

Residential Onsite Wastewater Treatment: Lagoon Maintenance

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This NebGuide is the result of a cooperative effort by the Nebraska Onsite Wastewater Task Force and discusses recommended practices for the operation and management of residential onsite lagoon wastewater treatment systems.

Many Nebraskans live in homes located in rural areas or small communities that do not have access to a public wastewater treatment system. Instead, they must rely on their own onsite wastewater treatment system for wastewater treatment and disposal. The wastewater lagoon (*Figure 1*) is a commonly used onsite system, which is suited for lots with at least three acres and where soils have very slow percolation rates. In addition, many small towns and villages use lagoons as their municipal wastewater treatment system. A

properly designed, installed and maintained system should treat wastewater to minimize the impact on groundwater, surface water and human health.

This publication covers proper maintenance of a residential lagoon onsite wastewater treatment system. A wastewater treatment lagoon is constructed and lined with material such as clay or an artificial liner that allows no more than 1/8 inch of seepage per day (*Figure 2*). Bentonite is a common clay material used to seal lagoons and other water confinement structures. Wastewater flows from the household wastewater plumbing through an underground pipe that leads to the lagoon. Usually, wastewater flows by gravity to the lagoon, where treatment occurs, and water returns to the environment.

A lagoon uses biological, chemical and physical processes to treat and dispose of wastewater (*Figure 3*). Aerobic decomposition, requiring oxygen, occurs near the water surface.

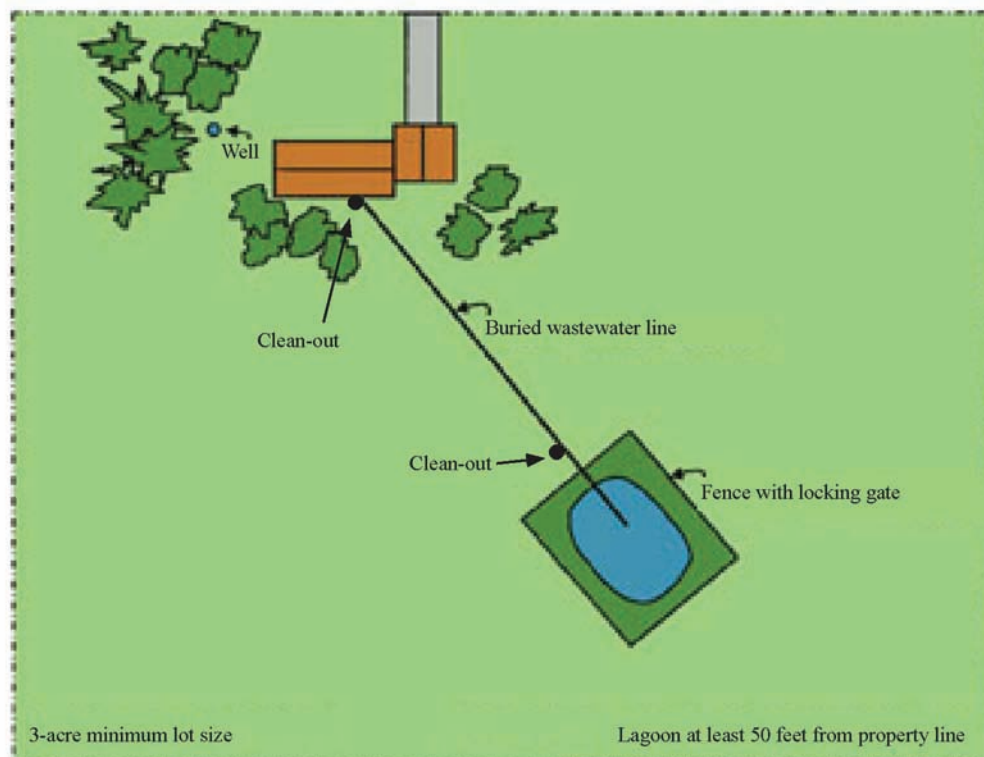


Figure 1. Wastewater lagoon on residential lot.

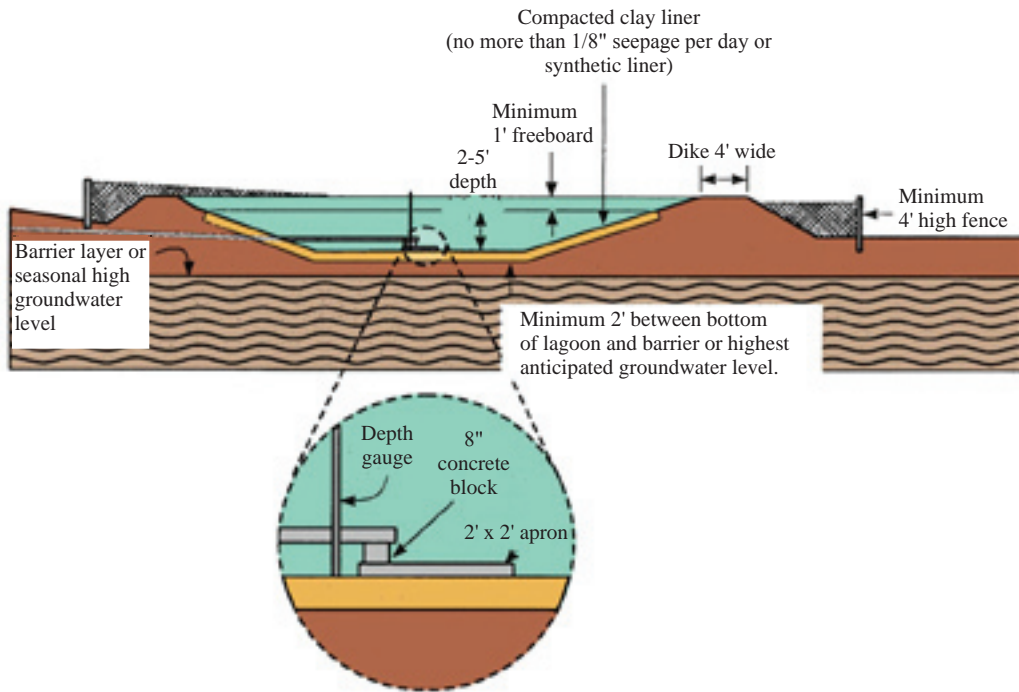


Figure 2. Wastewater lagoon showing some of the design requirements.

Aerobic microorganisms convert waste into carbon dioxide, ammonia and phosphates, which algae use as a food source. In turn, algae present in the lagoon use carbon dioxide and give off oxygen. The aerobic microorganisms are near the surface of the lagoon, where air movement or wind introduces oxygen into the system. Anaerobic decomposition occurs near the bottom of the lagoon where there is little oxygen and anaerobic microorganisms are found. These microorganisms break down wastes into gases, such as hydrogen sulfide, ammonia and methane.

Proper lagoon maintenance is critical to keep the system functioning efficiently. This protects human health and the environment. In addition, it delays the need to repair or replace a system, thereby saving the owner money. Lagoon maintenance includes tasks done at least monthly throughout the year, and other tasks done less frequently. When performing maintenance tasks, always minimize exposure to wastewater by wearing protective and waterproof gloves. After working

around wastewater, thoroughly wash hands or shower and disinfect any breaks in the skin.

Monthly Maintenance

Monthly maintenance includes checking and repairing the lagoon structure, managing vegetation in and around the lagoon, monitoring water color, and managing the water level.

Check and repair lagoon structure.

Check that the fence and gate are in good repair. There should not be any holes or gaps at the bottom of the fence or around the gate. Repair sags, damage or holes that would allow children or animals to get into the lagoon area. Make sure the gate fits well and the lock works.

Check that the dike is in good condition. It must be the same height and shape as when built. Any erosion or damage

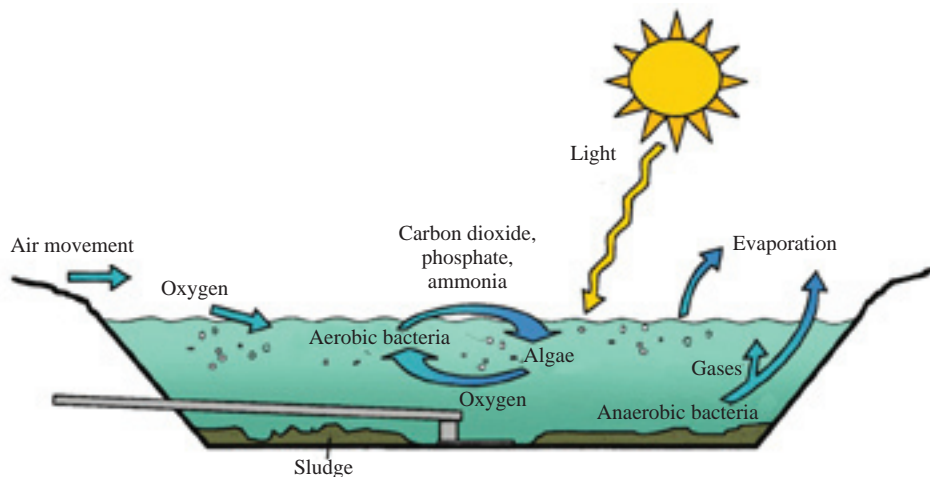


Figure 3. Processes occurring within a wastewater lagoon.

to the dike must be filled, compacted, leveled and reseeded to a perennial grass. Mulching helps control erosion until vegetation is established. Repeated seeding may be required to ensure a good grass cover. Check for and prevent damage to the dike by rodents and other burrowing animals.

Manage vegetation in and around the lagoon.

Healthy, vigorous perennial grass is the best type of vegetation with which to surround a lagoon. Maintain grass inside the fence to a height of no more than 6 inches. Tall vegetation restricts air flow, reducing evaporation from the lagoon. Cut to 3 inches often enough so no more than half the growth is removed at each mowing. Mow cool season grasses like fescue and bluegrass every two weeks in cool months, and monthly during hot weather. Do not let clippings fall into the water; totally removing clippings is a good option.

Maintain healthy perennial grass outside the dike. This grass should be vigorous and can be taller than grass inside the dike. Mow to stimulate a dense, healthy grass cover. Mow cool season grasses in early May and mid-June. Mow warm season types (native species) in early July and mid-August.

Do not allow trees and woody plants taller than the dike to grow within 50 feet of the dike. This is important to allow adequate air movement over the lagoon. Air movement is necessary to provide oxygen needed by microorganisms that break down wastewater, and is also important for evaporation of wastewater. Trees and shrubs close to the lagoon restrict air flow and block sunlight that algae need to produce oxygen. In addition, roots may grow into the dike, providing channels that could lead to eventual degradation and failure of the dike. Tree leaves and other plant debris or wildlife in the lagoon will contribute to faster sludge accumulation because they add organic matter to the wastewater.

Eliminate plants along lagoon edges except for perennial grass. Dig or pull young unwanted plants that are just getting started. After plants become established, removal is a formidable task. If it is not possible to dig or pull plants, use herbicides labeled for target plants that will not harm algae. *Extension Circular EC130, Guide for Weed Management in Nebraska* contains information on aquatic weed control. Apply herbicides directly to plants using a wick. Broadcast spraying risks getting chemicals in the water, requires more chemicals, and should only be used after careful evaluation.

Prevent rooted vegetation from growing in the lagoon. This will help reduce problems due to mosquitoes, aquatic animals and sludge accumulation. A minimum water depth of 2 feet helps prevent rooted plants from growing.

Prevent floating plants from growing in the lagoon. Floating plants like water lilies or duckweed block sunlight, preventing algae from thriving. Algae produce oxygen, which is essential for bacteria to make the lagoon function properly. If floating plants interfere with algae growth, the lagoon may begin to smell due to lack of oxygen. Floating plants may be physically removed or controlled with herbicides. Always act when plants first appear. Select a herbicide for the specific plants to be controlled that does not harm the algae or the environment. Dead plant material resulting from herbicide control adds organic load to the lagoon, which may cause odor and increase sludge accumulation.

Observe the lagoon water color.

The lagoon color is directly related to pH and dissolved oxygen. Color is a good indication of the lagoon’s health.

<i>Color</i>	<i>Health of lagoon</i>	<i>Comments</i>
Bright rich green	Great	Good conditions, plenty of algae are present.
Dull green or yellowish	Not very good	Undesirable type of algae (blue-green, filamentous algae) becoming dominant, indicating poor conditions. Dissolved oxygen levels and pH are dropping.
Tan, brown or red	Questionable	Either there is soil in the water from bank erosion or algae with different pigmentation are present.
Gray or black	Very bad	Anaerobic conditions may exist, so the lagoon is not treating waste water well. Odors are probably present.

Monitor and manage the water level.

A new lagoon must have a post with permanent markings located at the center of the lagoon to check water depth. Record depth at the same time each month in order to monitor changes. This provides information for normal operation of the lagoon, documents changes and trends, and provides a record in case of a problem.

Maintain a 2- to 5-foot depth of wastewater in the lagoon for best wastewater treatment. A minimum depth of 2 feet is necessary to prevent the lagoon floor from drying out, to maintain anaerobic treatment conditions there, reduce odors and prevent rooted vegetation from growing. Occasionally water may have to be added to maintain the minimum 2-foot depth. A maximum depth of 5 feet will help maintain anaerobic, intermediate and aerobic layers for optimal wastewater treatment. One foot of freeboard, or distance from the surface of the 5-foot depth of the lagoon to the top of the dike, is essential to contain a heavy rain event.

Infrequent Maintenance, Every One to Four Years

Infrequent maintenance includes having a certified professional check the depth of the sludge and repairing leaks or seeps.

Check the depth of the sludge.

For best lagoon performance, maintain at least 18 inches of water above the sludge. Have a certified professional measure the sludge accumulation at the same point every few years, preferably near the center of the lagoon. One strategy is to wrap a towel tightly around a stick and lower the stick into the water. The water surface level will show either on the towel or stick. After a few minutes, pull the stick out slowly. Solids clinging to the towel will show the sludge level (*Figure 4*). Measure the distance from the water surface mark to the sludge line, record the results, and compare with previous levels. Be sure to take appropriate safety precautions and wash hands and clothing that may have been in contact with wastewater.

Repair leaks or seeps.

The dike may leak due to faulty construction, erosion due to rainfall, or damage from vegetation or animals. Any leakage must be corrected by repairing the dike and/or sealing the inside surface of the lagoon. Nebraska regulations specify a domestic wastewater lagoon should allow no more than 1/8

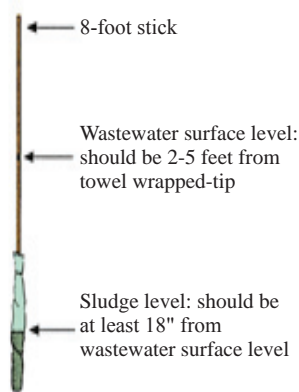


Figure 4. Towel wrapped on stick to measure sludge level.

inch of seepage per day. Should the lagoon become dry from an extended period of non-use or severe leaks, have a certified professional carefully remove sludge from the bottom and insides of the dike and properly dispose of the sludge. The seal material in the liner may need to be reworked to fill any cracks.

Rarely Needed Maintenance

Maintenance that is rarely needed includes removing sludge and abandoning a lagoon properly if it will no longer be used.

Remove sludge.

The sludge layer should be at least 18 inches from the wastewater surface level. If the sludge layer is closer than this, have a certified pumper remove some sludge, while taking care not to disturb the clay or artificial liner. This reduces sludge accumulation and delays rebuilding or completely cleaning the lagoon. Properly dispose of liquids and sludge at a wastewater treatment facility or if allowed by local permitting authorities, land apply according to septage disposal regulations found in Federal 40 CFR Part 503 and Nebraska *Title 124*.

Abandon the lagoon.

If the lagoon will no longer be used, it must be properly abandoned. Have a certified pumper abandon the lagoon following these steps. Drain all liquids from the lagoon and contain or hold for proper disposal. Scrape the settled solids and any liner material from the lagoon bottom. Dispose of all liquids and solids appropriately (see Remove sludge, above). Fill the lagoon basin with soil and mound over the area to provide for future settling.

Summary

A properly designed, installed and maintained residential lagoon system should treat wastewater to minimize the impact on groundwater, surface water and human health. Proper monthly maintenance includes checking and repairing the lagoon structure, managing vegetation in and around the lagoon, monitoring water color, and managing the water

level. Less frequent maintenance includes checking the depth of the sludge and repairing any leaks or seeps. Rarely needed maintenance might include removing sludge and abandoning the lagoon.

Additional Resources

UNL Extension publications:

Guide for Weed Management in Nebraska, EC130
Residential Onsite Wastewater Treatment: An Overview, EC798
Residential Onsite Wastewater Treatment: Lagoon Design and Construction, G1441

NDEQ publications:

Title 124: Rules and Regulations for the Design, Operation and Maintenance of Onsite Wastewater Treatment Systems. Available online at <http://www.deq.state.ne.us/RuleAndR.nsf/Pages/124-TOC>

Kansas State Agricultural Experiment Station and Cooperative Extension Service. Available online at <http://www.oznet.ksu.edu>.

Wastewater Pond Operation, Maintenance, and Repair (MF2290). April 2005. G. Morgan Powell, Barbara Dallengand, Ann Mayo, and Judith Willingham.

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