from a 100-year, 24-hour rainfall event.

4. **Location**

Waste storage facilities shall be located so the potential impacts from breach of embankment, accidental release, and liner failure are minimized. Potential failures and environmental impacts identified in the site assessment shall be addressed in the design phase, the operation and maintenance plan, and/or the emergency action plan.

5. **Design Storage Volume**

Design storage volumes shall be calculated with the procedures and default values found in the Wisconsin supplement to Chapter 10 of the NRCS Agricultural Waste Management Field Handbook (AWMFH) or site-specific estimates and measurements documented in the plan. The design storage duration and volume shall be consistent with the nutrient management plan and emptying schedule. Design volume shall include the sum of the following during the storage period:

- Manure, bedding and other wastes.
- The volume of wastewater from all sources that is anticipated to enter the storage facility. The wastewater volume shall be based on default values or estimates and measurements documented in the plan.
- Normal precipitation less evaporation on the surface of the facility.
- Runoff volumes from the drainage area for design storage duration.
- 25-year, 24-hour precipitation on the surface of the facility.
- 25-year, 24-hour runoff volume from the drainage area.

6. **Maximum Operating Level**

The maximum operating level for liquid or slurry waste storage facilities shall be the storage level that provides for the design storage volume listed in Section V.A.5 less the volume of precipitation and runoff from the 25-year, 24-hour storm event. See Figure 1.

A permanent marker or indicator that does not compromise the integrity of the liner shall be installed at the maximum operating level. The stored waste shall be managed such that it remains below the maximum operating level during normal operating conditions. State or local codes may require additional markers.

A contingency plan shall be implemented when the maximum operating level is reached.

7. **Extra Depth for Safety**

A minimum of one foot of depth shall be added to the design storage volume to reduce the risk of overtopping. This depth is not intended to add storage capacity. See Figure 1.

8. **Remaining Waste and Sumps**

An additional depth shall be added to the facility to accommodate the waste that cannot be routinely removed during emptying. A minimum of two feet shall be added to storage depth for facilities with side slopes and one foot for vertical walled facilities. The additional storage depth can be reduced if a sump is installed or other provisions to empty the facility have been made.

9. **Separation from Subsurface Saturation or Bedrock**

The separation is determined to be the closest distance from any point on the inside surface (bottom and sides) of the storage facility to the feature from which separation is required.

The definition of subsurface saturation is not intended for application in any context other than to protect structures installed from hydrostatic loadings.

a. For the purposes of this standard, factors used to identify subsurface saturation shall include observed saturation, gleyed soil, gray mottles, and soil color in conjunction with nearby surface water features. The highest subsurface saturation elevation in a test pit/soil boring will be identified by any of the following soil properties.

   1) Free water or wet soil identified by glistening, due to the slow release of water.

2) Gleyed soil, that may extend uninterrupted from an observed free water surface.

3) The presence of distinct gray redoximorphic features with a chroma of 2 or less based on Munsell color charts.

4) Depleted matrices having a value of 4 or more and chroma 2 or less based on Munsell color charts. In some cases soil parent materials have a natural color of 2 chroma or less or gleyed color that is not due to saturation. In these cases other indicators may be used: landscape position, elevation or soils in relation to nearby water features.

b. In soils not conducive to mottling, such as sand, the subsurface saturation elevation shall be established by evaluating the soil morphology of the soil profile. Other indicators that may be considered in making the determination are the position of the soil in the landscape, topography, nearby wetlands and well construction logs.

c. Subsurface saturation, if encountered shall not be drained (or have water-bearing layers removed) except as described for *perched conditions*. Perched conditions may be drained or water-bearing materials removed to achieve separation distances in the tables and relieve hydrostatic loads on the facility. Documentation to demonstrate that subsurface saturation is perched and of drainable extent or its effects otherwise eliminated shall be included in the site assessment. All *drainage systems* shall drain by gravity. The effect of temporary tailwater on the structure or liner and the effects of outletting to perennial and intermittent waterways shall be evaluated. A drainage system shall be located around the outside perimeter of the facility footprint and drain to a surface outlet. A drainage system may also be located around the outside perimeter of an impoundment floor within the facility footprint if the drainage system outlets to a manhole that can be monitored for liquid level, and pumped if needed to remove liquids.

d. If the site assessment indicates artesian features, a hydrogeologic and geotechnical evaluation of the site shall be completed to determine the site suitability for an in-ground waste storage facility.

e. Excavation of bedrock is permitted to achieve the required separation distance as specified in the tables. Bedrock shall not be removed by blasting. The exposed bedrock surface shall be evaluated to ensure a structurally sound base for liner or other soil material. Fractures or voids shall be treated to prevent migration of soil material. The surface of excavated bedrock shall have a positive grade, minimum of 1 percent, under and away from the storage facility, as to prevent any significant ponding on the rock surface. If bedrock is excavated, the material placed between the liner and the bedrock shall have a minimum of 20% passing the #200 sieve.

10. Safety Design

Safety design shall identify and minimize the hazards to animals and people. In particular, waste storage facility designs may create *confined spaces,* which may pose significant hazards in terms of the inhalation of poisonous gases, asphyxiation, or explosion. At a minimum, safety design shall include the following.

a. Warning signs, fences, ladders, ropes, rails, and other devices shall be provided, as appropriate. A fence is required unless the waste storage facility has vertical walls 5 feet above the ground surface or the waste storage facility has a cover that will support foot traffic. Fences shall discourage passage of livestock and people. The fence design needs to consider the production site conditions.

b. Safety stops, gates, or both installed at push-off ramps and load-out areas of impoundments and structures to prevent accidental entry of machinery.

c. Equipment access ramps and embankment slopes shall be compatible with the equipment intended to be used.

d. Confined spaces where human entry may occur shall be designed and operated in compliance with the provisions contained in ASABE EP470, Manure Storage Safety.

11. Engineering Design Documentation

Engineering design documentation shall be prepared in accordance with the criteria of this standard. The design documentation shall include:

- Management assessment,
- Site assessment,
- Operation and maintenance plan,
- Construction plan,
- Construction Quality Assurance Plan,
- Engineering computations, such as runoff, structural (unless using NRCS Standard Drawings), earthwork quantities, and volumetric computations for sizing of waste storage facility.

Documentation for siting temporary, unconfined stacks of manure and derivatives outside the animal production area shall include:

- Management assessment,
- Site assessment, and
- Location maps, soils maps, and USGS quadrangle maps.

12. Construction Plans and Specifications

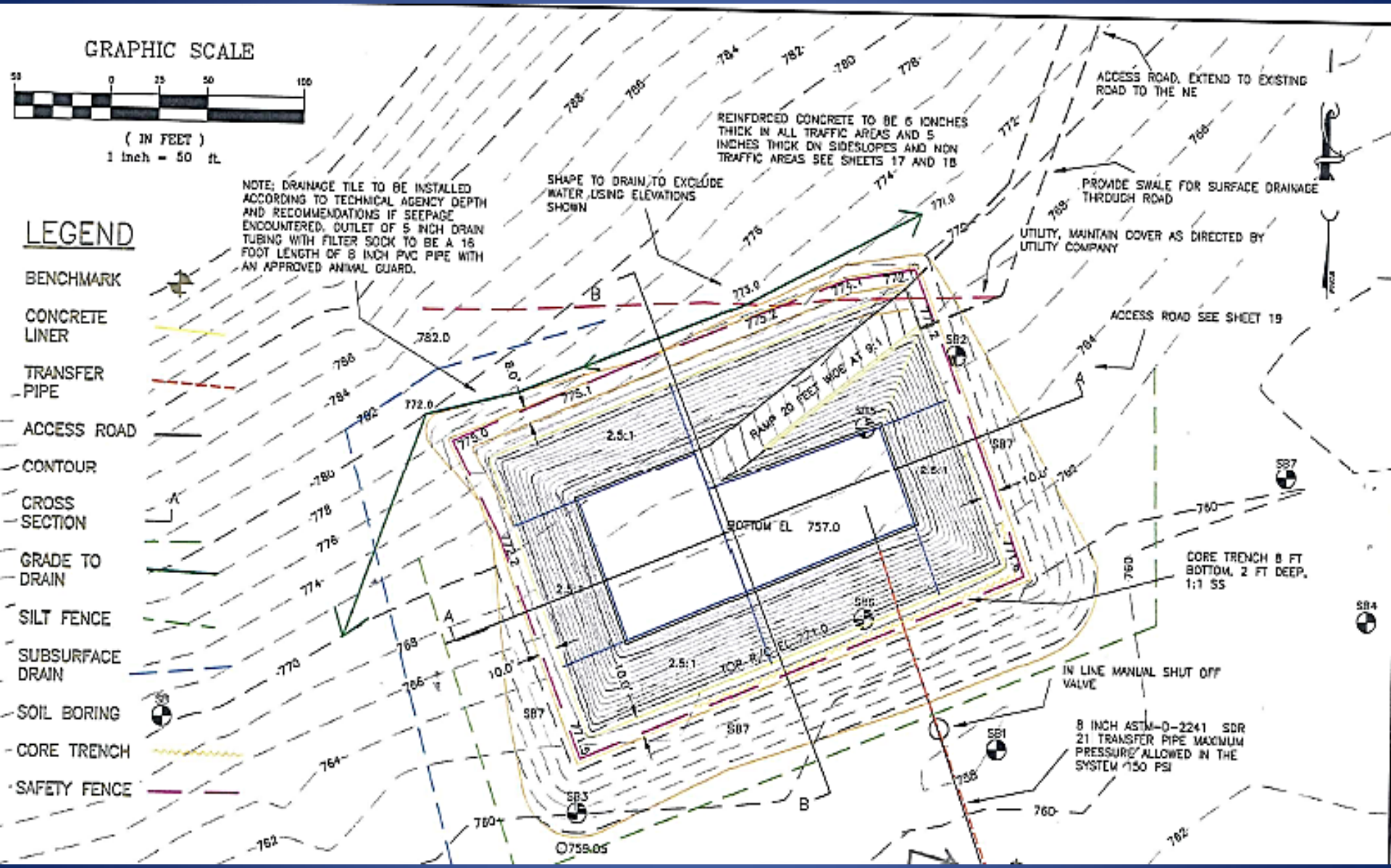
Construction plans and specifications for materials and installation shall be prepared to serve as a basis for construction of the practice. Construction plans and specifications shall include, as applicable:

- Plan view of system layout.
- Minimum of two cross sections, perpendicular to each other, for each waste storage facility.
- Structural details of components sufficient to clearly show the construction requirements.
- Details for joining different liner types or new liners to existing liners.
- Locations, sizes, and type of pipelines and appurtenances, including a profile of the waste transfer system.
- Requirements for foundation preparation and treatment, including bedrock treatment.
- References to components supplied by others (pumps, etc.).
- Vegetative requirements.
- Surface Drainage/Grading plan.
- Subsurface drainage details.
- Location of soil test pits within 100 feet of the facility footprint on the plan view, and a summary of soil logs plotted on the cross sections or profile.
- Identification of borrow source location(s)
- Safety features, roof covers, fencing, ladders, and safety signs.
- Construction site erosion control practices
- Approximate location of utilities and notification requirements.
- Specifications for materials and installation.
- Signature of the person responsible for the design, their engineering seal, NRCS Job Approval or WDATCP Agricultural Engineering Practitioner Certification level, the date, and a statement attesting the plans meet the requirements of the WI FOTG 313 Conservation Practice Standard.
- Other site-specific information necessary to construct the waste storage facility.

13. Construction Quality Assurance Plan

A construction quality assurance plan is required that describes the type and frequency of testing, items requiring observation, and the documentation required. The plan shall be implemented by a person with NRCS Job Approval, WDATCP Agricultural Engineering Practitioner Certification, a Wisconsin registered professional engineer, or staff under the direction and control of the person holding the aforementioned credentials. The construction quality assurance plan shall address all the following items:

- Contact information and responsibilities of key parties (including owner, designer, construction observer, and contractor).
- Pre-construction meeting agenda items (including quality assurance plan, construction plans and specifications,


GRAPHIC SCALE
50 0 25 50 100
(IN FEET)
1 inch = 50 ft
LEGEND
BENCHMARK
CONCRETE LINER
TRANSFER PIPE
ACCESS ROAD
CONTOUR
CROSS SECTION
GRADE TO DRAIN
SILT FENCE
SUBSURFACE DRAIN
SOIL BORING
CORE TRENCH
SAFETY FENCE
NOTE; DRAINAGE TILE TO BE INSTALLED ACCORDING TO TECHNICAL AGENCY DEPTH AND RECOMMENDATIONS IF SEEPAGE ENCOUNTERED. OUTLET OF 5 INCH DRAIN TUBING WITH FILTER SOCK TO BE A 16 FOOT LENGTH OF 8 INCH PVC PIPE WITH AN APPROVED ANIMAL GUARD.
SHAPE TO DRAIN TO EXCLUDE WATER USING ELEVATIONS SHOWN
REINFORCED CONCRETE TO BE 6 INCHES THICK IN ALL TRAFFIC AREAS AND 5 INCHES THICK ON SIDESLOPES AND NON TRAFFIC AREAS SEE SHEETS 17 AND 18
ACCESS ROAD, EXTEND TO EXISTING ROAD TO THE NE
PROVIDE SWALE FOR SURFACE DRAINAGE THROUGH ROAD
UTILITY, MAINTAIN COVER AS DIRECTED BY UTILITY COMPANY
ACCESS ROAD SEE SHEET 19
RAMP 20 FEET WIDE AT 9:1
BOTTOM EL 757.0
TOP R/C EL 771.0
2.5:1
10.0'
CORE TRENCH 8 FT BOTTOM, 2 FT DEEP, 1:1 SS
IN LINE MANUAL SHUT OFF VALVE
8 INCH ASTM-D-2241 SDR 21 TRANSFER PIPE MAXIMUM PRESSURE ALLOWED IN THE SYSTEM 150 PSI
SB1
SB2
SB3
SB4
SB5
SB6
SB7
759.05

c. Equipment access ramps and embankment slopes shall be compatible with the equipment intended to be used.

d. Confined spaces where human entry may occur shall be designed and operated in compliance with the provisions contained in ASABE EP470, Manure Storage Safety.

11. Engineering Design Documentation

Engineering design documentation shall be prepared in accordance with the criteria of this standard. The design documentation shall include:

- Management assessment,
- Site assessment,
- Operation and maintenance plan,
- Construction plan,
- Construction Quality Assurance Plan,
- Engineering computations, such as runoff, structural (unless using NRCS Standard Drawings), earthwork quantities, and volumetric computations for sizing of waste storage facility.

Documentation for siting temporary, unconfined stacks of manure and derivatives outside the animal production area shall include:

- Management assessment,
- Site assessment, and
- Location maps, soils maps, and USGS quadrangle maps.

12. Construction Plans and Specifications

Construction plans and specifications for materials and installation shall be prepared to serve as a basis for construction of the practice. Construction plans and specifications shall include, as applicable:

- Plan view of system layout.
- Minimum of two cross sections, perpendicular to each other, for each waste storage facility.
- Structural details of components sufficient to clearly show the construction requirements.
- Details for joining different liner types or new liners to existing liners.
- Locations, sizes, and type of pipelines and appurtenances, including a profile of the waste transfer system.
- Requirements for foundation preparation and treatment, including bedrock treatment.
- References to components supplied by others (pumps, etc.).
- Vegetative requirements.
- Surface Drainage/Grading plan.
- Subsurface drainage details.
- Location of soil test pits within 100 feet of the facility footprint on the plan view, and a summary of soil logs plotted on the cross sections or profile.
- Identification of borrow source location(s)
- Safety features, roof covers, fencing, ladders, and safety signs.
- Construction site erosion control practices
- Approximate location of utilities and notification requirements.
- Specifications for materials and installation.
- Signature of the person responsible for the design, their engineering seal, NRCS Job Approval or WDATCP Agricultural Engineering Practitioner Certification level, the date, and a statement attesting the plans meet the requirements of the WI FOTG 313 Conservation Practice Standard.
- Other site-specific information necessary to construct the waste storage facility.

13. Construction Quality Assurance Plan

A construction quality assurance plan is required that describes the type and frequency of testing, items requiring observation, and the documentation required. The plan shall be implemented by a person with NRCS Job Approval, WDATCP Agricultural Engineering Practitioner Certification, a Wisconsin registered professional engineer, or staff under the direction and control of the person holding the aforementioned credentials. The construction quality assurance plan shall address all the following items:

- Contact information and responsibilities of key parties (including owner, designer, construction observer, and contractor).
- Pre-construction meeting agenda items (including quality assurance plan, construction plans and specifications,

design change procedures, and critical project-specific items).
- Observation and construction verification (including items to be verified, sequencing, layout/staking, notification requirements, and onsite materials testing documentation).
- Items to be noted on as-built plans, job diary, and other certification (attesting) documentation.

14. Operation and Maintenance

An operation and maintenance plan shall be developed that is consistent with the purposes of this practice, intended life of the components, safety requirements, and the criteria for the design. At a minimum, the plan shall include:

a. A narrative describing the purpose of the system or structure and how it is intended to operate. This narrative should include design criteria such as number and type of animals, type of waste, type of bedding, days of storage, method for emptying, vehicle sizes intended to operate within or near the system and other pertinent operational information.

b. A requirement that waste be removed and utilized in accordance with Wisconsin NRCS Field Office Technical Guide, Section IV (WI FOTG), Standard 590, Nutrient Management.

c. Requirements for location and methods of waste removal in order to maintain liner integrity.

d. Requirements for monitoring the waste level relative to the permanent maximum operating level markers or indicators.

e. Requirements for inspecting and maintaining the structural components and mechanical systems.

f. A requirement to contact the appropriate regulatory authority for approval prior to storing any off-farm waste material in a waste storage facility that has been constructed using the criteria in this standard.

g. A contingency plan, which shall be implemented when the maximum operating level is reached. The contingency plan shall include how to handle unexpected volumes of wastewater and/or runoff that could cause the system to overflow before scheduled emptying can occur. The contingency plan shall provide for the safe disposition of waste.

h. An emergency response plan to deal with failures, spills, or overflows at the animal production area to minimize environmental impacts.

i. Safety issues and procedures/requirements connected with waste storage facilities, including confined spaces.

15. Seeding and Mulching

Disturbed areas and embankments shall be seeded and mulched in accordance with WI FOTG Standard 342, Critical Area Planting.

B. Specific Criteria for Waste Storage Impoundments and Structures

Waste Storage impoundments and structures shall be designed to contain all wastes until emptied and utilized in accordance with the Operation and Maintenance Plan. The storage facilities may be used alone or in combination to contain the various waste streams. There shall be no gravity outlets from the waste storage as a means of emptying the facility. Flow from an auxiliary spillway must discharge to secondary containment. Gravity flow between waste storage facilities is acceptable, however a secondary containment or additional storage capacity must be provided for the potential waste volume release. The following specific criteria apply to this practice:

1. Concrete Liners

Floors and slabs used as a liner shall be designed for anticipated loads along with crack control and joint treatments stated below. Slabs on ground that will be subject to heavy truck or heavy equipment loads shall be designed in accordance with ACI 360, Guide to Design of Slabs-on-Ground and Concrete Floors on Ground, Chapter 5, Portland Cement Association (PCA).

a. Concrete with waterstop – The concrete shall contain distributed reinforcing steel, and all joints shall have embedded waterstop in accordance with Wisconsin FOTG Construction Specification 4, Concrete (Spec. 4).

IF ITS NOT REQUIRED UP FRONT IN THE INSPECTION PLAN WE CAN'T ASK FOR IT LATER

Addendum #1

INSPECTION PLAN

erformed as stated below:
NRCS Job Approval;
WDATCP Agricultural Engineering Practitioner Certification;

c. Staff under the direction and control of the person holding the aforementioned credentials.

B. Waterstop Specifications:

1. Waterstop shall be 3/16"x6" PVC, ribbed with center bulb.

2. Waterstop shall be secured in place at all construction joints.

3. Embedded waterstops shall be located as shown on the drawings and secured in position so that displacement does not occur during concrete placement. Vertical applications (footing to wall joints and wall to wall joints) shall be secured to reinforcement using wire or "hog ring" type fasteners or factory installed grommets at the outermost rib at the spacing as recommended by the waterstop manufacturer (usually 12 inches on center). Hog rings shall be factory installed, if the manufacturer has that option available. Each waterstop shall be placed and secured with the hollow bulb aligned in the center of the planned joint.

4. Waterstop clearance shall be a minimum of one half the waterstops width to the face of the concrete (3" for 6" wide waterstop)

5. All corners, joints and intersections shall have welded connections.

6. Manufacturers' fabricated waterstop intersections shall be provided. Only straight butt joint splices are allowed for field fabrication. Splices in waterstops shall be welded as recommended by the manufacturer. Manufacturer certified contractors may fabricate waterstop intersections in a controlled environment and with proper manufacturers' equipment. Prior to the time of delivery of fabricated intersections, documentation of certification must be presented to the technician.

7. Construction joints on the floor must be constructed at a maximum of 100'x100' spacing.

5.0 Documentation of Construction

The DNR and NRCS requires that a Final Inspection Report be submitted by the project engineer to the department upon completion of construction. The report shall indicate that the structure(s) have been constructed according to NRCS Technical Standards and identify field modifications to the approved plans. [redacted] will document activities at the construction site with photographs and field notes. Critical points during construction and required documentation are identified below.

Date and initial all documentation and keep in construction file.

PRECONSTRUCTION MEETING

- ✓ Establish pre-construction conference and notify all participants. (Owner, [redacted] any county agencies concerned with project)
  Meeting at the site
- ✓ Review plans, specifications, and inspection plan. Address questions. Discuss anticipated schedules. Records names of individuals and company present.
  Meeting at the site
- ✓ Verify that the landowner or contractor notified all utilities prior to construction. Document Diggers Hotline Ticket Number_____

- ✓ Inspection services are to be provided under the direct supervision of the Project Engineer. **Inspection personnel from** [redacted]

- ✓ Provide photo documentation throughout the construction process.
  See materials documentation and construction photo sections

MATERIAL INSPECTION

- ✓ Concrete materials/mix. Verify meets Spec. 4 and attach material documentation.
  See attached concrete mix and batch tickets
- ✓ Reinforcing Steel. Verify steel grade as shown in plans (Grade 60). Free of loose rust, oil, grease, paint, or other deleterious matter. Document markings or save tags. **Inspection by** [redacted]

design change procedures, and critical project-specific items).
- Observation and construction verification (including items to be verified, sequencing, layout/staking, notification requirements, and onsite materials testing documentation).
- Items to be noted on as-built plans, job diary, and other certification (attesting) documentation.

14. Operation and Maintenance

An operation and maintenance plan shall be developed that is consistent with the purposes of this practice, intended life of the components, safety requirements, and the criteria for the design. At a minimum, the plan shall include:

a. A narrative describing the purpose of the system or structure and how it is intended to operate. This narrative should include design criteria such as number and type of animals, type of waste, type of bedding, days of storage, method for emptying, vehicle sizes intended to operate within or near the system and other pertinent operational information.

b. A requirement that waste be removed and utilized in accordance with Wisconsin NRCS Field Office Technical Guide, Section IV (WI FOTG), Standard 590, Nutrient Management.

c. Requirements for location and methods of waste removal in order to maintain liner integrity.

d. Requirements for monitoring the waste level relative to the permanent maximum operating level markers or indicators.

e. Requirements for inspecting and maintaining the structural components and mechanical systems.

f. A requirement to contact the appropriate regulatory authority for approval prior to storing any off-farm waste material in a waste storage facility that has been constructed using the criteria in this standard.

g. A contingency plan, which shall be implemented when the maximum operating level is reached. The contingency plan shall include how to handle unexpected volumes of wastewater and/or runoff that could cause the system to overflow before scheduled emptying can occur. The contingency plan shall provide for the safe disposition of waste.

h. An emergency response plan to deal with failures, spills, or overflows at the animal production area to minimize environmental impacts.

i. Safety issues and procedures/requirements connected with waste storage facilities, including confined spaces.

15. Seeding and Mulching

Disturbed areas and embankments shall be seeded and mulched in accordance with WI FOTG Standard 342, Critical Area Planting.

B. Specific Criteria for Waste Storage Impoundments and Structures

Waste Storage impoundments and structures shall be designed to contain all wastes until emptied and utilized in accordance with the Operation and Maintenance Plan. The storage facilities may be used alone or in combination to contain the various waste streams. There shall be no gravity outlets from the waste storage as a means of emptying the facility. Flow from an auxiliary spillway must discharge to secondary containment. Gravity flow between waste storage facilities is acceptable, however a secondary containment or additional storage capacity must be provided for the potential waste volume release. The following specific criteria apply to this practice:

1. Concrete Liners

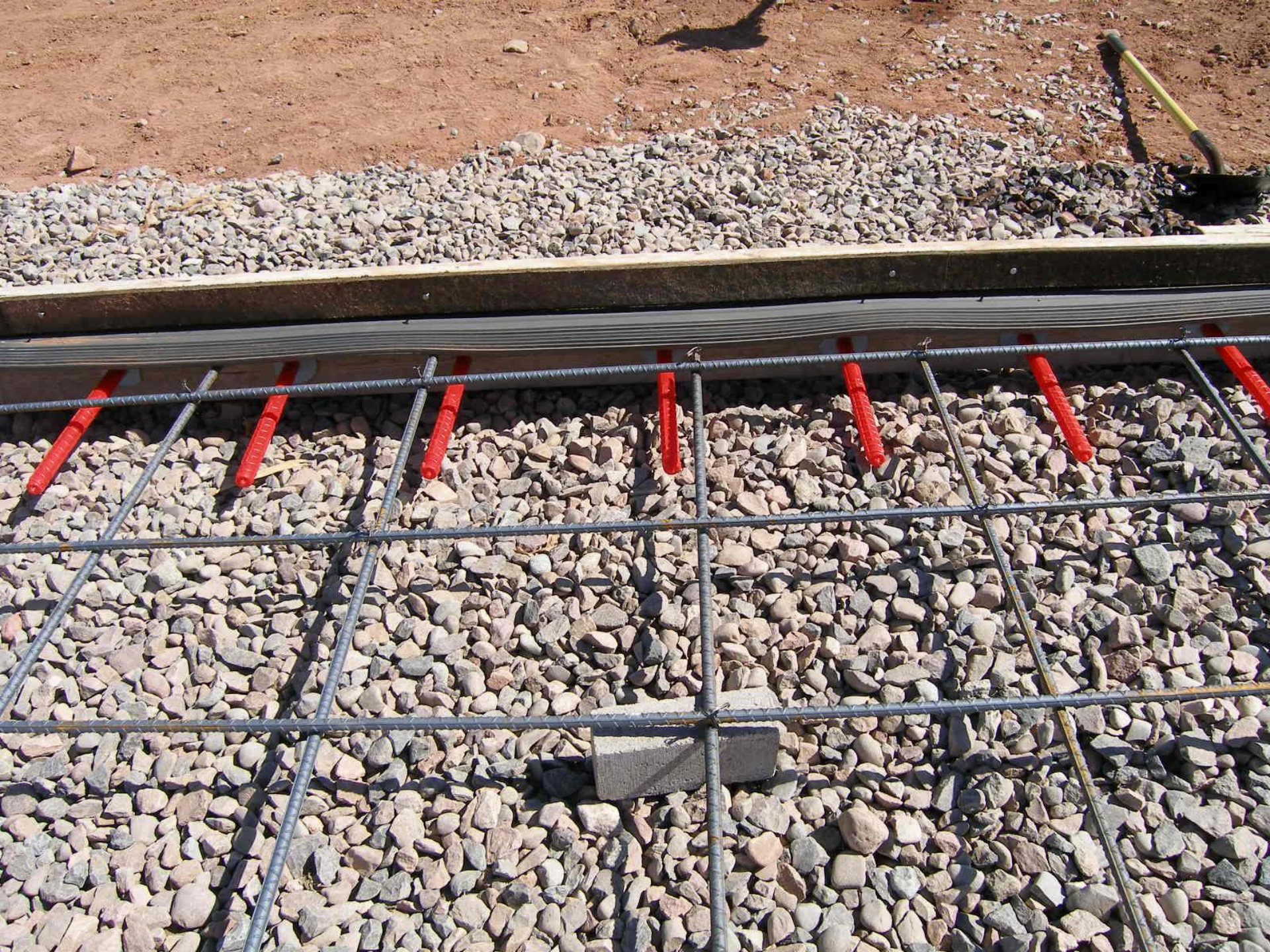
Floors and slabs used as a liner shall be designed for anticipated loads along with crack control and joint treatments stated below. Slabs on ground that will be subject to heavy truck or heavy equipment loads shall be designed in accordance with ACI 360, Guide to Design of Slabs-on-Ground and Concrete Floors on Ground, Chapter 5, Portland Cement Association (PCA).

a. Concrete with waterstop – The concrete shall contain distributed reinforcing steel, and all joints shall have embedded waterstop in accordance with Wisconsin FOTG Construction Specification 4, Concrete (Spec. 4).


705
50FT CALL GREENSTREAK 1-800-325-9504 MADE IN


WESTEC TPE-R 619 426837 FACTORY FABRICATIONS


DOWELS
CONSTRUCTION
JOINTS REQUIRED IN
TRAFFIC AREAS



A waterstop joint plan shall be included in the construction plans and contain the following: location of joints; cross-section details of joint(s); waterstop materials including factory fabricated corners, intersections, and transitions; installation specifications; and a quality assurance plan.

Construction quality assurance requirements for waterstop installation shall, at a minimum, include verification and documentation of the adequacy of the formwork, waterstop placement and welding prior to placement of the concrete, and continuous inspection during placement of concrete around embedded waterstop to ensure consolidation. The inspection shall be performed by a person under the direction and control of the individual responsible for approving the as-built construction plan. The person providing the inspection may not be an employee of the contractor or the owner.

A concrete mix in accordance with WI Spec. 4 shall be used.

Floors and slabs shall contain temperature and shrinkage reinforcing steel equal to or greater than shown in Table A. Steel shall be placed in the top ⅓ of the slab thickness with a minimum clear distance from the top of the slab of 1.5 inches.

Additional waterstop *control joints* shall be planned where stresses can be predicted to exceed the reinforcing steel's ability to restrain cracking and minimize leakage.

All waterstop joints in areas subject to equipment traffic shall be designed with a dowel system to transfer the load across the joint. Slab thickness changes at these joints shall be made with a minimum transition ratio of one inch of thickness change over ten inches of run (10:1).

Table A
Reinforcing Steel for Temperature and Shrinkage Control

Control Joint Spacing			
Concrete Thickness	Rebar Size (grade 60) and Spacing		
	≤ 100 ft.	≤ 150 ft.	≤ 175 ft.
≤ 5 "	#4 @ 18"	#4 @ 15"	#5 @ 18"
≤ 6 "	#4 @ 18"	#5 @ 18"	#5 @ 15"
≤ 7 "	#4 @ 15"	#5 @ 15"	#5 @ 12"
≤ 8 "	#5 @ 18"	#5 @ 15"	#5 @ 12"

b. Concrete soil composite – The concrete is in *intimate contact* with the soil and the concrete and soil work together to reduce seepage losses. Floors and slabs shall be a minimum of 5 inches thick with reinforcing consisting of #4 bars spaced at 18 inches on center each way. No control or *expansion joints* are required. The concrete shall be placed in intimate contact with the foundation soil. The reinforcing steel shall be continuous through all *construction joints*. Drain tile and/or drain fill material shall be kept outside of the soil component of the composite liner.

2. Impoundment Design Criteria

Soil criteria in Tables 1 through 5 refer to mineral soils. Construction shall not occur on or with organic soils.

Table 1 contains the criteria for constructing waste impoundments into existing soils with recompaction of the upper 1 foot of soil. Tables 2 through 5 contain the criteria for impoundments with liners.

A combination of liners is acceptable. There shall not be more than two liner types used in any one facility. The sump liner does not apply as a liner type in this regard. The liners shall be joined so as to preserve the performance and integrity of all liner types.

Concrete walls used within impoundments shall maintain the integrity of any liner.

Any penetration and overfall/outfalls of the liner shall be constructed to maintain the performance and integrity of the liner used.

FOTG Construction Specification 4, Concrete (Spec. 4).

A waterstop joint plan shall be included in the construction plans and contain the following: location of joints; cross-section details of joint(s); waterstop materials including factory fabricated corners, intersections, and transitions; installation specifications; and a quality assurance plan.

Construction quality assurance requirements for waterstop installation shall, at a minimum, include verification and documentation of the adequacy of the formwork, waterstop placement and welding prior to placement of the concrete, and continuous inspection during placement of concrete around embedded waterstop to ensure consolidation. The inspection shall be performed by a person under the direction and control of the individual responsible for approving the as-built construction plan. The person providing the inspection may not be an employee of the contractor or the owner.

A concrete mix in accordance with WI Spec. 4 shall be used.

Table A
Reinforcing Steel for Temperature and Shrinkage Control

Control Joint Spacing			
Concrete Thickness	**Rebar Size (grade 60) and Spacing**		
	≤ 100 ft.	≤ 150 ft.	≤ 175 ft.
≤ 5 "	#4 @ 18"	#4 @ 15"	#5 @ 18"
≤ 6 "	#4 @ 18"	#5 @ 18"	#5 @ 15"
≤ 7 "	#4 @ 15"	#5 @ 15"	#5 @ 12"
≤ 8 "	#5 @ 18"	#5 @ 15"	#5 @ 12"

b. Concrete soil composite – The concrete is in *intimate contact* with the soil and the concrete and soil work together to reduce seepage losses. Floors and slabs shall be a minimum of 5 inches thick with reinforcing consisting of #4 bars spaced at 18 inches on center each way. No control or *expansion joints* are required. The concrete shall be placed in intimate contact with the foundation soil. The reinforcing steel shall be continuous through all *construction joints*. Drain tile and/or drain fill material shall be kept outside of the soil component of the composite liner.

2. Impoundment Design Criteria

Addendum #1

INSPECTION PLAN

A. Inspections:

1. Inspections shall be performed as stated below:
    a. A person with NRCS Job Approval;
    b. A person with WDATCP Agricultural Engineering Practitioner Certification;
    c. Staff under the direction and control of the person holding the aforementioned credentials.

B. Waterstop Specifications:

1. Waterstop shall be 3/16"x6" PVC, ribbed with center bulb.

2. Waterstop shall be secured in place at all construction joints.

3. Embedded waterstops shall be located as shown on the drawings and secured in position so that displacement does not occur during concrete placement. Vertical applications (footing to wall joints and wall to wall joints) shall be secured to reinforcement using wire or "hog ring" type fasteners or factory installed grommets at the outermost rib at the spacing as recommended by the waterstop manufacturer (usually 12 inches on center). Hog rings shall be factory installed, if the manufacturer has that option available. Each waterstop shall be placed and secured with the hollow bulb aligned in the center of the planned joint.

4. Waterstop clearance shall be a minimum of one half the waterstops width to the face of the concrete (3" for 6" wide waterstop)

5. All corners, joints and intersections shall have welded connections.

6. Manufacturers' fabricated waterstop intersections shall be provided. Only straight butt joint splices are allowed for field fabrication. Splices in waterstops shall be welded as recommended by the manufacturer. Manufacturer certified contractors may fabricate waterstop intersections in a controlled environment and with proper manufacturers' equipment. Prior to the time of delivery of fabricated intersections, documentation of certification must be presented to the technician.

7. Construction joints on the floor must be constructed at a maximum of 100'x100' spacing.

WATERSTOP SPECIFICATIONS

WATERSTOPS TO BE LOCATED AS SHOWN ON PLAN.

WATERSTOP TO BE CENTERED ON JOINT AND HELD IN PLACE ON LOW STRENGTH CONCRETE BOX OUT WITH NAILS. THE NAILS SHALL TO EXTEND 4" MIN. PAST THE EDGE OF THE WATERSTOP.
AT JOINTS TO BE SAWED, PROVIDE EXTERIOR MARKS FOR THE LOCATION OF THE CENTER OF THE WATERSTOP TO ENSURE SAWED JOINT IS OVER THE CENTER OF THE WATERSTOP.

USE SOG, TO BE LOW STRENGTH CONCRETE.

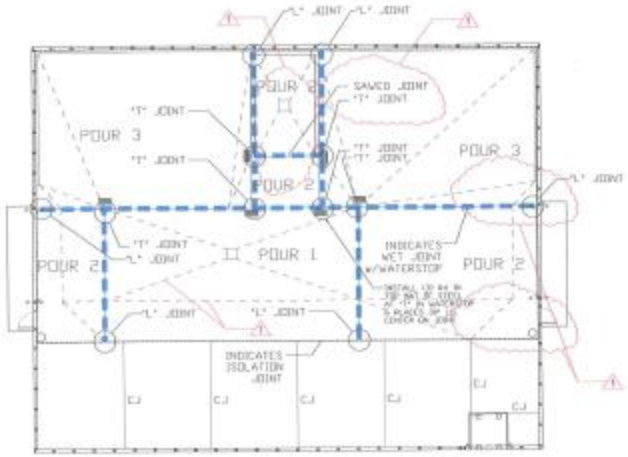
ALL "T" JOINTS TO BE FABRICATED BY MANUFACTURER.
END TO END BUTT JOINTS TO BE MADE SQUARE AND WELDED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.

WATERSTOPS ARE NOT TO BE PLACE HORIZONTALLY ACROSS SLOPED SLABS.

FLOOR REINFORCING NOT TO CONTINUE OVER WATERSTOPS.

THE CENTER OF THE WATERSTOP TO BE MARKED EXTERNALLY TO ENSURE JOINT IS CENTERED ON THE WATERSTOP.

ALL TOOLED GROOVES TO BE MADE WHEN THE CONCRETE IS STILL FORMABLE. ALL SAWED JOINTS TO BE DONE BETWEEN 24 HOURS OF THE POUR.



WATERSTOP PLAN

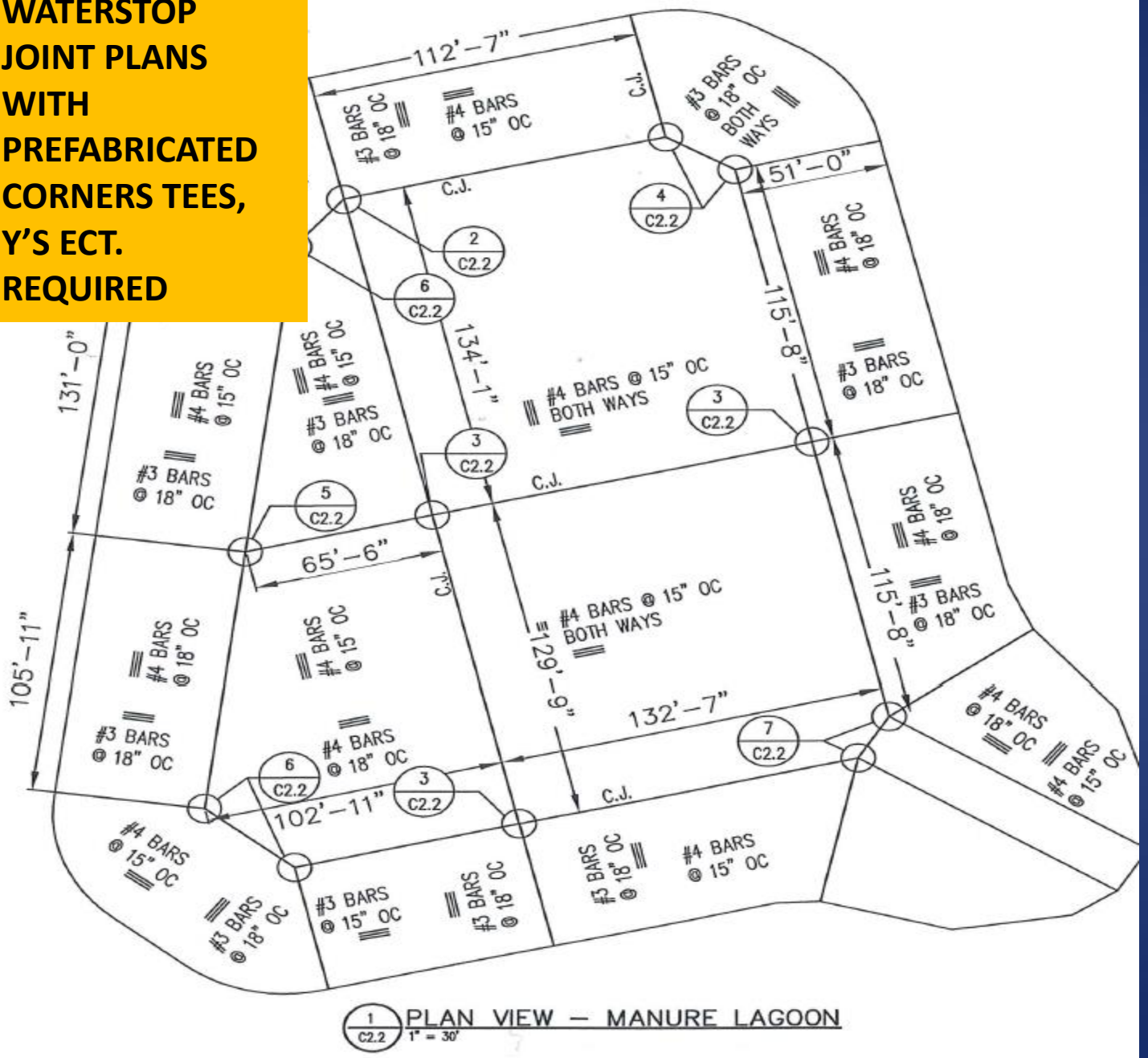
MENTE ENGINEERING

ALLIED COOPERATIVE
201 RAILROAD STREET
P.O. BOX 126
ADAMS, WI 53910

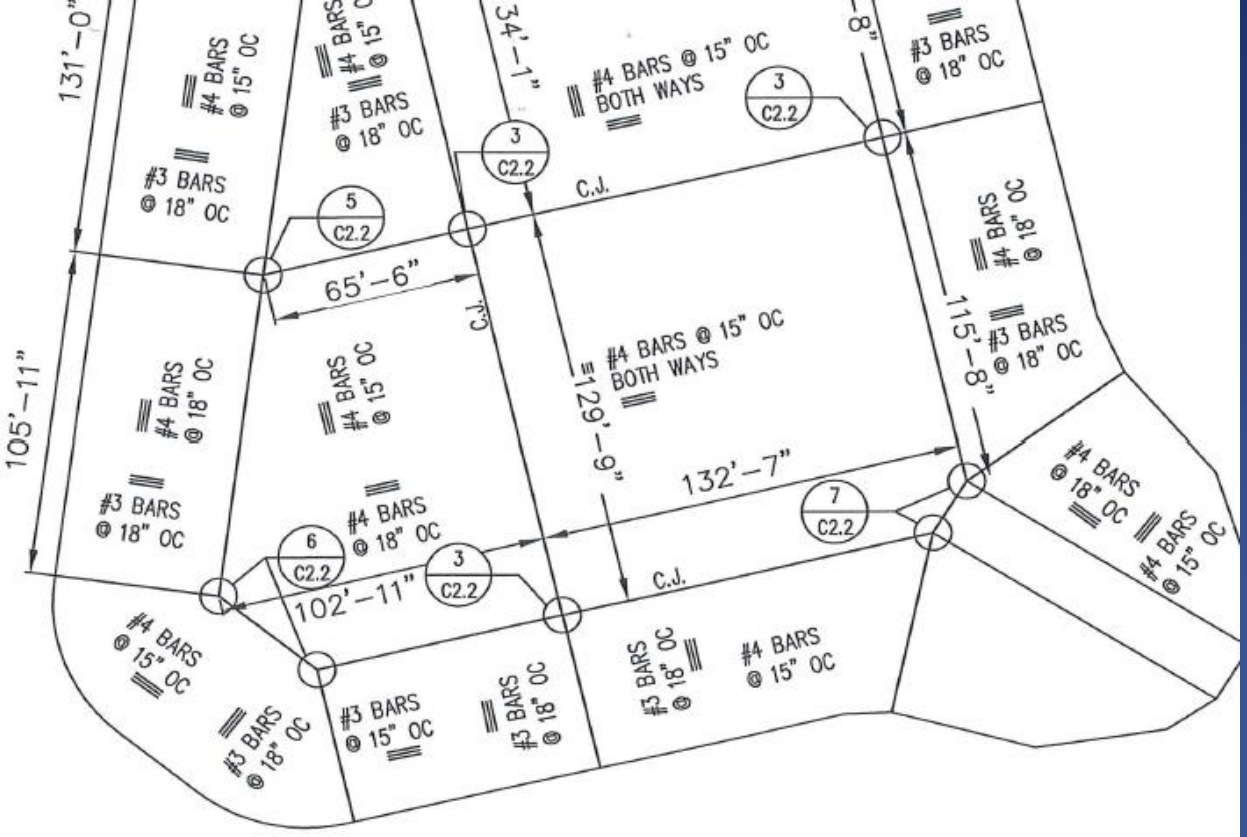
ALLIED COOPERATIVE
W10801 WISCONSIN ROAD
OAKDALE, WI
STORAGE BUILDING

S2.1

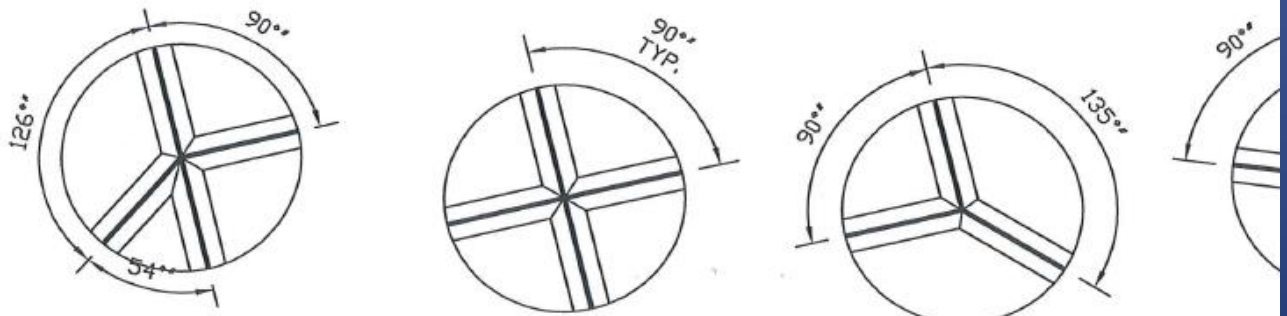
WATERSTOP JOINT PLANS WITH PREFABRICATED CORNERS TEES, Y'S ECT. REQUIRED



1 C2.2 PLAN VIEW — MANURE LAGOON
1" = 30'



1 C2.2 PLAN VIEW – MANURE LAGOON
1" = 30'

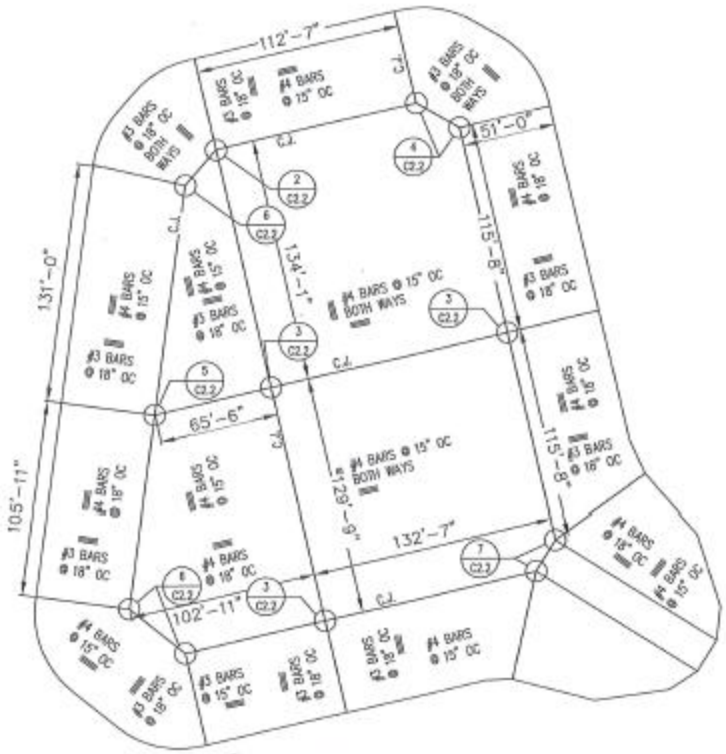


2 C2.2 WATERSTOP CROSS N.T.S.

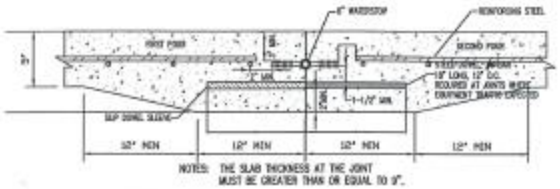
3 C2.2 WATERSTOP CROSS N.T.S.

4 C2.2 WATERSTOP "Y" N.T.S.

5 C2.2 WA N.T.S.



1 C2.2 PLAN VIEW – MANURE LAGOON
T-30



NOTES: THE SLAB THICKNESS AT THE JOINT MUST BE GREATER THAN OR EQUAL TO 9".

CROSS SECTION OF SLAB AT WATERSTOP JOINT AS REQUIRED DURING CONSTRUCTION
N.T.S.

NOTES:

1. SEE CONSTRUCTION SPECIFICATIONS FOR MATERIAL REQUIREMENTS SUCH AS CONCRETE, REINFORCING STEEL AND WATER STOPS.
2. INSTALL WATER STOP AT ALL CONTROL JOINTS. ALL WATERSTOPS TO MEET WISCONSIN CONSTRUCTION SPECIFICATION 4. GREENSTREAK 705 (OR EQUIV)
3. FACTORY CORNERS & TRANSITIONS SHALL BE USED, LEAVING ONLY STRAIGHT BUTT JOINT SPLICES FOR FIELD WELDING.
4. IF PERCHED WATER POCKETS ARE ENCOUNTERED, NOTIFY ENGINEER. CORRECTIVE MEASURES WILL BE TAKEN IN THE FIELD AFTER ENGINEER'S EVALUATION OF WATER POCKET. (PERCHED WATER POCKETS ARE NOT ANTICIPATED AT THIS PROJECT LOCATION)
5. ANY BEDROCK ENCOUNTERED SHALL BE OVER-EXCAVATED A MINIMUM OF 2' AND REPLACED WITH SUITABLE SOIL MATERIAL (P200>20%). BEDROCK IS ANTICIPATED IN THE SOUTHEAST CORNER OF THE PROPOSED LAGOON.

INSTALLATION AS PER MANUFACTURER

A. FIELD BUTT SPLICES SHALL BE HEAT FUSED WELDED USING A TEFLON COATED THERMOSTATICALLY CONTROLLED WATERSTOP SPLICING IRON AT APPROXIMATELY 380 DEGREES F. FOLLOW APPROVED MANUFACTURER RECOMMENDATIONS. LAPPING OF WATERSTOP, USE OF ADHESIVES, OR SOLVENTS SHALL NOT BE ALLOWED.

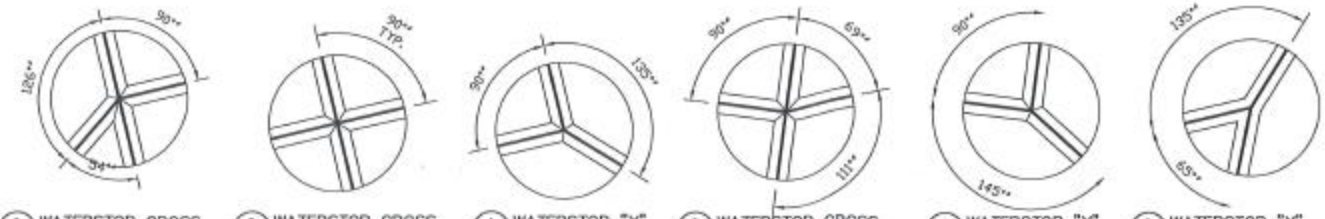
B. CENTER WATERSTOP IN JOINT AND SECURE WATER STOP IN CORRECT POSITION USING HOG RINGS OR GROMMETS SPACED AT 12" ON CENTER ALONG THE LENGTH OF THE WATERSTOP AND WIRE TIE TO ADJACENT REINFORCEMENT, PER MANUFACTURER RECOMMENDATIONS. LAPPING OF WATERSTOP, USE OF ADHESIVES, OR SOLVENTS SHALL NOT BE ALLOWED.

C. PLACE CONCRETE WITHOUT DISPLACING THE WATERSTOP.

D. VIBRATE CONCRETE AROUND WATERSTOP TO PREVENT VOIDS.

E. AFTER FIRST POUR, CLEAN UNEMBEDDED WATERSTOP WEB TO INSURE FULL CONTACT WITH THE SECOND POUR.

F. WATERSTOP INSTALLATION SHALL BE IN STRICT COMPLIANCE WITH MANUFACTURER'S REQUIREMENTS.



2 C2.2 WATERSTOP CROSS N.T.S.
3 C2.2 WATERSTOP CROSS N.T.S.
4 C2.2 WATERSTOP "Y" N.T.S.
5 C2.2 WATERSTOP CROSS N.T.S.
6 C2.2 WATERSTOP "Y" N.T.S.
7 C2.2 WATERSTOP "Y" N.T.S.

Concrete With Waterstop

- Has its own quality assurance plan
- Verification and documentation of adequacy of formwork
- Verification of adequacy of waterstop placement and welding prior to concrete placement
- *Continuous* Inspection during placement of concrete around embedded waterstop to ensure consolidation

Concrete With Waterstop

- Verification and documentation of adequacy of formwork

Concrete With Waterstop

- Verification and documentation of adequacy of formwork
- Verification of adequacy of waterstop placement and welding prior to concrete placement


STRAIGHT BUTT JOINTS ALLOWED IN THE FIELD PREFABRICATED PIECES REQUIRED FOR CROSSES, TEE'S CORNERS. Y'S ECT.


ST. LOUIS, MO.

Concrete With Waterstop

- Verification and documentation of adequacy of formwork
- Verification of adequacy of waterstop placement and welding prior to concrete placement
- *Continuous* Inspection during placement of concrete around embedded waterstop to ensure consolidation

ALLIED COOP
GALESVILLE

P. WURZER

④

11-12-13

NUMBER 4 BARS

11/00/5/4/5/:/— GRADE 60

LEFT SITE AT 2:00 PM

PETER M WURZER
11-12-13

11-13-2013

STOPPED OUT TO SITE AT 8:00 AM TO VIEW POUR. NOTED ALL NUMBER 4 BARS PLACED ALONG WATERSTOP JOINTS AS SPECIFIED.

SUMP IN SINGLE MAT AREA TIED WITH NUMBER 5 BARS 6 INCHES ON CENTER AS SPECIFIED IN PLANS.

SECURED BATCH TICKET FROM TRUCK DRIVER 5000 ST 2% INTERIOR BEING SUPPLIED BY RIVER CITY READY MIX.

ALLIED COOP
GALESVILLE

P. WURZER

⑤

11-13-2013

NUMBER 5 BARS GRADE 60

11/00/5/1/5/5/7-11-44

NOTED WOODEN SCREED STAKES BEING PULLED AS THE POUR PROGRESSED.

DISCUSSED VIBRATION BEING APPLIED ALONG THE BASE SEAL JOINT. CONTRACTOR SAID THEY TYPICALLY DID NOT COMPLETE IT ALONG THE BASE SEAL JOINT. WE DISCUSSED FURTHER AND CONTRACTOR GOT HAND HELD VIBRATOR AND BEGAN VIBRATING JOINT.

DEPARTED THE SITE AT APPROXIMATELY 10:00 AM.

PETER M WURZER
WQATCP
11-13-2013

A waterstop joint plan shall be included in the construction plans and contain the following: location of joints; cross-section details of joint(s); waterstop materials including factory fabricated corners, intersections, and transitions; installation specifications; and a quality assurance plan.

Construction quality assurance requirements for waterstop installation shall, at a minimum, include verification and documentation of the adequacy of the formwork, waterstop placement and welding prior to placement of the concrete, and continuous inspection during placement of concrete around embedded waterstop to ensure consolidation. The inspection shall be performed by a person under the direction and control of the individual responsible for approving the as-built construction plan. The person providing the inspection may not be an employee of the contractor or the owner.

A concrete mix in accordance with WI Spec. 4 shall be used.

Floors and slabs shall contain temperature and shrinkage reinforcing steel equal to or greater than shown in Table A. Steel shall be placed in the top ⅓ of the slab thickness with a minimum clear distance from the top of the slab of 1.5 inches.

Additional waterstop *control joints* shall be planned where stresses can be predicted to exceed the reinforcing steel's ability to restrain cracking and minimize leakage.

All waterstop joints in areas subject to equipment traffic shall be designed with a dowel system to transfer the load across the joint. Slab thickness changes at these joints shall be made with a minimum transition ratio of one inch of thickness change over ten inches of run (10:1).

Table A
Reinforcing Steel for Temperature and Shrinkage Control

Control Joint Spacing			
Concrete Thickness	Rebar Size (grade 60) and Spacing		
	≤ 100 ft.	≤ 150 ft.	≤ 175 ft.
≤ 5 "	#4 @ 18"	#4 @ 15"	#5 @ 18"
≤ 6 "	#4 @ 18"	#5 @ 18"	#5 @ 15"
≤ 7 "	#4 @ 15"	#5 @ 15"	#5 @ 12"
≤ 8 "	#5 @ 18"	#5 @ 15"	#5 @ 12"

b. Concrete soil composite – The concrete is in *intimate contact* with the soil and the concrete and soil work together to reduce seepage losses. Floors and slabs shall be a minimum of 5 inches thick with reinforcing consisting of #4 bars spaced at 18 inches on center each way. No control or *expansion joints* are required. The concrete shall be placed in intimate contact with the foundation soil. The reinforcing steel shall be continuous through all *construction joints*. Drain tile and/or drain fill material shall be kept outside of the soil component of the composite liner.

2. Impoundment Design Criteria

Soil criteria in Tables 1 through 5 refer to mineral soils. Construction shall not occur on or with organic soils.

Table 1 contains the criteria for constructing waste impoundments into existing soils with recompaction of the upper 1 foot of soil. Tables 2 through 5 contain the criteria for impoundments with liners.

A combination of liners is acceptable. There shall not be more than two liner types used in any one facility. The sump liner does not apply as a liner type in this regard. The liners shall be joined so as to preserve the performance and integrity of all liner types.

Concrete walls used within impoundments shall maintain the integrity of any liner.

Any penetration and overfall/outfalls of the liner shall be constructed to maintain the performance and integrity of the liner used.

Liners shall be designed to withstand all anticipated internal and external loads, and resist agitation scouring.

a. Embankment Requirements

1) The foundation area shall be stripped to remove vegetation and unsuitable materials.

2) A core trench shall be required whenever the settled embankment fill height at the centerline is ≥ 10 feet. Minimum dimensions of the core trench shall be 8-foot bottom width, 2-foot depth, and 1:1 or flatter side slopes.

3) Additional fill for settlement shall be a minimum of 5% of the fill height measured at the centerline.

4) After settlement, the top of the embankment shall be ≥ 1 foot above the surrounding grade. Any diversion along the embankment shall have a capacity for 25-year, 24-hour storm plus 0.5 feet of freeboard.

5) For liquid storage facilities with greater than one acre of surface area and where wave action is a concern, increase the embankment height to account for the calculated wave height, or provide other means to address the wave action concern.

6) The minimum top width shall be according to the table below.

Settled Embankment Fill Height (feet)	Top Width (feet)
0 - 10	≥ 8
10.1 - 15	≥ 10
15.1 - 20	≥ 15
20.1 - 25	≥ 20

7) The sum of interior and exterior side slopes shall be ≥ 5:1 with no slope steeper than 2:1. All slopes must be stable. Additional embankment requirements are contained in the tables.

8) Compaction shall be according to WI FOTG Construction Specification 204, Earthfill for Waste Storage Facilities (Spec. 204).

CORE TRENCH PREVENTS CREEPING EMBANKMENTS

LOST ACRES FARM
410 CONSTRUCTION

P. WURZER

07-19-2014

07-19-2014

STOPPED OUT TO SITE AT 8800AM CONTRACTOR HAS COMPLETED STRIPPING OF THE EMBANKMENT AREA. ALL ORGANICS REMOVED WITH STRIPPING COMPLETED TO A DEPTH OF 6 INCHES OR MORE. DISCUSSED COMPACTION METHODS FOR EMBANKMENT WITH THE CONTRACTOR. HE PLANS TO USE A 3500 LB FARM TRACTOR TO COMPACT ML SOILS LEFT SITE AT 9830AM.

PETER M WURZER
EES/WDATCP
07/19/2014

07/19/2014

STOPPED OUT TO SITE AT 1284S PM TO CHECK PROGRESS OF CUTOFF TRENCH EXCAVATION. 3 FT DEEP CUTOFF BEING EXCAVATED WITH A 9 FOOT BOTTOM AND 1:1 SIDESLOPES. STAYED ON SITE

LOST ACRES FARM
410 CONSTRUCTION

P. WURZER (1)

07-19-2014

UNTILL HORIZONTAL EXTENTS OF TRENCH COMPLETED FROM STATTION 0+10 - 1+90 AS SHOWN IN CONSTRUCTION PLANS. LEFT SITE AT 4800PM.

PETER M WURZER
EES/WDATCP
07-19-2014

07-20-2014

STOPPED OUT TO SITE AT 7800AM TO WITNESS COMPACTION OF CUTOFF TRENCH FILL MATERIALS. FARM TRACTOR USED FOR COMPACTION (3500LB+) OF ML SOILS IN 6 INCH LIFTS. ADEQUATE COMPACTION ACHIEVED WITH 2 PASSES. ENTIRE SURFACE COVERED WITH THREE PASSES. LEFT SITE AT 8:15AM.

PETER M WURZER
EES/WDATCP
07-20-2014

Liners shall be designed to withstand all anticipated internal and external loads, and resist agitation scouring.

a. Embankment Requirements

1) The foundation area shall be stripped to remove vegetation and unsuitable materials.

2) A core trench shall be required whenever the settled embankment fill height at the centerline is ≥ 10 feet. Minimum dimensions of the core trench shall be 8-foot bottom width, 2-foot depth, and 1:1 or flatter side slopes.

3) Additional fill for settlement shall be a minimum of 5% of the fill height measured at the centerline.

4) After settlement, the top of the embankment shall be ≥ 1 foot above the surrounding grade. Any diversion along the embankment shall have a capacity for 25-year, 24-hour storm plus 0.5 feet of freeboard.

5) For liquid storage facilities with greater than one acre of surface area and where wave action is a concern, increase the embankment height to account for the calculated wave height, or provide other means to address the wave action concern.

6) The minimum top width shall be according to the table below.

Settled Embankment Fill Height (feet)	Top Width (feet)
0 - 10	≥ 8
10.1 - 15	≥ 10
15.1 - 20	≥ 15
20.1 - 25	≥ 20

7) The sum of interior and exterior side slopes shall be ≥ 5:1 with no slope steeper than 2:1. All slopes must be stable. Additional embankment requirements are contained in the tables.

8) Compaction shall be according to WI FOTG Construction Specification 204, Earthfill for Waste Storage Facilities (Spec. 204).

WISCONSIN CONSTRUCTION SPECIFICATION

204. EARTHFILL FOR WASTE STORAGE FACILITIES

1. SCOPE

The work shall consist of all operations necessary to place the earthfill required by the drawings or directed by the Technician.

2 MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of materials in the various fills shall be subject to approval by the Technician.

Fill materials shall contain no sod, brush, roots, frozen soil, or other perishable materials. Stones larger than two-thirds of the uncompacted layer thickness shall be removed from the materials prior to compaction of the fill.

3. GENERAL

Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution will be minimized. The completed job shall present a professional appearance and shall conform to the lines, grades, and elevations as shown on the drawings or as staked in the field. All operations shall be carried out in a safe and skillful manner. Safety and health regulations shall be observed and appropriate safety measures used.

4. FOUNDATION PREPARATION

The foundation area shall be cleared of trees, stumps, roots, brush, rubbish, frozen soil, and stones having a maximum dimension greater than 6 inches. Foundations shall be stripped to remove vegetation and other unsuitable materials to a minimum depth of 6 inches or to a greater depth if so shown on the drawings. Topsoil shall be stripped from the foundation area and stockpiled for use as a top dressing for vegetation establishment unless otherwise shown on the drawings.

The moisture content of the scarified foundation materials shall be maintained as specified for the earthfill in Section 7. The surface materials of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

5. EXCAVATION

The required excavations shall conform to the lines, grades, and elevations as shown on the drawings. Excavation beyond specified limits shall be corrected by filling with approved compacted materials.

The required dimensions and side slopes of all structure and trench excavations shall be as shown on the drawings. Trenches deeper than 4 feet shall have side slopes above the 4-foot depth excavated at 0.5:1 or flatter depending on the materials being excavated or the trench shall be braced to safeguard the work and workers. When backfilling pipe trenches in the waste storage facility embankment, the trench slopes shall be cut back to 1:1 from 12 inches above the top of the pipe. The backfill material and compaction shall be equivalent to the surrounding embankment.

Table 1 - Embankment Compaction Requirements

Equipment Type	Applicable Soils[1]	Maximum Fill Height[2] (feet)	Layer Thickness[3] (inches)
Sheepsfoot or tamping roller 10,000 lb. min. operating weight	ML, MH, CL, CH SM, SC, GM, GC	None	9
Vibratory tamping roller 9,000 lb. min. operating weight	SM, SC, GM, GC	None	6
Smooth drum vibratory roller 10,000 lb. min.	SP, SW, GP GW	20	6
Rubber-tired scraper (fully loaded)	ML, MH, CL, CH SM, SC, GM, GC	None	9
Rubber-tired front end loader (fully loaded)	ML, MH, CL, CH SM, SC, GM, GC	20	6
Track-type crawler standard tracks 30,000 lb. min.	SM, SC, GM, GC, ML, CL SP, SW, GP, GW	10	6
Farm tractor 2,400 lb. min.	ML, MH, CL, CH, SM, SC, GM, GC	15	6

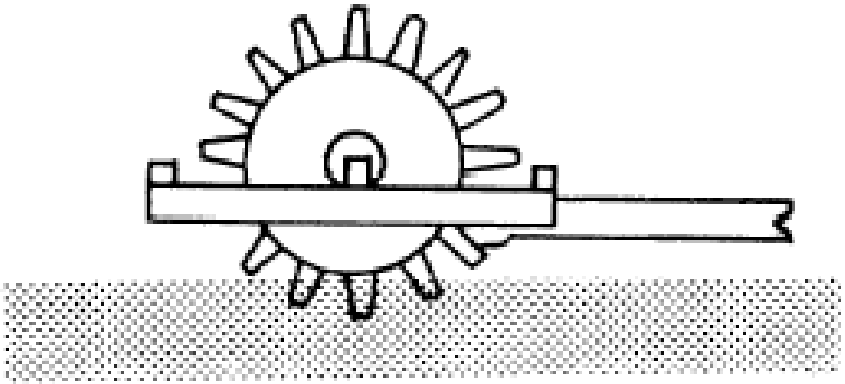
[1] Unified Soil Classification System.

[2] Measured from the top of the fill to the lowest point along the centerline of the fill.

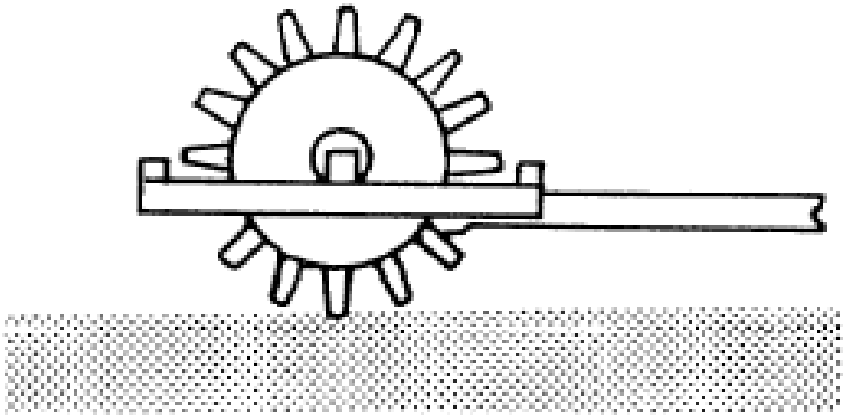
[3] Prior to compaction.

SHEEPSFOOT ROLLER,
10000 POUND MINIMUM OPERATING WEIGHT
ML,MH,CL,CH SOILS OR SM,SC,GM,GC SOILS WITH OVER 20% FINES

Roller Feet Embedded to
Within 2 Inches of the Drum



Roller After it has "Walked Out"




THIS IS ALSO CONSIDERED SHEEPSFOOT ROLLER ALTHOUGH IT'S A TAMPING ROLLER
DYNAPAC
DYNAPAC


CATERPILLAR


Farm Tractor(2400 lb. minimum)
SOILS; GM,GC,SM,SC,ML,MH,CL,CH
MAXIMUM FILL HEIGHT: 15 FEET
LAYER THICKNESS: 6 INCHES
MINIMUM PASSES: 2

Vibratory tamping roller(9000 lb. min. operating weight)

SOILS; SM,SC,GM,GC

MAX FILL HEIGHT; None

LIFT THICKNESS; 9 inches

NUMBER OF PASSES; 2

Table 1 - *In-Place Earth* Criteria for Impoundments 20 Feet Deep or Less [Note 1]

1. Size			
Design Storage Volume		≤ 300,000 cu. ft.	> 300,000 cu. ft.
Manure Produced at Farm per Year		≤ 600,000 cu. ft.	> 600,000 cu. ft.
Waste Characteristics		≥ 4% manure solids in stored waste, ruminant animals only	All
2. Soils [Note 2]			
% Fines		≥ 40%	≥ 40%
Plasticity Index (PI)		≥ 7	≥ 12
Total Thickness, (measured perpendicular to storage surface, includes thickness of recompacted layer)		≥ 5 ft.	≥ 5 ft.
Thickness of Recompacted layer (upper 1' of soil)		≥ 1 ft.	≥ 1 ft.
Construction Specification (for recompacted 1' layer)		WI Spec 204 [Note 4]	WI Spec 300 [Note 5]
3. Separation Distances			
- Well Distance [Note 3]		≥ 250 ft.	≥ 250 ft.
- Sinkholes		≥ 800 ft.	≥ 400 ft.
- Subsurface Saturation (V.A.9)		≥ 6 ft.	≥ 6 ft.
- Bedrock		≥ 6 ft.	≥ 6ft.
4. Impoundment			
Inside Slope		2.5:1 or flatter	
Embankment		Shall be constructed with material meeting criteria in Table 1 from the inside surface to the embankment centerline, in accordance with the applicable compaction specification for the recompacted 1' layer.	
5. Other			
Scour Protection	Agitation and Pumping Locations	Minimum 20 ft. wide x 30 ft. long x 4 in. thick concrete pad or sump in bottom and 20 ft. wide ramp or a 16 ft. wide ramp with 12 in. high curbs to the top of the facility.	
	Scraping and Other Mechanical Means of Removing Solids and Sand	Protect with hard surfacing designed for the expected conditions and loads, a minimum of 4 in. thick.	
Existing Field Drain Tile		Additional site investigation shall be completed to determine the presence of existing field drain tile within 100 ft. of the footprint of the facility. Any tile found must be abandoned or removed.	

Note 1 The depth is measured from the bottom of the impoundment to the maximum operating level.

Note 2 Soil tests shall be completed in a laboratory on representative samples of soil beneath the proposed liner grade at a rate of 1 test per 15,000 ft^2 of facility footprint, with a minimum of two tests. The PI shall be determined in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140.

Note 3 Community water system wells may require larger separation distances (see NR 811).

Note 4 WI FOTG Construction Specification 204, Earthfill for Waste Storage Facilities.

Note 5 WI FOTG Construction Specification 300, Clay Liner;


SIDESLOPES TOP WIDTH
SETTLEMENT AND CORE
TRENCH SPECIFIFIED(CORE
TRENCH IF OVER 10 FEET)


CAT
320C
CAT
CAT


CAT
320C
CAT


ITS NOT UNCOMMON TO ENCOUNTER LENSES, SEEPS ETC. DURING CONSTRUCTION
AGITATION AND PUMPOUT PADS REQUIRED FOR PROTECTION OF SOILS


DRAINAGE DURING CONSTRUCTION OFTEN REQUIRED


AGITATION BOATS BECOMING MORE AND MORE COMMON THEY CAN DAMAGE LINERS AND IN PLACE SOILS WITH SCOURING

Table 2 - Clay Liner Criteria for Impoundments

1. Size		
Design Storage Volume	≤ 300,000 cu. ft.	> 300,000 cu. ft. [Note 1]
Manure Produced at Farm Per Year	≤ 600,000 cu. ft.	> 600,000 cu. ft.
2. Clay Liner Requirements		
Thickness, Bottom	≥ 3 ft.	As specified in Table 2A
Thickness, Sides	≥ 5 ft.	≥ 5 ft.
% Fines [Note 2]	≥ 50%	≥ 50%
Plasticity Index (PI) [Note 2]	≥ 12	≥ 12
Permeability, cm/sec. [Note 3]	—	≤ $1x10^{-7}$
Construction Specification	WI Spec 204 [Note 4]	WI Spec 300 [Note 5]
3. Separation Distances		
Wells [Note 6]	≥ 250 ft.	≥ 250 ft.
Sinkholes	≥ 400 ft.	≥ 400 ft.
Subsurface Saturation (V.A.9)	≥ 4 ft.	As specified in Table 2A
Bedrock	≥ 4 ft.	As specified in Table 2A
4. Other		
Liner Protection Required		
Agitation and Pumping Locations	Minimum 20 ft. wide x 30 ft. long x 4 in. thick concrete pad or sump in bottom and 20 ft. wide ramp or a 16 ft. wide ramp with 12 in. high curbs to the top of the facility.	
Scraping and Other Mechanical Means of Removing Solids and Sand	Protect with hard surfacing designed for the expected conditions and loads, a minimum of 4 in. thick.	

[Note 1] These two columns show the minimum criteria for larger storage facilities and farms, but can also be used for smaller facilities and farms.

[Note 2] The PI shall be determined in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140.

[Note 3] Permeability shall be determined by ASTM D5084 from undisturbed samples of the compacted liner.

[Note 4] WI FOTG Construction Specification 204, Earthfill for Waste Storage Facilities.

[Note 5] WI FOTG Construction Specification 300, Clay Liner.

[Note 6] Community water system wells may require larger separation distances (see NR 811).

Table 2A – Clay Liner Thickness [Note 1] (Bottom) and Separations

Impoundment Depth [Note 2] (feet)	Liner Thickness (feet)	Separation to Subsurface Saturation and Bedrock (feet)
0 – 13	≥ 3.0	≥ 4.0
13.1 – 14	≥ 3.2	≥ 4.2
14.1 – 16	≥ 3.6	≥ 4.6
16.1 – 18	≥ 4.1	≥ 5.1
18.1 – 20	≥ 4.5	≥ 5.5
20.1 – 22	≥ 5.0	≥ 6.0
22.1 – 24	≥ 5.4	≥ 6.4
24.1 - 25	≥ 5.7	≥ 6.7

[Note 1] Thickness is calculated based on a maximum permeability of $1x10^{-7}$ cm/sec and a specific discharge limit of 500 gallons/acre/day using Darcy's Law.

[Note 2] Depth is the distance from the bottom of the impoundment up to the maximum operating level (M.O.L.).

WISCONSIN CONSTRUCTION SPECIFICATION

300. CLAY LINER

1. SCOPE

The work shall consist of the construction of the clay liner as shown on the construction plans.

2. CLAY LINER MATERIAL

Clay liner material shall have a minimum plasticity index of 12 (PI ≥12) and a minimum percentage passing the No. 200 sieve (P_{200}) as specified in the construction plans. The clay liner material shall be capable of providing a liner with a maximum hydraulic conductivity (permeability) of 1×10^{-7} centimeters per second.

Proposed liner material properties shall be determined in the lab prior to placement for each different borrow area and material, at the specified minimum frequency shown in Table 1. These tests are typically done in the design phase with additional tests required when unpredicted changes in borrow material are observed.

A standard or modified proctor test density curve, and optimum moisture, shall be developed from the borrow materials. A hydraulic conductivity (permeability) shall be determined on a re-compacted sample. The sample shall be re-compacted to the minimum density and moisture content specified in Section 6, Compaction.

Table 1 Borrow Material Testing

Test Reference	Minimum Frequency
Standard Proctor (ASTM D 698) or Modified Proctor (ASTM D 1557)	1 per 5,000 cubic yards of estimated in-place liner quantity
Atterberg Limit (ASTM D 4318) and Percent Fines (ASTM D 1140)	1 per 5,000 cubic yards of estimated in-place liner quantity
Permeability (ASTM D 5084)	1 per 5,000 cubic yards of estimated in-place liner quantity

3. FOUNDATION PREPARATION

Foundation surfaces shall be graded to remove surface irregularities and shall be scarified or otherwise acceptably scored or loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the clay liner. The surface materials of the foundation shall be compacted and bonded with the first layer of the clay liner as specified for subsequent layers of clay liner.

4. PLACEMENT

The clay liner shall not be placed until the required foundation preparation has been completed and the foundation has been inspected and approved by the Technician or Engineer. The clay liner shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the clay liner.

Clay materials shall contain no sod, brush, roots, frozen soil, or other perishable materials. Rock particles larger than 3 inches shall be removed prior to compaction of the clay.

- ASTM D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
- ASTM D 5084 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

9. TESTING FREQUENCY

Clay liner construction shall be tested and documented by a third party engineering or testing firm at the specified minimum frequency shown in Table 2.

Field density tests shall be completed on the compacted in-place clay liner, as the liner is being placed. Atterberg limit and percent fines shall be completed on samples obtained next to the field density test. After the completion of the liner, undisturbed samples shall be taken from the constructed clay liner for permeability verification.

Copies of the test locations and test results (documentation report) shall be provided to the owner to document compliance with this specification.

Table 2 Liner Testing

Test Reference	Minimum Frequency (Standard mathematical rounding rules apply)
Field Density (ASTM D 2922, or D 2937, or D 2167, or D 1556)	1 test per 500 cubic yards of in-place liner, distributed throughout the structure (Horizontally and Vertically)
Atterberg Limit (ASTM D 4318) and Percent Fines (ASTM D 1140)	1 test per 2000 cubic yards of in-place liner
Permeability (ASTM D 5084)	1 per 5,000 cubic yards of in-place liner (2 minimum per facility)[1]

1. At least one of these tests should be obtained from the side slope of the facility

All undisturbed sample test holes in the constructed clay liner shall be backfilled using powdered bentonite mixed with clay soil used in liner construction and compacted by hand tamping. The clay shall be broken down into clods less than ½ inch in diameter. A minimum of 25% of each backfilled test hole volume shall be occupied by powdered bentonite after backfilling.

- ASTM D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
- ASTM D 5084 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

9. TESTING FREQUENCY

Clay liner construction shall be tested and documented by a third party engineering or testing firm at the specified minimum frequency shown in Table 2.

Field density tests shall be completed on the compacted in-place clay liner, as the liner is being placed. Atterberg limit and percent fines shall be completed on samples obtained next to the field density test. After the completion of the liner, undisturbed samples shall be taken from the constructed clay liner for permeability verification.

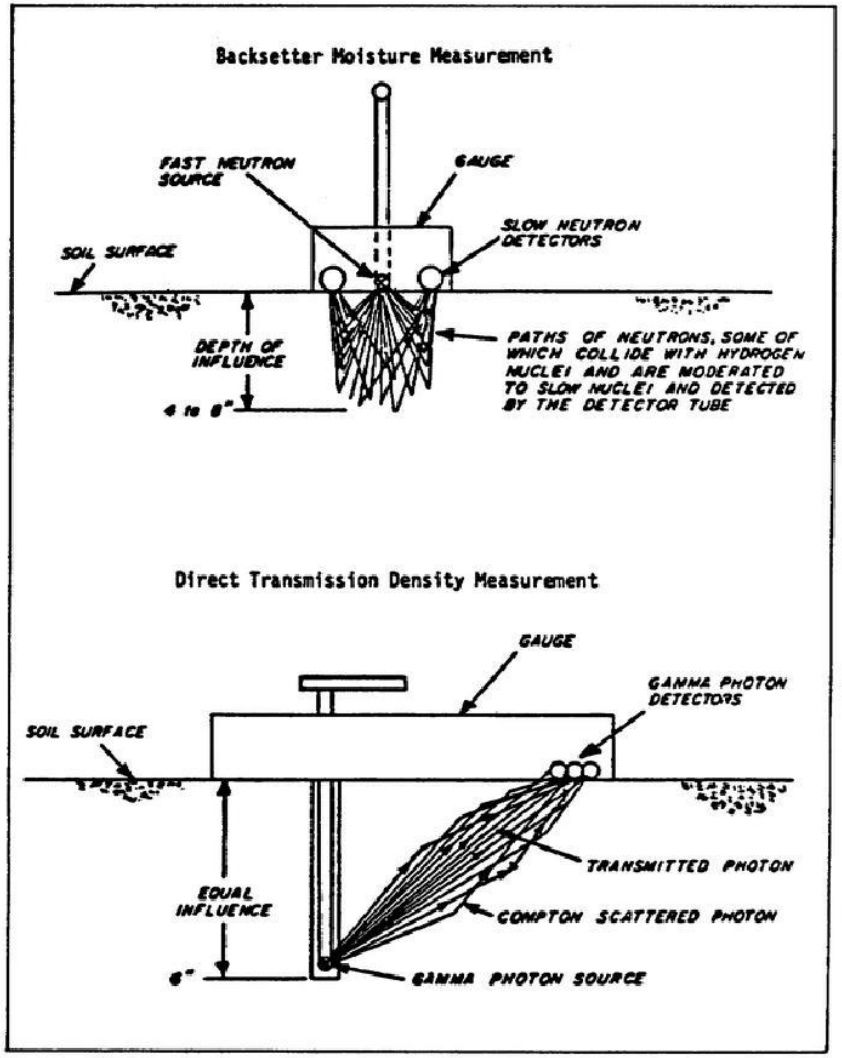
Copies of the test locations and test results (documentation report) shall be provided to the owner to document compliance with this specification.

Table 2 Liner Testing

Test Reference	Minimum Frequency (Standard mathematical rounding rules apply)
Field Density (ASTM D 2922, or D 2937, or D 2167, or D 1556)	1 test per 500 cubic yards of in-place liner, distributed throughout the structure (Horizontally and Vertically)
Atterberg Limit (ASTM D 4318) and Percent Fines (ASTM D 1140)	1 test per 2000 cubic yards of in-place liner
Permeability (ASTM D 5084)	1 per 5,000 cubic yards of in-place liner (2 minimum per facility)[1]

1. At least one of these tests should be obtained from the side slope of the facility

All undisturbed sample test holes in the constructed clay liner shall be backfilled using powdered bentonite mixed with clay soil used in liner construction and compacted by hand tamping. The clay shall be broken down into clods less than ½ inch in diameter. A minimum of 25% of each backfilled test hole volume shall be occupied by powdered bentonite after backfilling.


Backsetter Moisture Measurement
FAST NEUTRON SOURCE
GAUGE
SLOW NEUTRON DETECTORS
SOIL SURFACE
DEPTH OF INFLUENCE
4 to 6"
PATHS OF NEUTRONS, SOME OF WHICH COLLIDE WITH HYDROGEN NUCLEI AND ARE MODERATED TO SLOW NUCLEI AND DETECTED BY THE DETECTOR TUBE
Direct Transmission Density Measurement
GAUGE
GAMMA PHOTON DETECTORS
SOIL SURFACE
TRANSMITTED PHOTON
EQUAL INFLUENCE
COMPTON SCATTERED PHOTON
6"
GAMMA PHOTON SOURCE

- ASTM D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
- ASTM D 5084 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

9. TESTING FREQUENCY

Clay liner construction shall be tested and documented by a third party engineering or testing firm at the specified minimum frequency shown in Table 2.

Field density tests shall be completed on the compacted in-place clay liner, as the liner is being placed. Atterberg limit and percent fines shall be completed on samples obtained next to the field density test. After the completion of the liner, undisturbed samples shall be taken from the constructed clay liner for permeability verification.

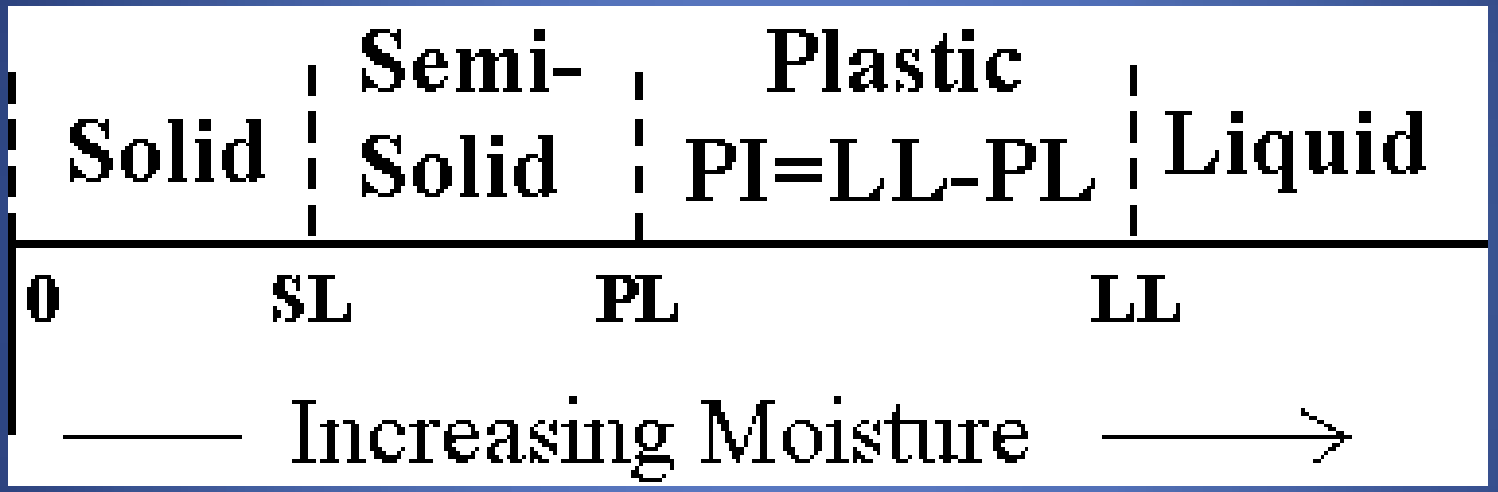
Copies of the test locations and test results (documentation report) shall be provided to the owner to document compliance with this specification.

Table 2 Liner Testing

Test Reference	Minimum Frequency (Standard mathematical rounding rules apply)
Field Density (ASTM D 2922, or D 2937, or D 2167, or D 1556)	1 test per 500 cubic yards of in-place liner, distributed throughout the structure (Horizontally and Vertically)
Atterberg Limit (ASTM D 4318) and Percent Fines (ASTM D 1140)	1 test per 2000 cubic yards of in-place liner
Permeability (ASTM D 5084)	1 per 5,000 cubic yards of in-place liner (2 minimum per facility)[1]

1. At least one of these tests should be obtained from the side slope of the facility

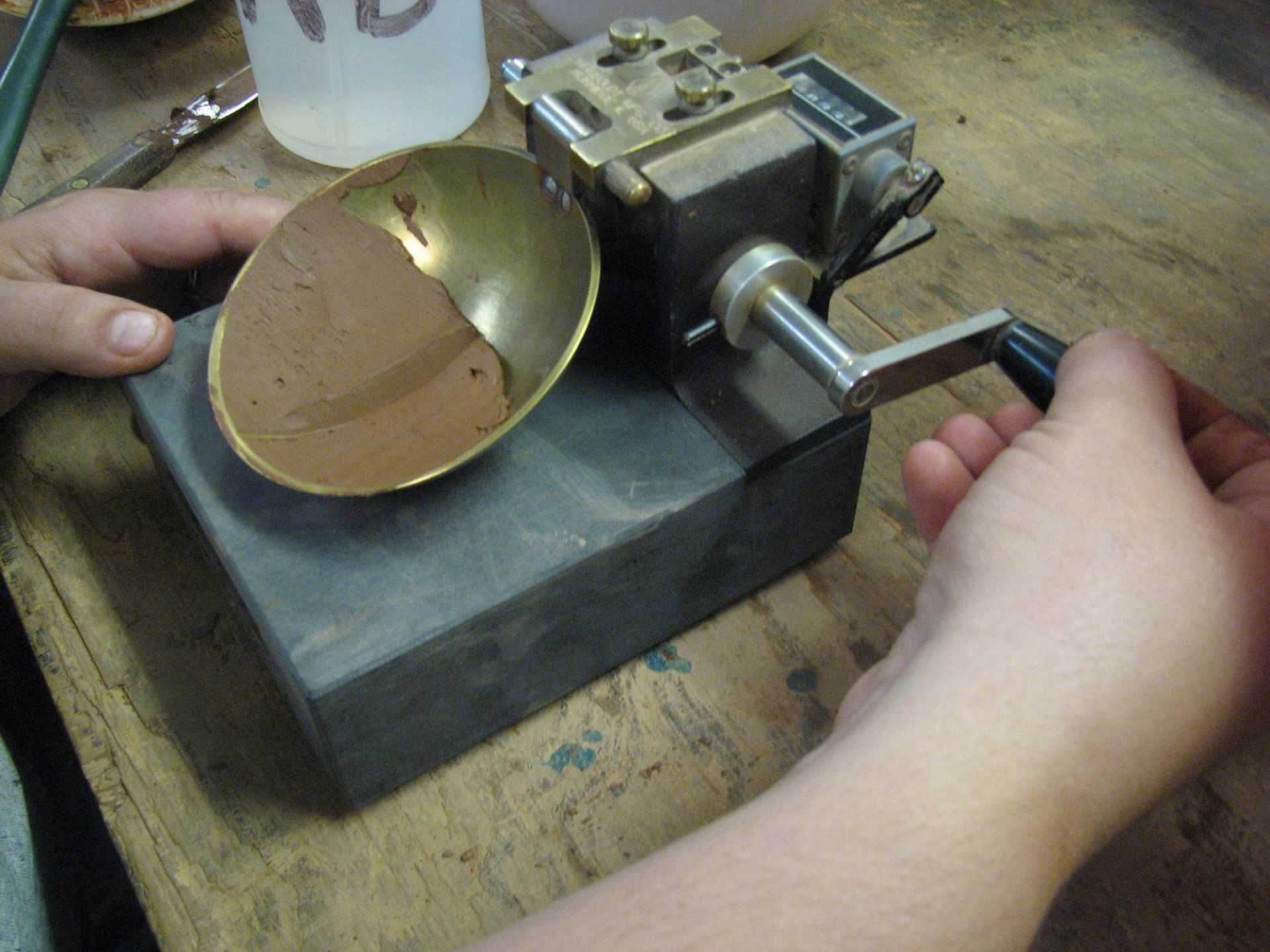
All undisturbed sample test holes in the constructed clay liner shall be backfilled using powdered bentonite mixed with clay soil used in liner construction and compacted by hand tamping. The clay shall be broken down into clods less than ½ inch in diameter. A minimum of 25% of each backfilled test hole volume shall be occupied by powdered bentonite after backfilling.

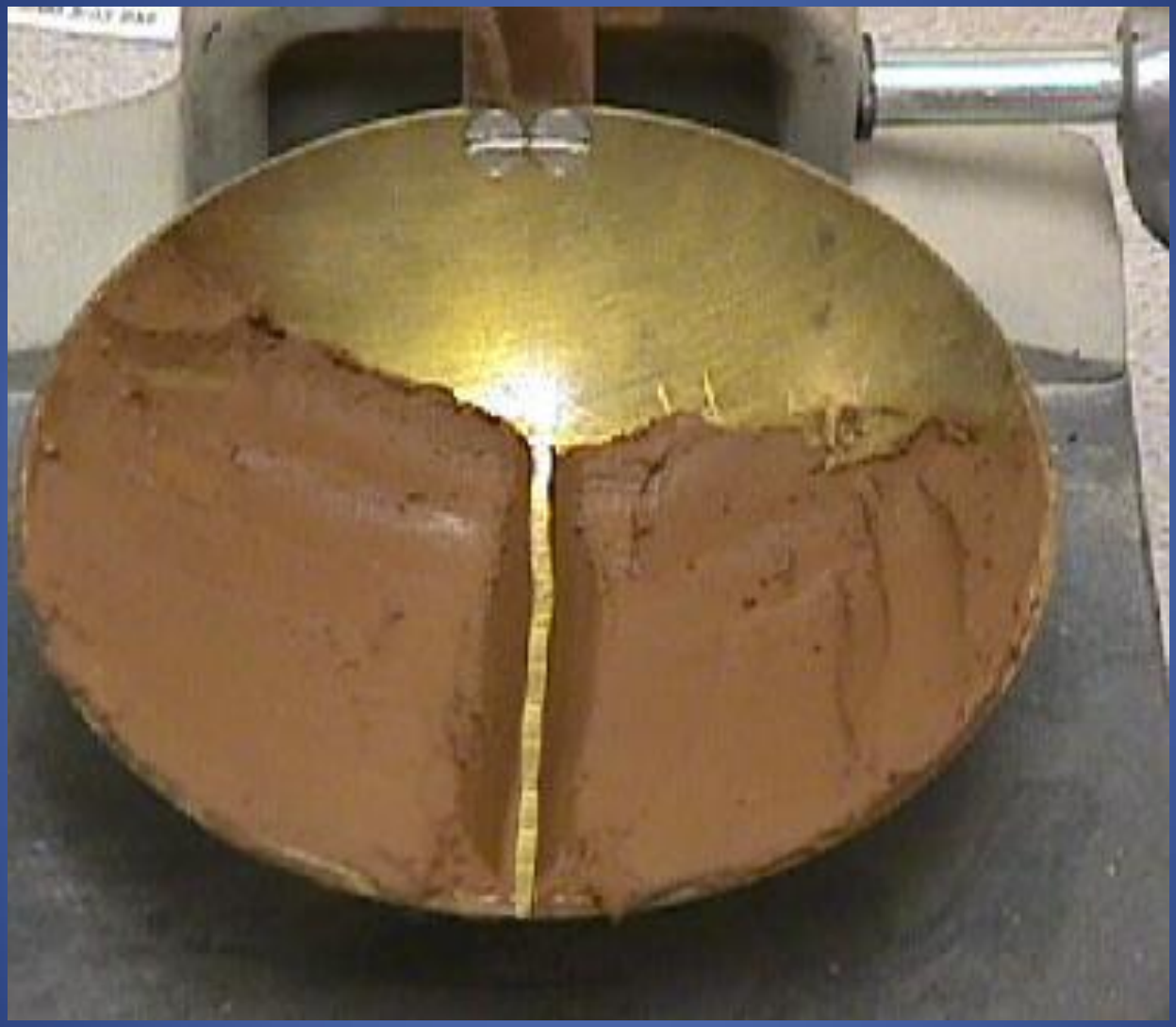

Solid
Semi-
Solid
Plastic
PI=LL-PL
Liquid
0
SL
PL
LL
Increasing Moisture

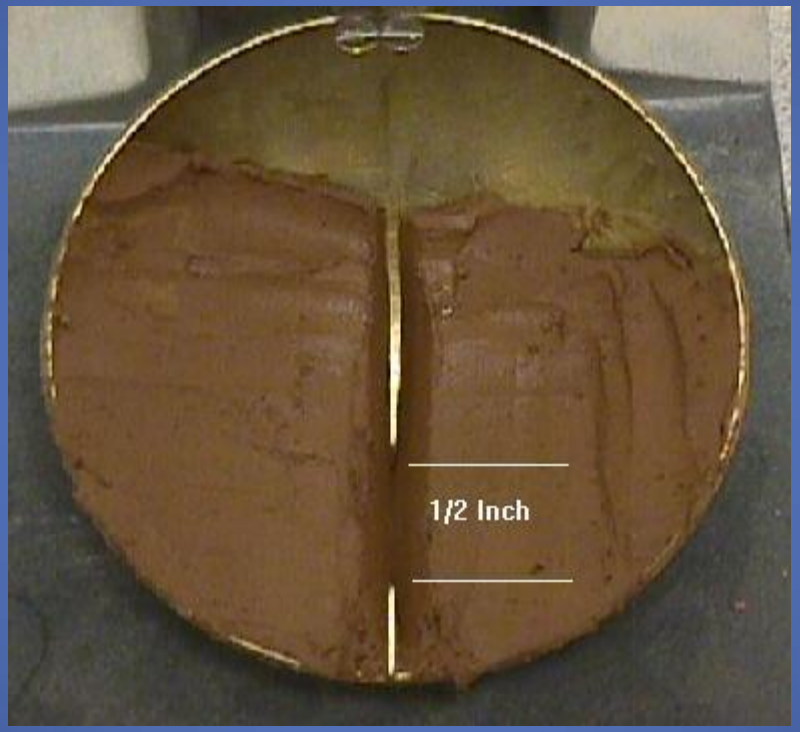
ATTERBERG LIMITS

- Liquid limit test:

A soil is place in the grooving tool which consists of a brass cup and a hard rubber base. A groove is cut at the center of the soil pat using a standard grooving tool. The cup is then repeatedly drooped from a height of 10 mm until a groove closure of 12.7 mm. The soil is then removed and its moisture content is determined. The soil is said to be at its liquid limit when exactly 25 drops are required to close the groove for a distance of 12.7 mm (one half of an inch)






1/2 Inch

- ASTM D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
- ASTM D 5084 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

9. TESTING FREQUENCY

Clay liner construction shall be tested and documented by a third party engineering or testing firm at the specified minimum frequency shown in Table 2.

Field density tests shall be completed on the compacted in-place clay liner, as the liner is being placed. Atterberg limit and percent fines shall be completed on samples obtained next to the field density test. After the completion of the liner, undisturbed samples shall be taken from the constructed clay liner for permeability verification.

Copies of the test locations and test results (documentation report) shall be provided to the owner to document compliance with this specification.

Table 2 Liner Testing

Test Reference	Minimum Frequency (Standard mathematical rounding rules apply)
Field Density (ASTM D 2922, or D 2937, or D 2167, or D 1556)	1 test per 500 cubic yards of in-place liner, distributed throughout the structure (Horizontally and Vertically)
Atterberg Limit (ASTM D 4318) and Percent Fines (ASTM D 1140)	1 test per 2000 cubic yards of in-place liner
Permeability (ASTM D 5084)	1 per 5,000 cubic yards of in-place liner (2 minimum per facility)[1]

1. At least one of these tests should be obtained from the side slope of the facility

All undisturbed sample test holes in the constructed clay liner shall be backfilled using powdered bentonite mixed with clay soil used in liner construction and compacted by hand tamping. The clay shall be broken down into clods less than ½ inch in diameter. A minimum of 25% of each backfilled test hole volume shall be occupied by powdered bentonite after backfilling.

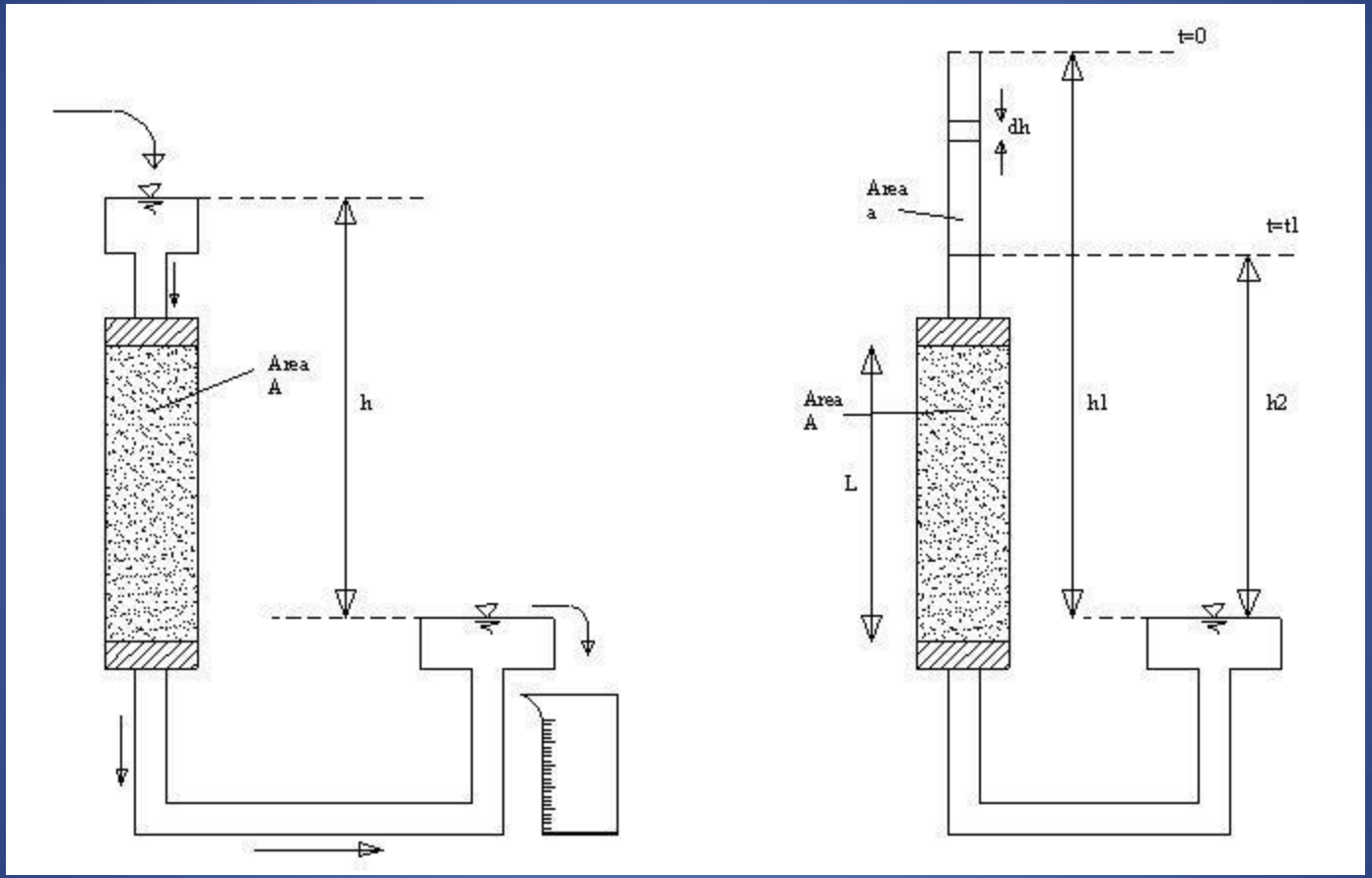

Area
A
h
t=0
dh
Area
a
t=t1
Area
A
L
h1
h2

Table 3 - *Geomembrane* Liner Criteria for Impoundments

1. Liner Material			
		60 mil High Density Polyethylene (HDPE) or 60 mil Linear Low Density Polyethylene (LLDPE) or 60 mil Ethylene Propylene Diene Monomer (EPDM). The geomembrane shall be installed with intimate contact to the soil below.[Note 1]	
2. Soils (Directly Below Liner)[Note 2]			
% Fines		≥ 40%	≥ 40%
Plasticity Index (PI)		≥ 7	—
Thickness		≥ 2 ft.	≥ 4 ft.
Compaction of Placed Material		WI Spec 204.[Note 3]	WI Spec 204.[Note 3]
Subgrade preparation requirements		WI Spec 202 or 205.[Note 4]	WI Spec 202 or 205.[Note 4]
3. Separation Distances			
Well Distance[Note 5]		≥ 250 ft.	≥ 250 ft.
Sinkholes		≥ 400 ft.	≥ 400 ft.
Subsurface Saturation (V.A.9)		≥ 4 ft.	≥ 6 ft.
Bedrock		≥ 4 ft.	≥ 6 ft.
4. Impoundment			
Inside Slope		2.5:1 or flatter.	
5. Other			
Liner Protection Required	Agitation and pumping locations.[Note 6]	Minimum dimension of 20 ft. wide x 30 ft. long concrete pad or sump in bottom and 20 ft. wide ramp with 18 in. curb to the top of the facility with provisions for liner integrity. Ramps shall be located to be accessible to the agitation equipment used.	
	Scraping and other mechanical means of removing solids and sand.[Note 7]	Protect with hard surfacing designed for the expected conditions and loads.	
Vent system		Required for all facilities. The system shall be designed in such a manner to vent gas from the system. Waste and runoff shall be prevented from entering the venting system. Liquid detection points may be installed as part of the system.[Note 1]	
Liner Installation		• Continuous Inspection Required • All geomembrane placement, seaming, seam testing, and repair and concrete placement for liner protection shall be completed under the continuous observation of a qualified third-party quality assurance inspector under the direction of a Professional Engineer. This inspector shall not be an employee of the contractor, owner, or geomembrane supplier.	

[Note 1] Intimate contact does not exclude the use of gravel trenches for gas venting or monitoring systems.

[Note 2] The liner is in intimate contact with the soil, and the two work together to reduce seepage losses. The PI shall be determined in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140.

[Note 3] WI FOTG Construction Specification 204, Earthfill for Waste Storage Facilities.

[Note 4] WI FOTG Construction Specification 202, Polyethylene Geomembrane Lining and 205, Ethyl Propylene Diene Monomer (EPDM) Geomembrane Lining.

[Note 5] Community water system wells may require larger separation distances (see NR 811).

[Note 6] Poured-in-place concrete slabs shall meet requirements of Table 5, Note 2 if the geomembrane will be joined to the liquid-tight concrete. All connections between the geomembrane and concrete shall be liquid tight and structurally sound. If the liner protection is placed on top of the geomembrane, it shall be structurally sound, but liquid-tightness is not required. Liner protection poured on top of the geomembrane shall be separated from the geomembrane by a sacrificial layer of the same weight geomembrane and a cushioning layer of 12 oz/sy non-woven geotextile. The sacrificial layer shall not be welded to the geomembrane liner. Liner protection installation over the geomembrane shall be completed by methods that will maintain the integrity and performance of the liner. Liner protection placed on slopes shall be designed with provisions to ensure stability.

[Note 7] Sand bedding may be used in conjunction with a geomembrane liner, but the design must include a method to remove sand from the waste stream before it enters the waste storage facility.


10/18/2006


10/18/2006


10/18/2006


AYRES
ASSOCIATES


DieHard
Portable Power
T150

Table 3 - *Geomembrane* Liner Criteria for Impoundments

1. Liner Material			
		60 mil High Density Polyethylene (HDPE) or 60 mil Linear Low Density Polyethylene (LLDPE) or 60 mil Ethylene Propylene Diene Monomer (EPDM). The geomembrane shall be installed with intimate contact to the soil below.[Note 1]	
2. Soils (Directly Below Liner)[Note 2]			
% Fines		≥ 40%	≥ 40%
Plasticity Index (PI)		≥ 7	—
Thickness		≥ 2 ft.	≥ 4 ft.
Compaction of Placed Material		WI Spec 204.[Note 3]	WI Spec 204.[Note 3]
Subgrade preparation requirements		WI Spec 202 or 205.[Note 4]	WI Spec 202 or 205.[Note 4]
3. Separation Distances			
Well Distance[Note 5]		≥ 250 ft.	≥ 250 ft.
Sinkholes		≥ 400 ft.	≥ 400 ft.
Subsurface Saturation (V.A.9)		≥ 4 ft.	≥ 6 ft.
Bedrock		≥ 4 ft.	≥ 6 ft.
4. Impoundment			
Inside Slope		2.5:1 or flatter.	
5. Other			
Liner Protection Required	Agitation and pumping locations.[Note 6]	Minimum dimension of 20 ft. wide x 30 ft. long concrete pad or sump in bottom and 20 ft. wide ramp with 18 in. curb to the top of the facility with provisions for liner integrity. Ramps shall be located to be accessible to the agitation equipment used.	
	Scraping and other mechanical means of removing solids and sand.[Note 7]	Protect with hard surfacing designed for the expected conditions and loads.	
Vent system		Required for all facilities. The system shall be designed in such a manner to vent gas from the system. Waste and runoff shall be prevented from entering the venting system. Liquid detection points may be installed as part of the system.[Note 1]	
Liner Installation		• Continuous Inspection Required • All geomembrane placement, seaming, seam testing, and repair and concrete placement for liner protection shall be completed under the continuous observation of a qualified third-party quality assurance inspector under the direction of a Professional Engineer. This inspector shall not be an employee of the contractor, owner, or geomembrane supplier.	

[Note 1] Intimate contact does not exclude the use of gravel trenches for gas venting or monitoring systems.

[Note 2] The liner is in intimate contact with the soil, and the two work together to reduce seepage losses. The PI shall be determined in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140.

[Note 3] WI FOTG Construction Specification 204, Earthfill for Waste Storage Facilities.

[Note 4] WI FOTG Construction Specification 202, Polyethylene Geomembrane Lining and 205, Ethyl Propylene Diene Monomer (EPDM) Geomembrane Lining.

[Note 5] Community water system wells may require larger separation distances (see NR 811).

[Note 6] Poured-in-place concrete slabs shall meet requirements of Table 5, Note 2 if the geomembrane will be joined to the liquid-tight concrete. All connections between the geomembrane and concrete shall be liquid tight and structurally sound. If the liner protection is placed on top of the geomembrane, it shall be structurally sound, but liquid-tightness is not required. Liner protection poured on top of the geomembrane shall be separated from the geomembrane by a sacrificial layer of the same weight geomembrane and a cushioning layer of 12 oz/sy non-woven geotextile. The sacrificial layer shall not be welded to the geomembrane liner. Liner protection installation over the geomembrane shall be completed by methods that will maintain the integrity and performance of the liner. Liner protection placed on slopes shall be designed with provisions to ensure stability.

[Note 7] Sand bedding may be used in conjunction with a geomembrane liner, but the design must include a method to remove sand from the waste stream before it enters the waste storage facility.

Table 4 - *Geosynthetic Clay Liner (GCL)* Criteria for Impoundments

1a. Soils (Directly Below Liner) [Note 1]			
% Fines		≥ 20%	≥ 20%
Plasticity Index (PI)		≥ 7	—
Thickness (from bottom and sides)		≥ 2 ft.	≥ 3 ft.
Compaction of placed material		WI Spec 203 [Note 2]	WI Spec 203 [Note 2]
1b. Liner Cover Material Thickness			
Bottom		≥ 1 ft.	≥ 1 ft.
Side Slopes		≥ 2 ft.	≥ 2 ft.
Compaction of Placed Materials		WI Spec 203 [Note 2]	WI Spec 203 [Note 2]
2. Separation Distances			
Well Distance [Note 3]		≥ 250 ft.	≥ 250 ft.
Sinkholes		≥ 400 ft.	≥ 400 ft.
Subsurface Saturation (V.A.9)		≥ 4 ft.	≥ 5 ft.
Bedrock		≥ 4 ft.	≥ 5 ft.
3. Impoundment			
Inside Slope [Note 4]		3:1 or flatter	
4. Other			
Liner Protection	Agitation and Pumping Locations	Minimum dimension of 20 ft. wide x 30 ft. long x 4 in. thick concrete pad or sump in bottom and 20 ft. wide ramp or a 16 ft. wide ramp with 18 in. high curb to top of facility. GCL continues under the concrete pad or sump. Poured in place concrete slabs shall meet requirements of Section V.B.1.	
	- Scraping and Other Mechanical Means of Removing Solids and Sand	Sand bedding may be used in conjunction with a geosynthetic clay liner, but the design must include a method to remove sand from the waste stream before the waste is stored in the liner or the liner must be protected to allow mechanical removal of the sand. Poured in place concrete slabs shall meet requirements of Section V.B.1.	
GCL Material [Note 5]		Non-woven needle punched.	

[Note 1] The liner is in intimate contact with the soil, and the two work together to reduce seepage losses. The PI shall be determined in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140.

[Note 2] WI FOTG Construction Specification 203, Geosynthetic Clay Liner.

[Note 3] Community water system wells may require larger separation distances (see NR 811).

[Note 4] The GCL and soil cover shall be stable at the designed side slope.

[Note 5] The liner shall be installed according to manufacturer's specifications and WI FOTG Construction Specification 203, Geosynthetic Clay Liner.


VOLTE
Granule
20kg

Table 5 - Concrete Liner Criteria for Impoundments

	Concrete with Waterstop [Note 1]	Concrete - Soil Composite [Note 2]			
1. Soils (Directly Below Liner) [Note 2]					
% Fines	—	≥ 20%	≥ 20%	≥ 40%	Foundry Sand [Note 5]
Plasticity Index (PI)	—	≥ 7	—	≥ 12	—
Thickness (bottom and sides)	—	≥ 1.5 ft.	≥ 3 ft.	≥ 8 Inches	≥ 1.5 ft.
Compaction of Placed Material	WI Spec 204	WI Spec 204	WI Spec 204	WI Spec 300	WI Spec 204
2. Separation Distances [Note 6]					
Sinkholes	≥ 400 ft.	≥ 400 ft.	≥ 400 ft.	≥ 400 ft.	≥ 400 ft.
Well Distance [Notes 3 and 4]	≥ 100 ft.	≥ 100 ft.	≥ 100 ft.	≥ 100 ft.	≥ 100 ft.
Subsurface Saturation (V.A.9)	≥ 2 ft. (1 ft. for sump)	≥ 4 ft. (3 ft. for sump)	≥ 5 ft. (4 ft. for sump)	≥ 3 ft. (2 ft. for sump)	≥ 4 ft. (3 ft. for sump)
Bedrock	≥ 2 ft. (1 ft. for sump)	≥ 4 ft. (3 ft. for sump)	≥ 5 ft. (4 ft. for sump)	≥ 3 ft. (2 ft. for sump)	≥ 4 ft. (3 ft. for sump)
3. Impoundment					
Inside Side Slopes	2.5:1 or flatter	2:1 or flatter			

[Note 1] Refer to section V.B.1.a. for design criteria specific to concrete with waterstop.

[Note 2] Refer to section V.B.1.b. for design criteria specific to concrete composite liners. The PI shall be determined in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140.

[Note 3] Community water system wells may require larger separation distances (see NR 811)

[Note 4] For operations subject to NR 243, the private or non-community Well Separation Distance is 250 ft.

[Note 5] The foundry sand must be ferrous foundry sand with only minimal concentrations of hazardous constituents, cores and other over-size materials crushed or removed, and at least 5% bentonite content. A site specific WDNR approval is required under NR 538 that may specify greater separation distances and parameters not addressed by this standard. An NR 538 Category I or II ferrous foundry sand may be appropriate.

[Note 6] Lesser separation distances shown for sumps apply only when the total sump area is less than 15% of the floor footprint area of the waste storage facility.


08/16/2013


08/16/2013


H&S

C. Specific Criteria for Permanent Stacking Facilities at the Animal Production Area

This criteria does not apply to the unstacked wastes that accumulate in animal housing units.

This criteria applies to stacking the following materials in a confined manner at the animal production area:

- Separated manure solids
- Compost
- Dewatered, recycled sand storage
- Poultry litter (turkey or broiler operations)
- Dry poultry layer manure
- Bedded manure (>50% solids)
- Waste feed (<50% moisture)

Facilities must be designed to prevent run-on and runoff, and operated to prevent ponding and significant hydrostatic head. Facilities may commonly be located near the ground surface, but may be above or below ground. Criteria for stacking facilities are shown in Table 9. **Solids stacking within the animal production area may also be done in an impoundment (Tables 1 through 5) or section V. B. 3.** Methods to ensure ongoing compliance with the criteria must be incorporated into the Operation and Maintenance Plan.

Table 9 – Liner Criteria for Permanent Solids Stacking Facilities at the Animal Production Area [Note 1]

	Roofed		Not Roofed [Note 2]	
	Work Surface [Note 3]	No Surface [Note 4]	Work Surface [Note 3]	No Surface [Note 4]
1. Soils In-Place Liner [Note 4]				
% Fines	≥ 30%	≥ 30%	≥ 40%	≥ 40%
Plasticity index (PI)	-	≥ 7	-	≥ 7
Thickness	≥ 2 ft.	≥ 2.5 ft.	≥ 3 ft.	≥ 5 ft.
2. Soils Compacted Liner [Note 4]				
% Fines	≥ 30%	≥ 40%	≥ 40%	≥ 40%
Plasticity index (PI)	≥ 5	≥ 7	≥ 7	≥ 7
Thickness	≥ 1.5 ft.	≥ 2 ft.	≥ 2 ft.	≥ 3 ft.
Compaction	WI Spec 204	WI Spec 204	WI Spec 204	WI Spec 204
3. Separation Distances				
Sinkholes	≥ 400 ft.	≥ 400 ft.	≥ 400 ft.	≥ 400 ft.
Well distance [Note 5]	≥ 100 ft.	≥ 100 ft.	≥ 100 ft.	≥ 100 ft.
Subsurface Saturation	≥ 3 ft.	≥ 3 ft.	≥ 5 ft.	≥ 5 ft.
Bedrock	≥ 3 ft.	≥ 3 ft.	≥ 5 ft.	≥ 5 ft.
4. Stacking Area	Stacking area not to exceed 7 acres for unroofed managed compost, 2 acres for sand, 2 acres for roofed facilities, or 1 acre for all other materials.			

[Note 1] Solids and sand stacking facilities, treatment areas and other production area structures and systems may be subject to surface water setbacks and other requirements under state and local rules. MOL requirements do not apply to this Table.

[Note 2] Facilities that are not roofed must have floors sloped to control surface drainage; and, unless used only for properly managed composting, all leachate and runoff (up to the 25-yr., 24-hr. storm) must be managed as follows:

Collect leachate and runoff in a facility suitable for liquid containment (Tables 1 through 6) or transfer receptacle (WI FOTG Standard 634), until land applied in accordance with WI FOTG Standard 590, or provide other acceptable treatment for runoff only. Acceptable treatment methods for runoff may only include those described in WI FOTG Standard 635 or WI FOTG Standard 629.

[Note 3] The work surface may be constructed of any of the following: minimum 3 in. for asphalt; minimum 4 in. for concrete; or minimum 8 in. for macadam, and designed for anticipated equipment loads. Refer to industry standard design criteria for each work surface material. The purpose of the work surface is to protect the liner material.

[Note 4] Facilities without a work surface must be operated to minimize rutting and removal of the soil liner. Ruts must be repaired and the soil liner thickness maintained after material handling. Stacking height is not to exceed 10 ft. The PI shall be determined in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140.

[Note 5] Additional separation distances to wells may be necessary on WDNR regulated farms.

D. Specific Criteria For Temporary, Unconfined Stacks of Manure and Derivatives Outside the Animal Production Area

This includes solid type manure and derivatives that are deposited for subsequent loading and spreading. Waste material having less than 16% solids shall not be stacked in the field. Storage of these materials shall be in facilities meeting the criteria in section V.B.1 and 2. Criteria for unconfined waste stacks are shown in Table 10.

Conservation BMPs shall be used above stacking sites to divert overland flow, and below stacking sites to provide containment or buffering to downstream channels and lakes.

The maximum amount of manure that is stacked on any one field shall be limited to the nutrient needs of fields adjacent to the stacking site in accordance with a 590 nutrient management plan.

Table 10 – Temporary, Unconfined Stacks of Manure and Derivatives Outside the Animal Production Area

1. Waste Consistencies [Note 1]		
	> 32% Solids	16% to 32% Solids [Note 2]
2. Size & Stacking Period		
Stacking Period	8 months	8 months
Maximum Volume/Stack	≤ 40,000 cu ft.	≤ 15,000 cu ft.
Maximum Number of Stacks/40 acres [Note 3]	–	2
Frequency of Stacking Site Use	1 year out of 2	1 year out of 3
3. *Hydrologic Soil Groups*		
	B or C	B or C
4. Subsurface Separation Distance		
Subsurface Saturation	≥ 3 ft.	≥ 3 ft.
Bedrock	≥ 3 ft.	≥ 5 ft.
5. Surface Separation Distance		
Wells [Note 4]	≥ 250 ft.	≥ 250 ft.
Lakes	≥ 1,000 ft.	≥ 1,000 ft.
Sinkholes, or other Karst Features	≥ 1,000 ft.	≥ 1,000 ft.
Quarries	≥ 1,000 ft.	≥ 1,000 ft.
Streams	≥ 300 ft.	≥ 500 ft.
Wetlands and Surface Inlets	≥ 300 ft.	≥ 500 ft.
Areas of Concentrated Flow	≥ 100 ft.	≥ 300 ft.
Land Slope Down Gradient of Stack	≤ 6%	≤ 3%
Floodplain	≥ 100 ft.	≥ 300 ft.
Tile lines	≥ 40 ft.	≥ 40 ft.

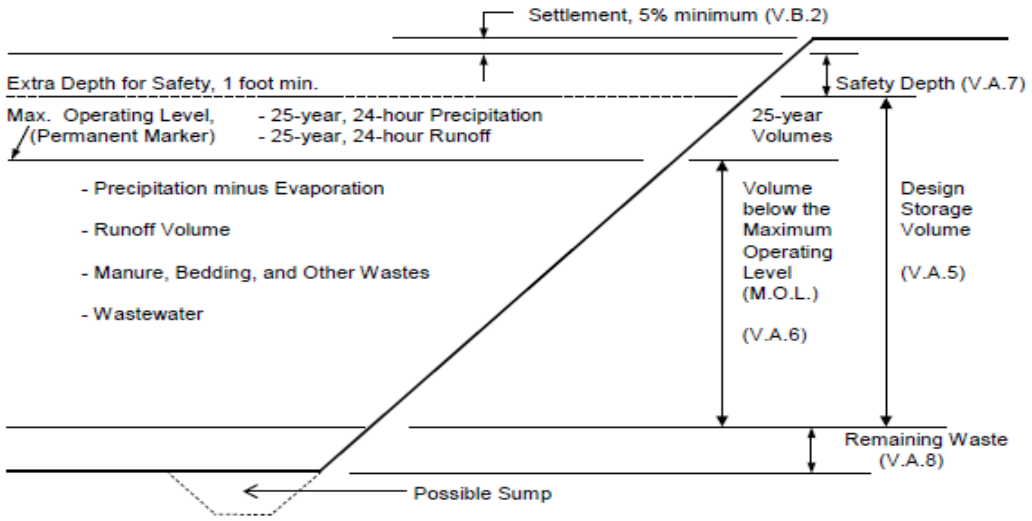
Note 1 Refer to AWMFH, Figure 9-1 for consistency values and Chapter 4 for % solids, for specific livestock types.

Note 2 16% to 32% solids represents waste at near saturation conditions where additions of free water from runoff, rain, or snowmelt can result in liquid flow conditions.

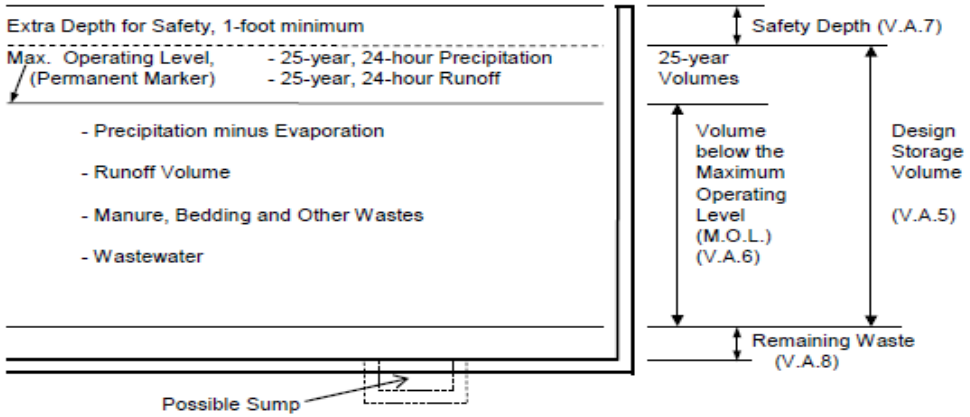
Note 3 The separation distance between stacks shall be at least 100 feet.

Note 4 Community water system wells may require larger separation distances (see NR 812).

Figure 1
Design Storage Volume



IMPOUNDMENT



STRUCTURE

WASTE TRANSFER

(No.)

Code 634

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A system using structures, conduits or equipment to convey byproducts (wastes) from agricultural operations to points of usage.

II. Purposes

To transfer waste (manure, *manure processing derivatives*[1], *contaminated runoff*, and *wastewater*, which includes milking center waste, *leachate* from feed holding areas, and similar waste materials) in a manner which safeguards the environment. It includes transfer through a *hopper, reception structure*, a pump, *channel*, or permanently installed conduit to:

- A waste storage facility,
- A waste treatment facility,
- A wastewater treatment system,
- A loading area,
- Cropland.

III. Conditions Where Practice Applies

The waste transfer component is part of a planned agricultural waste management or comprehensive nutrient management system.

This practice standard applies where manure and other waste is generated by livestock production or processing, and a permanently installed conveyance system is necessary to transfer material from the source to a storage facility, treatment facility or system, loading area, or cropland. This includes moving nutrients from one geographical area with excess nutrients to a geographical area that can utilize the nutrients in an acceptable manner.

This practice standard does not apply to conveyance systems using equipment or mechanisms such as *gutters*, barn cleaners, alley scrapers, or belts for moving manure in the housing facility to the manure transfer system.

This practice standard does not apply to transfer by vehicles or temporary surface pipe or hoses from the storage facility, treatment facility or system, or loading area to the field or another storage facility.

IV. Federal, Tribal, State and Local Laws

Waste transfer systems shall comply with all federal, tribal, state and local laws, rules or regulations or permit requirements governing waste transfer. The operator is responsible for securing required permits. This standard does not contain the text of the federal, tribal, state or local laws.

V. Criteria

The following minimum criteria shall apply to all waste transfer designs.

A. General Criteria

1. Management Assessment

A management assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed with the owner/operator to explore options and to determine the purpose of transfer components, available resources, manure handling practices, and waste characteristics.

The management assessment shall address the following:

a. Waste Characterization.

1) Sources, volumes and consistency of manure, contaminated runoff, manure processing derivatives, leachate, wastewater, and other inputs to the waste transfer system.

2) Animal types.

3) Bedding types and quantity.

b. Waste handling, transfer methods and duration.

c. Facility waste removal methods.

d. Access needs and limitations.

[1] Words in the standard that are shown in italics are described in VIII. Definitions. The words are italicized the first time they are used in the text.


GEA Farm Technologies
Houle
WARNING
AVERTISSEMENT
IMPORTANT

e. Safety needs.

f. Labor and equipment needs.

g. Odor production concerns and control strategies.

h. Aesthetics and animal health.

i. Provisions for facility expansion.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste transfer system. The assessment shall include input from the owner/operator. The site assessment shall include the following.

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, *cultural resources*, and wetlands.

b. Subsurface investigations for reception structures, channels and transfer pipes in the *animal production area* shall be located such that no portion of the structure, channel or pipe is greater than 100 feet from a subsurface investigation point. The investigation shall extend to a minimum depth to ensure required separation distances for the proposed component are achieved.

c. Additional soil investigations shall be conducted if there are substantial variations within or between the soil investigations that may affect the design.

d. Subsurface investigation logs shall include:

1) Soil layers described with respect to thickness, texture using the Unified Soil Classification System (USCS), Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

2) The elevation of *bedrock* and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.

3) The upper elevation of all saturated layers encountered shall be recorded in the field.

e. Subsurface investigations shall include a narrative describing the design limitations that have been derived from the soils data.

3. Separation from Subsurface Saturation or Bedrock

The separation is determined to be the closest distance from any point on the inside surface of the component to the feature from which separation is required.

The definition of subsurface saturation is not intended for application in any context other than to protect components installed from hydrostatic loadings.

a. For the purposes of this standard, factors used to identify subsurface saturation shall include observed saturation, gleyed soil, gray mottles, and soil color in conjunction with nearby surface water features. The highest subsurface saturation elevation identified in a test pit/soil boring will be identified by any of the following soil properties.

1) Free water or wet soil identified by glistening, due to the slow release of water.

2) Gleyed soil, that may extend uninterrupted from an observed free water surface.

3) The presence of distinct gray redoximorphic features with a chroma of 2 or less based on Munsell color charts.

4) Depleted matrices having a value of 4 or more and chroma 2 or less based on Munsell color charts. In some cases soil parent materials have a natural color of 2 chroma or less or gleyed color that is not due to saturation. In these cases other indicators may be used: landscape

position, elevation or soils in relation to nearby water features.

b. In soils not conducive to mottling, such as sand, the subsurface saturation elevation shall be established by evaluating the soil morphology of the soil profile. Other indicators that may be considered in making the determination are the position of the soil in the landscape, topography, nearby wetlands and well construction logs.

c. Subsurface saturation, if encountered, shall not be drained (or have water-bearing layers removed) except as described for *perched conditions*. Perched conditions may be drained or water-bearing materials removed to achieve separation distances in the tables and relieve hydrostatic loads. Documentation to demonstrate that subsurface saturation is perched and of drainable extent or its effects otherwise eliminated shall be included in the site assessment. All *drainage systems* shall drain by gravity. The effect of temporary tailwater on the component and the effects of outletting to perennial and intermittent waterways shall be evaluated. A drainage system shall be located around the outside perimeter of the component footprint and drain to a surface outlet.

d. If the site assessment indicates artesian features, a hydrogeologic and geotechnical evaluation of the site shall be completed to determine the site suitability for in-ground components.

e. Excavation of bedrock is permitted to achieve the required separation distance as specified in the tables. Bedrock shall not be removed by blasting. The exposed bedrock surface shall be evaluated to ensure a structurally sound base. Fractures or voids shall be treated to prevent migration of soil material. The surface of excavated bedrock shall have a positive grade, minimum of 1 percent, under and away from the component, as to prevent any significant ponding on the rock surface unless otherwise stated in specific criteria sections. If bedrock is excavated, the material placed between the component and the bedrock shall have a minimum of 20% passing the #200 sieve.

4. Flood Prone Areas

a. Reception structures, channels and hoppers located in *flood prone areas* shall be protected from inundation, structural damage and instability from the maximum water elevation resulting from the 25-year, 24-hour rainfall event.

b. Waste transfer components located within the maximum water elevation resulting from the 25-year, 24-hour rainfall event, shall be designed for additional loadings such as hydrostatic pressures and buoyancy/uplift. These systems shall also be evaluated for additional protections such as automatic shutoff systems, backflow prevention valves or check valves, watertight connections, main power disconnects, submersible type splices on electrical lines, etc. Any vents, power supplies, and automatic or manual shutoff controls shall be located at or above the maximum water elevation resulting from the 25-year, 24-hour rainfall event so that access is possible.

5. Safety

The system design shall identify and minimize the hazards to animals and people during construction and operation. Waste transfer designs may create *confined spaces*, which can pose significant hazards to people. At a minimum, a design shall include the following.

a. Open structures shall be provided with covers or barriers such as gates, safety fences (see Wisconsin NRCS Field Office Technical Guide, Section IV (WI FOTG), Conservation Practice Standard 382, Fence), etc., to restrict access of animals or people. Include warning signs as necessary.

b. Tank covers shall be designed to withstand both dead and live loads. The live load values for covers contained in ASAE EP378.4, Floor and Suspended Loads on Agricultural Structures Due to Use, and in ASAE EP393.3, Manure Storages, shall be the minimum used. For vehicles or equipment in excess of 20,000 pounds

10. Operation and Maintenance

An Operation and Maintenance (O&M) Plan shall be prepared and reviewed with the landowner and/or operator responsible for the application of this practice. The O&M Plan shall provide specific instructions for proper operation and maintenance of each component of this practice and shall detail the routine maintenance needed to assure the effectiveness and useful life of this practice. The O&M Plan shall be consistent with the purpose of this practice, safety requirements, criteria for design and the Operation and Maintenance Plan in WI FOTG Standard 313, Waste Storage Facility.

At a minimum, the O&M Plan shall include the following items:

a. System information including the general system description, assumed system performance, maximum design working pressure and the transfer system pressure rating of each transfer system.

b. Safety and emergency response including actions to address potential component failures identified in the waste transfer system failure analysis and an emergency response plan for actions needed to address spills and overflows.

c. Operating procedures including: typical operating procedures, procedures for proper start-up and shutdown for the operation of pumped transfer systems and valve operation sequence if applicable.

d. Maintenance items including: scheduled routine maintenance required by the component manufacturer, procedures for cleaning and unplugging pipe, and inspection and maintenance of all safety items.

B. Specific Criteria

1. Reception Structures, Channels, Hoppers, and Pumps

Reception structures, channels, hoppers, and pumps shall meet the following criteria.

a. Joints and appurtenances shall be liquid tight.

b. Separation distances criteria in Table 1 shall be met.

c. Reception structures shall be sized as follows:

1) Reception structures that are part of a manure transfer system.

a) Reception structures not receiving runoff and/or precipitation shall be sized to contain a minimum of one full day's manure production, plus six inches extra depth for safety; or

b) Reception structures receiving runoff and/or precipitation shall be sized to contain a minimum of one full day's manure production, plus six inches extra depth for safety, and the volume of runoff and/or precipitation from a 25-year, 24-hour rainfall event. The increase in storage volume due to runoff and/or precipitation may be reduced if a portion of this runoff and/or precipitation can be safely routed to and contained within the waste management system.

2) Reception structures that are part of a contaminated runoff or wastewater management system.

a) Reception structures not receiving runoff and/or precipitation shall be sized according to the appropriate conservation practice standard and design needs of the system; or

b) Reception structures receiving runoff and/or precipitation shall be sized according to the appropriate conservation practice standard and design needs of the system, plus the volume of runoff and/or precipitation from a 25-year, 24-hour rainfall event. The increase in storage volume due to runoff and/or precipitation may be reduced if a portion of this

Table 1
Separation Distances for Reception Structures Hoppers, Channels, Pumps, and Pipes

Transfer Components	Bottom of Pump, Floor Surface, or Pipe Invert Relative to Bedrock	Bottom of Pump, Floor Surface, or Pipe Invert Relative to Subsurface Saturation	Well, Spring, and Reservoir Separation Distance [Note 1]
Pumps			
Pumps encased in concrete	≥ 6 inches	Bottom of pump maximum depth into saturation shall be 2 feet	≥ 50 feet
Pumps housed in a drywell [Note 2]	≥ 6 inches	Floor may be at the subsurface saturation level	≥ 50 feet
Reception Structures and Hoppers			
Capacity < 6,000 gallons	≥ 1 foot	Floor may be at the subsurface saturation level [Note 3]	≥ 50 feet
Capacity ≥ 6,000 gallons	≥ 2 feet	≥ 2 feet (≥1 foot for sumps) [Note 3]	≥ 100 feet
Channels			
(≥ 2 foot depth)	≥ 2 feet	≥ 2 feet (≥1 foot for sumps) [Note 3]	≥ 100 feet
Pipes			
All	≥ 6 inches	No restrictions	≥ 25 feet

Note 1 Well, spring, and reservoir separation distances are in accordance with NR 812, Well Construction and Pump Installation. Items not listed in the table shall also be in accordance with NR 812. DNR-permitted animal feeding operations need to follow the 250-foot well separation distance requirements of NR 243.

Note 2 Drywells contain pump hardware and are not intended to contain waste.

Note 3 Separation distances from subsurface saturation is not required if the reception structure, hopper, or channel is designed to withstand anticipated hydrostatic loads and uplift (buoyancy).

Table 2
Summary of Criteria for Gravity Transfer Systems

	Slower Flowing Wastes	Faster Flowing Wastes
Description	For wastes that tend to be slower flowing due to bedding, feed, or dryness (typically stanchion barns or thick slurries with higher viscosities).	For wastes that tend to be faster flowing due to additional liquids or lack of bedding (typically free stall barns, veal or hog facilities, and contaminated runoff with lower viscosities).
Minimum Pipe Diameter	24 inches	No minimum diameter
Minimum Head in Gravity Flow Systems (as measured from the Maximum Operating Level (MOL) of the Waste Storage Facility)	Shall be a minimum of 4 feet below the bottom of the barn cleaner, scrape alley, etc., For pipe over 100 feet in length an additional height equal to 1% of the transfer pipe length shall be included.	Liquid or semi-solid wastes shall have a minimum of: • 2 feet below the scrape alley, barn cleaner, channel, etc., and • An additional height equal to 1% of the transfer pipe length Diluted wastes shall have a minimum of: • 1 foot below the scrape alley, barn cleaner, channel, etc., and • An additional height equal to 1% of the transfer pipe length
Minimum Volume of Reception Structure	One full day's manure production. A minimum of one-half a day's manure volume must be between the MOL of the waste storage facility and the bottom of the barn cleaner or scrape alley.	One full day's manure production.
Vent Pipe	A 6-inch diameter minimum vent pipe is required. Install within 10 feet of the reception structure.	A 6-inch diameter minimum vent pipe installed within 10 feet of the reception structure is required for reception structures with knife valves.

gross vehicle weight, the actual axle load shall be used.

c. In push-off areas, barriers shall be installed to prevent the accidental entry of tractors or other equipment.

d. Warning signs shall be provided for waste transfer systems as necessary to warn of the danger of entry and to reduce the risk of explosion, poisoning, or asphyxiation. Appropriate signage shall be visibly located at all access points.

e. Ventilation of enclosed areas shall be provided as necessary to reduce the risk of explosion and asphyxiation.

f. Waste transfer lines from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices where necessary to control gas entry into buildings.

g. A minimum of one in-line manual valve in the transfer pipe, located as close to the storage facility as practical, shall be installed when the top of the storage facility is higher than the top of the transfer structure. An in-line valve is not required if the transfer pipe does not penetrate the liner and terminates at an elevation above the top of the storage facility, thus providing an air gap.

h. Confined spaces where human entry may occur shall be designed and operated in compliance with the provisions contained in ASABE EP470, Manure Storage Safety. Covered channels and reception structures that require humanly occupied equipment operated in the transfer system for cleaning shall not be utilized because they do not meet this safety standard.

6. **Failure Analysis**

The overall functionality of the waste transfer system shall be evaluated for possible malfunctions that could lead to a release of the waste transfer system contents outside the normal operational confines of the waste management system. Identified potential failures should be addressed in the design phase, the operation and maintenance plan, and the emergency response plan.

7. **Construction Plans and Specifications**

Construction plans and specifications for installing waste transfer systems shall be in accordance with this standard and shall describe the requirements for applying the practice to achieve its intended purpose, including the maximum design *working pressure* and the *transfer system pressure rating* of each transfer system. Construction plans and specifications shall include a location map, plan view, profiles, cross sections, details and specifications to ensure that the project can be properly constructed.

8. **Engineering Design Documentation**

Engineering design documentation shall be prepared in compliance with the Design Deliverables in the Wisconsin NRCS Statement of Work for the WI FOTG Standard 634, and shall demonstrate that the criteria in the NRCS practice standard have been met. Design documentation shall include all substantiating data, assumptions, computations and analyses, and the maximum design working pressure and the transfer system pressure rating of each transfer system.

9. **Quality Assurance Plan**

A quality assurance plan is required that describes the type and frequency of testing, the items requiring inspection, the documentation required, and the qualifications of the person doing the work.

The quality assurance plan shall address the following items:

a. Site and Contact Information.

b. Introduction and Project Description – Narrative Format.

c. Responsibilities of Key Parties.

d. Pre-Construction Meeting.

e. Items Requiring Inspection, Observation, and Testing.

f. As-built Plans and other Certification (Attesting) Documentation.


7240
SOMERO LASER SCREED
DANGER