



ADMINISTRATIVE RULES OF MONTANA



17.30.1702 SETBACKS BETWEEN SEWAGE LAGOONS AND WATER WELLS

- (1) For purposes of this rule, the following definitions apply:
 - (a) "Lagoon area" means the surface area of the lagoon within the design of the high-water mark.
 - (b) "Maximum day well demand" means the highest volume of water discharged from a water well on any day in a year.
 - (c) "Sewage lagoon" means any holding or detention pond that is used for treatment or storage of water-carried waste products from residences, public buildings, institutions, or other buildings, including discharge from human beings or animals, together with ground water infiltration and surface water present. For purposes of this rule, the term includes concentrated animal feeding operations but does not include storm water facilities or subsurface wastewater treatment systems.
 - (d) "Water well" has the same meaning as 75-5-103, MCA.
- (2) All new water wells and new sewage lagoons must meet the setbacks in (3), unless the applicant demonstrates that a shorter setback is allowed under (4) or (6). Water wells and sewage lagoons that existed or were approved by the department before the effective date of this rule must meet the setbacks under either of the following circumstances:
 - (a) if the lagoon area is proposed to be increased; or
 - (b) if the maximum daily pumping rate of a water well is proposed to be increased.
- (3) The following setbacks apply, unless the applicant demonstrates that a lesser setback is allowed under (4) or (6):
 - (a) 1,000 feet between a water well and the design high-water mark of a sewage lagoon;
 - (b) 200 feet between a well for a public water supply system with continuous disinfection that meets the 4-log virus inactivation and the design high-water mark of a sewage lagoon;
 - (c) 200 feet between a water well and the design high-water mark of a sewage lagoon if the geometric mean number of E. coli bacteria in the influent flow to the sewage lagoon does not exceed 126 colony forming units per 100 milliliters and 10 percent of the total samples do not exceed 252 colony forming units per 100 milliliters during any 30-day period; and
 - (d) 100 feet between a water well and the design high-water mark of a sewage lagoon if the applicant demonstrates there is no hydraulic connection between the sewage lagoon and the water well as demonstrated by groundwater gradients under the maximum day pumping rate or by confined conditions that prevent lagoon discharges from impacting the water well.

- (4) A setback less than the setbacks in (3)(a) through (c) may be used if the applicant demonstrates that the distance needed to achieve 4-log pathogen reduction of effluent migration from the sewage lagoon to the water well is less than the setback distance in (3)(a) through (c). In no instance, however, may the setback be less than 100 feet.
- (5) To make the demonstration in (4), the pathogen reduction between the sewage lagoon and the water well must be calculated according to one of the following methods:
- (a) METHOD 1 – Travel Time Method - The vertical travel time in the vadose zone for the wastewater to reach groundwater is calculated using the following equation:

$$t_1 = [(d) * (\theta) \div (\alpha)] * 365$$

Where:

t_1 = vertical travel time (days)

α is total effluent recharge – the maximum allowable leakage rate or actual measured leakage rate if the measured rate is available (in/yr)

θ is volumetric soil moisture (percent)

d is the depth to groundwater (in)

The horizontal travel time in the saturated zone for the wastewater to reach the water well is calculated using the following equations:

$$t_2 = [ne \div (K * i)] * [x - \{(Q \div (2 * \pi * K * b * i)) * (\ln(1 + ((2 * \pi * K * b * i * x) \div Q)))\}]$$

Where:

t_2 = horizontal travel time (days)

K is hydraulic conductivity of the saturated aquifer (feet/day)

i is hydraulic gradient (feet/foot)

b is aquifer saturated thickness (feet)

ne is effective porosity (dimensionless)

π is pi, 3.14 (dimensionless)

ln is natural logarithm

Q is the maximum day well demand (feet³/day)

x is the horizontal distance from the sewage lagoon to the water well (feet). Value is positive when well is downgradient of sewage lagoon, negative if well is upgradient of sewage lagoon.

The total log pathogen reduction from the bottom of the sewage lagoon to the water well is calculated using the following equation:

$$P_t = (t_1 + t_2) * 0.02$$

Where:

P_t = Log reduction of pathogens during vertical and horizontal travel

0.02 = log 10 pathogen removal/day

- (b) METHOD 2 – Travel time and VIRULO - The horizontal travel time (t_2) is calculated the same as for Method 1. The horizontal log reduction is calculated using the following equation:

$$P_h = (t_2) * 0.02$$

Where:

P_h = Log reduction of pathogens during horizontal travel

The pathogen reduction during vertical movement in the vadose zone is calculated using VIRULO. The value of P_h is added to VIRULO results to provide the total pathogen reduction from the bottom of the sewage lagoon to the water well.

- (c) Other methods approved by the department.

- (6) In calculating 4-log pathogen reduction under (4), the following requirements apply:
- (a) Hydraulic conductivity must be based on the aquifer material most likely to transmit lagoon discharges to the water well and be determined by one of the following methods:
 - (i) The maximum hydraulic conductivity value of the aquifer material shown in Table 1. The hydraulic conductivity for aquifer materials not included in Table 1 may be calculated by the applicant using other methods acceptable to the department. The aquifer material must be the most permeable soil layer that is at least six inches thick and is below the bottom of the sewage lagoon infiltrative surface, as identified in any test pit or borehole. This method may only be used for facilities that are not requesting a source-specific ground water mixing zone, as defined in ARM 17.30.518.

TABLE 1

MATERIAL	HYDRAULIC CONDUCTIVITY (ft/d)
Basalt (permeable/vesicular)	5,100
Clay	0.025
Clay (unweathered, marine)	0.00054
Coarse sand	2,950
Fine sand	51
Glacial Till	0.72
Glacial Till (fractured)	29.5
Gravel	13,500
Gravelly sand	1,020
Igneous/metamorphic rock (fractured)	76.5
Igneous/metamorphic rock (unfractured)	0.000054
Karst limestone	18,000
Limestone	1.5
Limestone (unjointed, crystalline)	0.30
Loess	0.27
Medium sand	569
Sandstone	1.5
Sandstone (friable)	3.0
Sandstone (well cemented, unfractured)	0.0036
Sandy clay loam	1.4
Sandy silt	0.27
Shale	0.00054
Silt	0.27
Siltstone	0.0036
Silty clay	0.013
Silty sand	45
Tuff	7.2
Very fine sand	21.4

- (ii) A pumping test at least 8 hours long, representative of the hydraulic conductivity of the aquifer material, and conducted on a well(s) with complete lithology and construction details. Results for pumping tests must be submitted electronically on DNRC Form 633. Pumping tests must be conducted in accordance with the requirements in ARM 36.12.121(2)(a) through (f), (3)(a), (3)(c), (3)(g), (3)(i), (3)(j), and (3)(k).
- (b) Hydraulic gradient must be based on the aquifer material most likely to transmit lagoon discharges to the water well and must be determined by one of the following methods:
 - (i) The regional topographic slope in an area that includes the water well and the sewage lagoon. The minimum hydraulic gradient that may be used with this method is 0.005 feet/feet, and the maximum gradient that may be used is 0.05 feet/feet. This method may not be used for facilities requesting a source-specific ground water mixing zone as defined in ARM 17.30.518.
 - (ii) Groundwater potentiometric maps of the aquifer that accurately represent the local hydraulic gradient in the area of the water well and sewage lagoon.
 - (iii) Surveyed static water elevations in at least three wells that draw water from the aquifer, accurately represent the local hydraulic gradient in the area of the water well and sewage lagoon, and are measured on the same date to the nearest 0.01 foot.
- (c) Soil type must be determined by test pits or boreholes. The following requirements apply:
 - (i) Test pits or boreholes must be completed to a minimum depth of 10 feet below the bottom of the sewage lagoon infiltrative surface or until an impervious layer, as defined in Circular DEQ-4, is encountered.
 - (ii) A minimum of two test pits or boreholes must be completed for the first 0.5 acre of lagoon area that is within 1,000 feet of a water well. A maximum of one additional test pit or borehole for each additional acre of lagoon area within 1,000 feet of a water well may be required if the department determines that additional test pits or boreholes are necessary to adequately characterize the soils between the sewage lagoon and the water well. The test pits or boreholes must be located to provide representative information on the soils beneath the sewage lagoon that affect the vertical and horizontal migration of pathogens from the sewage lagoon to the affected water well.
 - (iii) If the test pit or borehole locations are not within 50 feet of the toe of the sewage lagoon embankment, then the locations must be approved by the department before they are completed. The borehole method must provide a continuous soil sample that is representative of the soil and lithology profile.
 - (iv) For purposes of defining soil effective porosity and volumetric soil moisture that are used in (5), soils must be described according to the Unified Soil Classification System. The soil description must include information regarding the presence or absence of seasonal saturated conditions. If there is no evidence of saturated conditions from the test pit, borehole, or other evidence, then the depth to groundwater must be estimated as the bottom of the test pit or borehole.

- (d) Soils with greater than 35 percent retained on the No. 10 sieve and geologic materials with fractures do not receive credit for virus reduction in the vadose zone.
 - (e) The well discharge rate used in calculations must be based on the maximum day well demand, which must be determined by using historic discharge rate records or other methods as approved by the department.
- (7) The department may determine the setback calculated in accordance with this rule should be decreased—but in no instance shorter than 100 feet—if the applicant demonstrates equivalent protection of the water source that supplies the water well.

Authorizing statute(s): 75-5-411, MCA

Implementing statute(s): 75-5-411, MCA

History: NEW, 2019 MAR p. 836, Eff. 6/22/19.