

*Recommended Standards and Guidance for Performance,  
Application, Design, and Operation & Maintenance*

# **Glendon® BioFilters**

July 1, 2009



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Performance, Application, Design and Operation & Maintenance*

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For information or additional copies of this report contact:  
Wastewater Management Section

Physical address: 111 Israel Road SE, Tumwater, WA 98501

Mailing address: PO Box 47824, Olympia, WA 98504-7824

Phone: 360.236.3062

FAX: 360.236.2257

Webpage: <http://www.doh.wa.gov/wastewater.htm>

Mary Selecky  
Secretary of Health

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## Preface

The recommended standards contained in this document have been developed for statewide application. Regional differences may, however, result in application of this technology in a manner different than it is presented here. In some localities, greater allowances than those described here may reasonably be granted. In other localities, allowances that are provided for in this document may be restricted. In either setting, the local health officer has full authority in the application of this technology, consistent with Chapter 246-272A WAC and local jurisdictional rules. If any provision of these recommended standards is inconsistent with local jurisdictional rules, regulations, ordinances, policies, procedures, or practices, the local standards take precedence. Application of the recommended standards presented here is at the full discretion of the local health officer.

Local jurisdictional application of these recommended standards may be:

- 1) **Adopted as part of local rules, regulations or ordinances** - When the recommended standards, either as they are written or modified to more accurately reflect local conditions, are adopted as part of the local rules, local rule authority governs their application.
- 2) **Referred to as technical guidance in the application of the technology** - The recommended standards, either as they are written or modified to more accurately reflect local conditions, may be used locally as technical guidance.

Application of these recommended standards may occur in a manner that combines these two approaches. How these recommended standards are applied at the local jurisdictional level remains at the discretion of the local health officer and the local board of health.

The recommended standards presented here are provided in typical rule language to assist those local jurisdictions where adoption into local rules is the preferred option. Other information and guidance is presented in text boxes with a modified font style to easily distinguish it from the recommended standards.

**Glossary of Terms:** A common glossary of terms for all RS&Gs can be found on the DOH Web site at <http://www.doh.wa.gov/ehp/ts/ww/pubs-ww-rsg.htm#glossary>

Throughout this document, new terms introduced that are included in the Glossary appear for the first time in italics.

**Typical RS&G Organization:**

Standards Section	Explanation
Performance	How this technology is expected to perform (treatment level and function)
Application	How this technology is to be applied. This section includes conditions that must be met prior to proceeding with design. Topics in this section describe the “approved” status of the technology, component listing requirements, permitting, installation, testing and inspection requirements, etc.
Design	How this technology is to be designed and constructed (includes minimum standards that must be met to obtain a permit).
Operation and Maintenance	How this technology is to be operated and maintained (includes responsibilities of various parties, recommended maintenance tasks and frequency, assurance measures, etc)
Appendices	Design examples, figures and tables, specific applications, and design and installation issues.



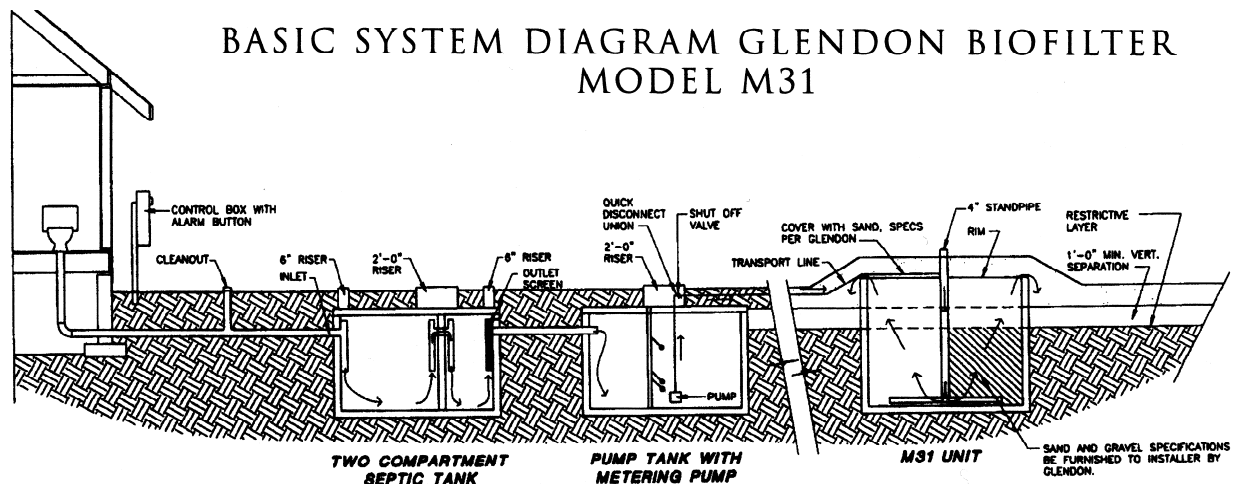
## Introduction

Glendon® BioFilter Technologies and their licensees currently market, design, construct, and install two models of residential wastewater treatment units. Glendon® licensees currently service three models of residential wastewater treatment unit. All units are upflow media filters and are based upon the same patented principles, which involve the biological treatment of septic tank effluent as it flows upward through sequential layers of synthetic or mineral filter media within a containment vessel that may be partially buried or set on grade depending on the model, and then out of the vessel through matrix and gravitational forces. No separate drainfield is required as final treatment and effluent dispersal occurs in the native soil surrounding the vessel.

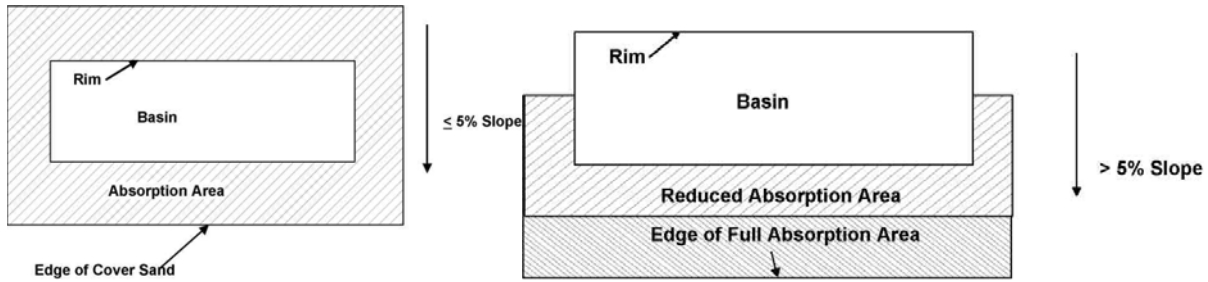
The effluent from the vessel is conveyed from the vessel to the prepared native soil through the cover sand material. This cover sand is the top layer of sand, which continues over the rim and out over the native soil at the perimeter of the containment vessel.

The two currently registered Glendon® BioFilter models share the same wastewater treatment components, incorporating pre-treatment (septic tank), dosed distribution (pump chamber, controls & mechanics), biological treatment (BioFilter), and treated wastewater dispersal (perimeter absorption area). Many of these components exist with other treatment systems. Glendon® BioFilters are uniquely characterized by the shape, size, volume and setting of its containment vessel or basin, the treatment media inside, the dispersal medium surrounding the unit, and the hydraulic dosing pattern to the filter.

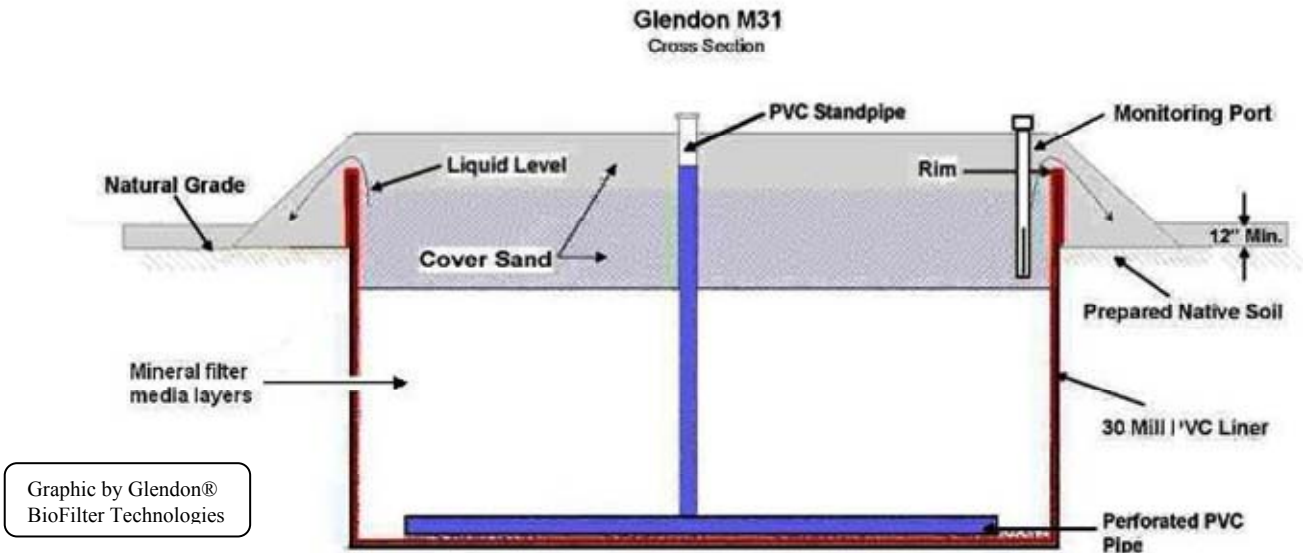
Figure 1



**Figure 2 – Top View, Sloped and Unsloped Sites, M31 & M32**

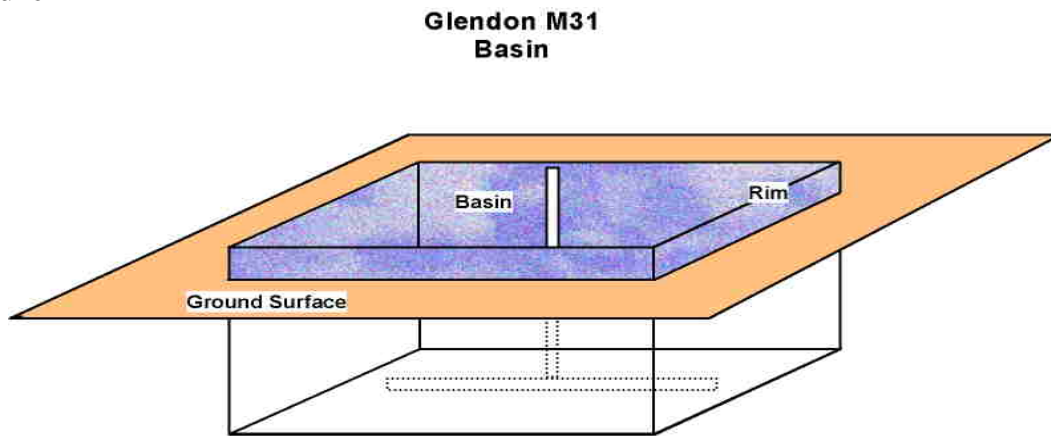


**Figure 3**



Graphic by Glendon®  
BioFilter Technologies

**Figure 4**



Example 1 – **Glendon** M31



Example 2 – **Glendon** M31



Example 3 – **Glendon** M31



## **1. Performance Standards**

### **1.1. Listing**

- 1.1.1. Before a local health jurisdiction may issue a permit for an on-site wastewater system incorporating a Glendon® BioFilter, the model must be registered with DOH (WAC 246-272A-0110(1)).
- 1.1.2. DOH reviews and registers proprietary products based upon the manufacturer-provided detailed information demonstrating that individual Glendon® BioFilter models meet or exceed the performance testing requirements defined in 1.2 of this document.
- 1.1.3. Models and Capacities: The following models are registered with DOH.
  - 1.1.3.1. Glendon® BioFilter Model M31 has design flow capacities from 120 GPD to 500 GPD. Basins may be prefabricated off-site or entirely site-constructed.
  - 1.1.3.2. Glendon® BioFilter Model M32 has design flow capacities from 120 GPD to 500 GPD. Units are set on grade and may be prefabricated off-site or entirely site-constructed.
  - 1.1.3.3. Multiple units, in the same or a variety of sizes, may be used in parallel to accomplish daily design flows to 3500 GPD. Additional requirements for systems between 1000 and 3500 GPD are listed in WAC 246-272A-0234(1)(d). (See 3.3. and 3.4.)

### **1.2. Performance Testing**

The Glendon® BioFilter models registered with DOH were tested in the field and according to the protocol in NSF Standard 40. In order to be registered for meeting Treatment Level A, B, and C, which includes fecal coliform threshold values, the Glendons® underwent additional testing according to the bacteriological reduction protocol in WAC 246-272A-0130.

### **1.3. Product Performance**

- 1.3.1. Glendon® BioFilter Models M31 and M32 meet all three parameters of Treatment Levels A, B, and C without disinfection, in the treatment of residential strength wastewater.
- 1.3.2. Performance with high strength wastewater has not been tested.

## 2. Application Standards

### 2.1. Listed Products

Only wastewater treatment and dispersal products registered with DOH WAC 246-272A-0110(1) may be permitted by local health jurisdictions for systems within their jurisdiction. Only the specific models registered are approved. If other models in a manufacturer's product-line are not registered with the department, they are not approved for use in Washington State. If in doubt, contact DOH for current registration information.

The most recent list of products registered with DOH can be obtained by downloading it from the web site: [www.doh.wa.gov/ehp/ts/WW/pubs-ww-topic.htm](http://www.doh.wa.gov/ehp/ts/WW/pubs-ww-topic.htm) or by calling 360-236-3062.

### 2.2. Permitting

- 2.2.1. Installation permits, and if required, operational permits must be obtained from the local health officer prior to installation and use.
- 2.2.2. Any application of Glendon® BioFilters outside of the conditions, allowances or criteria described in subsection 2. Application Standards may require a waiver of local health jurisdiction rules.
- 2.2.3. Because of the proprietary nature of some elements of the installed product, Glendon® BioFilter systems must only be constructed by installers licensed and certified by Glendon® BioFilter Technologies. Operation and maintenance activities outside the scope of the system owner must also be accomplished by service providers licensed and certified by the manufacturer. A list of certified licensees, who are the only entities currently authorized to install and to provide operation and maintenance services for Glendon® BioFilter systems, is available at [www.glendon.com](http://www.glendon.com).
  - 2.2.3.1. For local health jurisdictions that require designers of Glendon® systems to certify that the designs meet all the specifications of the tested and approved units, designers may also need to have knowledge of all components, including the elements protected by trade secret.

The **Glendon** company asserts that the installers and operation and maintenance specialists licensed by their company have received training in all aspects and features of installing or conducting O&M on Glendon® BioFilter, including the elements that are held as trade secrets. Local health jurisdictions may require the **Glendon** company to specify the type and number of hours of training given to the licensed installers, what continuing education is required and what type of follow-up supervision is being done to assure that the installations meet all the design elements of the tested models.

2.2.4. For sites where Treatment Level A, B or C must be met, some means acceptable to the local health jurisdiction must be implemented to assure proper on-going operation and maintenance (O&M) by a licensee of Glendon® BioFilter and the remaining system components as long as the facility is served by the on-site sewage system. The following options may be used separately or in combination, to assure long-term O&M of Glendon® BioFilter systems:

- 2.2.4.1. recording the requirement for an on-going service contract on the property deed;
- 2.2.4.2. issuing an operating permit (in addition to the initial installation permit), with the requirement for maintaining a service contract; or,
- 2.2.4.3. requiring a management entity to provide O&M assurance. Examples of management entities include: cities & towns, public utility districts, water and sewer districts, special-use districts, and corporations and home-owner associations with demonstrated capacity to assure long-term management.

2.2.5. Local health jurisdictions may implement O&M assurance measures (see 2.2.4) for sites other than those where Treatment Level A, B, or C is required to be met.

### **2.3. Influent Characteristics**

Models M31 and M32 were tested and approved for the treatment of residential wastewater. Therefore Glendon® BioFilters may only be used for influent that is typical of residential wastewater.

This technology may be used for facilities generating effluent that is higher strength or in some other way not typical of residential domestic wastewater if appropriate pretreatment is used to bring the wastewater flowing into the Glendon® system within the range of parameters describing residential domestic quality wastewater.

## 2.4. Site Requirements

For new construction where the installation and use of a Glendon® BioFilter is proposed, sites must exhibit the following conditions:

2.4.1. Soil Types 1-6 as classified in WAC 246-272A-0220.

2.4.2. A minimum of 12 inches of undisturbed, native soil. This 12 inches of soil must be reflected in the site-specific design, maintained by installation, and be free from the following conditions:

2.4.2.1. the maximum seasonal high groundwater level;

2.4.2.2. a layer of creviced or porous bedrock; or

2.4.2.3. a stratum of impermeable soil or bedrock (including very slowly permeable soil).

2.4.3. Maximum ground surface slope of 20%.

Glendon® BioFilter Technologies has asked for removal of this restriction to 20% slopes. The reason for this restriction for Glendon® BioFilter and mounds is the need for stability of the imported sand materials. There may also be some concerns for operating the installation equipment without damage to the downslope receiving soils. When a design for a Glendon® is proposed for slopes greater than 20%, it is the position of DOH that the designer must provide adequate documentation that proposed mitigation of the concerns will be realized.

2.4.4. Horizontal setbacks

2.4.4.1. are measured from the edge of the full absorption area (Figure 5) or from the edge of the full replacement absorption area if the replacement area is a concentric area around the initial area.

2.4.4.2. are specified in WAC 246-272A-0210, with the exception of certain downslope features as noted in the Table 1 below.

**Table 1. Minimum Setbacks From Downslope Feature**

Downslope Feature or Object	Vertical Separation (See 2.4.1 and 2.4.2)	
	12”- <18”	≥18”
Property & Easement lines	30 Feet	5 Feet
Building Foundations	30 Feet	10 Feet
Glendon Basins	30 Feet <sup>1</sup>	10 Feet

<sup>1</sup> As measured from the downslope edge of the full absorption area (and the full replacement area, if the replacement area is concentric with the initial area) of the upper unit to the upslope wall of the lower basin.

The setback distances for soil depth of 18 inches to less than 30 inches are what are allowed for a pressure distribution drainfield following a Treatment Level A system with this depth of soil.

Glendon® BioFilter Technologies has asked that the restrictions in Table 1 be removed. The DOH position is that shallow soils offer a limited conduit for water to leave the site of application. Therefore, the shallower the soils, the greater the need to protect the downstream soil profile for conducting water away from the site. Therefore, these restrictions remain in place.

- 2.4.5. Extreme Cold Weather Climates Excluded – Application of Glendon® BioFilter Models M31 and M32 is limited to areas with climates exhibiting an annual accumulation of 6000 degree heating days or less. Glendon® BioFilter Technologies must furnish local health jurisdictions the reference material needed to determine these areas in Washington State. Alternatively, local health officers may require designers to show that the proposed system is not in a cold weather prohibited area.

Heating Degree Days - Heating engineers who wanted a way to relate each day’s temperatures to the demand for fuel to heat buildings developed the concept of heating degree days.

To calculate the heating degree days for a particular day, find the day’s average temperature by adding the day’s high and low temperatures and dividing by two. If the number is above 65, there are no heating degrees for that day. If the number is less than 65, subtract it from 65 to find the number of heating degrees for the day. Annual degree heating days is the sum of all the individual heating degrees for the year.

For example, if the day’s high temperature is 60 and the low is 40, the average temperature is 50 degrees. 65 minus 50 is 15 heating degree days.



## 2.5. Data Plate

2.5.1. The Glendon® system must have a permanent and legible Glendon® BioFilter data plate (as shown in Appendix B) located on the front of the electrical control panel box. These plates may be in the form of a permanent sticker, decal or embossed plate.

2.5.2. Each data plate must include:

2.5.2.1. service provider's name and phone number,

2.5.2.2. model number, and

2.5.2.3. rated daily hydraulic capacity.

The data plate on the electrical control panel box will verify that a licensed and certified Glendon® installer accomplished the installation.

## 3. Design Standards

### 3.1. Pretreatment

External pre-treatment for solids separation and settling must be provided by a conventional two-compartment septic tank, sized according to state (WAC 246-272A-0232) and local rules, except that the minimum size is 1000 gallons. When a pump vault is used in a single-compartment septic tank for combined septic tank and dosing functions, refer to the appropriate sections of the DOH publication *Recommended Standards and Guidance for Pressure Distribution Systems*. Septic and pump tanks must be on the *List of Approved On-site Sewage Tanks*.

### 3.2. Daily Design Flow

Design flow calculations / specifications must be consistent with state (WAC 246-272A-0230(2)(d)) and local rules.

### 3.3. Treatment Capacity

Site-specific treatment system capacity may be met with any combination of Glendon® BioFilter models and sizes. Units of various sizes (GPD capacity) may be combined in parallel flow to meet daily design flow up to 3500 GPD (See 3.4. and note in 1.1.3.2.).

**3.3.1.** Model M31: 120 – 500 GPD per individual unit

**3.3.2. Model M32: 120 – 500 GPD per individual unit**

**3.4. Wastewater Flow Patterns**

Wastewater flows from a conventional 2-compartment septic tank, through a pump chamber / surge tank, to one or more Glendon® BioFilters. Wastewater must be distributed to all units throughout each site-specific system in a parallel pattern such that each unit receives a proportional share, based on the GPD capacity of each unit. Pumping cycles / timing must be set to assure that the design capacity of each unit is not exceeded in any 24 hour period. The specifics of the pump cycles / patterns have been identified by Glendon® BioFilter Technologies as subject to statutory trade secret protection. This information is available to local health jurisdictions in a letter to them from DOH. Local health jurisdictions are subject to restrictions relative to proprietary information. See Section 3.9.

**3.5. Containment Vessel Requirements**

Various design element requirements for containment vessels (basins) are presented in Table 2.

**Table 2. Containment Vessel**  
(Also see 3.5.1.)

Design Element	Glendon® BioFilter Models	
	M31	M32
Basin (containment vessel)		
Volume w/o media	2.2 ft <sup>3</sup> . per GPD capacity of individual unit.	0.93 ft <sup>3</sup> . per GPD capacity of individual unit
Shape <sup>1,2</sup>	Depth: 5-5.5 feet Width: 4-7 feet Length: 8-60 feet	Depth: 30 inches Width: 4-7 feet Length: 8-60 feet
Perimeter rim length	1 lineal foot per each 4 GPD capacity of the individual unit	1 lineal foot per 4.23 GPD capacity of the individual unit
Perimeter rim grade	Level, ± ½ inch	
Shape established by:	Excavation, manufactured tank, or built-on-site basin.	Set manufactured tank or built-on-site basin on grade using settled sand to establish rim level criteria.
Basin sides:	Vertical; may be sloped to 50 degrees	Vertical or slightly tapered
Basin bottom:	Flat	Flat
Perimeter rim:	Grade established by posts, board and sheet-goods frame (also supplies basic shape to geomembrane-lined basin). Manufactured tank may also be used: rim established by top perimeter edge.	Grade established by posts, board and sheet-goods frame (also supplies basic shape to geomembrane-lined basin). Manufactured tank may also be used: rim established by top perimeter edge.

Design Element	Glendon® BioFilter Models	
	M31	M32
Backfill requirements:	For geomembrane-lined basins, the internal filter media, and the backfill material must be placed at the same time in an alternating sequence to equalize pressures on the frame and membrane. A similar approach may be necessary for manufactured containers, depending upon the materials used in manufacture.	
Liner	Required for in-ground construction with lumber and 30 mil PVC geomembrane. Must be protected from puncture and abrasion during construction. May also be necessary for prefabricated concrete vessels in order to assure water tightness.	
Materials	Impervious liner of 30 mil PVC (or equivalent), or pre-cast concrete tank, site-inspected to assure water-tightness. All lumber used in the containment vessel frame must be pressure treated and rated for ground contact for critical structural components or difficult replacement. Fasteners must be corrosion resistant.	

<sup>1</sup> Basin configurations outside the above parameters should be subject to agreement with the Washington State Department of Health.

<sup>2</sup> The specific shape of a Glendon® BioFilter is governed by the design flow capacity (see subsection 3.3), the volume and the perimeter rim length criteria noted in this table.

3.5.1. Containment vessel design and construction standards – A professional engineer licensed in the state of Washington must stamp all containment vessel designs. However, prefabricated tanks included on the DOH *List of Approved On-Site Sewage Tanks* for the specific Glendon® BioFilter models may also be incorporated in the design applications without further engineering review. For those built-on-site containment vessels requiring engineering review and stamp, the evaluation must include:

- 3.5.1.1. a review and listing of the material specifications, fasteners and construction methods to be used,
- 3.5.1.2. a conclusion that the vessel will maintain its watertightness and rim elevations over the life of the system, and
- 3.5.1.3. a description of how the rim would be reconstructed, if decay of the lumber caused it to be out of tolerance, while maintaining the water tightness of the vessel.

3.5.2. Watertightness

To achieve treatment to the levels in the tested units, the containment vessels (basins) of the Glendon® BioFilter must be constructed and remain watertight during its entire service life. Liners or concrete additives as specified by the manufacturer may be necessary for prefabricated vessels to assure watertightness.

3.5.3. Annular Space Outboard of the Containment Vessel

In order to place a M31 prefabricated vessel or to construct a vessel on site, the excavation includes an annular space between the outside of the **Glendon** vessel

and the sides of the excavation. The following criteria must apply to the annular space:

- 3.5.3.1. Must not be larger than 6 inches on each side of the vessel.
- 3.5.3.2. Must not be calculated as part of the absorption area.
- 3.5.3.3. Must be backfilled with soil material of Type 2-6 (may be spoils from excavating the hole for the basin, if from Type 2-6).
- 3.5.3.4. Must be backfilled at the same time as the internal materials are placed, in an alternating sequence to equalize pressures on the vessel walls if the containment vessel is susceptible to deflection and damage under uneven loading.

### **3.6. Absorption Area Requirements**

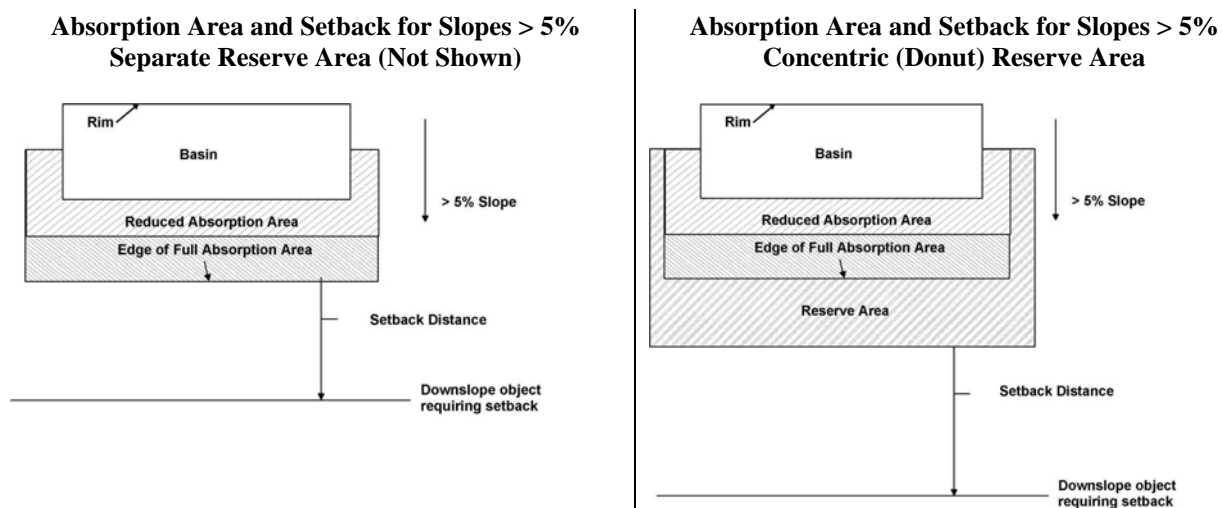
The absorption area required is based on the soil type and the daily design flow. Daily design flow and application rates for the various soil types are specified in WAC 246-272A-0230(2) (d) and WAC 246-272A-0234 Table VIII, respectively. Additional requirements are in Table 3 of this document. See Figure 5.

- 3.6.1. M31 Absorption Area – The absorption area begins outside of the basin at the edge of the undisturbed native grade (i.e. the over-excavation for the vessel is not to be counted as absorption area) and extends to the outer edge of the BioFilter cover sand.
- 3.6.2. M32 Absorption Area - The absorption area begins outside of the basin at the edge of the undisturbed native grade and extends to the outer edge of the BioFilter cover sand. The area under the M32 basin may be part of the absorption area provided:
  - 3.6.2.1. Rubber tired construction equipment is kept off the basin and absorption area.
  - 3.6.2.2. Before placing the leveling sand course, follow the site preparation requirements in Appendix A.
  - 3.6.2.3. A minimum of 12 inches vertical separation is maintained.
  - 3.6.2.4. Water-settled cover sand is used to establish a level course (pad) large enough for the basin to firmly set horizontally to meet rim level (grade) criteria. Do NOT use mechanical compaction methods. If this method is used, the absorption area extends to the boundary of the cover sand and includes the area under the basin.

3.6.3. Reductions – The local health officer may approve the installation of smaller absorption areas according to the requirements in WAC 246-272A-0234(7) as long as the remainder of the required area is available and protected from damage and other development.

3.6.4. Reserve Area – Reserve area must also be sized and located according to the criteria stated in 3.6. and in Table 3. Also see Figure 5.

**Figure 5 M31 and M32 Patterns**



**Table 3. Absorption Area**

Design Element	Glendon® BioFilter Models M31 and M32
Effluent-to-Soil Absorption	
Maximum Hydraulic Loading Rates	As specified per WAC 246-272A, Table VIII. The local health officer may reduce the minimum installed absorption area as per WAC 246-272A-0234(7) and -0234(8).
Absorption Area & Location <sup>1</sup>	Ground Slope: <ul style="list-style-type: none"> <li>• ≤5%: Entire perimeter may be used for sizing adjacent absorption area.</li> <li>• &gt;5%: Downslope side, and ½ of end slope sides may be used for sizing adjacent absorption area.</li> </ul>
Replacement Area	The replacement area may be: <ol style="list-style-type: none"> <li>1) an entirely separate, reserved location providing adequate area and soil conditions for a complete system replacement or</li> <li>2) reserved area surrounding each unit (if site has 5% slope or less) or downslope from each unit (if site has more than 5% slope), for placement of additional cover sand media to provide a full-sized replacement basal area beyond the area necessary for a full-sized initial area.</li> </ol>

<sup>1</sup> See 3.6.1. & 3.6.2

### **3.7. Media Specifications**

Depth of the cover sand, specifications for the media, their depth and arrangement within the Glendon® BioFilter are parts of the system that have been identified by Glendon® BioFilter Technologies as subject to trade secret protections. See Section 3.9. for details.

#### **3.7.1. Cover Sand**

- 3.7.1.1. Must be within the specifications contained in the trade secret materials released to the local health jurisdictions (See 3.9.).

When sands in the specified range are used, the system is acceptable for meeting Treatment Level A and B. Until performance testing of sands having other specifications are submitted, reviewed, and approved, the only sands acceptable for meeting Treatment Level A and B are those within the range specified in 3.7.1.

- 3.7.1.2. Must be stabilized from sloughing from animal and foot traffic, erosion and other forces.

Jute netting, cyclone fencing, or equivalent laid over the cover sand after seeding are two methods currently prescribed by Glendon® BioFilter Technologies. Other strategies may be possible, but some effective way to maintain the integrity and stability of the steep sand slopes must be employed.

- 3.7.1.3. Have a minimum of 12 inches of unsettled cover sand over the absorption area.

- 3.7.2. Other Media – The depth of the cover sand and the specifications and depth of the other media are available to Local Health Jurisdictions (See 3.9.)

### **3.8. Location and Orientation**

- 3.8.1. The long axis of each BioFilter unit must be oriented along the contour of the native soil, and multiple units must also be aligned along the same contour line, where possible. When not located on the same contour, multiple units must not be placed along the same line of groundwater flow without meeting the horizontal separations specified in Section 2.4.4. of this document.

The design goal for all on-site sewage systems is to maintain subsurface flow of wastewater discharged to the soil. The concept of Linear Loading Rate (LLR) has been developed in the scientific literature.<sup>1,2</sup> LLR is defined as the loading rate of wastewater per linear foot of infiltrative system in the native soil (gallons per day per linear foot) along the contour. The LLR can be greater for deep, permeable soils and will be less for shallow soils over a restrictive layer or shallow water table. One rule of thumb is: if the flow away from the soil absorption system is primarily vertical, then the LLR can approach 10 gpd/lineal feet; if the flow away from the soil absorption system is primarily horizontal, then the LLR should be constrained to 3-4 gpd/lineal foot. Shallow soils have limited carrying capacity for conducting water and are in this latter category. Glendon® BioFilter are typically used on sites with shallow soils and therefore it is imperative that designers and installers of this technology be mindful of these concepts and principles.

<sup>1</sup>Tyler, JE and Kuns, LK. 2000. Designing with Soil: Development and Use of a Wastewater Hydraulic Linear and Infiltration Loading Rate Table, Proceedings of the National On-site Wastewater Recycling Association Conference, Grand Rapids, MI. (unnumbered pages between pp. 90 and 91).

<sup>2</sup>Converse, JC and Tyler, JE. 1998. Soil Dispersal of Highly Pretreated Effluent – Considerations for Incorporation into Code, Proceedings of the National On-site Wastewater Recycling Association Conference, Ft. Mitchell, KY.

3.8.2. Normal principles of soil hydraulics must be applied. Examples include:

- 3.8.2.1. Locating the soil absorption area out of swales, concave landscapes, and the toe of slopes.
- 3.8.2.2. Locating the soil absorption area so that the downslope areas are free of physical obstructions, such as building foundations, road cuts, or other Glendon® BioFilter basins (see 2.4.4.).
- 3.8.2.3. The effluent should be spread out along the contour to facilitate conduction of the liquid away from the site.

3.8.3. The reserve area must be sited according to these same principles and be identified and preserved from damage during construction and after the home or facility is occupied.

### 3.9. Protected Design Elements

The design and installation elements addressed in these standards represent most, but not all, of the critical elements for the Glendon® BioFilter models.

- 3.9.1. Glendon® BioFilters are patented and are protected by federal and state statutes regarding trade secrets. Glendon® BioFilter designs and installations must be according to the standards of this document and consistent with the tested and approved models. To this end, local health jurisdictions must have access to the system details protected as trade secrets. These protected critical elements are

available to local health jurisdictions upon request to DOH Wastewater Management Section.

- 3.9.2. Design Specifics Not Available to the Public Domain / Trade Secrets - The specifics of the following design considerations have been identified as trade secrets and are subject to statutory protection and are the sole property of Glendon® BioFilter Technologies:
  - 3.9.2.1. the filter media: their material descriptions and their arrangement,
  - 3.9.2.2. the influent dosing pattern or schedule, and
  - 3.9.2.3. the relationship of unit depth-of-bury to native soil depth of M31.
- 3.9.3. Glendon® BioFilter must be installed and maintained only by persons certified by the local health jurisdiction to do this work (if required by the jurisdiction). In addition, these persons must also be trained and licensed by Glendon® BioFilter Technologies. Suspension or revocation of certification by the local health jurisdiction will also place the **Glendon** license in the same status. A list of certified licensees, who are the only entities currently authorized to install and to provide operation and maintenance services for Glendon® BioFilter systems, is available at [www.glendon.com](http://www.glendon.com).

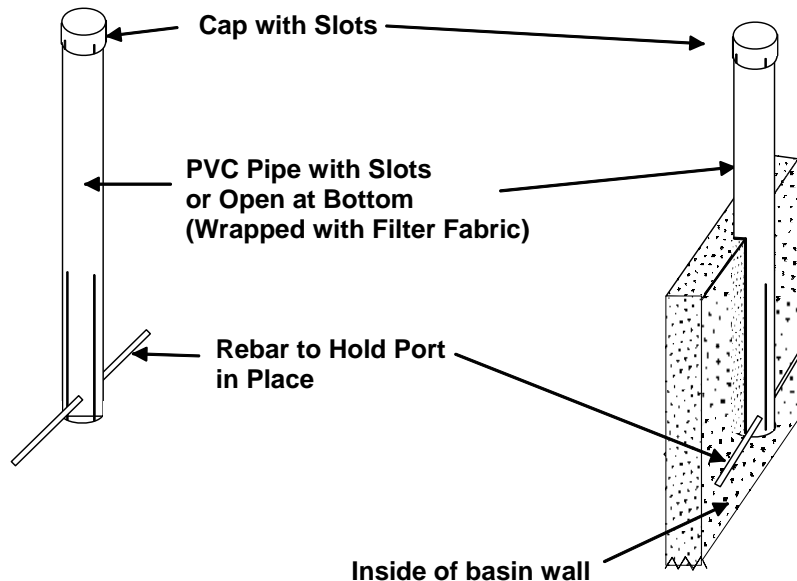
### **3.10. Monitoring Ports**

Monitoring ports, separate from the influent standpipe, may be placed at or near the rim (Figures 3 and 6) to facilitate monitoring of the level of saturation relative to the rim. If monitoring ports are used they should have the following characteristics:

- 3.10.1. be anchored to prevent accidental or intentional removal,
- 3.10.2. be at least 4 inches in diameter,
- 3.10.3. be inserted to a depth of several inches below the level of the rim and inside the basin,
- 3.10.4. be free of any media,
- 3.10.5. be perforated, or be open at the bottom, and the outside wrapped with filter fabric, and
- 3.10.6. have the relative vertical distance from the top of the monitoring port to the basin rim recorded in the record drawing, or be designed and located so that the rim and the saturation level can be observed at the same time.



**Figure 6 Monitoring Port –Two Options**



The purpose of the monitoring port and the recorded height of the rim relative to the top of the monitoring port is to provide a means to determine the level of saturation within the basin relative to the rim. This port is useful because observations by some **Glendon** installers reveal that the height of water in the standpipe does not correspond to the saturation level in the sand at the wall of the vessel. It is important to have the height of the rim recorded or readily observable in the observation port. Otherwise the rim elevation cannot readily be determined in the field without disturbing the cover sand.

### 3.11. Plan Review and Approval

All aspects of the design of Glendon® BioFilters are subject to local health officer review and approval.

### 3.12. Site Preparation / Protection During Construction

3.12.1. All models of Glendon® BioFilter rely on the soil surface adjoining the perimeter of the containment vessel to accept and conduct the treated effluent away from the site. To assure that the site is properly prepared prior to, and protected during, construction, the standards for site preparation and protection are included with this document as Appendix A.

3.12.2. Specific details for protecting the site include:

3.12.2.1. a prepared and approved construction plan that includes a construction sequence,

- 3.12.2.2. proceeding with installation only when soil moisture is low,
- 3.12.2.3. proceeding only when seasonally high water tables are not present,
- 3.12.2.4. upslope and downslope soils are adequately protected with temporary sand fill, steel plates or other protective measures,
- 3.12.2.5. use of proper tracked equipment,
- 3.12.2.6. cautions and precautions in the **Glendon** Design and Installation Manuals are followed, and
- 3.12.2.7. prefabricated tanks are leveled and bedded with sand or 3/8 inch minus pea gravel. M32 units must be bedded with sand after the area under the basin is prepared as described in 3.12.1.

### **3.13. Inspection**

All aspects of the installation of Glendon® BioFilters are subject to local health officer inspection and approval.

## **4. Operation and Maintenance**

### **4.1. General**

- 4.1.1. The system owner is responsible to assure that routine operation and maintenance of the Glendon® BioFilter is provided in compliance with the manufacturer's recommendations, but in all cases at least two times per year for the first two years, and at a minimum annually after that. Where the system is required to meet Treatment Level A or B, the local health jurisdiction may require additional O&M service.
- 4.1.2. Monitoring and maintenance events and activities are described in the Glendon® BioFilter Technologies Operation and Maintenance Manual, along with recommended service frequencies.

This information is available to local health jurisdictions to assist them in achieving the necessary monitoring and maintenance for the systems.

- 4.1.3. The authorized representative for Glendon® BioFilter Technologies must instruct or assure that instruction is provided to the owner of the residence or facility regarding proper operation of the entire on-site wastewater system. This instruction should emphasize operating and maintaining the entire on-site wastewater system within the parameter ranges for which it is designed.

- 4.1.4. Conditions in and around the Glendon® BioFilter must be observed and recorded by the **Glendon** licensed service provider during all operation and maintenance activities. Those observations must be reported to the local health jurisdiction in a manner that is consistent with the operation and maintenance requirements of the local jurisdiction.
- 4.1.5. If observations reveal a failure (defined by WAC 246-272A-0010) in the BioFilter or the surrounding soil absorption system, the owner of the system must take appropriate action, according to the direction and satisfaction of the local health jurisdiction to alleviate the situation. Any repair or modification activity must be reported as part of the monitoring activity for the site. Appropriate actions may include:
  - 4.1.5.1. repairing or replacing the Glendon® BioFilter (local permits must be obtained before construction begins according to local health jurisdiction requirements for repairs.);
  - 4.1.5.2. pertaining to reduced size absorption areas, enlarging the absorption area to initial design size required by WAC 246-272A (local permits must be obtained before construction begins according to local health jurisdiction requirements.); and/or
  - 4.1.5.3. modifying the wastewater strength and/or quantity from the structure served.

## **4.2. Limited Warranty**

- 4.2.1. Glendon® BioFilter Technologies licensed installers must:
  - 4.2.1.1. warrant all Glendon® BioFilter units of the installation to be free from defects in material and workmanship for a minimum of two years from the date of installation, and all other system components for a period of one year from the date of installation, and
  - 4.2.1.2. fulfill the terms of the warranty by repairing or exchanging any components that, in the company's judgment, show evidence of defect.

## **4.3. Owner's Manual**

The system designer must develop / assemble and provide to the system owner a comprehensive owner's manual. The document must include:

- 4.3.1. a basic system description;

- 4.3.2. system owner operation, troubleshooting and maintenance procedures;
- 4.3.3. the names of and contact information for the designer, installer and initial O&M specialist; and
- 4.3.4. construction record drawings including:
  - 4.3.4.1. all items as per WAC 246-272A-0260 and -0265,
  - 4.3.4.2. exact location of 2 opposite corners of each basin, relative to two permanent fixed objects that are anticipated to be identifiable and accessible over time,
  - 4.3.4.3. dimensions of the absorption area(s), and
  - 4.3.4.4. locations and dimensions of the reserve area(s) relative to two permanent fixed objects that are anticipated to be identifiable and accessible over time.

## **Appendix A – Site Preparation and Protection During Construction**

### **Site Preparation for Glendon® BioFilter**

Cut trees to ground level; remove excess vegetation by mowing. Rake the cut vegetation if it is or will become, matted. Prepare the site with the following goals in mind:

- a. To break up the vegetative mat so there is no continuous restriction to the vertical flow of water, to slow the movement of water at the sand-soil interface, and to stabilize the sand at the sand-soil interface.
- b. To avoid compacting the soil with heavy, wheeled equipment (light track mounted equipment should be used for any traffic on the infiltrative surface and on the area 30 feet downslope of the infiltrative surface).
- c. To avoid smearing the soil.
- d. To avoid breaking of the structure of the soil.
- e. To remove excessive vegetation so that it does not form a biomat at the sand-soil interface as it degrades.
- f. To disturb the soil no deeper than necessary. Depth is determined by the thickness of the vegetation and should be no greater than 8 inches. The goal is to loosen the matted layer.

**Soil Preparation Process** – A spring-loaded agricultural chisel plow is the implement of choice because it is less likely to smear the soil. An implement attached to a backhoe bucket that reaches in is preferred to driving over the basal area. Agricultural cultivators the same shape as a chisel plow are also acceptable implements for soil preparation. Both of these implements are narrow rectangular shapes, which present a diamond shape to the soil. Cutting the soil with backhoe teeth is not acceptable, but chisel plows and other agricultural implements described above can be mounted on the leading edge of the bucket using a bar on the outside with the teeth attached to the bar. Alternatively, they can be mounted on a wheeled implement that is dragged across the slope where the infiltrative area is planned. Hand-spading the surface is also an acceptable alternative and may be the preferred method on some sites. Rototilling is not an acceptable substitute and must not be used.

**Soil Moisture Content** – The important point is that a rough, unsmear surface should be left, especially in fine textured soils. Careful observation is required to assure that the soil moisture content is not too high so that the soil surface is not smeared by the action of the soil preparation process. Preparation should not proceed while the soil moisture content is too high. The finer textured soils should not be too dry, either, as the preparation process will pulverize it, destroying the structure.

Immediate construction after soil preparation is desirable. Avoid rutting and compaction of the prepared area by traffic. If it rains after the soil preparation is completed, wait until the soil dries out before continuing construction.

Appendix B – **Glendon** Data Plate



For service call \_\_\_\_\_

Model # \_\_\_\_\_ Design Daily Cap. (US Gal.) \_\_\_\_\_

Serial # \_\_\_\_\_ Software Ver. \_\_\_\_\_

The Glendon BioFilter and its method of operation are covered by one or more of the following Patents - US Patents 4,997,568; 5,281,332; 5,632,896; and 7,041,203  
Canada Patents 2,065,350; 2,073,969; and 2,906,865  
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