



3,000 Gallon Per Day or Less No-Discharge Permit Exemption for Domestic Wastewater Design Guidance

Some small, no-discharge, domestic wastewater treatment facilities are eligible for permit exemptions. The exemption is available for facilities that generate only domestic wastewater (bathroom and toilet waste, residential laundry waste, residential kitchen waste, etc.) at a rate of 3,000 gallons per day or less. At no time may the domestic wastewater be discharged from the operating location (property) or into surface or ground waters in the state.

What is a “no-discharge” wastewater system?

A no-discharge facility is one that is designed, constructed, operated and maintained to hold or irrigate, without discharging to surface or ground waters, all domestic wastewater generated by the facility it serves.

This fact sheet gives design guidance that should help your facility satisfy the criteria for the 3,000-gallon per day no-discharge construction or operating permit exemptions when using a lagoon for wastewater treatment that is either followed by on-site land application or is pumped and hauled to a permitted treatment or disposal facility.

When is the exemption possible?

The exemption from a construction and operating permit is possible when a facility generates 3,000 gallons per day or less of domestic wastewater that is held within a no-discharge lagoon and followed by either on-site land application or is pumped and hauled to a permitted treatment or disposal facility. See 10 CSR 20-6.015 (3)(B) 6, which is available on the Missouri Secretary of State’s Web site at www.sos.mo.gov/adrules/csr/current/10csr/10c20-6a.pdf. If a facility satisfies those criteria, it is then exempt by rule and does not require department approval, unless the department determines that construction or operating practices are not adequate.

- Wastewater cannot be land applied during frozen, snow covered or saturated soil conditions.
- The storage lagoon must be sealed in accordance with 10 CSR 20-8.
- This exemption does not apply to single-family residential lagoons. The Missouri Department of Health and Senior Services or the local administrative authority (commonly the local health department) regulate single-family residential lagoons. That is one lagoon serving one house only. The department has jurisdictional authority over all other lagoons in the state.
- The exemption does not satisfy Section (1)(C) 6 of 10 CSR 20-6.030 as a centralized waste water collection and treatment system for a subdivision. To satisfy that section, all requirements of the Missouri Clean Water Law and regulations, including continuing authority, in accordance with 10 CSR 20-6.010, must be established. This includes obtaining construction and operating permits.

What is the definition of domestic wastewater?

Section 701.025 (12), RSMo, Definitions, defines domestic wastewater as "...Human excreta and wastewater, including bath and toilet waste, residential laundry waste, residential kitchen waste and other similar waste from household or establishment appurtenances."

System Design Information

The following information is provided to assist in the sizing, siting and construction of a no-discharge system.

If a proposed or existing 3,000 gallons per day or less no-discharge facility satisfies the non-discharge exemption, then it is exempt by rule and does not require department approval.

The information stated below should be used as a guide to ensure your facility meets the definition of a "no-discharge" facility (10 CSR 20-6.015). The department strongly suggests you follow this guidance and the guidance in 10 CSR 20-8.020, Design of Small Sewage Works, to ensure your facility can be considered exempt.

As described in 10 CSR 20-6.015 (2)(B), nothing shall prevent the department from taking action to assure that facilities do not discharge into surface or ground waters of the state, including requiring permits for facilities that were exempt. The department may require permits to correct noncompliance or when the department determines that construction or operating practices are not adequate.

Locating the Lagoon

Select a lagoon site with a clear sweep of the surrounding area by prevailing winds. Heavy timber should be removed for a distance of at least 50 feet from the water's edge to enhance wind action and prevent shading. Avoid steeply sloping areas.

The lagoon must be located a minimum of:

- 100 feet, and preferably 300 feet, from any water well or water supply structure.
- 50 feet from a stream, water course, lake or impoundment.
- 50 feet from any residence or establishment.

The lagoon should be located a minimum of 100 feet from the building(s) that it serves and a minimum of 200 feet from an existing built up area or existing residence.

The lagoon should be located a minimum of

- 75 feet from property lines, as measured from the lagoon's nearest shoreline.
- 50 feet, and preferably 100 feet, from trees, which may drop leaves, provide shade or send roots into the lagoon.

Sizing the Lagoon and Land Application Field

In order to size the lagoon, you must determine the amount of wastewater flow expected to be produced per day when the facility reaches its maximum loading. This is known as the design flow and is measured in gallons per day. The flow expected from a residence is estimated to be about 300 gallons per day. This would represent the flow from a single family home or a single apartment within an apartment building. The flows expected from hotels, restaurants or other facilities can be determined by using Table 1 of 10 CSR 20-8.020 (11)(B)3.

The lagoon sizes shown in Tables 1 and 2 include storage for all of the flows listed above and rainfall. Tables 1 and 2 also provide the land areas required to land apply the amount of wastewater flow. Table 1 uses the recommended 3:1 berm side slopes, while Table 2 uses a side slope of 2:1 for limited property sizes. The lagoon dimensions shown in Tables 1 and 2 refer to Figure 2.

The lagoon must be large enough to accommodate the following volumes of water and wastewater:

- There must be sufficient storage volume in the lagoon to store wastewater when the soil is frozen during winter or during extended periods of saturated soil conditions. The storage volume between the 2 foot operating level and the 5 foot level should be at least 60 days in southern Missouri to 120 days in northern Missouri. The following tables are generally adequate to achieve these storage periods except that the lagoons should be constructed a foot deeper or 6 foot operating depth in the northern third of Missouri to accommodate a 120 day storage period. The storage volume can be minimal for seasonal use facilities that are not in operations in wintertime, however, it is recommended that storage lagoons be built in accordance with the following tables.
- The total lagoon depth must include 2 feet of freeboard above the 5 foot operating level for a total lagoon depth of 7 feet. Lagoons in the northern one-third of Missouri should have a total depth of 8 feet.
- Additional storage must be provided for the one-in-ten year rainfall minus evaporation for 90 days. This volume of water can be contained using one foot of the two feet of freeboard.

Table 1

LAGOON DIMENSIONS (L X W)					
(Using a side slope of 3:1)					
FLOW (GPD)	SQUARE LAGOON		RECTANGLE LAGOON		LAND APPLICATION AREA (SQ. FT.)
	Bottom L_B x W_B	Bern Top L_T x W_T	Bottom L_B x W_B	Bern Top L_T x W_T	
300	14 x 14	56 x 56	17 x 10	59 x 52	11,200
600	28 x 28	70 x 70	38 x 20	80 x 62	18,500
900	39 x 39	81 x 81	50 x 30	93 x 72	25,810
1200	49 x 49	91 x 91	73 x 30	115 x 72	33,130
1500	57 x 57	99 x 99	86 x 35	128 x 77	40,450
1800	64 x 64	106 x 106	97 x 40	139 x 82	47,770
2100	71 x 71	113 x 113	118 x 40	160 x 82	55,100
2400	77 x 77	119 x 119	125 x 45	167 x 87	62,410
2700	83 x 83	125 x 125	138 x 47	180 x 89	69,730
3000	89 x 89	131 x 131	146 x 51	188 x 93	77,050

Table 2

LAGOON DIMENSIONS (FT.) (L X W)					
(Using a side slope of 2:1)					
FLOW (GPD)	SQUARE LAGOON		RECTANGLE LAGOON		LAND APPLICATION AREA (SQ. FT.)
	Bottom L _B x W _B	Bern Top L _T x W _T	Bottom L _B x W _B	Bern Top L _T x W _T	
300	21 x 21	49 x 49	32 x 12	60 x 40	11,200
600	35 x 35	63 x 63	51 x 23	79 x 51	18,500
900	46 x 46	74 x 74	60 x 35	88 x 63	25,810
1200	56 x 56	84 x 84	75 x 40	103 x 68	33,130
1500	64 x 64	92 x 92	88 x 45	116 x 73	40,450
1800	71 x 71	99 x 99	99 x 50	127 x 78	47,770
2100	78 x 78	106 x 106	108 x 55	136 x 83	55,100
2400	85 x 85	113 x 113	116 x 60	144 x 88	62,410
2700	91 x 91	119 x 119	123 x 65	151 x 93	69,730
3000	96 x 96	124 x 124	130 x 70	158 x 93	77,050

- *1. Lagoons constructed in the northern 1/3 of the state should have a total depth of 8 feet.
- 2. The above dimensions are for 7 foot deep lagoons. The bottom dimensions will be smaller for deeper lagoons.

Constructing the Lagoon

A small bulldozer or skid loader is the best equipment for building a lagoon. Construction must be done during moist soil conditions or the lagoon may leak. It is important to destroy the original soil structure by repeated compaction or diking with rubber-tired equipment, such as a wheel tractor or with a sheepsfoot roller, to assure an adequate seal in the clay liner on the lagoon bottom. Where soils are too gravelly to provide an adequate seal, an artificial liner may be used, or clay soil may be brought in, to create a seal.

Figures 1 and 2 provide details about many of the desired construction features. Round, square or rectangular lagoons with rounded inside corners are most desirable. Lagoon length should not be more than three times its width and no islands, coves or peninsulas are permitted.

Figure 1

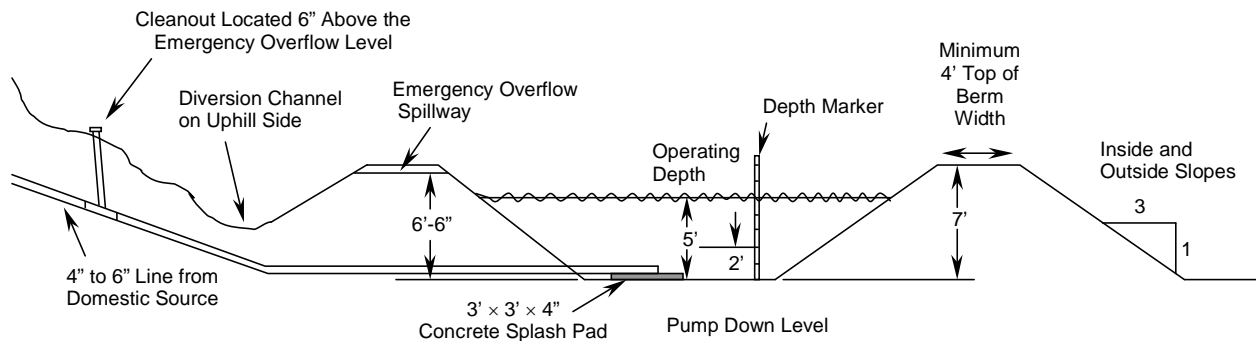
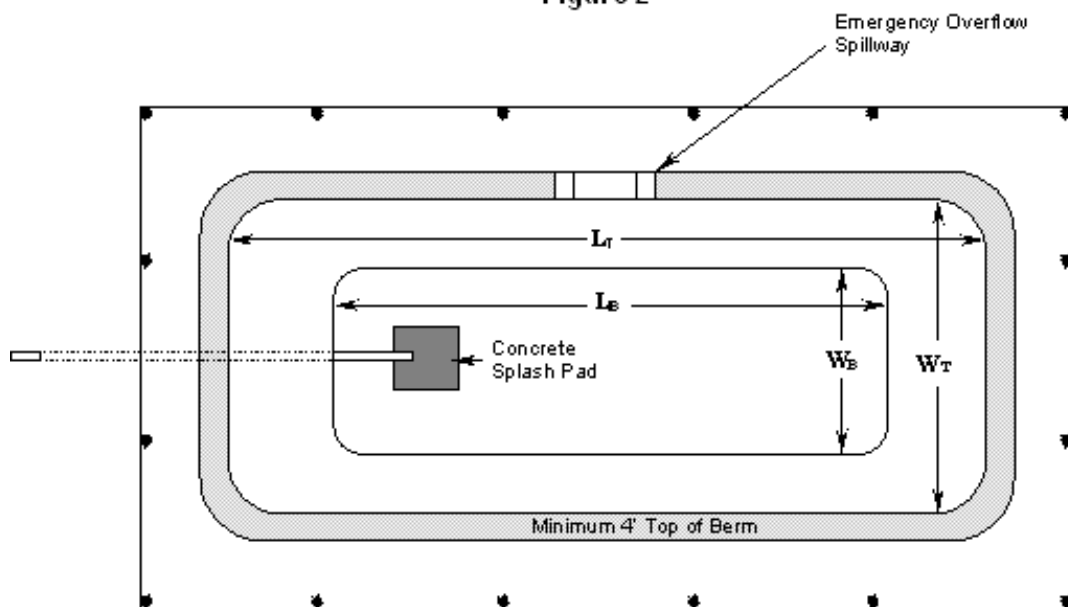


Figure 2



Rectangular Lagoon Shown

A terrace should be placed above the lagoon to divert surface water around the lagoon. It is recommended that a uniform 3:1 or flatter slope be used on the inner and outer lagoon banks and any terraces so that vegetation can be easily mowed. However, steeper slopes, up to 2:1 on the inner slopes, are allowable when site conditions are limited. Provide an outer berm height of at least 2 feet to prevent surface water from entering the lagoon. The lagoon banks must be at least 4 feet wide on top.

Establish good vegetative cover on lagoon banks as soon as possible after construction. Do not use alfalfa or similar long-rooted crops, which might interfere with the water-holding capacity of the embankment. Riprap may be necessary to provide protection of embankments from erosion.

Use at least SDR 35 (schedule 40 recommended) PVC or other acceptable pipe with a 4-inch minimum diameter for the influent line from the source to the lagoon. Place the pipe in a trench on top of undisturbed earth at a minimum grade of 1/8 inch per foot (1 foot of drop per 100 feet of distance). Provide a cleanout on the influent line near the lagoon bank with the bottom elevation of the cleanout a minimum of 6 inches above the high water level in the lagoon. The influent line should lay on the bottom of the lagoon and discharge onto a concrete splash pad 3 feet square, with the discharge point as far as practical from the outlet side of the lagoon.

If the wastewater source(s) has a garbage grinder, it is best to precede the lagoon, with a watertight septic tank with a minimum 1,000-gallon capacity, at each source, to reduce the fats and solids loading on the lagoon.

Install a marker in the lagoon to show the water depth.

Construct an emergency spillway on the cut-face of the lagoon by making a slight depression, approximately 6-inches deep and 2-3 feet wide, in the top of the berm. Riprap may be necessary to prevent soil erosion if the lagoon discharges in an emergency event. The spillway will allow water to discharge from the lagoon in an emergency situation, thereby helping prevent the berms from eroding if the water level gets too high and flows over the berms.

Enclose the lagoon with a minimum 5 foot high chain link, barbed, welded or woven wire fence to restrict entry by children, livestock and unauthorized persons. Locate the fence to permit mowing of the lagoon banks. Provide a gate large enough for entry of mowing equipment.

Place a warning sign on each side of the facility. Suggested wording: SEWAGE LAGOON – KEEP OUT. The signs must be made of a durable material with lettering at least two inches high and be securely fastened to the fence.

Prefill the lagoon with water to the 2 foot level before putting it into service. Enough water in the lagoon to cover the inlet pipe is essential, and then the lagoon can be filled gradually by incoming wastewater.

In order to be exempt from the regulations, the storage lagoon must not have percolation losses exceeding 1/16 inch per day.

Locating the Application Area and Constructing the Irrigation System

The application area must be at least:

- 150 feet from existing dwellings or public use areas, excluding roads or highways.
- 50 feet from the property line
- 300 feet from any potable water supply well not located on the property. Adequate protection should be provided for any wells located on the property.
- 300 feet from any sinkhole, losing stream or other geographical feature that may provide a direct connection between the groundwater table and the surface.

Fence the application area if it is accessible by the public.

Use an irrigation system to land apply the wastewater. This can be performed by using a pump with movable sprinklers or by installing a pump and a solid-set sprinkler system. Either system must be designed to handle lagoon effluent.

Operation and Maintenance

Maintenance requires keeping the berms in good condition and fence in good repair, preventing organic debris from entering the lagoon and preventing shading of the lagoon surface.

Regular mowing of the banks from inside the fence to the water's edge will prevent tall grass from drooping into the lagoon where it provides mosquito-breeding areas and could contribute to premature filling. Mowing debris should be prevented from entering the lagoon.

It is recommended that trees within at least 50 feet of the lagoon be removed to keep leaf debris from entering, avoid shading the surface and help control tree roots. Any other vegetation or trees, that shade the lagoon, especially during the winter months, should be removed. Watch for damage to the banks, especially from burrowing animals. Any damage should be repaired immediately and reseeded with grass as needed. Cattails or other vegetation, including duckweed and floating algae masses, should be removed from the lagoon immediately to minimize mosquito breeding and excess organic loading, and to improve oxygen transfer. To help reduce damage to the banks, the fence should be kept in good repair so animals cannot get on the embankments.

Operation and maintenance also includes land application of the wastewater. Once the wastewater level in the lagoon reaches the 5 foot water depth, the wastewater must be land applied. The wastewater should be land applied until the level in the lagoon is lowered to the

2 foot water depth. This process should also be performed just before winter, because wastewater cannot be land applied when the ground is frozen or snow covered. In addition, wastewater cannot be land applied when the soil is saturated.

How No-discharge Lagoons Work

Lagoons are earthen basins for the biological treatment of wastewater. Microorganisms break down wastes in sewage, and oxygen is required for the microorganisms to treat the sewage. Algae, which give the lagoon its green color, produce part of the oxygen. Another source of oxygen occurs at the water surface where oxygen enters from the atmosphere. This exchange is enhanced substantially when the wind is blowing.

Sunlight is essential for algae to produce oxygen; therefore, the lagoon surface should not be shaded. Bacteria and other organisms consume oxygen and give off carbon dioxide, which is used by algae in their growth. In a properly constructed lagoon, solids are distributed over such a large area that it should take at least 10 years before sludge removal is required. The presence of trees, water vegetation, fish, animals and waterfowl in or near the lagoon will contribute to the need for more frequent sludge removal.

Properly sized and maintained lagoons usually have little or no odor. However, during spring and fall turnover in lagoons, odors may be present for a few days. Odors are also likely when the natural biological system is upset. Overloading can cause this, chemicals entering the system that disrupt the natural processes, or extended cloudy weather, especially in spring.

Odors most commonly develop when lagoon contents become anaerobic, or septic. This may occur during extended periods of cloudy weather or following cold winter weather when algae growth is reduced. When the weather warms up, microbiological activity quickly increases, resulting in reduced oxygen levels and possibly in odors. Broadcasting agricultural sodium nitrate or ammonium nitrate (10-10-10) at the rate of two-pounds per day over the surface of the lagoon until algae growth turns the lagoon green helps control odors. Odors will disappear during the warm season in a properly constructed and managed lagoon, whether or not fertilizer is added to promote algae growth.

Can I receive a letter of exemption?

The department will not issue letters of exemption for systems functioning satisfactorily, since they are considered exempt by rule and do not require department approval. The system will be considered out of compliance when there is evidence it is not being properly operated and maintained.

If documentation is requested by a lending institution, Missouri Department of Health and Senior Services or local authority that your facility satisfies the no-discharge exemption, then the Department of Natural Resources recommends you have a registered professional engineer provide that information. The engineer should certify that the size of the lagoon and land application area are sufficient to achieve no-discharge and the percolation losses do not exceed 1/16 inch per day per the sealing requirements in 10 CSR 20-8.020. If the lagoon is pumped and hauled to a permitted treatment or disposal facility, the name and location should be provided. While such a letter may serve to verify the facility is exempt, the department will not deem the letter as certifying the system is in compliance.

If a letter is requested from the department, a registered professional engineer must submit a letter certifying the above documentation to the appropriate department regional office. A copy of the actual design is not required. The regional office may then issue a letter of "No Permit Required." Again, this is not certifying the system is in compliance.

Nothing shall prevent the department from taking action to assure that facilities do not discharge into surface or ground waters of the state, including requiring permits for facilities that were previously exempt. Permits may be required to correct noncompliance or when the department has determined that construction or operating practices are not adequate, see 10 CSR 20-6.015 (2)(B).

After it is determined a facility is exempt from 10 CSR 20-6.015, who has jurisdiction?

The facility (lagoon) will remain the department's jurisdiction throughout its life.

Summary

If a proposed or existing 3,000 gallons per day or less no-discharge lagoon satisfies the exemption, then it is exempt by rule and does not require department approval, unless the department determines that construction or operating practices are not adequate.

The department strongly recommends that you read the fact sheet *3,000 Gallons Per Day or Less No-Discharge Permit Exemption for Domestic Wastewater Facilities (Lagoons)*—PUB2213, to help determine if your facility is eligible for a no-discharge permit exemption. The fact sheet is available on the Web at www.dnr.mo.gov/pubs/pub2213.pdf.

The burden of proof of exemption is on the owner and it is their responsibility to demonstrate to the department that the system is and should be exempt and that it meets the standards set out in the definition of "No-Discharge Facility".

Note: Certain establishments, for example food service or lodging facilities, are regulated by the Missouri Department of Health and Senior Services or the local public health agency. The facility may be required by those agencies to demonstrate that a no-discharge lagoon system complies with the above guidance and is being operated adequately.

For More Information

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Water Protection Program
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800-361-4827 or 573-751-1300
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