United States Department of Agriculture

Notice of Proposed Changes to the National Handbook of Conservation Practices for the Natural Resources Conservation Service

[Docket No.]
PROPOSED FULL TEXT FOR PRACTICE STANDARD CODE 359

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WASTE TREATMENT LAGOON

CODE 359

(no)

DEFINITION

A waste treatment impoundment made by constructing an embankment and/or excavating a pit or dugout.

PURPOSE

This practice is applied for one or more of the following purposes:

- Reduce nitrogen, phosphorus, and biological oxygen demand of the effluent.
- Reduce manure odors.
- Minimize emissions such as greenhouse gases to improve air quality.
- Minimize or eliminate the impacts on surface water.
- Minimize or eliminate the impacts on groundwater resources.
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CONDITIONS WHERE PRACTICE APPLIES

Use where storage and treatment ~~is~~are needed for organic wastes generated by agricultural production or processing and where soils, geology, and topography are suitable for construction of the facility. For reception pits, use NRCS Conservation Practice Standard (CPS) Waste Transfer (Code 634). For waste storage facilities without treatment, use NRCS CPS Waste Storage Facility (Code 313).

~~For~~This practice applies only to low hazard structures for liquid waste storage and treatment facilities implemented with an embankment~~, this practice applies only to~~., . A low hazard ~~structures as~~structure is defined as a dam in ~~NRCS~~a rural or agricultural area where failure may

damage farm buildings, agricultural land, or township and country roads (Title 210-, National Engineering Manual (NEM), Part 520, ~~Subpart C,~~ Section 520.~~23, "Classification."~~21, "Definition and Classes").

This practice does not apply to the storage or treatment of human waste or animal mortality.

CRITERIA

General Criteria Applicable to All Purposes **Laws and regulations**

Plan, design, and construct the waste treatment lagoon to meet all Federal, Tribal, State, and local laws and regulations.

Location

Locate ~~and design~~ the waste treatment lagoon ~~such that it is~~ outside the 100-year floodplain, unless site restrictions require locating it within the floodplain. If located ~~in~~within the floodplain, protect the facility from inundation ~~or damage~~ from a 25-year- flood event~~.~~ and structural damage from the 100-year flood event. Additionally, follow the policy found in ~~NRCS~~Title 190- General Manual ~~(GM),~~, Ecological Sciences, Part 410, Subpart B, Section 410.25, "Flood Plain Management~~," that~~, which may require ~~providing~~ additional protection, planning, or operating measures.

Foundation

Perform surface and subsurface investigations for ~~storage structures located within the floodplain~~all waste treatment lagoons sufficient in detail and analysis to support the design in accordance with Title 210, National Engineering Manual, Part -531, "Geology" (210-NEM-531). Document the soil material encountered, the location of any seeps, the depth to water table, the depth to bedrock, the presence of sink holes, karst topography, the description and location to nearest water well(s), and other conditions that might affect the suitability of the site.

Storage period

The storage period is the maximum length of time anticipated between emptying events. Base the minimum storage period on the timing required for environmentally safe waste utilization considering ~~the nutrient management plan.~~ climate, crops, soils, and equipment.

Base daily waste loading on the maximum daily loading anticipated. Include all waste sources to be treated by the lagoon. Use reliable local information or laboratory test data if available. If local information is not available, NRCS 210-National Engineering Handbook (NEH), Part

651, Agricultural Waste Management Field Handbook (AWMFH), Chapter 4, "Agricultural Waste Characteristics" may be used for estimating waste loading.

Design volume

Size the facility to contain the following as

appropriate: Operational volume

- Manure, wastewater, bedding, and other wastes accumulated during the storage period.
- Minimum treatment volume (MTV) for anaerobic lagoons only.
- Normal precipitation ~~less~~minus evaporation during the storage period.
- Normal runoff from the facility's drainage area during the storage period.
- Planned maximum residual solids. Provide a minimum of 6 inches for residual solids in tanks unless ~~there is a sump or other device allows~~provisions that allow for complete

emptying are included.

- Additional storage ~~when required~~ to meet management goals or regulatory requirements.

Emergency volume

- 25-year, 24-hour precipitation on the surface area ~~within the top edges~~ of the ~~confining structure~~waste treatment lagoon.
- 25-year, 24-hour runoff from the facility's drainage area.

Freeboard volume

- Minimum of 6 inches for vertical walled facilities.
- Minimum of 12 inches for all other facilities.

Exclude ~~nonpolluted~~non-polluted runoff from the structure ~~to the fullest extent~~ where practical except where ~~including the runoff~~inclusion is advantageous to the operation of the ~~agricultural waste management system~~facility.

Inlet
Design inlet to resist corrosion, plugging, freeze damage, and ultraviolet deterioration. ~~Incorporate~~Design must incorporate erosion protection ~~as necessary.~~. For inlet structures, use NRCS CPS Waste Transfer (Code 634).

Waste removal components
~~Provide~~Design components for removing waste (i.e., such as gates, pipes, docks, wet wells, pumping platforms, retaining walls, or ramps~~.~~) in accordance with the applicable CPS, including but not limited to NRCS CPS Heavy Use Area (Code 561), Pumping Plant (Code 533) or Waste Transfer (Code 634). Account for all items that will influence the performance of the component including loading, durability, serviceability, material properties, and construction quality. Incorporate features to protect against erosion, tampering, and accidental release of stored waste ~~as necessary.~~. Design ramp slopes to accommodate anticipated equipment and~~-~~

traction ~~available. Use NRCS CPS Nutrient Management (Code 590) for~~ . Components must be compatible with land application ~~of stored material or follow other disposal options outlined in a comprehensive~~methods specified in the nutrient management plan ~~(CNMP~~, NRCS CPS Nutrient Management (Code 590).

Accumulated solids removal
~~To preserve~~Preserve lagoon storage volume~~, make~~ by including a provision for periodic removal of accumulated solids. ~~The~~ Design the facility to accommodate the anticipated method ~~for~~of removing accumulated solids ~~removal must be accommodated in design, particularly in~~. This is important for determining the configuration of impoundments and the ~~type of~~ liner to be used.

Maximum operating level
The maximum operating level for ~~liquid storage~~the waste treatment lagoon ~~structure~~ is the level that provides the operational volume.

Staff gauge
~~Place~~Locate and specify the requirements for a staff gauge or other permanent marker in the

waste treatment lagoon to clearly indicate the following elevations:

- Maximum operating level (top of the operational volume~~)~~).
- ~~Emergency level (top~~Top of ~~the operational volume plus the~~ emergency volume~~)~~.
- ~~—~~Minimum operating level (maximum operational drawdown level that provides MTV for anaerobic

- lagoons plus the volume of accumulated sludge between sludge removal events~~)~~.)

For lagoons where the contents are not visible and a staff gauge would not be visible, identify the method for the operator to measure the depth of accumulated waste in the ~~operation~~Operation and ~~maintenance~~Maintenance (O&M) plan.

Safety
Include appropriate safety features to minimize the hazards of the facility (refer to American Society of Agricultural ~~and Biological~~ Engineers (~~ASABE~~ASAE) Standard EP470, Manure Storage Safety, for guidance).

Provide appropriate warning signs, ~~fences,~~ ladders, ropes~~,~~ bars, rails, and other safety devices~~ as appropriate, to ensure the safety of humans~~. Include type, number, location, and ~~livestock. Provide ventilation and~~details for installation of required safety features.

Use warning signs ~~for covered lagoons, as necessary, to prevent~~to identify the potential for explosion, poisoning, or asphyxiation.

Design covers and ~~grating~~gratings over openings such that livestock or humans cannot accidentally displace them and fall into the facility. Design covers and gratings to handle expected operation loads.

Design pipelines with a water-sealed trap and vent, or similar device, if there is a potential for gases from the pipe to accumulate in confined spaces.

~~Place a~~A fence or wall with a minimum height of 5 feet is required around impoundments~~.~~, excavated ponds, and uncovered tanks. Use NRCS CPS Fence (Code 382) ~~for~~to design ~~of~~ a fence that will prevent accidental entry by people or animals ~~likely to be onsite.~~. Post universal warning signs to prevent ~~children and others from entering the lagoon~~entry into lagoons.

Roofs and covers
Use NRCS CPS Roofs and Covers (Code 367) for design of the lagoon cover or roof, as needed. Covers are required for anaerobic lagoons on operations that are equal to or greater than 1,000 animal units (A.U.).

Treated ~~Wood~~wood
Use criteria from NRCS CPS Roof and Covers (Code 367) for treated wood and fasteners.

Foundation
Locate the impoundment in soils with a permeability that meets all applicable regulations or line the impoundment with suitable material. Use liners which meet or exceed NRCS CPS Pond Sealing or Lining, Compacted Soil Treatment (Code 520), Pond Sealing or Lining, Geomembrane or Geosynthetic Clay Liner (Code 521), or Pond Sealing or Lining, Concrete (Code 522). Install an engineered pond liner or

ensure foundation materials meet the maximum specific discharge rate as recommended by NRCS in AWMFH Appendix 10D or that meets state or local regulations, whichever is more restrictive.

Include an evaluation in the liner design of all buoyant uplift forces on the liner for sites located in a floodplain or where there is potential for uplift. Limit projected uplift head under clay liners to a gradient of less than 0.5 ft/ft in the clay liner. The gradient is determined as the difference in total head between the top and the bottom of a clay liner when buoyant forces exist (such as when the floodplain is flooded) divided by the thickness of the clay liner.

Design bottom elevation

~~Locate~~To protect the integrity of the liner, locate the impoundment bottom elevation a minimum of 2 feet above the seasonal high ~~-~~water table, unless special design features are incorporated that address buoyant forces, impoundment seepage rate and ~~nonencroachment~~non-encroachment of the water table by contaminants. The water table may be lowered by use of drains to meet this requirement.

Embankments

Design embankments to withstand loads associated with the lagoon structure. Increase embankment height by a minimum of 5% to allow for settling. Stabilize all embankments to prevent erosion or deterioration. Raise the embankment height where wave action may be a concern and protect the slope from wave action.

- Top width: Design minimum embankment top widths according to Table 1.
- Side slopes: Design the combined side slopes of the settled embankment no steeper than 5-to-1. Design both side slopes no steeper than a 2-to-1 ratio, unless provisions are made for stability.
- Effective height: The difference between the bottom of the spillway crest (or the settled top of the embankment if there is no auxiliary spillway) and the lowest point on the existing ground along the embankment.
- Total embankment height is the difference between the settled top of the embankment and the lowest point on the existing ground along the embankment.

Table 1. Minimum Top Widths

Total embankment height (ft)	Top width, (ft)
Less than 15	8
15–19.9	10
20–24.9	12
25–34.9	14
35 or more	15

When effective height exceeds 20 feet, provide embankment protection by:

- Including an auxiliary spillway with the capacity to route the 25-year, 24-hour storm runoff from the facility drainage plus the 25-year, 24-hour precipitation volume on the surface of the liquid or slurry storage facility, or a minimum of two feet of elevation difference between the crest of the auxiliary spillway and the top of the settled embankment, whichever is greater.

- For embankments without an auxiliary spillway, raise the embankment above the design storage volume an additional 25-year, 24-hour storm runoff from the facility drainage plus the 25-year, 24- hour precipitation volume on the surface of the liquid or slurry storage facility or one foot of freeboard whichever is greater.

Excavations

Specify excavated side slopes to meet the requirements for the type of liner selected, see NRCS CPS Pond Sealing or Lining, Compacted Soil Treatment (Code 520), Pond Sealing or Lining, Geomembrane or Geosynthetic Clay Liner (Code 521) or Pond Sealing or Lining, Concrete (Code 522).

Structural design

Use criteria from NRCS CPS Waste Storage ~~Structure~~Facility (Code 313~~) for embankment, excavation, spillway, foundation, outlet, and structural design.~~

~~**Seepage control**~~

~~Where seepage will create a potential water quality problem, provide a liner which meets the requirements of NRCS CPSs Pond Sealing or Lining - Compacted Soil (Code 520), Pond Sealing or Lining – Concrete (Code 522), or Pond Sealing or Lining – Geomembrane or Geosynthetic Clay Liner (Code 521). **NOTE:** NRCS CPS Code 521 is included in this Federal Register notice and will replace the current CPS Pond Sealing or Lining - Flexible Membrane (Code 521a~~).

Additional Criteria for Anaerobic Lagoons Loading Rate

Design anaerobic lagoons to have an MTV based on the volatile solids (VS) loading per unit of volume. Use actual loading rate data if available. Otherwise, follow the maximum loading rates in NRCS AWMFH, Figure 10-27, or ~~State~~state regulatory requirements, whichever is more stringent.

Minimum operating level

Provide a minimum operating level (also referred to as the maximum operational drawdown) that provides volume for the required MTV plus the volume of accumulated sludge between sludge removal events.

The proper operating range of the lagoon is above the maximum operational drawdown level and below

the maximum operating level. Waste lagoons can be drawn down for sludge removal as described in the O&M plan.

Depth requirements

The minimum depth for the planned maximum residual solids plus the minimum treatment volume is 6 feet. If subsurface conditions prevent practicable construction to accommodate the minimum depth at maximum operational drawdown, a lesser depth may be used if the volume requirements are met.

Additional Criteria for Naturally Aerobic Lagoons Loading Rate

Design naturally aerobic lagoons to have a minimum treatment surface area as determined on the basis of the daily five-day biochemical oxygen demand (BOD5) loading per unit of lagoon surface. The required minimum treatment surface area is the surface area at maximum sludge

storage. The maximum loading rate is as indicated by AWMFH Figure 10-30 or according to ~~State~~state regulatory requirements, whichever is more stringent.

Depth requirements
Use a maximum operating level of between 2 and 5 feet.

Additional Criteria for Mechanically Oxygenated Lagoons Loading rate
Design mechanically oxygenated waste treatment lagoons on the basis of daily BOD5 loading and oxygenation equipment manufacturer's performance data for oxygen transfer and mixing. Select oxygenation equipment to provide a minimum of 1 pound of oxygen for each pound of daily BOD5 loading.

Operating levels
The maximum operating level is the lagoon level that provides the required lagoon volume and must not exceed the site and oxygenation equipment limitations. The proper operating range of the lagoon is below the maximum operating level and above the minimum treatment elevation established by the manufacturer of the oxygenation equipment. Waste lagoons can be drawn down for sludge removal as described in the O&M ~~plan~~Plan.

CONSIDERATIONS

For exposed liners utilizing high-density polyethylene (HDPE) or similar materials that are slippery when wet, consider the use of textured liners or addition of features such as tire ladders that would allow for escape from the waste ~~storage structure.~~treatment lagoon.

Consider solid/liquid separation of runoff or wastewater entering impoundments to minimize the frequency of accumulated solids removal and to facilitate pumping and application of the stored waste.

Since the economics and risks associated with waste treatment lagoons are ~~quite~~ high, consider providing the operator with the cost to close the facility. Cost should include removal of the planned sludge accumulation volume and the waste stored at the maximum operating volume. See NRCS CPS Waste Facility Closure (Code 360) for guidance.

Consider the required energy usage of any mechanically oxygenated lagoon since energy usage can be ~~quite~~ high.

Additional Considerations for Siting
Consider the following factors ~~in~~when selecting a site for waste treatment lagoons:

- Proximity ~~of the waste treatment lagoon~~ to the source of waste.
- Access to other facilities.
- Ease of loading and unloading waste.
- ~~Compatibility with the existing landforms and vegetation, including building arrangement, to~~

- ~~minimize odor impacts and adverse impacts on visual resources.~~
- Adequate maneuvering space for operating, loading, and unloading equipment.
- ~~If the site is within a known karst area~~

- Distance to surface water, wells, non-farm residence(s), and property lines.
- Avoid locating lagoons upwind of areas where heavy gasses may accumulate.

Additional Considerations for ~~for~~ Minimizing the Potential for and Impacts of Sudden Breach of ~~Embankment~~Em- bankment or Accidental Release from the Waste Treatment Lagoon

Consider features, safeguards, and management measures to minimize the risk of failure or accidental release, or to minimize or mitigate impact of this type of failure when any of the categories listed below might be significantly affected.

Potential impact categories from breach of embankment or accidental release include—

- Downstream drinking water sources.
- Surface water bodies—perennial streams, lakes, wetlands, and estuaries.
- Critical habitat for threatened and endangered species.
- Riparian areas.
- Farmstead, or other areas of habitation.
- Off-farm property.
- Historical and archaeological sites or structures that meet the eligibility criteria for listing in the National Register of Historical Places.

~~Either singly~~Consider the following, either individually or in combination to minimize the potential of or the consequences of sudden breach of embankments~~, consider~~ :

- An auxiliary ~~(emergency)~~ spillway.
- Additional emergency volume.
- Additional freeboard.
- Storage for wet year rather than normal year precipitation.
- Reinforced embankment— such as, additional top width, flattened, and armored downstream side slopes.
- Secondary containment.
- ~~Double~~Dual liners.

~~Options to consider~~

Consider the following options to minimize the potential for accidental release from the waste treatment lagoon through gravity outlets ~~include~~ :

- Outlet gate locks or locked gate housing.
- Secondary containment.
- ~~Alarm system.~~
- Addition of an electronic water elevation monitoring device or alarm system.
- Another nongravity means of emptying the waste treatment lagoon.

~~Additional~~ Considerations for Minimizing the Potential of Waste Treatment ~~Lagoons~~Lagoon Liner Failure

Avoid sites with categories listed below unless no reasonable alternative

exists. Potential impact categories for liner failure are—

- Any underlying aquifer is at a shallow depth and not confined.
- The vadose zone is rock.
- The aquifer is a domestic water supply or ecologically vital water supply.
- The site is located in an area of water- soluble bedrock such as limestone or gypsum.

For a site with one or more of these site conditions, consider Consider providing a leak detection system in conjunction with the planned liner to provide an additional measure of safety for a site with one or more of these site conditions.

Additional Considerations for Health and Safety

Consider the following options to minimize health and safety issues:

- Include adequate ventilation, especially when agitating stored manure.
- Add emergency equipment such as a multi-gas monitor, buoys and a self-contained breathing apparatus.
- Remove potential sources of sparks.
- Impacts of low berms around manure storage structures that can trap heavy gases and allow gases to collect above manure storages.

Considerations for Improving Air Quality

Liquid manure storage may result in emissions of volatile organic compounds, ammonia, hydrogen sulfide, methane, nitrous oxide, and carbon dioxide.

To reduce Reduce emissions of greenhouse gases, ammonia, volatile organic compounds, particulate matter, and odor, by adding other NRCS CPSs such as: Anaerobic Digester (Code 366), Roofs and Covers (Code 367), Waste Treatment (Code 629), Amendments for Treatment of Agricultural Waste (Code 591), Composting Facility (Code 317), Waste Separation Facility (Code 632), and Air Filtration and Scrubbing (Code 371) can be added to the waste management system.

Adjusting pH below 7 may reduce ammonia emissions from the waste treatment lagoon but may increase odor when waste is surface-applied—see NRCS CPS Nutrient Management (Code 590).

Some fabric and organic covers have been shown to be effective in reducing odors.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice to achieve its intended use. As a minimum, include the following in the engineering plans and specifications:

- Plan view of system layout with relevant benchmark elevation and descriptions.
- Structural details of all components, including reinforcing steel, type of materials, and thickness, anchorage requirements, lift thickness.

- Locations, sizes, and type of pipelines and appurtenances.
- Requirements for foundation preparation and treatment.
- ~~Vegetative requirements~~
- ~~Quantities~~
- Backfill requirements: lift thickness, method of compaction, material type, material size and moisture content.
- Safety features including saftey fence and universal warning sign locations.
- Material quantities.
- Approximate location of utilities and notification requirements.
- ~~Details of signage, fencing, and other safety features, as needed~~Vegetative requirements.
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OPERATION AND MAINTENANCE

Develop an O&M plan that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. At a minimum, the plan will contain the following information where appropriate—

- Operational requirements for emptying the waste treatment lagoon ~~including~~and the expected storage period. Begin removal of the liquid from the waste treatment lagoon as soon as practical ~~after~~before the maximum operating level has been reached. ~~Also include~~Include the requirement that waste be removed from the lagoon and utilized at locations, times, rates, and volume in accordance with ~~the overall waste management system plan.~~NRCS CPS Nutrient Management (Code 590).
- ~~Include an explanation~~Explanation of the staff gauge or other permanent marker to indicate the maximum operating level and the maximum operational drawdown.
- ~~A provision~~Provisions for emergency removal and disposition of liquid waste in the event of an unusual storm event that may cause the waste treatment lagoon structure to fill to capacity prematurely.
- Instructions as needed for ventilating confined spaces according to ASABE ~~standard~~Standard S607, ~~Venting~~Ventilating Manure Storages to Reduce Entry Risk.
- An emergency action plan for lagoons where there is a potential for significant impact from breach or accidental release. Include site-specific provisions for emergency actions that will minimize these impacts.
- ~~A description~~Descriptions of the routine maintenance needed for each component of the facility. ~~Also include~~Include provisions for maintenance that may be needed as a result of waste removal or material deterioration.
- Instructions for keeping records on sludge accumulation and removal of sludge when the sludge accumulation reaches the maximum residual solids storage level.

~~accumulation reaches the maximum residual solids storage level.~~

Additional Operation and Maintenance for Anaerobic Lagoons

- ~~Include instructions for anaerobic lagoons for including a precharging volume at lagoon startup or following sludge removal. Precharge~~Instructions to precharge the anaerobic lagoon with fresh water equal to the MTV prior to volatile solids loading.

including initial lagoon startup and following sludge removals.

- Provide instruction on timing removal and spreading of wastewater in a manner that will reduce odor released.

REFERENCES

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