PRIVATE SEWAGE SYSTEMS VARIANCE

STANDATA

September 2013

VARIANCE
Province Wide
LFH At-grade System Soil Based Sewage Treatment and Dispersal System

Subject of Variance:

This is a variance allowing the option to select this alternative design, referred to as the LFH At-grade system, as the final treatment and dispersal system in a private sewage system that is subject to the requirements set out in the Alberta Private Sewage Systems Standard of Practice 2009 (Standard of Practice).

Application of Variance:

- **This variance applies throughout the province of Alberta. Non-Compliance with this variance is an offence under the Safety Codes Act.**

- The design, installation and material requirements set out in this variance must be met as a minimum when this system is used as an alternate design to the systems now allowed in the Standard of Practice.

- This variance does not make or imply any assurance or guarantee with respect to life expectancy, durability or performance using this alternate design choice.

- Details of the requirements that apply to this system regarding the objectives and design standards, installation requirements and material requirements are set out in Appendix A of this Variance.

Issue of this STANDATA is Authorized by
the Chief Private Sewage Administrator

[Original Signed]

Alf Durnie

Alberta Government

SAFETY CODES COUNCIL

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Appendix A
LFH At-grade Systems
Objectives and Design Requirements; Installation Standards; and Material Requirements

Within this STANDATA:

- Sections, Sub-sections and Articles refer to the Alberta Private Sewage Systems Standard of Practice 2009.
- Italicized words in this variance have the defined meaning set out in Sub-Section 1.1.5. of the Alberta Private Sewage Systems Standard of Practice 2009.
- Cover Material **means the material covering the LFH At-grade system infiltration chambers that cover the effluent *distribution lateral pipe*.**
- Photos of an LFH At-grade system are provided in Appendix A.1 for illustrative and informative purposes.

1.1.1. LFH At-grade Treatment Systems—Objectives and Design Standards

1.1.1.1. General

1) An *LFH At-grade system* shall meet the following objectives
   a) break down the organic loading contained in the *effluent*,
   b) provide an area of *soil* over which the *effluent* is spread to reduce the hydraulic and organic loading on each part of the *soil infiltration surface*,
   c) spread the *effluent* over a suitably sized area to enable sufficient oxygen to be transferred through the *soil* to achieve treatment objectives and long term utilization, and
   d) introduce the *effluent* into the *soil* and be constructed in a manner that minimizes the risk of *effluent* breakout through the material covering the *soil infiltration surface* area that provides a barrier against direct contact with the *effluent*.
2) The design of an *LFH At-grade system* shall meet all requirements and objectives set out in Section 8.1

1.1.1.2. Effluent Treatment Objectives in Soil

1) An *LFH At-grade system* is to treat the applied *effluent* as it migrates through the *soil*, as measured at the *vertical separation treatment boundary limit* required for the design and *effluent* quality being applied, to the following quality
   a) fecal coliform < 10 cfu/100 mL above background levels, or
   b) fecal coliform < 2 MPN/gram of dry *soil* above background levels.

1.1.1.3. Applied Effluent Quality

1) The *effluent* applied to the *soil infiltration surface* of an *LFH At-grade system* shall meet a *secondary treatment* standard Level 2 as set out in Article 5.1.1.1 or better quality.

1.1.1.4. Located in Forested Area

1) The *LFH At-grade system* shall be located in a forested area that
   a) provides shelter from the cooling effect of winds and also maximizes snow cover over the system, and
   b) has a minimum 50 mm (2 in) LFH layer that allows the relatively fast horizontal spread of the applied effluent over the *soil treatment area* that is under the *cover material* of the system.

1.1.1.5. Cover Material and Stability

1) The material covering the *LFH At-grade system soil treatment area* shall be consistent with the ecology of the forested area and be effective at minimizing the risk of direct contact with the *effluent* by humans and animals.[1]
2) The depth of the *cover material* shall be a minimum of 230 mm (9 in.) above the infiltration chambers after settlement of the cover material occurs.
3) The slope of the *cover material* shall be minimized to prevent slumping and loss of cover depth or be stabilized using acceptable methods.
4) The *cover material* shall extend a sufficient distance beyond the infiltration chambers to ensure the effluent applied at the design effluent hydraulic loading rate infiltrates into the soil within the cover material to prevent risk of direct contact.

[1] *Note: Sentence (1) — The cover material typically used is wood chips. Wood chips are suitable with the forest ecology where these systems are to be installed. The wood chips allow the forest undergrowth to grow through the cover material consolidating the entire system into the forest floor over time This is important to minimize the risk of direct contact with the effluent by people or animals.*

1.1.1.6. Effluent Loading Rates

1) The *effluent hydraulic loading rate* on the *soil infiltration surface* directly under the infiltration chambers shall not exceed the *effluent hydraulic loading rate* set out in sentences 8.1.2.2 (2) and (3) to achieve effective treatment of the effluent.
2) Notwithstanding sentence (1) the maximum *effluent hydraulic loading rates* set out in clause 8.1.2.2 (2) (b) and (c) may be exceed when the conditions of Clauses 8.1.1.5 (1) (a), (b), and (c) are achieved.
3) The design *effluent hydraulic loading rate* on the *soil infiltration* area under the *LFH At-grade system cover* material shall not exceed the values set out in Table 8.1.1.10[1]
4) The *soil infiltration* area required by Sentence 3 shall include the area covered by the infiltration chambers and the cover material
   a. on both sides of the infiltration chamber when the slope is less than 1%, or
   b. only on the down slope side of the infiltration chamber when the system is on a slope greater than 1%.

[1] *Note: Sentence (3) — The total area covered by both the infiltration chambers and cover material, as set out in sentence 4, is determined by dividing the peak daily wastewater flow by the allowed effluent loading rate set out in Table 8.1.1.10 for the soil at the site.*

1.1.1.7. Time Controlled Pressure Distribution of Effluent

1) *Effluent* shall be distributed using an *effluent* pressure *distribution lateral pipe* system meeting the design requirements and objectives of Sub-section 2.6.1.
2) Time controlled dosing of the individual doses of *effluent* applied to the *LFH At-grade system* shall be evenly spread over a 24 hr period and the volume of each *effluent* dose shall be minimized to achieve as many doses as possible in a 24 hr period based on system design flows.

1.1.1.8. System Geometry and Linear Loading Rate Design

1) The design and geometry of the *effluent soil treatment area* of the *LFH At-grade system* shall result in an *effluent hydraulic linear loading* rate that does not exceed the *soil* profile's capability to allow the horizontal movement of the *effluent* away from the

treatment system when downward vertical *effluent* flow will be restricted and shall be designed to meet

a) the values set out in Table 8.1.1.10. that relate horizontal movement of *effluent* through the *soil* to the characteristics of the *soil* profile and the slope of the landscape, or
b) a comprehensive and documented assessment and calculation of the *soil's* capacity to transmit the *effluent* horizontally as set out in Article 8.1.1.9.

1.1.1.9. Orientation on Slopes

1) The geometry of the *LFH At-grade system* shall conform to the surface slope contour of the site it is placed on such that
   a) the long axis of the *LFH At-grade system* (its longest dimension), including any 3m (10 ft.) segment of the *LFH At-grade system*, shall be oriented at 90 degrees to the slope direction, and
   b) the downslope edge of the *LFH At-grade system* where it makes contact with the in situ (original) *soil* surface shall
      i) be level along its length within 2% as measured from end to end or in any 3m (10 ft.) segment of the *LFH At-grade system*,
      ii) be level within 100 mm (4 in.) as measured within any 600 mm (2 ft.) segment of its length, and
      iii) when placed on a convex slope, the deflection of curvature of the *LFH At-grade system* where it meets the in situ *soil* will not exceed 15%, as measured by the horizontal deflection from a plane drawn from each end of the *LFH At-grade system*.

1.1.2. LFH At-grade Treatment Systems – Prescriptive Requirements and Installation Standards

1.1.2.1. Separation Distances

1) An *LFH At-grade system* shall not be located within
   a) 15 m (50 ft.) of a *water source*,
   b) 15 m (50 ft.) of a *water course*, except as restricted in Article 2.1.2.4,
   c) 3 m (10 ft.) of a *property* line where ground is level or slope is less than 1%,
   d) 6 m (20 ft.) of a *property* line that is located downslope of the *LFH At-grade system* where the slope is 1% or more,
   e) 3 m (10 ft.) of a *septic tank, packaged sewage treatment plant, effluent tank* or other tank in the system, and
   f) 10 m (33 ft.) of a *building.*

2) For the purposes of Sentence (1), all measurements are to be taken from the point where the side slope of the *cover* material intersects with the natural *soil* contour

1.1.2.2. Infiltration Chambers Covering the Effluent Pressure Distribution Laterals

1) Each distinct row of infiltration chambers that provide the direct *soil infiltration surface* area required for the *LFH-At-grade system* shall include an effluent pressure *distribution lateral pipe* having orifices spaced at not more than 600mm (2 ft.) apart and that meets the requirements of Section 2.6.
2) Chambers shall meet the requirements set out in Sub-section 8.6.3.

1.1.2.3. Individual Infiltration Chamber Laterals Level Throughout Length

1) Each lateral that consists of the effluent pressure *distribution lateral pipe* and covering infiltration chamber shall be level along the long axis within
   a) 2% end to end,
   b) 2% within any 3 m (10 ft.) segment of the lateral, and
   c) 10 cm (4 in.) within any 2 foot segment.

1.1.2.4. Design For 5 Individual Effluent Doses Per Day

1) The design of the pressure *distribution lateral pipe* system, effluent dose tank and controls shall be based on achieving the ability to deliver individual doses of *effluent* that do not exceed 20% of the average daily *effluent* volume over the entire *LFH At-grade system*.[1]

[1] *Intent: Sentence (1) — Smaller individual dose volumes provide better treatment conditions and minimizes the chance that the effluent will break out of the At-grade system due to a large individual dose volume. Doses may be smaller than 20%. A 20% dose volume results in 5 doses per day. The entire At-grade systems does not have to be dosed during an individual dose event; however the design must be based on each dosed area of the At-grade system receiving 5 doses of effluent per day based on average daily flow. For example, if a distribution system was designed with two alternating zones, the system needs to be designed on the basis of 10 doses per day in total — 5 doses for each zone.*

1.1.2.5. Cover Material Depth, Slope and Stabilization

1) The *cover material* shall be a minimum of 225 mm (9 in.) depth over all infiltration chambers in the *LFH At-grade system* when settled.
2) The *cover material* shall consist of materials set out in Article 1.1.3.2 of this Standata.
3) The placed cover material shall have a maximum slope of
   a) 2 horizontal to 1 vertical when no stabilization method is used, or
   b) 1 horizontal to 1 vertical when acceptable geo-tech erosion control and slope stabilizing material is used to contain and stabilize the *cover material.*

1.1.2.6. Minimize Impact on LFH Layer and Underlying Soil During Construction

1) The LFH layer of the *soil* profile shall not be removed in the area of the *LFH At-grade system.*
2) Brush and small trees shall be cut off at ground level, not pulled out of the ground.
3) The installation shall be carried out in a manner that minimizes compaction of the soil under the *LFH At-grade system* and the down slope side of the *LFH At-grade system*.

1.1.2.7. Effluent Monitoring Access Ports

1) The *LFH At-grade system* shall include access ports into the infiltration chambers that have a minimum dimension of 100 mm (4 inch) and that terminate at the surface of the *cover material* to enable monitoring the depth of *effluent* ponding and soil moisture conditions at the *soil infiltration surface*.
2) At a minimum there shall be two access ports as required by sentence (1), each one located not more than 4.5 m (15 ft.) from each end of a continuous row of infiltration chambers that cover an individual effluent pressure *distribution lateral pipe*.
3) The access ports required by sentence (1) shall
   a) be accessible from the surface of the *cover material* at finished elevation,
   b) be fitted with a manufactured top to prevent entry of foreign material, and

c) allow viewing of both the infiltration chamber interior and *soil infiltration surface* and to provide access for sampling of the *soil infiltration surface*.

1.1.3. Material requirements

1.1.3.1. Infiltration Chambers

1) All chambers shall be *certified* as meeting or exceeding the requirements of the American Association of State Highway and Transportation Officials H -10 or H -20 ratings.

1.1.3.2. Cover material

1) The *cover material* used shall be
   a) chips of wood that are of a size that easily allows the grain of the wood to be seen, sawdust is not acceptable, or
   b) peat moss that is seeded with a vegetative selection, free of invasive species, suitable to the forest ecology to establish a vegetative cover that will stabilize the peat moss.
2) Material use to stabilize *cover material* shall be a geo-tech erosion control and stabilizing material that
   a) will hold the *LFH At-grade system cover material* in place to prevent slumping from mechanical or natural forces; and
   b) is made of a decomposable material.

The following graphic is to illustrate the concept of design and function of the At-grade system. This photo shows a single lateral of an LFH At-grade system uncovered after four years of operation. The system was uncovered for research conducted by the University of Alberta. The system was installed on top of the LFH layer (the leaf litter layer) of the forest. The plastic infiltration chambers are not dug into the ground as intended by the design. In this photo the wood chip covering has been pulled back to the sides of the chamber to enable the research.

The LFH At-grade system in this photo handles approximately 20 cubic meters (4,400 Imp gallons) per day average peak flow. Only one lateral of many is shown here.