



# Blue Marina Feasibility Study

Prepared for:

## COMMUNITY OF BLUE MARINA

East Jefferson Lake  
Le Sueur County, Minnesota



Prepared by:

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# 1.0 Introduction

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## 1.1 BACKGROUND

The community of Blue Marina is located in four Sections. The majority of the community is located in the southeast quarter of Section 31, Township 110, and Range 24 along the north shore of East Jefferson Lake in Le Sueur County, Minnesota (Figure 1 and 2). The community is also located within Section 32, Township 110, Range 24 and Sections 5 and 6 of Township 109, Range 24. The community is unsewered, and residential wastewater needs are met by individual subsurface treatment systems (ISTS)<sup>1</sup>. Wenck Associates, Inc. (Wenck) was retained to assess the probable compliance status of any existing ISTS, and to provide soil-based subsurface sewage treatment system alternatives for viable long term infrastructure to collect and treat wastewater for the community of Blue Marina.

The Blue Marina Community Feasibility Study is one of three feasibility studies produced by Wenck as an addition to a larger project; the Jefferson German Septic Inventory Project (JGSIP). The goal of the JGSIP was to complete as many SSTS compliance inspections within the German Jefferson Subordinate Service District (District) as possible, in order to determine to what extent a septic system compliance problem exists within the District. Wenck was retained to assess the compliance status of any existing SSTS in the project area with respect to Minnesota Rules Chapters 7080-7081, the Le Sueur County Zoning Ordinance: Section 17 Subsurface Sewage Treatment Systems, and the Interim SSTS Standards for the District.

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<sup>1</sup> ISTS (a.k.a. septic system) is defined in Minnesota Rule Chapter 7080 as a type of Subsurface Sewage Treatment System (SSTS) that treats and disperses wastewater.

The JGSIP was funded through a Clean Water Legacy Grant from the Minnesota Board of Water and Soil Resources. The JGSIP was open and available to all property owners who have an SSTS in the District. The Le Sueur County Board decided to make participation in the project voluntary. In order to be included in the JGSIP, the homeowner was required to fill out a survey form and return it to Wenck with a signature affirming their participation in the program. Once the homeowner survey with permission signature was received, the property was placed within the active properties and the SSTS compliance inspection process began. All properties that did not choose to participate in the JGSIP were evaluated for likely septic system compliance via an Unsewered Area Needs Documentation (UAND)<sup>2</sup>.

Upon completion of the JGSIP inspection process, it was decided that select high-need areas within the District should also be evaluated for future wastewater infrastructure options. The Blue Marina Area was one such area chosen for a feasibility study based on its status with a low percentage of compliant soil treatment areas and the high number of small lots with very few future ISTS options outside of holding tanks. The findings presented in this report will aid homeowners in the Blue Marina study area and the District as a whole in making decisions related to future wastewater infrastructure.

## **1.2 FEASIBILITY STUDY PURPOSE**

This report is a planning document for possible long-term solutions for wastewater collection and treatment within the community of Blue Marina. Within this report are developed concepts and a framework to provide sanitary sewer service to the existing residences in this area. A cluster system alternative has been developed in this report for long-term wastewater treatment infrastructure. This feasibility study and associated projects will be used by the

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<sup>2</sup>Unsewered Area Needs Documentation is an MPCA protocol for estimating community wastewater conditions. Permit and housing records, aerial imagery, soil survey data, knowledge and experience in the area, survey responses, conversations with local residents, and off-property field assessments are used to determine likely ISTS compliance status for properties when an on-site inspection is not possible.

District for overall wastewater management planning for the communities along the Jefferson-German chain of lakes.

### **1.3 WORK PERFORMED**

To determine the baseline for the analysis, a field investigation and county file review was completed in 2011 and 2012 to assess the existing condition of ISTS as part of the JGSIP. The feasibility study went beyond this to evaluate future ISTS and cluster soil-based wastewater treatment options for residents. Useful background information regarding some different ISTS specifics (i.e., drain field trench vs. mound) produced by the University of Minnesota Onsite Sewage Treatment Program (OSTP)<sup>3</sup> is found in Appendix A.

Building from the information gathered in the county file review and field investigation, three alternatives were evaluated for long-term wastewater infrastructure.

- Alternative 1: Existing homes install compliant ISTS
- Alternative 2: Cluster system serving entire community
- Alternative 3: Cluster system serving select homes with remaining homes to install compliant ISTS

There are 17 property owners in the Blue Marina Community Assessment Area; 11 of which participated in the JGSIP. There are currently 16 properties with permanent wastewater generating structures in place and one vacant property. A particular property may be comprised of multiple tax parcels and is identified by a single property ID number in this feasibility study.

All potential wastewater generating properties (17) were selected for possible inclusion in analysis of a cluster system to serve the community. Of these properties, three properties

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<sup>3</sup> University of Minnesota Onsite Sewage Treatment Program is the organization that provides the technical training and continuing education for individuals who design, inspect, install, and maintain ISTS in Minnesota. Additional homeowner information regarding ISTS can be found at their website: <http://septic.umn.edu/>

(Study ID# 1, 2, and 3) comprise the Summer Breeze Resort. It is estimated the resort includes one three-bedroom home, an office/resort check-in building, 55 mobile homes, and 12 campers. After estimating total wastewater flow, the Summer Breeze Resort would comprise the majority of flow and would generate enough wastewater that the entire Blue Marina study area would exceed Large Subsurface Sewage Treatment System (LSTS) State permit threshold. Therefore, as the resort is commercial and the property owner owns land across Scotch Lake Road which could be investigated for possible wastewater treatment, it was decided that the resort should construct its own system and be removed from analysis with the other properties. According to the tabulated design flow, the Summer Breeze Resort by itself would be classified as a Midsized Subsurface Sewage Treatment System (MSTS) and therefore would need to follow applicable rules. Due to the nature of the establishment, the resort should consider implementing a pretreatment device and may need tertiary treatment for total nitrogen removal. Wenck has gone forward and estimated a wastewater system cost estimates for the resort including MSTS costs with and without total nitrogen treatment and removal. These estimates are included in Appendix E.

After removing the Summer Breeze Resort from the study area, selected properties (14) were included in cluster SSTS options analysis. Properties may be added or removed from the cluster system as a project develops.

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## 2.0 Existing Conditions

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### 2.1 INTRODUCTION

This section summarizes the findings of the existing condition of ISTS in the Blue Marina study area. All the properties evaluated were served by an ISTS, including holding tank systems. A determination of likely ISTS compliance status was made at each property. In addition, a determination was made as to whether it was feasible to replace the existing system with a combination of ISTS and/or cluster systems to provide compliant wastewater treatment. In the Blue Marina feasibility study area, there are 22 distinct tax parcels. Several properties are composed of two or more tax parcels, but are being operated as one residence with one wastewater treatment system. For this reason, each distinct residence has been assigned a Feasibility Study ID Number to represent situations where a single residence and septic system cover more than one tax parcel. Parcels are labeled by their Feasibility Study ID Number in applicable figures and in the parcel data spreadsheet in Appendix B.

Individual parcel information was provided by Le Sueur County. The community of Blue Marina features 17 properties, 16 of which containing wastewater generating residences with onsite wastewater systems (including holding tanks). One property is currently vacant. Of these 17 properties, 10 received an onsite ISTS compliance inspection from a licensed ISTS inspector. The Summer Breeze Resort contained ten SSTS which were all inspected. MPCA compliance inspection reports were submitted to Le Sueur County for the properties inspected as part of the JGSIP. Compliance status for the UAND-evaluated properties was determined through examination of public records, conversations with local residents, and roadside observation.

## 2.2 METHODS

Wenck was able to access all inspected properties to complete a visual site inspection of any existing ISTS to: document Imminent Threats to Public Health or Safety (ITPHS)<sup>4</sup>; assess likelihood of ISTS protection of groundwater<sup>5</sup>; and evaluate future onsite ISTS options. The feasibility of a soil based treatment system naturally depends on local soil conditions. In addition to examining available Le Sueur County Soil Survey data, Wenck performed soil borings on each inspected property to determine soil type and determine depth to the seasonally saturated soil. Soil survey and field collected soil boring data were used to estimate likely soil conditions throughout the study area, including non-participating properties and potential cluster system soil treatment areas.

Prior to commencement of field work, Le Sueur County provided available past permitting/design/inspection records for individual properties as well as a GIS shape file of individual tax parcels, structures, and infrastructure. Homeowner surveys were collected by Wenck to gain further knowledge of the property occupancy status, water supply, and wastewater treatment infrastructure. The surveys were used to evaluate seasonal and property specific water usage and wastewater generation and to provide a baseline for property investigation and evaluation. Information gleaned from these surveys was incorporated into Appendix B.

Upon completion of compliance inspections performed during the JGSIP, Wenck began the feasibility study by visiting the community to conduct a UAND of the non-inspected properties. In addition, land for a potential cluster treatment area was visually inspected from the public

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<sup>4</sup> ITPHS is defined in 2011 MN Rules Chapter 7080.1500 Subp. 4A. "...a system that is an imminent threat to public health or safety is a system with a discharge of sewage or sewage effluent to the ground surface, drainage systems, ditches, or storm water drains or directly to surface water; systems that cause a reoccurring sewage backup into a dwelling or other establishment; systems with electrical hazards; or sewage tanks with unsecured, damaged, or weak maintenance hole covers."

<sup>5</sup> Failure to protect groundwater is defined in 2011 MN Rules Chapter 7080.1500 Subp. 4B. "...a system that is failing to protect groundwater is a system that is a seepage pit, cesspool, drywell, leaching pit, or other pit; a system with less than the required vertical separation distance described in items D and E; and a system not abandoned in accordance with part 7080.2500."

right of way for potential soil disturbance or other issues that would affect cluster design. Upon return to the office, aerial photos, available soil information, and local topography were evaluated in concert to determine the most likely potential cluster treatment area locations. An evaluation was also made to determine if suitable area exists for a future ISTS and what type of system would most likely be installed.

## **2.3 FINDINGS**

The purpose of the site visit was to obtain:

- information on source of drinking water,
- the type of dwelling or wastewater generator contained within the property,
- type of ISTS (if any) currently serving the residence,
- the likely compliance status of the ISTS, and
- the most likely next ISTS to serve the dwelling.

### **2.3.1 Drinking Water Source**

All properties in the study area are served by six shared wells. All wells were identified as “deep” wells (screened at greater than 50 feet below ground surface). Depth and location of wells must be taken into account when considering ISTS setback requirements—a deep well requires a 50 foot setback to a drainfield or mound. Well locations reported on homeowner surveys were identified and located via GPS in the field by Wenck staff. All currently known wells are shown on Figure 3.

### **2.3.2 Property Type**

Table 1 shows the type of wastewater generating structures in the study area. Blue Marina property types include vacant, permanent, seasonal, and business. The data in the table was collected via homeowner surveys, conversations with homeowners, and conversations with individuals knowledgeable about the properties. An important factor when considering the type of structure is the flow and strength of wastewater generated. Both seasonal residences

and businesses can produce a different strength of waste, as well as a different pattern of wastewater flow than a full-time residential home. See Appendix B for information on individual property type. Note that the Summer Breeze Resort is comprised of three properties.

**Table 1: Property Type**

Usage Pattern	Number	Percentage
Business	4	23%
Seasonal Residential	9	53%
Permanent Residential	3	18%
Vacant	1	6%
Unknown	0	0%

### 2.3.3 ISTS Types

Table 2 provides a breakdown of ISTS types in the study area for all 17 properties. The descriptions listed in this table are common names. The Summer Breeze Resort includes multiple systems (10 ISTS); therefore the total number of ISTS in Table 2 (23) exceeds the number total properties (17). One property is vacant and does not have an ISTS.

**Table 2: Existing ISTS Types**

ISTS Type	Number	Percent of Total ISTS
Holding Tank	4	17%
Drainfield	10	43%
Cesspool	3	13%
Mound	2	9%
Unknown	4	17%

### 2.3.4 ISTS Compliance Status

The JGSIP and UAND process determined if the property’s system is compliant or non-compliant with Minnesota Rules Chapter 7080 and Le Sueur County ordinance. Compliance inspections reports were submitted to Le Sueur County. The ISTS that are non-compliant were identified as such for Failure to Protect Groundwater (FTPG).

Table 3 summarizes the ISTS compliance status data for the 16 evaluated properties with wastewater systems (23 total ISTS). Compliance status is based on county permit information, soils data, information provided by county staff and property owners, and our site visits. Appendix B contains a table that shows the likely compliance status of evaluated properties. See Figure 4 for a map of the each property’s compliance status.

**Table 3: Likely ISTS Compliance Status**

Status	Number	Percent of Total ISTS
Non-Compliant ITPHS	0	0%
Non-Compliant FTPG	17	74%
Compliant	6	26%

### 2.3.5 Existing Septic Tank Compliance

Even though a property’s ISTS soil treatment area may be non-compliant, a septic tank may exist at a property that meets current compliance requirements and could be used in a future ISTS or community cluster system. During field reconnaissance, tanks were evaluated (probed, permit records reviewed, and evaluated based on information provided by residents) for water tightness below the outlet of the tank. Some tanks were found buried at excessive depth (preventing inspection) and did not have installation records, therefore they could not be considered water-tight. Average costs for replacement of non-compliant tanks are accounted for in Appendix B. For estimating future costs, it was assumed that UAND-assessed properties with likely non-compliant ISTS also have non-compliant tanks that will need to be replaced. Table 4 summarizes the tank compliance status of the 23 ISTS with septic tanks.

**Table 4: Likely Tank Compliance Status**

Status	Number	Percentage
Compliant Tank	15	65%
Non-Compliant Tank	8	35%

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## 3.0 Alternatives Analysis

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### 3.1 INTRODUCTION

When considering alternatives for long term wastewater infrastructure, three components need to be evaluated. These components are:

1. Collection: The means in which wastewater leaves the individual structure and is conveyed to the primary treatment unit.
2. Treatment: Removal of pathogens and nutrients in primary and secondary processes.
3. Effluent Dispersal: Final distribution of treated effluent to surface waters, the ground surface, or subsurface soils.

With many ISTS, treatment and effluent dispersal components occur within the same infrastructure. A drain field removes pathogens and viruses while dispersing the effluent. The two components are broken out separately, however, because a septic tank does provide a primary treatment mechanism. In addition, state rules require some cluster SSTS to employ additional “pre-treatment” methods prior to effluent dispersal. The following alternatives are available for long-term wastewater infrastructure:

- Alternative 1: Existing homes install compliant ISTS
- Alternative 2: Cluster system serving entire community
- Alternative 3: Cluster system serving select homes with remaining homes to install compliant ISTS

This section discusses the alternatives and highlights advantages and disadvantages. Cost estimates for the alternatives are discussed in Section 4.0.

## **3.2 INDIVIDUAL SEWAGE TREATMENT SYSTEMS (ALTERNATIVE 1)**

There are two possible management/ownership options for utilizing ISTS for treatment of wastewater: community management/ownership and private management/ownership.

### **3.2.1 Community Managed ISTS Program**

A community managed ISTS program utilizing the best available onsite technologies and management can be effective in protecting public health and the environment. The District would be the financial and operational vehicle to assist property owners with ISTS upgrades. The District would oversee management of the systems through either employees or sub-contracts for financial and operational services.

In this scenario, once property owners upgrade their ISTS to a compliant status, all would pay annual sewer treatment fees for ongoing operation, maintenance, pumping, and an ISTS repair reserve fund. The amount each pays may be proportional to the required annual maintenance expense incurred and/or requirements of the lender. All system types would require some level of annual maintenance expense; however, fees may vary based on the system type.

There are a few noted advantages to a community managed ISTS program. Individual property owners have fewer worries about management, as the community oversees maintenance, such as tank pumping. The community has the assurance that all systems are being properly managed. Finally, because the ISTS are owned and operated by a public entity, public funding is accessible.

A disadvantage to District ownership is that wastewater flows from each ISTS within ½ mile radius, would be cumulative for permitting purposes. Therefore, if all ISTS within the Community of Blue Marina (including Summer Breeze Resort) are owned and operated by the District, a State Disposal System (SDS) permit would be required and the system would be

classified as a LSTS. Hand in hand with greater permitting effort is greater cost for both the installation and operation and maintenance of the LSTS when permitted under an SDS permit.

### **3.2.2 Private ISTS Program**

In this scenario, operation and management of ISTS would continue as is currently practiced. Individual property owners would be responsible for the installation, management, and operation and maintenance of their ISTS. Upgrade and operation and maintenance costs would be paid by the ISTS owner to the appropriate party with no District involvement. Management decisions regarding ISTS in this scenario are made by the property owner, not the community. Because ISTS would be owned by several individuals rather than one, a county-issued ISTS permit would be required for each ISTS. Typical life expectancy for a properly installed and maintained ISTS is 20-30 years, but varies by system depending on use patterns, construction, materials, and maintenance. Costs estimated in Section 4.0 for Alternative 1 assume a private ownership structure.

Advantages of private ISTS ownership include lower permitting requirements and lower overall costs for installation and operation and maintenance. Disadvantages include management by individuals rather than the community, which can lead to poor decision making and potential environmental concerns such as are being experienced now in the Blue Marina service area.

### **3.2.3 ISTS Upgrades**

As stated in Section 2.3.4, 65% of ISTS at evaluated properties are estimated to be in non-compliance. This accounts for some type of upgrade on 11 ISTS. ISTS type needed at upgrade is significant as it directly influences the capital costs for the upgrade as well as long term operation and maintenance costs.

Figure 5, as well as the spreadsheet in Appendix B, shows each property's most likely future ISTS option. The type of future ISTS varies based on the lot size, soils at the site, and current

land use. Soil was evaluated and confirmed at all properties receiving full compliance inspections, with depths to seasonally saturated soil at each lot recorded in Appendix B.

For a dwelling that does not have a suitable area for an ISTS, the next ISTS would likely need to be a holding tank because of the lack of space. Minnesota Rules, part 7080.2200 – 7080.2400 (March 2011) define different ISTS system types; a brief summary of system types is given below:

- **Type 1:** Standard systems including subsurface drain fields or mound systems on undisturbed soils with or without a pump system.
- **Type 2:** Holding tanks (tank with a sealed outlet requiring regular pumping), privies, and systems in floodplains.
- **Type 3:** Systems installed on problem soils, disturbed soils, or soils where high groundwater is within one foot of the ground surface.
- **Type 4 and 5:** Commonly referred to as “performance” systems. These systems offer a level of pre-treatment through a mechanical treatment unit or media filter prior to discharge to a drain field or mound. Also included in this category are systems installed with higher soil loading rates or reduced vertical separation distance to groundwater.

Type 1 systems meet all technical rule requirements, have adequate onsite soils, and are able to meet setbacks. Type 2 systems are holding tanks that need visual and/or audible alarms to notify the owner when pumping is required. The lack of an alarm on a holding tank or the neglect of a homeowner not to pump the tank when full can cause an ITPHS and fail to protect groundwater. Type 2 systems also include systems in floodplains. Type 3 systems require county approval, but can be installed on sites where disturbed soils exist or where a variance is required to install a system not meeting typical setbacks. Type 1 systems that do not meet compliance due to FTPG may be upgraded to a Type 4 or 5 system if they currently have at least one foot of vertical separation. Adding pretreatment allows wastewater effluent to be discharged to a reduced sized soil dispersal area.

ISTS rules dictate that systems that are not considered Type 1 may require an operating permit. Any system with an operating permit may require annual operation and maintenance of the systems by a licensed Service Provider<sup>6</sup>.

Table 5 summarizes the most likely ISTS to be installed when the 17 non-compliant ISTS are upgraded, assuming a homeowner would not install a holding tank if another option exists. For purposes of this ISTS alternative analysis, it is assumed the Summer Breeze Resort would only be able to upgrade to holding tanks.

**Table 5: Likely Replacement of Non-compliant ISTS**

<b>ISTS Type</b>	<b>Number</b>	<b>Percentage</b>
Type 1 Drainfield	0	0%
Type 2 Holding Tank	16	94%
Type 3 Drainfield	1	6%
Type 4 Pretreatment	0	0%

Type 2 (holding tanks) comprise 16 out of 17 likely future ISTS and can become necessary on small lots, lots with high groundwater, lots with setback constraints, and/or lots with multiple structures with little usable land. These lot constraints can make the installation of any system that discharges to the soil unfeasible.

County governments typically will only permit a holding tank system in situations where no other system type is feasible and will not allow them with the construction of new homes. Holding tanks require a higher level of oversight/management than a standard mound or trench system. The hesitation for permitting holding tank systems comes from experiences where homeowners take it upon themselves to empty the tank in an unapproved manner or do not pump the tank when full. Not pumping when the tank is full allows it to overflow out the top or through the seam along the top of the tank. Permitting of Type 2 systems would need to

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<sup>6</sup> Service Provider is a license category under MN Rules Chapter 7083.0780. A Service Provider can assess, adjust, and service ISTS for proper operation.

encompass the oversight and pumping frequency of holding tank systems to prevent these situations.

A disadvantage to a holding tank system for a homeowner is the ongoing operational expense of pumping the tank. A full-time residence with two bedrooms and 2-3 residents on average uses approximately 4,000 gallons per month. With a holding tank capacity of 1,000 gallons, pumping frequency would be approximately four times per month. Average tank pumping costs of \$150/ 1000 gallons will yield an estimated annual pumping cost of approximately \$7,200 (4 times per month\*12 months per year\*(\$0.15 per gallon pumped) = \$7,200 annually).

One non-compliant property may be able to upgrade to a Type 3 system. A Type 3 system is a standard mound or in-ground trench system on a property with problem soils or that will require a county variance due to the system not meeting various setback requirements (well, property line, surface water, or building) for installation.

Table 6 summarizes the future ISTS in the entire community after upgrades to all properties (including currently compliant parcels and currently vacant parcels) if all properties stay on ISTS rather than choosing a cluster system (including all 10 Summer Breeze Resort ISTS). Even if a property has a currently compliant Type 1 ISTS, the future system type installed when the current ISTS no longer functions as designed may be a Type 2, 3, or 4. This same information is depicted on Figure 5.

**Table 6: Community Makeup of Future ISTS**

<b>ISTS Type</b>	<b>Number</b>	<b>Percentage</b>
Type 1 Drainfield	1	4%
Type 2 Holding Tank	22	92%
Type 3 Drainfield	1	4%
Type 4 Pretreatment	0	0%

Data presented in Table 6 indicates that one currently compliant property has adequate room and suitable soil conditions on their property to install a Type 1 ISTS for the next system. This dwelling can achieve compliance with the installation of Type 1 system (mound) with three feet of vertical separation beneath the effluent dispersal area and the seasonally saturated condition. Type 1 systems have nominal operation and maintenance expenses of septic tank pumping on average once every three years and components such as pump replacement, when required. Average annual operating costs for a Type 1 are estimated at less than \$100.

The majority of properties (92%) have a Type 2 holding tank as their only feasible future ISTS option, and will require tank pumping on a regular basis. This is due to seasonally saturated conditions in the underlying soils, lot sizes, and location of houses and/or other permanent structures that prevent homeowners from installing a different system type.

Appendix B contains a table that documents the likely next ISTS for the evaluated properties.

### **3.2.4 ISTS Alternatives Summary**

- **Community Owned/Managed ISTS Program Alternative**
  - Advantages
    - Economy of scale for operation and maintenance expenses
    - Capital costs based on need, you pay for your problem and nobody else's
    - Public financing

- Disadvantages
  - High operation and maintenance expenses for full-time residents on holding tanks
  - Holding tanks pose practical limitations for future use and development of a property
  - Type 1 or Type 3 mound systems are not desirable for some residents based on visual impact or planned property use preferences
- Private ISTS Program Alternative
  - Advantages
    - Capital and operation and maintenance costs based on need, you pay for your problem and nobody else's
  - Disadvantages
    - High operation and maintenance expenses for full-time residents on holding tanks
    - Holding tanks pose practical limitations for future use and development of a property
    - Type 1 or Type 3 mound systems are not desirable for some residents based on visual impact or planned property use preferences
    - Individuals may choose to forgo proper operation and maintenance practices leading to ISTS failure and environmental degradation

### **3.3 CLUSTER SYSTEMS (ALTERNATIVE 2 & 3)**

When a series of homes, generally less than 100, are connected to a decentralized wastewater treatment system, it is commonly referred to as a cluster system (a.k.a. a big septic system). Cluster system ownership, operation, and management occur through a municipality, the formation of a special purpose district such as the German-Jefferson Subordinate Service District (District), or through private ownership. For the purpose of this report the assumption

is made that any cluster system would fall under the ownership of the District to qualify for public funding. Private ownership is an option but presents legal challenges as it relates to land ownership/easements and fee collection.

In the analysis for this alternative, 14 out of 17 study area properties are included in an evaluation of a cluster system to serve wastewater treatment needs in the Blue Marina area. As stated earlier, after estimating wastewater flow, the Summer Breeze Resort would comprise the majority of flow and would generate enough wastewater that the entire Blue Marina study area would exceed Large Subsurface Sewage Treatment System (LSTS) State permit threshold. Therefore, as the resort is commercial and the property owner owns land across Scotch Lake Road which could be investigated for possible wastewater treatment, it was decided that the resort should likely construct its own system and be removed from analysis with the other properties. Table 7 highlights the estimated daily flow to the potential treatment area (calculation in Appendix D). Figures 6 and 7 show the potential collection line routes and a potential cluster treatment area location. Note property #17 is a small rental property that contains six small structures. It was assumed each structure is a 2-bedroom unit for design flow calculation purposes.

**Table 7: Estimated Permitting Wastewater Flow Rates**

<b>Treatment System Type</b>	<b>Properties Included</b>	<b>Total Daily Permitting Flow Gallons/Day*</b>	<b>Permit Type Required**</b>
Summer Breeze Resort	3	8,074	County MSTS
Alternative 1: ISTS	14	6,150	County ISTS
Alternative 2: LISTS	14	4,960	County LISTS
Alternative 3: LISTS + ISTS	14	4,315	County LISTS + County ISTS

\*The permitting flow is not the actual flow, but rather is a design flow that dictates the level of permitting effort required for the system. The permitting flow takes into account allowed reduction in flow for cluster systems with over 10 dwellings and increases in flow for infiltration and inflow into the collection system. If a collection system is needed, Infiltration/Inflow volumes have been estimated and included per MPCA Rule.

\*\*The permit type required for ISTS assumes that the individual property owners are the owners/managers of the ISTS. The permit type required for the cluster systems assumes the District is the owner of the collection and treatment systems. A mid-sized-SSTS (MSTS) is a cluster system with a daily permitting flow between 5,000 and 10,000 gallons per day.

Using 2011 Minnesota Rules, Part 7081.0120, an average daily flow for each system or wastewater generator is estimated using a formula specified in the rule. This formula calculates a flow based on the number of bedrooms in each of the residences, the treatment system type (individual or cluster), and the total number of wastewater generating properties included in each system.

To provide the analysis in this report, we have assumed an average of two-bedrooms per residence for homes included in the cluster system analysis which did not fill out a homeowner survey or have a septic permit on record with Le Sueur County. Two bedroom homes have an average daily flow of 300 gpd for a Type 1 dwelling. Residences indicating only one bedroom on surveys or permit records were included in design analysis as two bedroom dwellings, as directed in 2011 Minnesota Rules, Part 7080.1860.

In the future, when a design plan is created an actual flow for a selected cluster system would need to be determined based on the actual number of bedrooms in each home. Design flow considerations for properties not included in the study area that desire to be included in the selected cluster system would also be required. Design flows shown include additions for infiltration and inflow into a collection system as well as reductions allowed by 2011 Minnesota Rule Part 7081.0120 in estimation of daily flows when the number of residential wastewater generating properties connected to a cluster treatment system exceeds 10.

Design flows would impact permitting of any wastewater alternative. Average daily flow estimates dictate the level of treatment required and other permitting requirements. For average daily flows greater than 10,000 gallons per day within a ½ mile radius of each SSTS owned by one entity, permitting is completed through a Minnesota Pollution Control Agency SDS Permit. Future SSTS with an average daily flow under 10,000 gallons per day would be permitted by Le Sueur County using Minnesota Rules Chapters 7080-7083 and would be considered a midsized SSTS (MSTS). In addition, SSTS with an average daily flow greater than 2,500 gallons per day would be required to meet MPCA design guidance, including design

guidance for nitrogen reduction. Greater permitting effort increases the overall cost of SSTS design, construction, and operation and maintenance as more research and investigation is required upfront and pretreatment of effluent may also be required. Table 7 also highlights permitting requirements for individual and cluster treatment options based on average daily flows for the system alternatives.

### **3.3.1 Collection System**

Four collection system methods to convey wastewater or effluent to the cluster system treatment and dispersal sites are available:

- gravity collection via septic tank effluent gravity systems (STEG);
- gravity raw effluent collection to a large septic tank located near the cluster site;
- grinder pump basins at each home to a low pressure force main; and
- septic tank effluent pump (STEP) system at each residence to a small diameter force main.

Based on topography and depth to groundwater of the area and the cost of installing a lift station relative to the small population of the study area, pressure collection would likely be the least expensive collection method. The two pressure options employ similar technologies. A grinder basin sends macerated sewage to the treatment site. With a STEP system, solids are retained at all individual properties. STEP collection does not require the same level of hydraulic retention at the treatment site as solids remain at each property.

Onsite solids retention with a STEP system requires less capital cost at the treatment site. Other advantages of STEP systems over grinder basins include: utilizing existing septic tanks; greater reserve capacity during power outages or pump failures; less maintenance required on the force main; and longer pump life. For these reasons, the most cost effective collection of solids is within individual septic tanks at each residence. Existing septic tanks already in compliance at individual residences can still be used; a pump vault would just need to be installed in an adjacent tank. In cases where the property does not have an existing compliant septic tank,

new tanks would need to be installed along with the STEP system. Appendix C illustrates a typical schematic of a STEP tank.

STEP systems connect to a small diameter pressurized force main installed in road right of ways and easements. The force main follows topography below frost line (6-9 feet) with air release/vacuum release valves installed at high points in the line. Small diameter force main lines would only transfer effluent with solids management occurring at the individual septic tank. Force mains would discharge effluent into a stilling tank at the cluster site.

### **3.3.2 Treatment and Dispersal System**

Cost estimates generated for this alternative assume that the residents on the proposed cluster systems would agree to be connected to a cluster system at the same time. Project development would likely re-define properties interested in connecting, which could have an impact on the estimated costs.

General locations for this alternative have been identified for the potential of a cluster treatment and dispersal system. The locations are being used for comparison purposes only to provide a preliminary cost estimate based on length of the collection system, type of dispersal system, etc. At the time of project development these locations, or different locations, would need to be further investigated. At this time the site chosen has the best available characteristics for size and treatment. Farmland adjacent to and across German Lake Road has been selected as a potential location for a cluster treatment and dispersal area (Figures 6 and 7). After reviewing soil maps, contours, and general viewing of the property, the most favorable location of this parcel is the northwestern area. It appears that a large drainage swale exists to the south. The northwest area is higher in elevation, contains flatter slopes, and has better likelihood of containing suitable soils. It is assumed that soils in this location would support a Type 1 mound dispersal system. If this area is selected, a detailed soil and site investigation will need to be completed.

With the cluster system alternative, the District would own and operate the cluster system, collection system, and maintain the STEP tank on each property. Design of the cluster system would need to follow applicable state rules based on the size (daily flow) of all SSTS owned and operated by the District within a ½ mile radius.

### **3.3.3 Cluster System Summary**

- Advantages
  - Subsidized interest rate loans and grants for cluster system construction and STEP installation
  - Lower operation and maintenance expenses for properties to replace holding tanks
  - Dispersal of treated effluent away from surface waters
  - Allows for more usable land on individual lots
  - Increase in resale values above what a holding tank property provides
  - Large parcel owners removed from dense development could be allowed to stay on individual ISTS, while dense and high need areas are allowed to connect to a cluster system
- Disadvantages
  - Obtaining land in close proximity can be difficult based on landowner preferences
  - More local involvement required for project development

### **3.4 OTHER ALTERNATIVES**

No other alternatives have been investigated for treatment and dispersal of wastewater from the Community of Blue Marina. However, it is expected that any mechanical or biological system with a new continuous surface discharge of treated wastewater to a nearby surface water would be cost prohibitive based on likely MPCA permitting and discharge limit requirements, especially related to Phosphorus reduction. In addition, long-range pumping of effluent to a nearby wastewater treatment plant would also likely be cost prohibitive based on the location of Blue Marina relative to an existing wastewater treatment plant with capacity for additional wastewater treatment. Construction of a pond system to meet wastewater needs is also likely cost prohibitive based on the cost of a pond system relative to the population of Blue Marina. A pond system would also need to acquire a new continuous surface discharge permit to a nearby surface water.

### **3.5 SUMMARY**

Three alternatives are being analyzed in this feasibility study to provide wastewater infrastructure: Alternative 1-ISTS, Alternative 2-cluster system LISTS, and Alternative 3-cluster system LISTS in combination with ISTS. Each alternative has advantages and disadvantages and may be incorporated solely or in combination to best fit the needs of the residents. Section 4.0 incorporates the estimated costs from the alternatives.

## 4.0 Cost Comparison of Alternatives

Three wastewater infrastructure alternatives have been identified within the scope of this report. Side by side comparisons of capital and operation and maintenance costs have been provided for each alternative. This section gives cost comparisons, starting with capital costs, and ending with a present worth analysis for 25 years.

### 4.1 INDIVIDUAL SEWAGE TREATMENT SYSTEMS (ALTERNATIVE 1)

Table 8 reflects the average cost estimates to replace/upgrade each non compliant property with an ISTS owned and operated by the individual homeowner.

**Table 8: 25 Year Capital Cost Estimates Private ISTS Program**

	ISTS Treatment System	Contingency	Legal, Eng., Admin	Total Cost Estimate	Avg. Cost/ Residential Connection
Non-compliant Properties	\$ 93,000	\$ 9,300	\$ 26,000	\$ 128,300	\$ 9,200

This analysis of ISTS is an average over the entire study area. Individual property costs for ISTS upgrades would vary by property. Each property can locate their estimated cost in Appendix B. The table has been created to allow for side by side comparisons with the other alternatives in the present worth analysis. Estimated capital costs by system type that were used to create the table are as follows for a 3-bedroom residential system (cost estimates for Type 1-3 systems including tank based on local Contractor correspondence and Wenck experience). For properties not needing new tanks, \$4,000 was subtracted from the above prices.

- Type 1 Drainfield (Mound): \$11,000-\$13,000
- Type 2: \$5,500 (new tank & alarm)

- Type 3: \$15,000-\$17,000 (including tank upgrade costs)
- Type 4: Approximately \$18,000 (including tank upgrade costs)

What can be noted from Table 9 is there are no collection system costs as this component is already in place at each residence. On average, this alternative has the least capital cost.

#### 4.2 CLUSTER SYSTEM (ALTERNATIVE 2 & 3)

Table 9 provides the cost estimates for cluster systems with the installation of a STEP system at each cluster residence, collection system, and a treatment/dispersal system.

**Table 9: 25-Year Capital Cost Estimates Cluster System Alternative**

Alternative and Type of Treatment System	Cluster Treatment System*	ISTS at Non-cluster Properties	Land Acquisition *	Collection System	Contingency (10%)	Legal, Eng., Admin	Total Cost Estimate	Avg. Cost/ Cluster Dwelling	Avg. Cost/ ISTS Dwelling	Avg. Cost/ All Dwellings
Alternative 2: Cluster LISTS	\$ 150,700	\$ -	\$ 30,000	\$ 347,300	\$ 49,800	\$ 137,000	\$ 714,800	\$ 51,100	\$ -	\$ 51,100
Alternative 3: Cluster LISTS & ISTS	\$ 140,650	\$ 25,500	\$ 30,000	\$ 297,000	\$ 43,765	\$ 120,400	\$ 657,315	\$ 52,700	\$ 12,800	\$ 47,000

\* Cost for 2.5 acres at \$12,000 per acre. Final purchase size depends on final sizing of treatment system.

Both replacement wastewater alternatives would qualify as a LISTS (2,500-5,000 gpd) and would likely require a nitrogen best management practice (BMP). The BMP would depend upon results of a hydrogeological investigation for nitrogen impacts to the aquifer. Costs for this investigation are included in the legal, engineering, and administration estimates in the table above. A mound wastewater treatment and dispersal system placed on loamy or finer textured topsoil which has medium or high organic matter content would qualify as a nitrogen BMP. Phosphorus standards are not applied to LISTS. Figure 7 shows the potential LISTS cluster system and collection line locations. Properties not included in the LISTS would continue with compliant ISTS. Properties within the Blue Marina study area to remain on ISTS are shown in Figure 8.

Treatment system costs were based on average daily flow estimates for all properties in the study area, including properties that chose not to participate in the field evaluation. Adding bedrooms to residential properties would change the size requirement for the cluster system,

as well as the overall cost and the cost per dwelling. Prices included in Table 9 also take the increased cost of design due to permitting into account. Prices assume residential strength waste from each wastewater generator.

Collection system costs were based on cost estimates of force main installation on a lineal foot basis for both the mainline and laterals based on the routes shown in Figure 6 and 7.

STEP system costs were calculated as shown in Appendix E. The cost of the collection system takes into account compliant tanks and tank upgrade costs.

Costs assume ownership of the LISTS cluster systems by the District and ownership of ISTS by a private party. Both LISTS alternative assumes drain field dispersal areas consisting of mound cells with 10 foot wide pressurized beds. The mound treatment and dispersal areas would qualify as a nitrogen BMP if required.

### 4.3 SUMMARY OF CAPITAL COSTS

Sections 4.1 – 4.2 highlight the cost estimates for each of the wastewater infrastructure alternatives. The cost estimates for each alternative assume the entire area would be served by the alternative chosen. Table 10 is a side by side comparison of the average per unit capital cost for each of the alternatives.

**Table 10: Summary of Capital Costs**

	<b>Alternative 1 Managed ISTS Program</b>	<b>Alternative 2: LISTS Cluster</b>	<b>Alternative 3: LISTS Cluster + ISTS</b>
Total Assessed System Costs	\$ 128,300	\$ 714,800	\$ 657,400
Average Cost/Dwelling	\$ 9,200	\$ 51,100	\$ 47,000

It is important to note that costs are applied to *all* properties that currently have structures that could generate wastewater (including properties that currently have a compliant ISTS or that

did not chose to be included in the field evaluation). Section 3.0 identifies the necessary components, advantages, and disadvantages of the three alternatives. While an ISTS program is the least expensive alternative on an average per unit basis, other considerations such as operational costs, ISTS type, and limited flexibility of lots (i.e. a drainfield in a small yard takes up space that could be used for parking, gardening, building, etc.) must be considered as well.

#### 4.4 ANNUAL OPERATION AND MAINTENANCE COSTS

When comparing costs for a wastewater infrastructure alternative, all costs, capital and annual operation and maintenance (O&M) must be considered. Table 11 provides the average annual operation and maintenance cost estimates for each alternative.

**Table 11: Annual Operation and Maintenance Costs**

	Alternative 1: Managed ISTS Program	Alternative 2: LISTS Cluster	Alternative 3: LISTS Cluster + ISTS
Total All Properties	\$ 34,600	\$ 5,700	\$ 5,520
Residential Average Cost for All Properties/Year	\$ 2,471	\$ 407	\$ 394
Residential Average Cost for All Properties/Month	\$ 206.00	\$ 34.00	\$ 33.00
Residential Average Cost for ISTS Properties/Month	\$ 206.00	-	\$ 10.00
Residential Average Cost for Cluster Properties/Month	-	\$ 37.00	\$ 37.00

Assumes 90 days of use for seasonal holding tank properties

Tank pumping costs were assumed at \$0.15/gallon (i.e. \$150/1000 gallons). Property use (seasonal or permanent) was also taken into account. If the property was seasonal and a holding tank served as the ISTS, pumping costs were calculated based on 3-months of full-time occupancy (25% of the year). Annual operation and maintenance costs for Alternative 1 over the complete estimated 25-year life span that was used to create the table are as follows for a residential system:

- Type 1: \$100
- Type 2: Bedrooms/home \* 50 gallons/day/bedroom \* 365 days/year \* (\$0.15/gallon)  
1000 gallon holding tank capacity
- Type 3: \$100
- Type 4: \$400

Alternative 2 and 3 O & M costs include costs for the cluster drainfield and STEP collection systems (see Appendix E). The largest expense in O & M of Alternative 1 is the annual pumping costs for all of the holding tank systems. A typical Type 1 or 3 ISTS may have only a nominal \$100 annual fee for maintenance, where as a holding tank system can run into the thousands of dollars annually with full time occupancy. Of the 17 properties (including the Summer Breeze Resort) and the currently vacant lot assessed for future ISTS type, it is estimated that 15 have only a Type II holding tank as their future ISTS option. Alternative 2 and 3 costs with the addition of a nitrogen best management practice (BMP) do not increase above what costs would be without a nitrogen BMP, as the proposed BMP (mound over organic topsoil) is passive in nature.

#### **4.5 PRESENT WORTH ANALYSIS**

Alternatives discussed in this report require different capital costs and operation and maintenance costs. These options also realize the costs at different times during the life of the infrastructure. Certain options can require more infrastructure (capital) costs at the start of the project; while other options experience higher maintenance costs throughout the life of the project. Also, infrastructure components have different expected life spans requiring replacement costs at varying intervals. All of these variables can create misconceptions when trying to compare the costs of one alternative versus another.

A present worth analysis allows the direct comparison of alternatives by converting all future costs into present-day dollar amounts. Future expenditures including capital and operation and

maintenance are converted into present-day dollar amounts by using standard financial calculations, an assumed time-frame for the expense to occur, and a discount rate. The timing for the expenses was based on typical recurrences for maintenance and average life spans for infrastructure. The discount rate is generally described as the difference between the available rate of return on an investment and the average inflation rate. A discount rate of 4% was utilized in this study in the conversion of future costs to a present worth. After converting future costs into a present worth, these costs were added to initial capital costs and used in comparing the alternatives.

Section 4.5 evaluated operation and maintenance costs of the alternatives, a present worth analysis also takes inflation and debt service into account. Table 12 summarizes a present worth analysis over a 25-year period showing the *average* present worth costs for the entire District based on the different cluster and ISTS scenarios proposed in the report.

**Table 12: Present Worth Analysis (25-year) Average Costs Study-Area-Wide by Alternative**

	Alternative 1 Managed ISTS Program*	Alternative 2: LISTS Cluster	Alternative 3: LISTS Cluster + ISTS
Total System Costs	\$ 128,300	\$ 714,800	\$ 657,400
Annual Operation & Maintenance Costs (25 year present worth value)	\$ 541,000	\$ 90,000	\$ 87,000
Estimated Total Present Worth	\$ 669,300	\$ 804,800	\$ 744,400
Estimated Total Equivalent Annual Cost (annualized over a 25-year period, 2% interest)	\$ 34,282	\$ 41,222	\$ 38,128
Estimated Average Equivalent Annual Cost per Property	\$ 2,450	\$ 2,950	\$ 2,730
Estimated Average Equivalent Monthly Cost per Property	\$ 204.17	\$ 245.83	\$ 227.50

\*Assumes 90 days of use for seasonal holding tank properties

The estimated Total Present Worth amounts (of the alternatives cost over a 25-year period) are tallied in Table 12. The estimated Total Equivalent Annual Cost represents the annual cost to pay the Total Present Worth Cost over a 25-year period assuming a 2% subsidized loan rate. The estimated Average Equivalent Annual Cost per Property is simply the total annual cost divided by the number of participating properties (number of participating properties varies by option).

The Estimated Average Equivalent Annual Cost per Unit shown in the last row of Table 12 is not the actual cost experienced by the property owner each year. The timing and magnitude of actual costs will vary including upfront capital costs (i.e., assessments, individual system repairs, etc.) and periodic operation and maintenance (fees, utility bills, pump replacements, etc.). The Present Worth Analysis serves as a method of comparison and does not reflect the timing of actual payment. Table 12 assumes that for Alternative 1 ISTS, the future ISTS type as shown in Appendix B is the ISTS in use at the residences during the present worth analysis period. In addition, as in other tables, actual cost per unit will vary-units with more wastewater volume will face larger costs while units with lower wastewater volume will likely have lower actual costs.

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## 5.0 Summary and Recommendations

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### 5.1 SUMMARY

This report estimates the likely compliance status for existing ISTS and provides the side by side comparison of the alternatives for long-term wastewater infrastructure for properties in the Community of Blue Marina. A summary of the findings:

- 65% (11) of the field evaluated ISTS are likely non-compliant and either an imminent health threat or fail to protect groundwater
- 1 of the 16 properties with existing ISTS have the option of installing a Type 1 ISTS to replace their current system in the future
- Estimated capital costs on average per property for the evaluated alternatives:
  - Alternative 1: ISTS = \$9,200
  - Alternative 2: LISTS Cluster system for 14 properties (minus Summer Breeze Resort) = \$51,000
  - Alternative 3: LISTS Cluster system serving 12 properties and ISTS at remaining 2 properties (minus Summer Breeze Resort) = \$47,000
  - Summer Breeze Resort collection and treatment estimated costs are included in Appendix E. As this establishment would be classified as a MSTs, associated costs with and without nitrogen treatment have been estimated

### 5.2 RECOMMENDATIONS

This report will aid in making an informed decision on what steps to take as the alternatives are considered. It is our recommendation that the study area be treated by property, with the following recommendations based on Community values:

- If the Community values the lowest capital cost alternative, then the following recommendations apply:
  - Currently compliant properties not included in cluster Alternative 3 continue with ISTS and explore private funding options for any future upgrades.
  - Currently non-compliant properties not included in cluster Alternative 3 suggested for ISTS; install compliant ISTS and explore private funding options.
  - Properties included in cluster Alternative 3, evaluate potential to obtain land in close proximity for placement of a small cluster drainfield. Evaluate potential to attain public financing to fund systems owned and operated by the District.
  - All systems (private ISTS and public cluster) be included in a future management plan.
- If the Community desires to own and manage all wastewater systems to ensure environmental stewardship, or if the Community desires to free up space on individual lots currently occupied by ISTS, with consideration to cost of the overall system applying secondarily, then the following recommendation applies:
  - Further evaluate Alternative 2; evaluate potential to attain public financing to fund this option.
- If the Community desires to continue with the status quo of individual system ownership and management, then the following recommendation applies:
  - Pursue Alternative 1: Private ISTS to serve each property.
  - Currently compliant properties continue with ISTS and explore private funding options for any future upgrades.
  - Currently non-compliant properties install compliant ISTS and explore private funding options.

### **5.3 NEXT STEPS**

The following describes future actions that could be taken by the Community of Blue Marina based on the recommendations.

- Explore public financing grant options to reduce debt service for upgrades.
- Explore possibility of land acquisition for any cluster system.
- Explore the suitability of the proposed cluster site(s) for wastewater treatment via a Hydrogeological Assessment using soil pits, and (where applicable) borings to groundwater, and groundwater mounding assessments.
- Le Sueur County would continue to enforce the ISTS regulations of Chapter 7080. Non-compliant systems will require upgrades in the near future. Homeowners would be on their own to ensure their ISTS remains in compliance.
- Summer Breeze Resort:
  - Review included cost estimates of a MSTS wastewater collection and treatment system with and without nitrogen treatment.
  - Explore private funding options for necessary upgrades to existing ISTS infrastructure.
  - Explore the suitability of the resort owned land across Scotch Lake Road for wastewater treatment via a soil and site investigation; including a Hydrogeological Assessment.

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## 6.0 Professional Certification

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*I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Registered Professional Soil Scientist and MPCA Advanced Designer/Inspector under the laws of the State of Minnesota.*



**Peter Miller, P.S.S.**

**Registration No. 42636**

*I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer and MPCA Inspector under the laws of the State of Minnesota.*



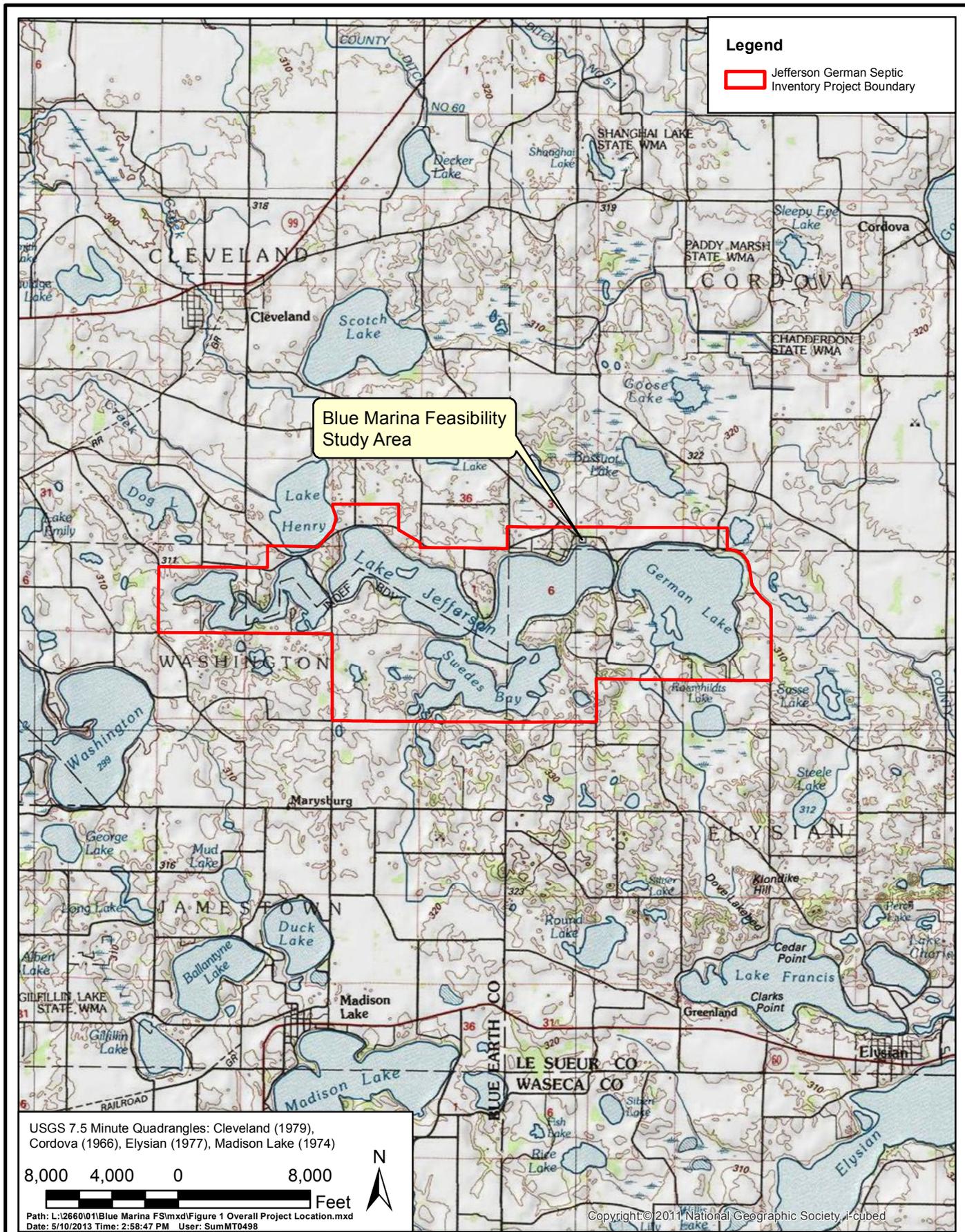
**Eric Blasing, P.E.**

**Registration No. 45781**

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## Figures

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**Legend**

Jefferson German Septic Inventory Project Boundary

Blue Marina Feasibility Study Area

USGS 7.5 Minute Quadrangles: Cleveland (1979), Cordova (1966), Elysian (1977), Madison Lake (1974)

8,000 4,000 0 8,000 Feet

Path: L:\2660101\Blue Marina FS\mxd\Figure 1 Overall Project Location.mxd  
Date: 5/10/2013 Time: 2:58:47 PM User: SumMT0498

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**LE SUEUR COUNTY**

**Project Location-Blue Marina Feasibility Study**



**Wenck**  
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Business Professionals  
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**MAY 2013**

**Figure 1**



**Legend**

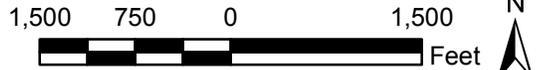
Blue Marina Feasibility Study Area

*Bossuot Lake*

*East Jefferson Lake*

*German Lake*

2010 Aerial Photograph (Source: Le Sueur County)



Path: L:\266010\Blue Marina FS\mxd\Figure 2 Blue Marina Study Location.mxd  
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**LE SUEUR COUNTY**  
**Blue Marina Feasibility Study Area**



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**Figure 2**



**Legend**

- Deep Well
- 50 Foot Well Setback
- Tax Parcels With Feasibility Study ID#

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Well Locations and Setbacks

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Figure 3



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Compliance Status of Existing ISTS

  
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Figure 4



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Alternative 1: ISTS

  
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Figure 5

**Legend**

-  Potential Collection Line
-  Tax Parcels With Feasibility Study ID#
-  Did Not Volunteer for JGSIP
- Alternative 2**
-  LISTS Cluster
-  Type II (Holding Tank)



2010 Aerial Photograph (Source: Le Sueur County)

250 125 0 250 Feet

Path: L:\2660\01\Blue Marina FS\mxd\Figure 6 Alternative 2 LISTS Cluster.mxd  
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LE SUEUR COUNTY

Alternative 2: LISTS Cluster Serving All Residential Properties

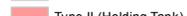
  
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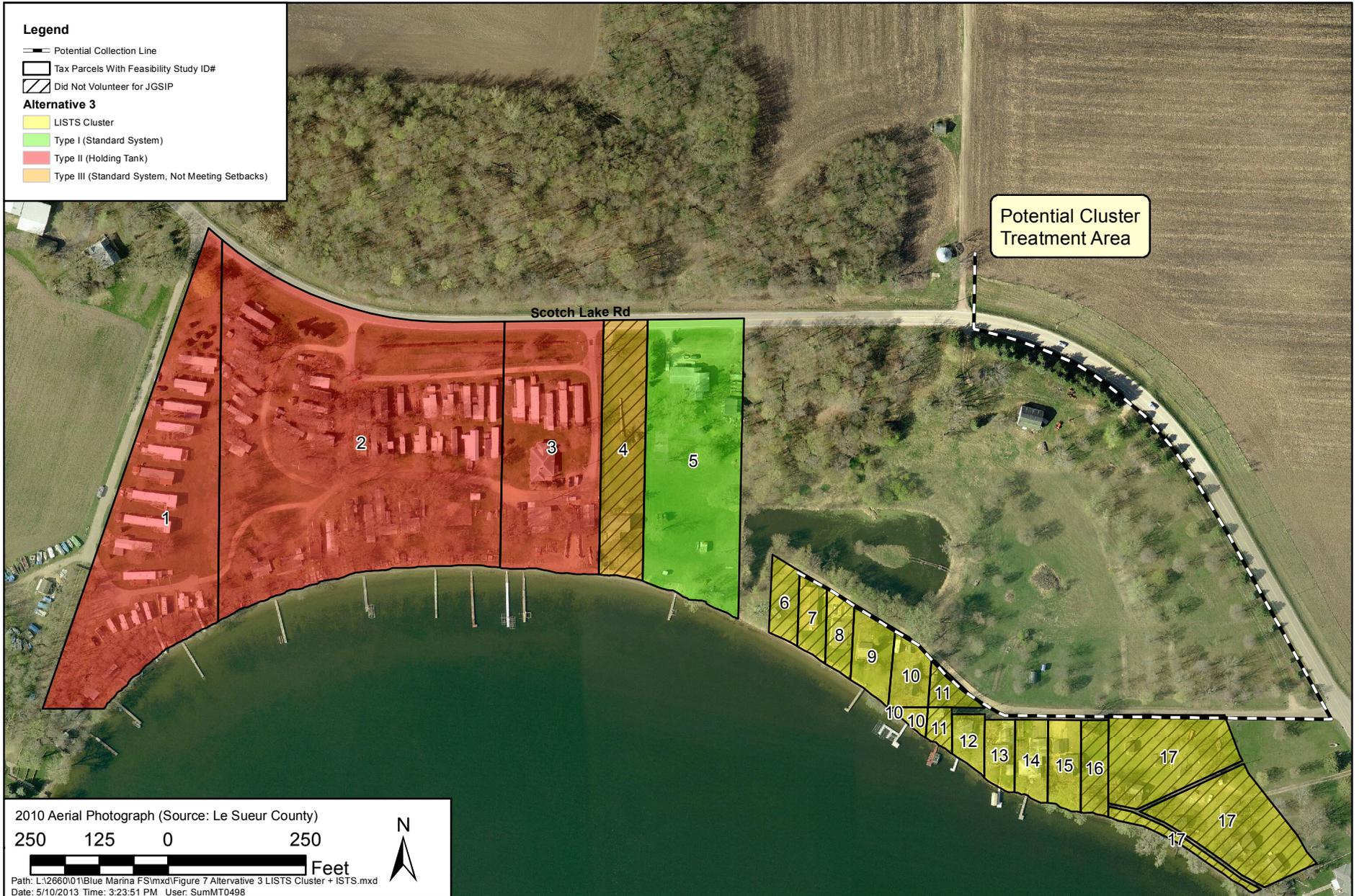
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Figure 6

**Legend**

-  Potential Collection Line
-  Tax Parcels With Feasibility Study ID#
-  Did Not Volunteer for JGSIP
- Alternative 3**
-  LISTS Cluster
-  Type I (Standard System)
-  Type II (Holding Tank)
-  Type III (Standard System, Not Meeting Setbacks)



2010 Aerial Photograph (Source: Le Sueur County)

250 125 0 250 Feet



Path: L:\2660\01\Blue Marina FS\mxd\Figure 7 Alternative 3 LISTS Cluster + ISTS.mxd  
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Alternative 3: LISTS Cluster and ISTS



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Figure 7

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## **Appendix A**

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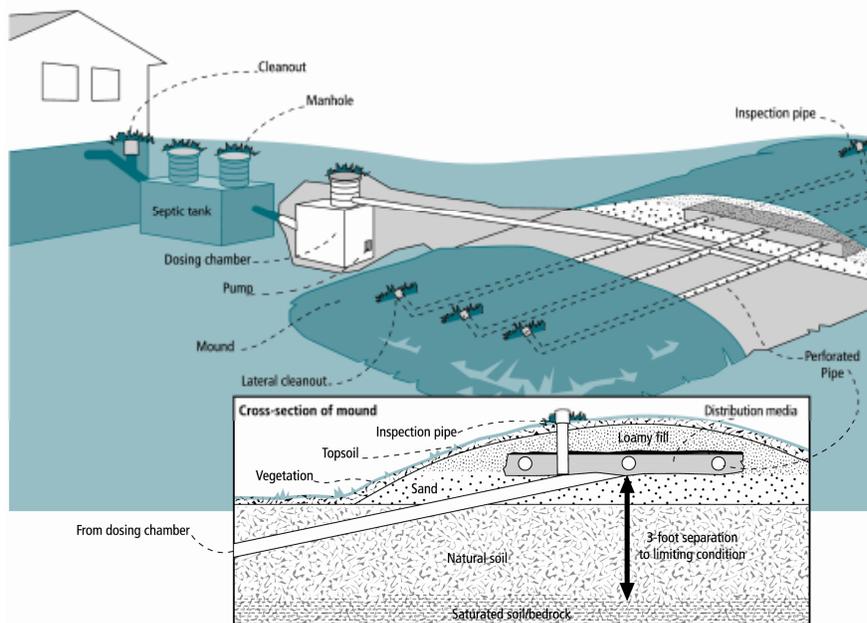
### **U of M ISTS Information**

# Mound Systems

Mound systems are defined in Chapter 7080.1100, Subp. 50, as “a soil treatment and dispersal system designed and installed such that all of the infiltrative surface is installed above grade, using clean sand between the bottom of the infiltrative surface and the original ground elevation, utilizing pressure distribution and capped with suitable soil material to stabilize the surface and encourage vegetative growth.”

A sewage treatment mound is nothing more than a seepage bed elevated by clean sand fill to provide adequate separation between where sewage effluent is applied and a limiting soil layer as shown in the figure below. Mounds were developed in the early 1970s to overcome soil and site conditions, which limit the use of trenches and beds (Converse et al., 1977). Limiting conditions include high water tables, shallow soil depth to bedrock, slowly permeable soil, or soil too coarse for treatment.

Figure 1 - Mound System and Components



A mound system is a two-stage process involving both effluent treatment and dispersal. Treatment is accomplished predominately by physical and biochemical processes within the clean sand material and native soil. The physical characteristics of the influent wastewater, influent loading rate temperature, and the nature of the receiving fill material and in situ soil affect these processes.

Physical entrapment, increased retention time, and conversion of pollutants in the effluent are important treatment objectives accomplished under unsaturated conditions. Pathogens contained in the effluent are eventually deactivated through filtering, retention, and adsorption by the fill material. In addition, many pollutants are converted to other chemical forms by oxidation processes.

The mound system addresses high water table conditions by elevating the infiltration bed to achieve the needed vertical separation. By using uniform distribution and adequate vertical separation in the selected sand media, vertical unsaturated flow is maintained, thus ensuring the maximum treatment permitted by this technology. On sites with slowly permeable soils, the mound system helps assure a known level of effluent treatment before effluent is discharged to the native soil. These soils are subject to severe damage from smearing and compaction, especially during the construction of conventional systems, which drastically reduces the permeability of the soil by destroying water-moving

pores and channels. As a result these sites present a high potential for site and soil interface damage in addition to the need for large soil treatment systems to provide adequate infiltration area. For these sites, mound systems provide the following advantages:

- The mound effluent enters the more permeable natural topsoil over a larger area where it can move laterally until absorbed by the less permeable subsoil.
- The bio-mat that develops at the bottom of the media/sand infiltration area will not clog the filter media as readily as it would the less permeable natural soil.
- The infiltration area within the filter media is much smaller than it would be if placed in the more slowly permeable subsoil, yet the total mound area is probably larger than it would be for a conventional soil treatment system, if one could be used.

Mound systems are used primarily in shallow soils overlying a restrictive layer or elevated groundwater table. The shallower the soil, the more attention must be paid to transporting the treated effluent away from the point of application. Fifteen mound systems in Wisconsin were found to have a total nitrogen reduction of at least 55% from the pretreatment effluent to mound toe effluent (Blasing and Converse, 2004). Sufficient numbers of mounds have been installed in Minnesota and elsewhere to prove that the mound treatment system is a Type I technology. There are more than 50,000 single-family mounds successfully treating sewage in Minnesota.

Dispersal is primarily affected by the depth of the unsaturated receiving soils, their hydraulic conductivity, land slope, and the area available for dispersal. The mound consists of sand material, an absorption bed, and cover material. Effluent is dispersed into the absorption bed, where it flows through the fill material and undergoes biological, chemical, and physical treatment. It then passes into the underlying soil for further treatment and dispersal to the environment. Clean sand (defined by state rule) is required for mounds to effectively treat and disperse effluent.

Cover material consists of material that provides erosion protection, a barrier to excess precipitation infiltration, and allows gas exchange. The native soil serves, in combination with the fill, as treatment media, and it also disperses the treated effluent.

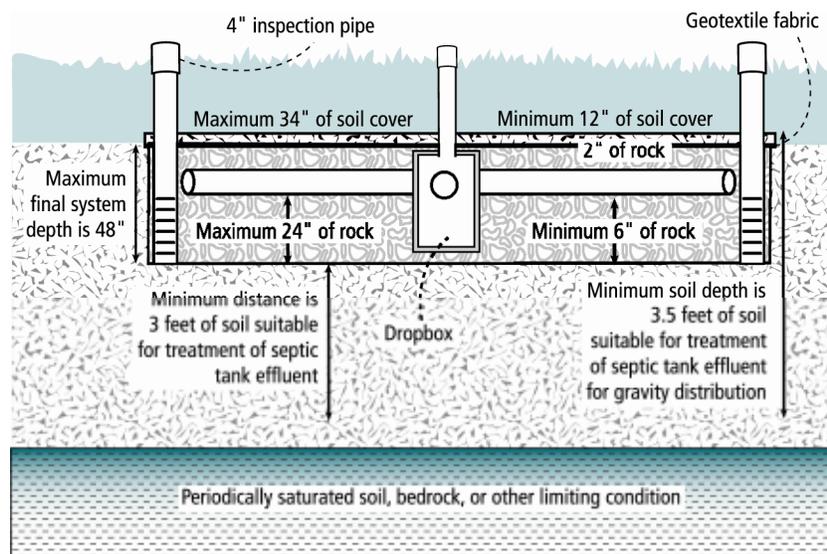
# Below-Grade Systems

Below-grade systems are constructed in original soil with distribution of effluent occurring below the soil surface. With below grade systems the soil treatment area is designed and installed such that the infiltrative surface is below the original ground elevation and a final cover of topsoil stabilizes the completed installation, supports vegetative growth, and sheds runoff. It is the underlying soil that treats the many harmful components in the effluent before it reaches surface or ground waters. The two types of below-grade soil treatment systems commonly used are trenches and seepage beds.

Trenches have better oxygen transfer than beds and are recommended whenever the site conditions allow although seepage beds are often more attractive due to reduced land area requirements. In addition, the cost and time of construction, trenches are preferred because they have greater infiltrative surface for the same bottom area, and less damage typically occurs to the infiltrative surface during construction (Otis et al, 1977).

The figure below shows minimum depths and separation requirements for trenches or seepage beds. For systems without pretreatment, at least three feet of soil suitable for treatment should be located below the bottom of the distribution media. The minimum depth of distribution media is six inches, followed by a minimum soil cover of twelve inches, so that the total distance from the periodically saturated or other limiting condition to the final grade is approximately 4.5 feet. Note that this total could be made up of 3.5 feet of original soil and one foot of soil (7080.2150, Subp. 3) over the distribution media of the system.

Figure 1 - Trench and Bed Depth



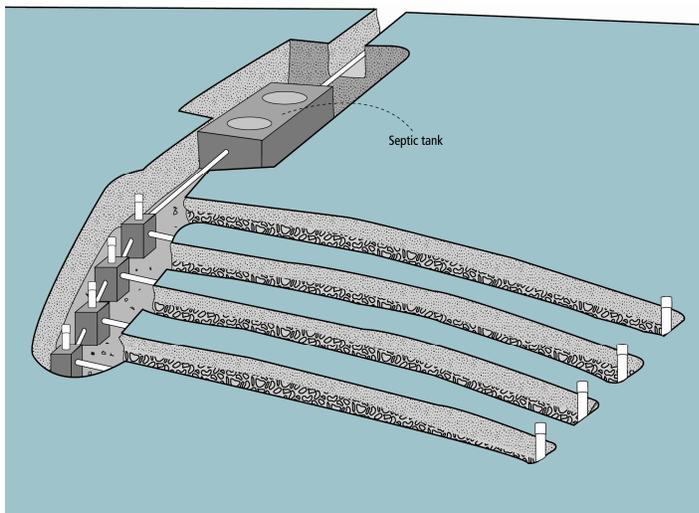
From MN Rules 7080.2260 Subp. 3. If the distribution media in a trench or a bed is in contact with soil texture group 2 through 4 (medium sand, fine sand, coarse and medium loamy sand) pressure distribution must be used.

## Below-Grade Systems: Specifications

### Trenches

The trench is the most common of the soil treatment systems. **According to MN Rules Chapter 7080.1100, Subp. 89 a trench is defined as a soil treatment and dispersal system, the absorption width of which is 36 inches or less.** Trenches are narrower than they are wide, no wider than three feet, and are laid out along the contours of the soil. A typical trench is constructed by making a level excavation 18 to 36 inches wide. The method of distributing the septic tank effluent can be either pressure or gravity. There are a number of different configurations by which the trenches can be connected with each other and with the septic tank: parallel, serial, and continual. A typical trench is constructed by making a level excavation 18 to 36 inches wide. A typical layout for a trench system is shown in Figure 2.

Figure 2 - Typical Trench Layout



The soil around and beneath the trench must be neither too coarse nor too fine. A coarse soil may not adequately filter pathogens, and a fine soil may be too tight to allow water to pass through. Soils with percolation rates between 0.1 and 60 mpi or soils with a listed loading rate on Table IX in Chapter 7080.2150 are suitable for treating sewage using a Type I below-grade design. **Trench media must never be placed in contact with soils having a percolation rate faster than 0.1 mpi or soil type 1 or slower than 60 mpi. For soils with percolation rates faster than 0.1 mpi and between 61 and 120 mpi, Type I below-grade systems may not be used (7080.2150, Subp. 3).**

The trench soil treatment system consists of distribution media, covered with a minimum of 12 inches of soil and a close-growing and vigorous vegetation. Many trench systems utilize a pipe and gravel distribution system where effluent passes through the pipe and is stored within the media until it can be absorbed into the soil. Partial treatment is achieved as effluent passes through the biomat. The biomat also distributes effluent across the soil surfaces and maintains aerobic conditions outside the trench.

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## **Appendix B**

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### **Parcel Data Spreadsheet**



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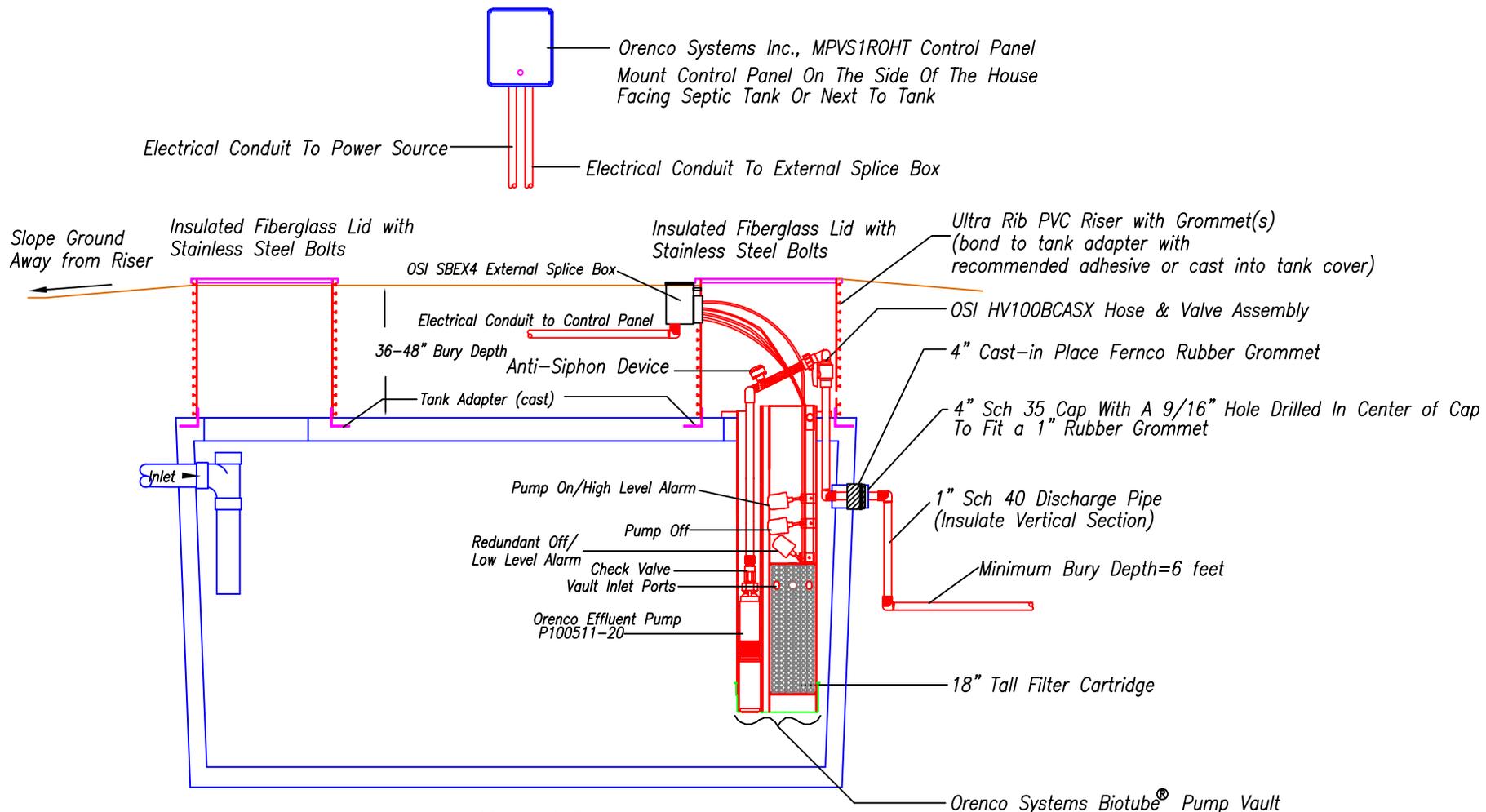
## **Appendix C**

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### **Septic Tank Effluent Pump (STEP) Detail**

# STEP TANK - TYPICAL

Drawing provided by Orenco, Systems, Inc.



SCALE: NONE

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## **Appendix D**

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### **Flow Calculations**









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## **Appendix E**

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### **Cost Analysis**

## ESTIMATED LISTS CAPITAL COSTS : CLUSTER ALTERNATIVE 2

ITEM	# PROPERTIES	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
<b><u>Collection</u></b>					
Individual Septic Tank (New)	8	13,000	gal	\$1.50	\$19,500
Individual Pump Tank (New)	14	14,000	gal	\$1.50	\$21,000
Individual Tank Install	14	27,000	gal	\$1.50	\$40,500
Individual Septic Tank (Upgrade)	6	6	ls	\$1,500.00	\$9,000
Individual Pump Tank (Upgrade)	0	0	ls	\$1,500.00	\$0
Septic Tank Abandonment	8	8	ea	\$500.00	\$4,000
STEP Pump Package	14	14	ea	\$4,000.00	\$56,000
STEP Electrical Installation	14	14	ea	\$1,500.00	\$21,000
Building Sewer Cleanout	14	14	ea	\$400.00	\$5,600
4" Building Sewer Replacement	14	420	lf	\$25.00	\$10,500
2" Forcemain Collection	14	2,905	lf	\$20.00	\$58,100
2" Laterals	14	985	lf	\$20.00	\$19,700
Air/Vacuum Release Valves	14	2	ea	\$5,000.00	\$10,000
Isolation Valves/Cleanouts	14	5	ea	\$3,000.00	\$15,000
2" Curb Stops	14	14	ea	\$750.00	\$10,500
Insulation (4")	14	230	sy	\$40.00	\$9,200
Lawn Seeding/Restoration	14	1	ls	\$15,000.00	\$15,000
Class V Roadway Replacement	14	640	sy	\$22.50	\$14,400
Class V Roadway Crossing	14	1	ea	\$800.00	\$800
Mobilization	14	1	ls	\$7,500.00	\$7,500
Total Collection	14	1	ls	-	\$347,300
<b><u>Treatment</u></b>					
Common Septic (Stilling) Tank	14	2,500	gal	\$1.50	\$3,750
Stilling Tank Effluent Screen	14	1	ea	\$750.00	\$750
Common Pump Tank	14	4,200	gal	\$1.50	\$6,300
Common Tank Install	14	6,700	gal	\$1.50	\$10,050
Common Dosing Package (duplex)	14	2	package	\$4,000.00	\$8,000
Common Control Panel	14	1	unit	\$7,500.00	\$7,500
Common Drainfield (Mound)	14	1	unit	\$63,000.00	\$63,000
Mound Cell Supply Piping	14	600	lf	\$20.00	\$12,000
Insulation (4")	14	145	sy	\$40.00	\$5,800
Electrical Component Install Costs	14	1	ls	\$7,500.00	\$7,500
Service Road	14	100	lf	\$50.00	\$5,000
Electrical Service to Treatment Site	14	150	lf	\$30.00	\$4,500
Erosion Control	14	1	ls	\$5,000.00	\$5,000
Clearing, grubbing, etc.; md trees/brush	14	0.00	ac	\$6,000.00	\$0
Site Restoration	14	1.0	ac	\$4,000.00	\$4,000
Mobilization	14	1	ls	\$7,500.00	\$7,500
Total Common Treatment	14	1	ls	-	\$150,650
Total Treatment	14	1	ls	-	\$150,650
TOTAL*	14	1	LS	-	\$497,950
AVERAGE/PROPERTY*	14	1	LS	-	\$35,568

\*Does not include costs for land acquisition, legal, engineering, administration, or contingency.

### ESTIMATED LISTS & ISTS CAPITAL COSTS : CLUSTER ALTERNATIVE 3

ITEM	# PROPERTIES	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
<b><u>Collection</u></b>					
Individual Septic Tank (New)	6	12,000	gal	\$1.50	\$18,000
Individual Pump Tank (New)	12	12,000	gal	\$1.50	\$18,000
Individual Tank Install	12	24,000	gal	\$1.50	\$36,000
Individual Septic Tank (Upgrade)	6	5	ls	\$1,500.00	\$7,500
Individual Pump Tank (Upgrade)	0	0	ls	\$1,500.00	\$0
Septic Tank Abandonment	6	6	ea	\$500.00	\$3,000
STEP Pump Package	12	12	ea	\$4,000.00	\$48,000
STEP Electrical Installation	12	12	ea	\$1,500.00	\$18,000
Building Sewer Cleanout	12	12	ea	\$400.00	\$4,800
4" Building Sewer Replacement	12	360	lf	\$25.00	\$9,000
2" Forcemain Collection	12	2,275	lf	\$20.00	\$45,500
2" Laterals	12	600	lf	\$20.00	\$12,000
Air/Vacuum Release Valves	12	2	ea	\$5,000.00	\$10,000
Isolation valves/cleanouts	12	4	ea	\$3,000.00	\$12,000
2" Curb stops	12	12	ea	\$750.00	\$9,000
Insulation (4")	12	205	sy	\$40.00	\$8,200
Lawn Seeding/Restoration	12	1	ls	\$13,500.00	\$13,500
Class V Roadway Replacement	12	720	sy	\$22.50	\$16,200
Class V Roadway Crossing	14	1	ea	\$800.00	\$800
Mobilization	12	1	ls	\$7,500.00	\$7,500
Total Collection	12	1	ls	-	\$297,000
<b><u>Treatment</u></b>					
Common Septic (Stilling) Tank	12	2,500	gal	\$1.50	\$3,750
Stilling Tank Effluent Screen	12	1	ea	\$750.00	\$750
Common Pump Tank	12	4,200	gal	\$1.50	\$6,300
Common Tank Install	12	6,700	gal	\$1.50	\$10,050
Common Dosing Package (duplex)	12	2	package	\$4,000.00	\$8,000
Common Control Panel	12	1	unit	\$7,500.00	\$7,500
Common Drainfield (Mound)	12	1	unit	\$54,000.00	\$54,000
Mound Cell Supply Piping	12	550	lf	\$20.00	\$11,000
Insulation (4")	12	145	sy	\$40.00	\$5,800
Electrical Component Install Costs	12	1	ls	\$7,500.00	\$7,500
Service Road	12	100	lf	\$50.00	\$5,000
Electrical Service to Treatment Site	12	150	lf	\$30.00	\$4,500
Erosion Control	12	1	ls	\$5,000.00	\$5,000
Clearing, grubbing, etc.; md trees/brush	12	0.00	ac	\$6,000.00	\$0
Site Restoration	12	1.0	ac	\$4,000.00	\$4,000
Mobilization	12	1	ls	\$7,500.00	\$7,500
Total Common Treatment	12	1	ls	-	\$140,650
Individual ISTS	2	1	ls	\$25,500.00	\$25,500
Total Treatment	12	1	ls	-	\$166,150
TOTAL*	14	1	LS	-	\$463,150
AVERAGE/PROPERTY*	14	1	LS	-	\$33,082

\*Does not include costs for land acquisition, legal, engineering, administration, or contingency.

## OPERATION AND MAINTENANCE FOR CLUSTER ALTERNATIVE 2

Costs remain the same both with and without the Nitrogen BMP added

### ESTIMATED STEP OPERATION AND MAINTENACE COSTS FOR 3 BDR HOME

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE/YEAR	NOTES
Tank pumping	500	gal	\$0.15	\$75.00	1500 gallons 1x/3 years
Electricity (0.5 hp pump)	101	kwh	\$0.10	\$10.13	gpd/ gallons/min /min/hr * days/year * kwh
Service Visit	0.5	hr	\$65.00	\$32.50	.25 hrs 2x/year
Pump Replacement	0.1	each	\$500.00	\$50.00	1x/10 years
<b>Total</b>				<b>\$167.63</b>	
Contingency (10%)				\$16.76	
Final Total				\$184.39	
Total for 14 properties				\$2,581.48	

### ESTIMATED OPERATION AND MAINTENACE COSTS FOR 4,960 GPD DRAINFIELD

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE/YEAR	NOTES
Tank pumping	2167	gal	\$0.15	\$325.00	6500 gallons 1x/3 years
Electricity (0.5 hp pump)	1116	kwh	\$0.10	\$111.64	gpd/ gallons/min /min/hr * days/year * kwh
Service Visit	4	hr	\$65.00	\$260.00	2 hrs 2x/year
Pump Replacement	0.8	each	\$500.00	\$400.00	1x/5 years - four pumps
Remote Monitoring/Reporting	26	hr	\$65.00	\$1,690.00	0.5 hrs/week
<b>Total</b>				<b>\$2,786.64</b>	
Contingency (10%)				\$278.66	
Final Total				\$3,065.31	
<b>Final Total for All</b>				<b>\$5,700.00</b>	
Total/property/month				\$33.93	

## OPERATION AND MAINTENANCE FOR ALTERNATIVE OPTION 3

Costs remain the same both with and without the Nitrogen BMP added

### ESTIMATED STEP OPERATION AND MAINTENACE COSTS FOR 3 BDR HOME

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE/YEAR	NOTES
Tank pumping	500	gal	\$0.15	\$75.00	1500 gallons 1x/3 years
Electricity (0.5 hp pump)	101	kwh	\$0.10	\$10.13	gpd/ gallons/min /min/hr * days/year * kwh
Service Visit	0.5	hr	\$65.00	\$32.50	.25 hrs 2x/year
Pump Replacement	0.1	each	\$500.00	\$50.00	1x/10 years
<b>Total</b>				<b>\$167.63</b>	
Contingency (10%)				\$16.76	
Final Total				\$184.39	
Total for 12 properties				\$2,212.70	

### ESTIMATED OPERATION AND MAINTENACE COSTS FOR 4,315 GPD DRAINFIELD

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE/YEAR	NOTES
Tank pumping	2167	gal	\$0.15	\$325.00	6500 gallons 1x/3 years
Electricity (0.5 hp pump)	971	kwh	\$0.10	\$97.12	gpd/ gallons/min /min/hr * days/year * kwh
Service Visit	4	hr	\$65.00	\$260.00	2 hrs 2x/year
Pump Replacement	0.8	each	\$500.00	\$400.00	1x/5 years - four pumps
Remote Monitoring/Reporting	26	hr	\$65.00	\$1,690.00	0.5 hrs/week
<b>Total</b>				<b>\$2,772.12</b>	
Contingency (10%)				\$277.21	
Final Total				\$3,049.34	
<b>Final Total for All Cluster</b>				<b>\$5,300.00</b>	
Total/property/month				\$36.81	

### ESTIMATED OPERATION AND MAINTENACE COSTS FOR ISTS

Property	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE/YEAR
Type 1	1	ea	\$100.00	\$100.00
Type 3	1	ea	\$100.00	\$100.00
<b>Total</b>				<b>\$200.00</b>
Contingency (10%)				\$20.00
Final Total				\$220.00
Total/property/month				\$9.17

**ESTIMATED MSTs CAPITAL COSTS WITH NITROGEN BMP FOR SUMMER BREEZE**

<b>ITEM</b>	<b>QUANTITY</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>TOTAL PRICE</b>
<b><u>Collection</u></b>				
Additional Septic Tank (New)	20,000	gal	\$1.50	\$30,000
Individual Pump Tank (New)	10,000	gal	\$1.50	\$15,000
Individual Tank Install	30,000	gal	\$1.50	\$45,000
Individual Septic Tank (Upgrade)	10	ls	\$1,500.00	\$15,000
Non-Compliant Tank Abandonment	4	ls	\$500.00	\$2,000
STEP Pump Package	10	ea	\$4,000.00	\$40,000
STEP Electrical Installation	10	ea	\$1,500.00	\$15,000
4" Building Sewer Replacement	0	lf	\$25.00	\$0
2" Forcemain Collection	2,160	lf	\$20.00	\$43,200
2" Laterals	750	lf	\$20.00	\$15,000
Air/Vacuum Release Valves	2	ea	\$5,000.00	\$10,000
Isolation valves/cleanouts	3	ea	\$3,000.00	\$9,000
2" Curb stops	0	ea	\$750.00	\$0
Insulation (4")	335	sy	\$40.00	\$13,400
Lawn Seeding/Restoration	1	ls	\$7,500.00	\$7,500
Class V Driveway Replacement	830	sy	\$22.50	\$18,675
Mobilization	1	ls	\$7,500.00	\$7,500
<b>Total Collection</b>	<b>1</b>	<b>ls</b>	<b>-</b>	<b>\$286,275</b>
<b><u>Treatment</u></b>				
Common Septic (Stilling) Tank	4,000	gal	\$1.50	\$6,000
Stilling Tank Effluent Screen	1	ea	\$750.00	\$750
Common Pump Tank	5,000	gal	\$1.50	\$7,500
Aerobic Pretreatment Unit Tank	12,000	gal	\$1.50	\$18,000
Common Tank Install	21,000	gal	\$1.50	\$31,500
Aerobic Pretreatment Unit	1	ea	\$30,000.00	\$30,000
Common Dosing Package (duplex)	2	ea	\$4,000.00	\$8,000
Common Control Panel	1	unit	\$7,500.00	\$7,500
Common Drainfield (Mound)	1	unit	\$153,000.00	\$153,000
Mound Cell Supply Piping	750	lf	\$20.00	\$15,000
Insulation (4")	145	sy	\$40.00	\$5,800
Electrical Component Install Costs	1	ls	\$10,000.00	\$10,000
Service Road	600	lf	\$50.00	\$30,000
Electrical Service to Treatment Site	600	lf	\$30.00	\$18,000
Erosion Control	1	ls	\$5,000.00	\$5,000
Clearing, grubbing, etc.; md trees/brush	0.50	ac	\$6,000.00	\$3,000
Site Restoration	2.5	ac	\$4,000.00	\$10,000
Mobilization	1	ls	\$7,500.00	\$7,500
<b>Total Treatment</b>	<b>1</b>	<b>ls</b>	<b>-</b>	<b>\$366,550</b>
<b>SUBTOTAL</b>	<b>1</b>	<b>LS</b>	<b>-</b>	<b>\$652,825</b>
<b>10% CONTINGENCY</b>	<b>1</b>	<b>LS</b>	<b>-</b>	<b>\$65,283</b>
<b>TOTAL*</b>	<b>1</b>	<b>LS</b>	<b>-</b>	<b>\$718,108</b>

\*Does not include costs for land acquisition, legal, engineering, OR administration

**ESTIMATED MSTs CAPITAL COSTS INCLUDING NITROGEN REMOVAL FOR SUMMER BREEZE**

<b>ITEM</b>	<b>QUANTITY</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>TOTAL PRICE</b>
<b><u>Collection</u></b>				
Additional Septic Tank (New)	20,000	gal	\$1.50	\$30,000
Individual Pump Tank (New)	10,000	gal	\$1.50	\$15,000
Individual Tank Install	30,000	gal	\$1.50	\$45,000
Individual Septic Tank (Upgrade)	10	ls	\$1,500.00	\$15,000
Non-Compliant Tank Abandonment	4	ls	\$500.00	\$2,000
STEP Pump Package	10	ea	\$4,000.00	\$40,000
STEP Electrical Installation	10	ea	\$1,500.00	\$15,000
4" Building Sewer Replacement	0	lf	\$25.00	\$0
2" Forcemain Collection	2,160	lf	\$20.00	\$43,200
2" Laterals	750	lf	\$20.00	\$15,000
Air/Vacuum Release Valves	2	ea	\$5,000.00	\$10,000
Isolation valves/cleanouts	3	ea	\$3,000.00	\$9,000
2" Curb stops	0	ea	\$750.00	\$0
Insulation (4")	335	sy	\$40.00	\$13,400
Lawn Seeding/Restoration	1	ls	\$7,500.00	\$7,500
Class V Driveway Replacement	830	sy	\$22.50	\$18,675
Mobilization	1	ls	\$7,500.00	\$7,500
<b>Total Collection</b>	<b>1</b>	<b>ls</b>	<b>-</b>	<b>\$286,275</b>
<b><u>Treatment</u></b>				
Anoxic/Equalization Tank	14,000	gal	\$1.50	\$21,000
Common Reactor Tank #1	6,000	gal	\$1.50	\$9,000
Common Clearwater Tank #1	6,000	gal	\$1.50	\$9,000
Common Reactor Tank #2	1,000	gal	\$1.50	\$1,500
Common Clearwater Tank #2	3,000	gal	\$1.50	\$4,500
Dose Tank	5,000	gal	\$1.50	\$7,500
Common Tanks Install	35,000	gal	\$1.50	\$52,500
Common Dosing Package	2	ea	\$4,000.00	\$8,000
Common Control Panel	1	unit	\$7,500.00	\$7,500
Common Drainfield (Mound)	1	unit	\$153,000.00	\$153,000
Mound Cell Supply Piping	750	lf	\$20.00	\$15,000
Insulation (4")	145	sy	\$40.00	\$5,800
Electrical Component Install Costs	1	ls	\$25,000.00	\$25,000
Service Road	600	lf	\$50.00	\$30,000
Electrical Service to Treatment Site	600	lf	\$30.00	\$18,000
Erosion Control	1	ls	\$5,000.00	\$5,000
Clearing, grubbing, etc.; md trees/brush	0.50	ac	\$6,000.00	\$3,000
Site Restoration	2.5	ac	\$4,000.00	\$10,000
Mobilization	1	ls	\$7,500.00	\$7,500
Amphidrome Plus Reactor	1	ls	\$180,000.00	\$180,000
Control Building	1	ls	\$40,000.00	\$40,000
Labor and Install of Amphidrome	1	ls	\$75,000.00	\$75,000
<b>Total Drainfield</b>	<b>1</b>	<b>ls</b>	<b>-</b>	<b>\$374,800</b>
<b>Total Nitrogen Removal</b>	<b>1</b>	<b>ls</b>	<b>-</b>	<b>\$313,000</b>
<b>Total Treatment</b>	<b>1</b>	<b>ls</b>	<b>-</b>	<b>\$687,800</b>
<b>SUBTOTAL</b>	<b>1</b>	<b>LS</b>	<b>-</b>	<b>\$974,075</b>
<b>10% CONTINGENCY</b>	<b>1</b>	<b>LS</b>	<b>-</b>	<b>\$97,408</b>
<b>TOTAL*</b>	<b>1</b>	<b>LS</b>	<b>-</b>	<b>\$1,071,483</b>

\*Does not include costs for land acquisition, legal, engineering, OR administration

## OPERATION AND MAINTENANCE FOR SUMMER BREEZE MSTs

### ESTIMATED STEP OPERATION AND MAINTENANCE COSTS

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE/YEAR	NOTES
Tank pumping	1083	gal	\$0.15	\$162.50	3250 gallons 1x/3 years (total septic needed = 32,500 gallons so 32,500/10=3,250 gallons each)
Electricity (0.5 hp pump)	182	kwh	\$0.10	\$18.23	gpd/ gallons/min /min/hr * days/year * kwh (8075/10 dose pumps = 810 gallons each)
Service Visit	0.5	hr	\$65.00	\$32.50	.25 hrs 2x/year
Pump Replacement	0.1	each	\$500.00	\$50.00	1x/10 years
<b>Total</b>				<b>\$263.23</b>	
Contingency (10%)				\$26.32	
Final Total				\$289.55	
Total for 10 Pump Tanks				\$2,895.55	

### ESTIMATED OPERATION AND MAINTENANCE COSTS FOR 8,075 GPD TREATMENT SITE

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE/YEAR	NOTES
Tank pumping	7000	gal	\$0.15	\$1,050.00	21,000 gallons 1x/3 years
Electricity (0.5 hp dose pumps)	1818	kwh	\$0.10	\$181.75	gpd/ gallons/min /min/hr * days/year * kwh
Electricity (Aerobic Treatment Unit)	22466	kwh	\$0.10	\$2,246.58	Based off 5hp blower, 123.1 kwh per day running @ 50% (April through September)
Service Visit	8	hr	\$65.00	\$520.00	2 hrs 4x/year
Pump Replacement	0.8	each	\$500.00	\$400.00	1x/5 years, four pumps
Remote Monitoring/Reporting	26	hr	\$65.00	\$1,690.00	0.5 hrs/week
<b>Total</b>				<b>\$6,088.33</b>	
Contingency (10%)				\$608.83	
Final Total				\$6,697.16	
<b>Final Total for All</b>				<b>\$9,600.00</b>	
Total Cost/Month				\$800.00	

## OPERATION AND MAINTENANCE FOR SUMMER BREEZE MSTs W/ NITROGEN REMOVAL

### ESTIMATED STEP OPERATION AND MAINTENANCE COSTS

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE/YEAR	NOTES
Tank pumping	1083	gal	\$0.15	\$162.50	3250 gallons 1x/3 years (total septic needed = 32,500 gallons so 32,500/10=3,250 gallons
Electricity (0.5 hp pump)	182	kwh	\$0.10	\$18.23	gpd/ gallons/min /min/hr * days/year * kwh (8075/10 dose pumps = 810 gallons each)
Service Visit	0.5	hr	\$65.00	\$32.50	.25 hrs 2x/year
Pump Replacement	0.1	each	\$500.00	\$50.00	1x/10 years
<b>Total</b>				<b>\$263.23</b>	
Contingency (10%)				\$26.32	
Final Total				\$289.55	
Total for 10 Pump Tanks				\$2,895.55	

### ESTIMATED OPERATION AND MAINTENANCE COSTS FOR 8,075 GPD DRAINFIELD SITE

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE/YEAR	NOTES
Tank pumping	1667	gal	\$0.15	\$250.00	5000 gallons 1x/3 years (remaining tank pumping taken into account in Nitrogen removal
Electricity (0.5 hp pump)	1818	kwh	\$0.10	\$181.75	gpd/ gallons/min /min/hr * days/year * kwh
Service Visit	8	hr	\$65.00	\$520.00	2 hrs 4x/year
Pump Replacement	0.8	each	\$500.00	\$400.00	1x/5 years, four pumps
Remote Monitoring/Reporting	26	hr	\$65.00	\$1,690.00	0.5 hrs/week
<b>Total</b>				<b>\$3,041.75</b>	
Contingency (10%)				\$304.18	
Final Total				\$3,345.93	

### ESTIMATED NITROGEN REMOVAL OPERATION AND MAINTENANCE COSTS

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE/YEAR	NOTES
Amphidrome Power	8170	kwh	\$0.10	\$817.00	Taken from vendor quote
Sludge Disposal	19000	gal	\$0.15	\$2,850.00	Taken from vendor quote
Methanol	250	gal	\$3.00	\$750.00	Taken from vendor quote
Alkalinity	1	ls	\$250.00	\$250.00	Taken from vendor quote
Telephone/Internet	12	\$/month	\$50.00	\$600.00	Estimate
Amphidrome Repair Reserve	0.25	total	\$10,000.00	\$2,500.00	Pump/Blower Replacement at 1x/8 years, 8 pumps, 2 blowers
Service Visit	104	hr	\$65.00	\$6,760.00	Estimated 2 hours/week average
Sampling	12	sample	\$100.00	\$1,200.00	Sample effluent 1x/month for TN, CBOD, and TSS.
Building Heating and Power	12.00	\$/month	\$50.00	\$600.00	Assumed cost of \$50/month
Remote Monitoring/Reporting	26	hr	\$65.00	\$1,690.00	0.5 hrs/week
<b>Total</b>				<b>\$18,017.00</b>	
Contingency (10%)				\$1,801.70	
Final Total				\$19,818.70	
<b>Final Total for All</b>				<b>\$26,100.00</b>	
Total Cost/Month				\$2,175.00	