Lakeview Township Community Assessment Report

Fairhaven, Pebble, Woodland, and Barbara Beaches on Lake Sallie, Lakeview Township, Becker County, Minnesota

Prepared for

Lakeview Township

Wenck

December 2010

Lakeview Township Community Assessment Report

Fairhaven, Pebble, Woodland, and Barbara Beaches on Lake Sallie, Lakeview Township, Becker County, Minnesota

Wenck File #2423-01

Prepared for:
LAKEVIEW TOWNSHIP

Prepared by:

WENCK ASSOCIATES, INC.
1800 Pioneer Creek Center
P.O. Box 249
ple Plain, Minnesota 55359-0249
(763) 479-4200

December 2010

Wenck

certify that this report was prepared by me or under my direct supervision and that I am a duly ed Professional Soil Scientist and MPCA Advanced Designer/Inspector under the law of the Minnesota

Patty A. Miller

iller, P.S.S. *Registration No. 42636*

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

Ryan Zefers

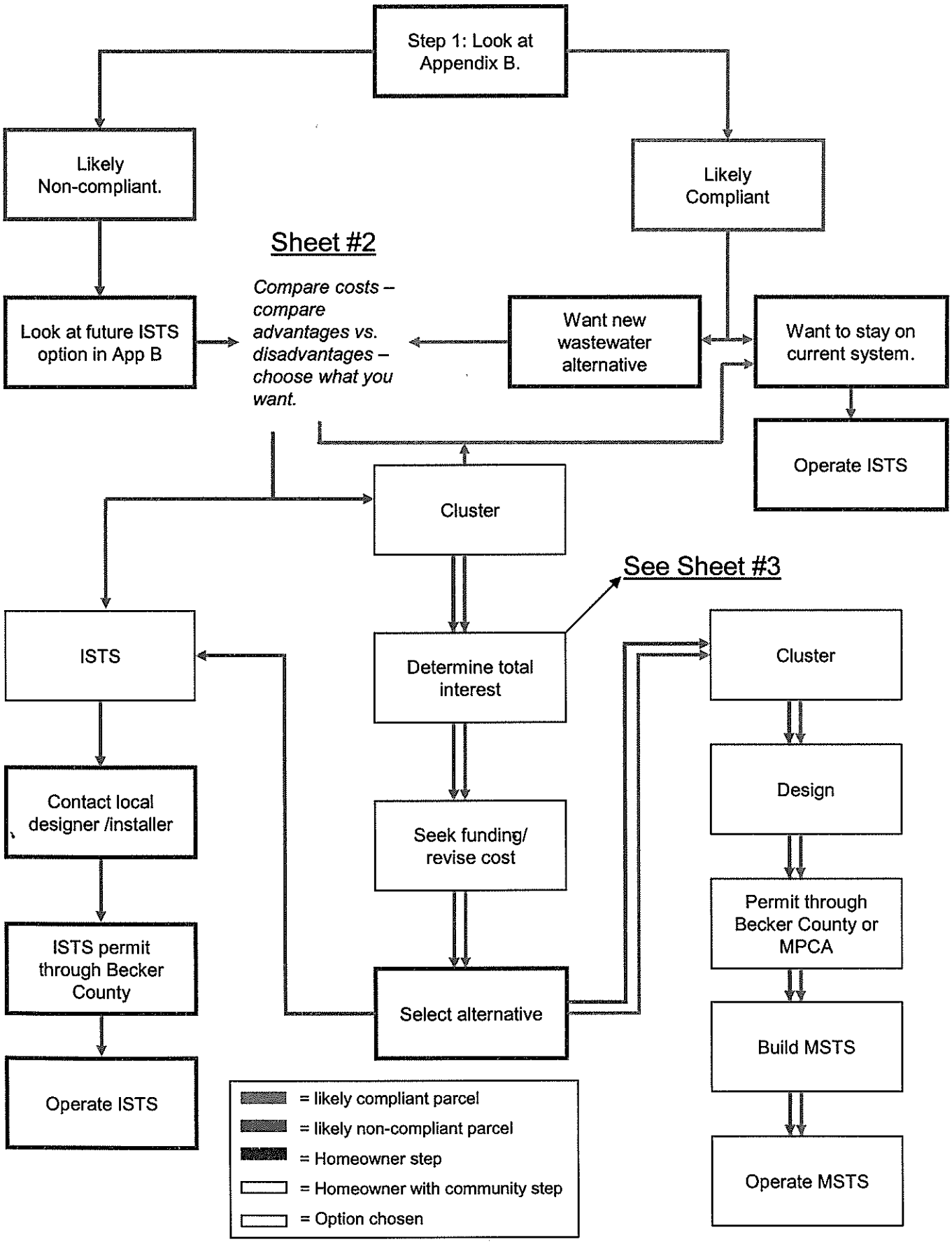
efers, P.E. *Registration No. 47502*

Community Assessment Report Overview

How to Use This Document:

1. If you are a homeowner interested in the results of the study as it pertains to *your* property only, follow the flow chart as shown on Sheet #1 to determine the results of the study as well as next steps for your property's wastewater treatment needs.
    a. Reference Sheet #2 where applicable
    b. Reference Sheet #3 where applicable
    c. If desiring to participate in cluster alternative, let your neighbors, beach captain, and the Township know.
2. To get an overview of the results and recommendations of the entire study, read Section 5: Summary and Recommendations
3. To understand the Community Assessment Report rationale and methodology, as well as study results for all properties and beaches studied, read the entire Community Assessment Report document.
    a. If only certain sections of the document are of interest, reference the Table of Contents, which documents where each section can be found.
    b. Of special interest to those only interested in cost may be the 25-year present worth analysis for the options, located in Section 4 of the Report.

Sheet #1
Homeowner Flowchart



Sheet #2
ISTS vs. Cluster

	ISTS	Cluster
Capital Costs	Type 1 Mound: $8-10K Type 2 HT: $500-$3,500 Type 3 Mound: $11-13K Type 4 Pretreatment: $14-16K Type 4 add Pretreatment: $8K	Pebble Beach: ~$22-23K/hookup Woodland Beach: ~$20K/hookup North Barbara Beach: ~$22K/hookup South Fairhaven Beach: ~$15K/hookup
Operation and Maintenance (O&M) Costs	Type 1 Mound or Drainfield: $100/yr Type 2 Holding Tank (Seasonal): $500/yr Type 2 Holding Tank (Full time): $3,600/yr Type 3 Mound: $200/yr Type 4 Pretreat: $400/yr	$125/yr
Advantages	• Capital cost based on need of property alone • Lower capital cost • No collection system cost	• Lower O&M cost than some ISTS • Dispersal of treated effluent away from lake and shallow wells • More usable land on individual lots than Type 1, 3 or 4 system • Possible increase in property resale value due to connection to cluster • Possible subsidized loan and/or grant
Disadvantages	• High O&M cost for holding tanks • Holding tanks pose limits on use for future development • Systems other than holding tanks take up usable space on lots	• Need to obtain land • More work in organizing project

Sheet #3

Cost Per Dwelling vs. Number of Dwellings Included In Cluster System

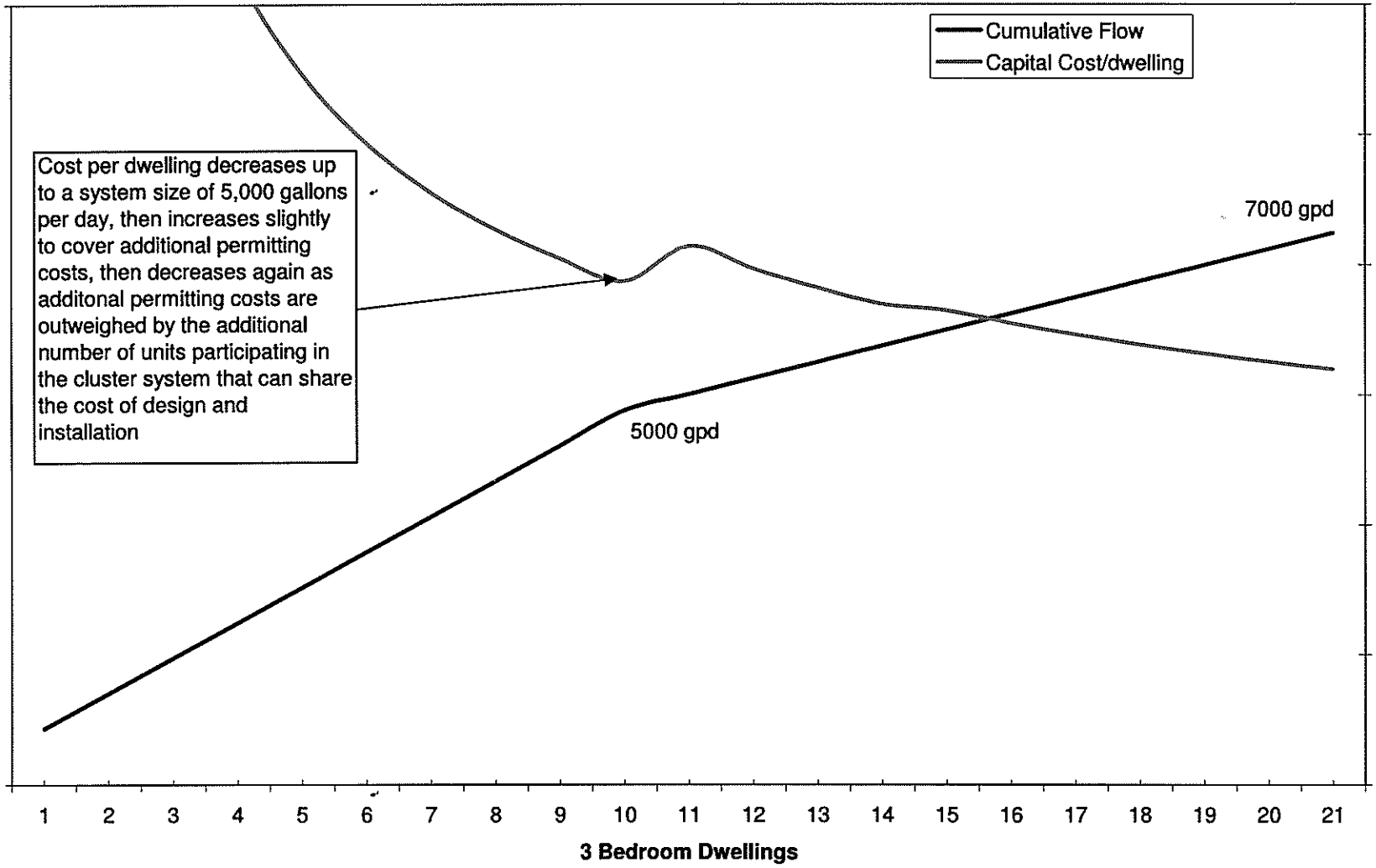


Table of Contents

1.0 Introduction 1-1

1.1 BACKGROUND 1-1
1.2 PREVIOUS INVESTIGATIONS 1-2
1.3 REPORT PURPOSE 1-2
1.4 WORK PERFORMED 1-2

2.0 Existing Conditions 2-1

2.1 INTRODUCTION 2-1
2.2 METHODS 2-1
2.3 FINDINGS 2-3
2.3.1 Drinking Water Source 2-3
2.3.2 Occupancy Status of Residences 2-4
2.3.3 ISTS Types 2-5
2.3.4 ISTS Compliance Status 2-6
2.3.5 Existing Septic Tanks 2-8
2.3.6 Next ISTS Options 2-8
2.4 SUMMARY 2-12

3.0 Alternatives Analysis 3-1

3.1 INTRODUCTION 3-1
3.2 INDIVDUAL ISTS (ALTERNATIVE 1) 3-2
3.2.1 ISTS Upgrades 3-2
3.2.2 ISTS Alternatives Summary 3-4
3.3 COMBINATION OF INDIVIDUAL AND CLUSTER ISTS (ALTERNATIVE 2) 3-5
3.3.1 Collection System 3-7
3.3.2 Treatment and Dispersal System 3-8
3.3.3 Cluster System Summary 3-9
3.4 SUMMARY 3-10

4.0 Cost Comparison of Alternatives 4-1

4.1 MANAGED ISTS PROGRAM (ALTERNATIVE 1) 4-1
4.2 CLUSTER SYSTEMS (ALTERNATIVE 2) 4-2
4.2.1 Fairhaven Beach Cluster Alternative Rationale 4-3
4.2.2 Woodland Beach Cluster Alternative Rationale 4-4

Table of Contents (Cont.)

4.2.3 Pebble Beach Cluster Alternative 4-4
4.2.4 Barbara/Pebble Beach Cluster Alternative Rationale 4-5
4.3 SUMMARY OF CAPITAL COSTS 4-5
4.4 ANNUAL OPERATION AND MAINTENANCE COSTS 4-6
4.5 PRESENT WORTH ANALYSIS 4-7

5.0 Summary and Recommendations 5-1

5.1 SUMMARY 5-1
5.2 RECOMMENDATIONS 5-2
5.3 NEXT STEPS 5-3

TABLES

1 Well Types 2-3
2 Seasonal Status of Occupancy 2-4
3 Estimate of Existing ISTS Types 2-5
4 ISTS Existing Condition 2-7
5 Next ISTS Replacing FTPG Systems by Property 2-9
6 Next ISTS by Property after Upgrade 2-10
7 Estimated Flow Rates 3-6
8 Imminent Upgrade Capital Cost Estimates for Managed ISTS Program 4-1
9 25-Year Capital Cost Estimates Cluster Systems 4-3
10 Summary of Capital Costs 4-5
11 Annual Operation and Maintenance Costs 4-6
12 Present Worth Analysis (25-year) 4-8
13 Present Worth Analysis (50-year) 4-10

FIGURES

1 Site Location Map
2A-2D Soils and Soil Borings Maps
3A-3D Well Location Maps
4A-4D Property Compliance Status Maps
5A-5D Service Areas and Future Cluster Options Maps

Table of Contents (Cont.)

APPENDICES

A U of M ISTS Information
B Parcel Data Spreadsheet
C Septic Tank Effluent Pump (STEP) Detail
D Soil Borings

1.0 Introduction

1.1 BACKGROUND

Lake Sallie is located in Lakeview Township, approximately 5 miles southwest of the City of Detroit Lakes, Becker County, Minnesota (Figure 1). Residents currently have individual water supply wells. The area is unsewered, resident wastewater needs are met by individual subsurface treatment systems (ISTS)[1] or by holding tanks, which collect and store effluent until it is collected by a pump truck and disposed of off-site. Wenck Associates, Inc. (Wenck) was retained to assess the condition of existing ISTS, and provide alternatives for viable long term infrastructure to collect, treat, and disperse wastewater within four distinct Service Areas on the Lake Sallie shoreline. The Service Areas include all or a portion of Fairhaven Beach, Barbara Beach, Pebble Beach, and Woodland Beach (Figure 1).

The approximate population of the Community Assessment Report (CAR) area is 300, based on the average number of bedrooms per residence as determined by the homeowner surveys. The population is expected to remain steady, based on the set CAR boundaries and the relatively small lot sizes that will prevent future subdivision of lots. The population in the CAR area is largely seasonal, although some residents have indicated plans to convert seasonal residences to permanent residences in the future.

This CAR was made possible through a Small Community Wastewater Technical Assistance Grant from the Minnesota Public Facilities Authority. These grants are available to small unsewered communities so they may analyze possible solutions to wastewater problems associated with non-complying septic systems. The Small Community Wastewater Technical Assistance Grants are designed to help communities develop the technical, managerial and

[1] 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 with an average daily flow less than 5,000 gallons per day.

financial capacity necessary to build, operate, and maintain new subsurface sewage treatment systems (SSTS).

1.2 PREVIOUS INVESTIGATIONS

In 2008, Wenck completed an Unsewered Area Needs Documentation (UAND) for the CAR area. Using Becker County permit records, soil survey data, compliance inspections at a number of the properties, and a visual survey of the CAR area; Wenck determined that numerous parcels in the CAR area were likely non-compliant for failing to protect groundwater and that the remaining parcels likely had difficulty meeting at least one of the required setbacks. Based upon these preliminary numbers, a Technical Assistance Grant was applied for and received from the Minnesota Public Facilities Authority to complete a CAR.

1.3 REPORT PURPOSE

This report is a planning document for possible long term solutions for wastewater collection and treatment within the investigated Service Areas on Lake Sallie, Lakeview Township. Within this report are developed concepts and a framework to provide sanitary sewer service to the existing residences in the CAR area. Alternatives are given for long-term wastewater treatment.

1.4 WORK PERFORMED

To determine the baseline for the analysis, a field investigation and county file review was completed in July, August, and September 2010 to assess the existing condition of any ISTS and septic tanks. The analysis also evaluated future onsite wastewater and cluster soil-based wastewater treatment options for residents. Information regarding some specifics of different

ISTS (i.e., drain field trench vs. mound) produced by the University of Minnesota Onsite Sewage Treatment Program[2] is found in Appendix A.

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

Alternative 1:	Existing homes upgrade existing ISTS
Alternative 2:	Combination of upgraded individual ISTS and new cluster ISTS

Service Areas (based on geographic location, topography, density, access, existing ISTS compliance status, and size of parcels) were identified to allow for calculation of average costs for the Alternatives; these boundaries may be modified or altered as future projects develop. The CAR boundaries include four Service Areas to provide flexibility in evaluating alternatives. In addition, costs for individual properties using only ISTS are included in Appendix B.

[2] 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/

2.0 Existing Conditions

2.1 INTRODUCTION

This section summarizes the findings of the existing ISTS conditions. All the properties to be evaluated were served by ISTS of varying age. Each property had a determination made of existing condition in regard to protecting the environment. In addition, a determination was made as to whether it was feasible to replace a system in the future with a combination of standard ISTS and/or cluster systems.

Individual parcel information was provided by Becker County. The number of properties identified for investigation by Lakeview Township was 97. Four of these properties were currently vacant (no wastewater generating structure located onsite). Two of the vacant parcels had existing ISTS that could be operated again at anytime in the future. A total of 93 properties were occupied by some type of residential wastewater generating structure with an ISTS, making a total of 95 ISTS in the CAR study area.

2.2 METHODS

Determination of feasibility of ISTS and/or cluster system installation required evaluation of the soils. In addition to the soil survey data available (Figures 2A-2D), Wenck used available permit records and onsite soil borings to establish a profile of soils in the area. Wenck was able to access all included properties to complete a visual site inspection of any existing ISTS with the intent of documenting: Imminent Threats to Public Health or Safety (ITPHS)[3]; assessing

[3] ITPHS is defined in 2008 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 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

likelihood of the ISTS system protecting groundwater; and determine setback from surface waters, wells, buildings, and lot lines. In addition, at properties with adequate room for a replacement mound or drain field, soil analysis was completed to determine future ISTS type.

Prior to commencement of field work, Becker County provided available past permitting/design/inspection records for individual parcels as well as the GIS shape file of the parcels. Homeowner surveys were sent to parcel owners to gain further knowledge of the existing wastewater treatment infrastructure and to evaluate occupancy and parcel-specific water usage.

Wenck began the CAR by participating in a town hall meeting hosted by Lakeview Township on July 10, 2010 to inform the citizens of the project and answer questions. Field work began in July 2010 and included an initial data gathering phase where a site visit was conducted at each parcel. The site visits included an assessment to obtain the information found in Section 2.3. Wells were located, and tanks with surface access were located and evaluated for water-tightness. Holding tank only properties simply required evaluation of holding tank condition, since no additional ISTS components were in use. An evaluation was also made to determine if suitable area existed onsite for a future ISTS.

At properties where an ISTS soil treatment area existed, the vertical separation between seasonally high groundwater (as determined using soil borings and nearby surface water features) and the bottom of the effluent dispersal area was determined. Properties with less than three feet of vertical separation were determined to be failing to protect groundwater (FTPG). Setback to wells, property lines, surface waters, and buildings was also assessed. Finally, an evaluation was made to determine if suitable area existed onsite for a future ISTS and what type of system would most likely be installed.

---

establishment; systems with electrical hazards; or sewage tanks with unsecured, damaged, or weak maintenance hole covers."

2.3 FINDINGS

The purpose of the site visit was to obtain: information on source of drinking water, the type of dwelling contained within the parcel, type of ISTS (if any) currently serving the residence, the existing condition of the ISTS, setbacks, and the next ISTS to serve the dwelling.

2.3.1 Drinking Water Source

The source of drinking water for the dwellings in the CAR area are individual wells. The individual onsite wells are either shallow (screen at less than 50 feet below ground surface) or deep (screened at greater than 50 feet below ground surface). Depth and location of wells must be taken into account when considering ISTS setbacks. Some wells were not able to be located during field survey, but their locations were reported either on homeowner surveys or in conversations with property owners. Tables 1A-1D summarize the wells in the CAR Area by Service Area:

Table 1A: Existing Well Types-Fairhaven Beach

Well Type	Number	Percentage
Shallow (<50')	28	78%
Deep (>50')	7	19%
No Well	1	3%

Table 1B: Existing Well Types-Woodland Beach

Well Type	Number	Percentage
Shallow (<50')	5	27%
Deep (>50')	13	68%
No Well	1	5%

Table 1C: Existing Well Types-Pebble Beach

Well Type	Number	Percentage
Shallow (<50')	6	32%
Deep (>50')	12	63%
Unknown	1	5%

Table 1D: Existing Well Types-Barbara Beach

Well Type	Number	Percentage
Shallow (<50')	8	38%
Deep (>50')	13	62%

A number of shallow wells exist in the CAR area. Shallow wells are especially susceptible to potential groundwater contamination from septic systems. Figures 3A-3D show the locations of wells and the required setback to the wells based on well depth.

2.3.2 Occupancy Status of Residences

Tables 2A-2D show the estimated current occupancy status of the evaluated residences in the CAR area. The data in the tables was collected via homeowner surveys, conversations with homeowners, and conversations with individuals knowledgeable about the occupancy status of the CAR area. An especially important factor when considering seasonal occupancy of a residence is the cost of maintaining ISTS, particularly a Type II Holding Tank. A seasonal resident will pay much less in annual pumping costs for a holding tank than a permanent resident. Theses costs are discussed in detail in Section 3.2.1.

Table 2A: Existing Status of Residences-Fairhaven Beach

Usage Pattern	Number	Percentage
Vacant	2	5%
Resort	2	5%
Seasonal	31	85%
Full-Time	2	5%

Table 2B: Existing Status of Residences-Woodland Beach

Usage Pattern	Number	Percentage
Seasonal	16	84%
Full-Time	2	11%
Vacant (currently under development)	1	5%

Table 2C: Existing Status of Residences-Pebble Beach

Usage Pattern	Number	Percentage
Seasonal	17	89%
Full-Time	2	11%

Table 2D: Existing Status of Residences-Barbara Beach

Usage Pattern	Number	Percentage
Vacant	1	5%
Seasonal	11	50%
Full-Time	10	45%

2.3.3 ISTS Types

Tables 3A-3D provide a breakdown of the ISTS types (95 total) in the four Service Areas. The descriptions listed are common names.

Table 3A: Existing ISTS Types-Fairhaven Beach

ISTS Type	Number	Percentage
Individual Drain Field	5	14%
Mound	8	22%
Privy	1	3%
Holding Tank	22	61%

Table 3B: Existing ISTS Types-Woodland Beach

ISTS Type	Number	Percentage
Individual Drain Field	7	37%
Mound	2	10%
Holding Tank	10	53%

Table 3C: Existing ISTS Types-Pebble Beach

ISTS Type	Number	Percentage
Individual Drain Field	8	42%
Mound	5	26%
Holding Tank	6	32%

Table 3D: Existing ISTS Types-Barbara Beach

ISTS Type	Number	Percentage
Individual Drain Field	20	95%
Holding Tank	1	5%

2.3.4 ISTS Compliance Status

Upon visiting each individual parcel, a determination was made regarding the potential that the ISTS for the dwelling(s) at the address would be compliant or non-compliant with respect to Minnesota Rules Chapter 7080.

The ISTS that could likely be non-compliant were identified as such for one of two reasons; 1) ITPHS as identified from site reconnaissance or 2) failure to protect groundwater[4] (FTPG).

Tables 4A-4D summarize the ISTS compliance status data for the properties. The compliance status is based on county permit information, soils data, known surface and groundwater elevations, anecdotal information provided by county staff, site visits, and our experience.

[4] Failure to protect groundwater is defined in 2008 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."

Table 4A: ISTS Existing Condition-Fairhaven Beach

Status	Number	Percentage
Compliant Holding Tank	22	62%
Compliant Non-Holding Tank	2	6%
FTPG	12	32%

Table 4B: ISTS Existing Condition-Woodland Beach

Status	Number	Percentage
Compliant Holding Tank	10	53%
Compliant Non-Holding Tank	2	10%
FTPG	7	37%

Table 4C: ISTS Existing Condition-Pebble Beach

Status	Number	Percentage
Compliant Holding Tank	6	32%
Compliant Non-Holding Tank	7	36%
FTPG	6	32%

Table 4D: ISTS Existing Condition-Barbara Beach

Status	Number	Percentage
Compliant Holding Tank	1	5%
Compliant Non-Holding Tank	18	85%
FTPG	2	10%

Appendix B contains a table that shows a detailed breakdown of the evaluated parcels.

Of the currently complaint properties (67 currently compliant ISTS), 60% (40 systems) do not meet the setback (100 feet) to a nearby shallow well.

2.3.5 Existing Septic Tanks

Even though a property's ISTS soil treatment area may not protect groundwater , a septic tank may exist at a property that meets current compliance requirements and could be used in a future ISTS or community wastewater treatment system. During field reconnaissance, tanks with surface access were inspected for water tightness below the outlet of the tank. If a septic tank was not accessible, the age of the tank, the permit status, field reconnaissance, and/or homeowner information assisted in determining the condition. All tanks were found to be water tight below the normal operating level during field reconnaissance. However, a number of tanks were noted to have infiltration and inflow occurring above the normal operating level through risers that were not water-tight.

2.3.6 Next ISTS Options

The final piece of information obtained during the investigation was determining the type of ISTS that the property could accommodate in the future. Appendix B shows the properties' most-likely future ISTS option. Trenches are generally not an option at most of the lakeside properties in the CAR area due to the depth to seasonally saturated soil conditions which were confirmed by soil borings. The exception to this is the Barbara Beach Service Area, which is generally higher in elevation above groundwater than the other Service Areas. At Barbara Beach, a number of trench ISTS systems had the required vertical separation to seasonally high groundwater. Figures 2A-2D show the location of soil borings, with boring results documenting depths to seasonally saturated soil conditions located in Appendix D. Soil borings were conducted and existing records consulted to determine the depth to seasonal saturation and assess likely infiltration rates of soils for future SSTS options.

For a dwelling that does not have a suitable drainfield area, the next ISTS would likely need to be a holding tank. Minnesota Rules, part 7080.2200 – 7080.2400 (February 2008) 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), Floodplain sites.

- **Type 3:** Systems installed on problem soils, disturbed soils, or soils where high groundwater is within one foot of the ground surface. Also systems where some setbacks cannot be met and a variance for the setback is granted.
- **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 than what is allowed in rule.

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 3 systems require county approval, but can be installed on sites where disturbed soils would otherwise limit the landowner to a Type 2 holding tank system. Type 1 systems that do not meet compliance due to FTPG may be able to upgrade to a Type 4 or 5 system by adding pretreatment that allows wastewater to be discharged with a reduced vertical separation to seasonally saturated soils.

Tables 5A-5D summarize the next ISTS likely to be installed when the non-compliant systems are upgraded at the four Service Areas.

Table 5A: Next ISTS Replacing FTPG Systems by Property-Fairhaven Beach

ISTS Type	Number	Percentage
1 (Mound)	0	0%
2 (Holding Tank)	11	92%
3 (Mound)	1	8%
4/5 (Performance)	0	0%

Table 5B: Next ISTS Replacing FTPG Systems by Property-Woodland Beach

ISTS Type	Number	Percentage
1 (Mound)	2	29%
2 (Holding Tank)	2	29%
3 (Mound)	0	0%
4/5 (Performance)	3	42%

Table 5C: Next ISTS Replacing FTPG Systems by Property-Pebble Beach

ISTS Type	Number	Percentage
1 (Mound)	4	50%
2 (Holding Tank)	0	0%
3 (Mound)	2*	33%
4/5 (Performance)	1	17%

*An additional replacement mound is being installed imminently at a currently compliant property because of property redevelopment.

Table 5D: Next ISTS Replacing FTPG Systems by Property-Barbara Beach

ISTS Type	Number	Percentage
1 (Mound)	1	50%
2 (Holding Tank)	0	0%
3 (Mound)	1	50%
4/5 (Performance)	0	0%

Tables 6A-6D summarize what the likely make-up of the ISTS in the community will be after upgrades if all parcels stay on ISTS rather than choosing a cluster SSTS.

Table 6A: Next ISTS by Property after Upgrade-Fairhaven Beach

ISTS Type	Number	Percentage
1	2	6%
2	33	91%
3	1	3%
4	0	0%

Table 6B: Next ISTS by Property after Upgrade-Woodland Beach

ISTS Type	Number	Percentage
1	4	21%
2	12	63%
3	0	0%
4	3	16%

Table 6C: Next ISTS by Property after Upgrade-Pebble Beach

ISTS Type	Number	Percentage
1	10	53%
2	6	32%
3	2	10%
4	1	5%

Table 6D: Next ISTS by Property after Upgrade-Barbara Beach

ISTS Type	Number	Percentage
1	19	90%
2	1	5%
3	1	5%
4	0	0%

Data presented in Tables 6A-6D indicates that a number of parcels have a Type 2 holding tank as their likely option for the next system in the Fairhaven Beach and Woodland Beach service areas. 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 Type 1 or Type 3 mound.

Appendix B contains a table that documents the recommended next ISTS for the evaluated parcels.

2.4 SUMMARY

Of the existing 95 properties that currently have an ISTS, 28% are estimated to be failing to protect groundwater and potentially contaminating shallow wells . These properties lack the required three-foot vertical separation distance from the bottom of the drain field to seasonally saturated soil. An additional 40 properties with currently compliant ISTS do not meet the 100 foot setback to a nearby shallow well.

Of the 95 wastewater-generating properties evaluated, 19 of 21 parcels at Barbara Beach have a suitable area onsite for installation of a Type 1 mound or drain field; whereas only 17 of 74 have suitable area onsite for installation of a Type 1 mound or drain field at the other three service areas combined. Four more of the 74 have a suitable area onsite and would be best served by a Type 3 system. An additional four properties of the 74 would be best served by a Type 4 system. The remaining 49 properties (approximately 2 out of every 3) likely have a Type 2 holding tank as their replacement option.

Becker County has been in the midst of an inspection program of ISTS over the past three years on Lake Sallie. The CAR used the results of recent inspections by ISTS Inspectors to assist in evaluating individual parcels. Wenck was one of the ISTS Inspectors that completed approximately 50 inspections on Lake Sallie in 2008. Through those inspections and the CAR field work it has been revealed that some of the ISTS Inspectors have come to different conclusions with respect to ISTS on Lake Sallie adequately protecting groundwater. We have approximately a dozen examples of ISTS that are recorded as compliant at Becker County that likely are failing to protect groundwater. Localized training may be beneficial to assist in ensuring accurate inspections are completed.

3.0 Alternatives Analysis

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, the treatment and effluent dispersal components occur with 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:

1. ISTS
2. Combination of individual and cluster ISTS

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

3.2 INDIVDUAL ISTS (ALTERNATIVE 1)

A Managed ISTS Program utilizing the best available onsite technologies and management can be effective in protecting public health and the environment. For the purpose of this report, the discussion of this alternative assumes that Lakeview Township would provide financial management, ISTS maintenance, and component replacement. An economy of scale and assurance of long-term performance is achieved using this management structure.

The Township would be the financial and operational vehicle to assist property owners with ISTS upgrades. The Township 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 property owners would pay annual sewer treatment fees for ongoing operation, maintenance, pumping, and a repair reserve fund for their ISTS. The amount each pays would be proportional to the required annual maintenance expense incurred and/or requirements of the lender. All system types, discussed in Section 2.3.4, would require some level of annual maintenance expense; however, fees will vary based on the system type.

3.2.1 ISTS Upgrades

As stated in Section 2.0, ISTS upgrades are likely needed at 28 evaluated properties (27 FTPG plus 1 lot redevelopment). ISTS type needed is significant as it directly influences the capital costs for the upgrade as well as long-term operation and maintenance costs.

Recent changes to the ISTS rules dictate that systems that are not considered Type 1 – 3 will require some type of operating permit for the life of the system. State rules dictate that the permit requirements include annual operation and maintenance of the systems by a licensed Service Provider[5].

[5] Service Provider is a new license category under 2008 MN Rules Chapter 7083. A Service Provider can assess, adjust, and service ISTS for proper operation.

Tables 5A-5D illustrated the number of ISTS needed by type at the four Service Areas for the next system at the non-compliant addresses. Type 1 systems comprise only 26% (7 parcels) of the ISTS types needed at upgrade. These dwellings can achieve compliance with the installation of a Type 1 system utilizing a mound with three feet of vertical separation beneath the effluent dispersal area and the seasonally saturated condition. These Type 1 mound systems have nominal operation and maintenance expenses of septic tank pumping on average once every three years, electrical costs, and components such as pump replacement. The Type 3 systems that are recommended for 15% of the properties (4 parcels) also fall into this category. The difference in the Type 1 and Type 3 systems is that the Type 3 systems will require special design and installation procedures; increasing their overall capital cost. Average annual operating costs for a Type 1 mound are estimated at approximately $100. Average annual operating costs for a Type 3 mound are estimated at approximately $200.

Type 2 (holding tank) comprises an upgrade group of 13 properties. Holding tanks are required on small lots, lots with setback constraints, and/or lots with multiple structures with little usable land. These lot constraints make the installation of any system that discharges to the soil not permittable.

County governments typically will only permit a holding tank system in situations where no other system type is feasible and will not allow them on the construction of new homes. 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. These examples cause an ITPHS and/or fail to protect ground water. A Managed ISTS Program would need to encompass the oversight and pumping frequency on 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 2-3 residents on average uses approximately 4,000

gallons per month. With a holding tank capacity of 2,000 gallons, pumping frequency would be approximately every two weeks. Average tank pumping costs of $150/2,000 gallons will yield an estimated annual pumping cost of approximately $3,600. For a seasonal dwelling, the cost would likely be around $75/week occupied; again depending upon number of residents in occupancy and water use habits of the residents. An average of 6 weeks occupied per year yields annual pumping costs around $500.

The remaining properties could upgrade to a Type 4-5 ISTS. Similar to Type 2 systems, Type 4-5 systems would also require annual operation and maintenance oversight and expenses, estimated at about $400 per system per year for a Type 4-5 system. Service Providers are trained on ISTS technologies and have the knowledge to operate and maintain Type 4-5 systems that provide alternative treatment in addition to a conventional subsurface drain field or mound.

3.2.2 ISTS Alternatives Summary

- 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
  - 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
    - Mounds and drain fields take up space on the lot, reducing the overall amount of land available for other uses

3.3 COMBINATION OF INDIVIDUAL AND CLUSTER ISTS (ALTERNATIVE 2)

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 systems with daily flows of 5,000 – 10,000 gallons are classified as Mid-sized Sewage Treatment Systems (MSTS) and systems greater than 10,000 gallons per day are Large Sewage Treatment Systems (LSTS). Cluster system ownership, operation, and management occur through a municipality, the formation of a special purpose 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 Township. Private ownership is an option but presents legal challenges as it relates to land ownership/easements, fee collection, and using low-interest public financing.

For this alternative it was determined that there exists some properties that are not in need of anything other than an individual ISTS. Large properties that are relatively removed from denser development do not stand to gain significantly from the connection to a cluster system. This assumes a landowner is not interested in sub dividing land to obtain additional building sites.

In the analysis for this alternative, the CAR area has been divided into four Service Areas as shown on Figure 1. Service Areas have been selected based on geographic location and similar property conditions. Smaller Service Areas using shared systems across backyards or other small clusters spread throughout the community were also evaluated, but were ruled out for a majority of the properties due to small lot sizes and soils within the CAR area. A select few properties have the small cluster option; however, it was not a best-case scenario for keeping average wastewater treatment system costs down area-wide. The Service Areas as selected and shown on Figures 5A-5D have the best potential for minimizing wastewater treatment system costs area-wide.

Table 7 highlights the number of wastewater generating parcels per Service Area included in the cluster analysis and the estimated daily flow to the cluster.

Table 7: Estimated Flow Rates

Service Area	System Type	Existing Dwellings	Permit Daily Flow Gallons/Day	Permit Type Required
Woodland	**Cluster**	9	4,499	County ISTS
Pebble	**Cluster**	11	5,911	County MSTS
Fairhaven	**Cluster**	8	4,308	County ISTS
Barbara+Pebble	**Cluster***	13	6,444	County MSTS*
Total	**Cluster**	30	15,252	

Cluster flows include allowed reductions in flow if over 10 properties in cluster plus additional flow from infiltration and inflow to the collection system.

*Assumes joining the two non-compliant Barbara Beach properties to Pebble Beach cluster site

Using 2008 Minnesota Rules, Part 7081.0120, an average daily flow for each Service Area 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 parcels in the Service Area.

To provide the analysis in this report, we have assumed an average of 3 bedrooms per residence for homes which did not fill out a homeowner survey, which have an average daily flow of 450 gpd (the average bedroom size in the CAR area based on returned surveys was 3.1).

In the future, if a design plan is created an actual flow for each Service Area would need to be determined based on the actual number of bedrooms in each home (as required by state rules). Design flow considerations for properties not included in the study area that desire to be included in the selected wastewater system would also be required. Design flows shown included additions for infiltration and inflow into a collection system as well as allowed reductions in estimation of daily flows due to the number of wastewater generating properties connected to a cluster treatment system. These numbers could also change slightly based on actual numbers of bedrooms in each home and any additional wastewater generating properties to be included in a final cluster treatment system design.

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 (dispersal sites within ½ mile of each other) of each subsurface sewage treatment system or (SSTS) owned by one entity, permitting is completed through Minnesota Pollution Control Agency. Future SSTS with an average daily flow under 10,000 gallons per day would be permitted by Becker County using Minnesota Rules Chapters 7080-7083. In addition, SSTS with an average daily flow greater than 2,500 gallons per day would be required to meet design guidance found in Minnesota Rules Chapter 7081. 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 be required. Table 7 also highlights permitting requirements for individual and cluster treatment options based on average daily flows for the different Service Area scenarios.

3.3.1 Collection System

Four collection system methods to convey wastewater or effluent to the cluster system treatment and dispersal site 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 Service Areas and the cost of installing a lift station relative to the small population of the CAR area, pressure collection would likely be the least expensive collection method. The two pressure options employ similar technologies. A grinder basin sends solids to the treatment site. With a STEP system, solids are retained on site. STEP collection does not require the same level of hydraulic retention at the treatment site as solids remain at each parcel.

Onsite solids retention with a STEP system requires less capital cost at the treatment site. Other advantages of STEP systems over grinder basins include: 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 STEP system 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 manholes 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 treatment site.

3.3.2 Treatment and Dispersal System

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

A general location within or adjacent to the Service Area practical for this alternative has been identified for the potential of cluster treatment and dispersal system sites. These 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.

Property access allowed for a soil investigation on three potential cluster system sites, including two neighboring parcels used as farmland and the local golf course. The field investigation on these properties, reviewing soil maps, and general viewing of the properties lead to the assumption that soils at all of these locations would support Type 1 drain field effluent dispersal systems.

An additional cluster system site, State of Minnesota Department of Natural Resources (DNR) land near the Pebble Beach Service Area, was considered. Soils at the DNR land appear suitable based on soil surveys and the proximity to the Service Area makes the land desirable for keeping collection costs low. A number of discussions were held with local, regional, and state DNR staff about the possibility of using the land for wastewater treatment. At this time, DNR staff is unwilling to consider using the land for wastewater treatment; therefore no further analysis has been conducted regarding costs to design, install, and maintain a cluster or individual SSTS at the site.

With a cluster alternative, the Township would own and operate the cluster system(s), collection system(s), and maintain the septic tanks with STEP on each property. The Township could phase this approach as Service Areas organize and property becomes available. Design of the cluster systems would need to follow applicable state rules based on the size (daily flow) of the cluster system.

The cluster treatment systems considered included a drain field cluster system for Woodland Beach, a drain field cluster system for Fairhaven Beach, a drain field cluster system for Pebble Beach, and a drain field cluster system serving a combination of residents at Pebble Beach and the two north properties of Barbara Beach. Cluster systems were not considered for the rest of Barbara Beach because remaining on individual ISTS appears to be a better option financially based on the size of and soils at the lots.

3.3.3 Cluster System Summary

- Advantages
  - Subsidized interest rate loans for cluster system construction and STEP installation
  - Lower operation and maintenance expenses for properties with holding tanks
  - Dispersal of treated effluent away from surface waters and shallow wells
  - Allows for more usable land on individual lots

- Large parcel owners with adequate soils are allowed to stay on individual ISTS, while small parcel owners or difficult soil areas are allowed to connect to a cluster system

- Disadvantages
  - Obtaining land in close proximity to Service Areas could be difficult based on landowner preferences
  - More local involvement required for project development

3.4 SUMMARY

Two alternatives are being analyzed to provide wastewater infrastructure. Each alternative has advantages and disadvantages and can be incorporated solely or in combination to best fit the needs of the residents. Section 4.0 incorporates the estimated costs from the three alternatives.

4.0 Cost Comparison of Alternatives

Two 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 and 50 years.

4.1 MANAGED ISTS PROGRAM (ALTERNATIVE 1)

Table 8 reflects the average cost estimates to replace/upgrade each property that currently needs upgrading with an ISTS for the four Service Areas.

Table 8: Imminent Upgrade Capital Cost Estimates Managed ISTS Program

Service Area	Estimated Number to Upgrade	Treatment System	Contingency	Legal, Eng., Admin	Total Cost Estimate	Avg. Cost/ Property
Woodland	7	$ 69,200	$ 7,000	$ 8,000	$ 84,200	$ 13,000
Pebble	7	$ 83,500	$ 9,000	$ 10,000	$ 102,500	$ 15,000
Fairhaven	12	$ 24,700	$ 3,000	$ 3,000	$ 30,700	$ 3,000
Barbara	2	$ 21,000	$ 3,000	$ 3,000	$ 27,000	$ 14,000
Total	28	$ 177,400	$ 19,000	$ 21,000	$ 217,400	$ 8,000

This analysis of ISTS is an average over an entire Service Area. Individual parcel costs for ISTS upgrades would vary by parcel. The table has been created to allow for side by side comparisons with the other alternatives in the present worth analysis. Individual parcel owners should reference Appendix B for an estimate of upgrade costs to their particular parcel. Capital costs by system type that were used to create the table are as follows for a residential system (cost estimates for Type 1-3 systems based on Wenck experience with similar projects.):

- Type 1: $9,000
- Type 2: $500-3,500
- Type 3: $12,000
- Type 4/5: $15,000

What can be noted from Table 8 when compared with Table 9 is there are no collection system costs in Table 8, as this component is already in place at each residence. On average, the ISTS alternative has the least capital cost.

4.2 CLUSTER SYSTEMS (ALTERNATIVE 2)

Table 9 provides the cost estimates for a combination of a number of ISTS and three cluster MSTS systems to serve the four Service Areas. The cluster MSTS include prices for the installation of a STEP system at each residence, a 2 inch diameter force main collection system, and a treatment/dispersal system. Treatment/dispersal costs are for cluster pressurized bed drain fields. It was determined that due to larger parcel sizes and location relative to other parcels that the majority of Barbara Beach would not benefit financially from a cluster alternative. The two properties located farthest north on Barbara Beach have been added to the Pebble Beach cluster MSTS to provide comparison of prices and flexibility in choice of future alternatives for these two residences. Note that the cluster cost estimates include only properties that are FTPG plus some properties currently on holding tanks that may benefit financially or otherwise from connection to a cluster SSTS.

Table 9: 25-Year Capital Cost Estimates Cluster Systems

Service Area	Estimated Number to Cluster	Treatment System	Land Acquisition**	STEP Collection System	Contingency	Legal, Eng., Admin	Total Cost Estimate	Avg. Cost/ Dwelling
Woodland	**9**	$ 19,125	$ 6,000	$ 108,200	$ 14,000	$ 26,000	$ 173,325	$ 20,000
Pebble	**11**	$ 57,972	$ 8,000	$ 120,200	$ 19,000	$ 40,000	$ 245,172	$ 23,000
South Fairhaven	**8**	$ 18,309	$ 6,000	$ 64,800	$ 9,000	$ 17,000	$ 113,109	$ 15,000
Barbara+Pebble	**13**	$ 63,204	$ 8,000	$ 143,000	$ 22,000	$ 46,000	$ 282,204	$ 22,000
Total	**30**	$ 100,638	$ 20,000	$ 314,000	$ 45,000	$ 89,000	$ 568,638	$ 19,000

** Assumed cost of $4,000/acre * # of acres

Treatment system costs were based on average daily flow estimates. Any changes in occupancy would change the size requirement for the clusters, 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.

Land acquisition costs were estimated at $4,000/acre. As stated in Section 3.3 additional project development is needed to address the acquisition of land within close proximity to the Service Areas. Collection system costs were based on cost estimates of force main installation on a linear foot basis for both the mainline and laterals to the cluster sites shown on Figures 5A-5D.

STEP system costs were calculated using the same individual unit prices across the entire Service Area. A STEP system cost of $5,000 includes a pump package, new 1000 gallon pump tank, and new water-tight risers for old septic tanks. The cost takes into account compliant tanks within the Service Area.

An explanation of cluster rationale by Service Area follows.

4.2.1 Fairhaven Beach Cluster Alternative Rationale

Eight properties were selected for inclusion in evaluating the cost of installing a cluster to serve residents of Fairhaven Beach. The eight properties selected for cost evaluation purposes were included for one or more of three reasons: proximity to land available at golf course for cluster drain field, declared interest in a cluster alternative by the resident, and proximity to other

residents desiring to be evaluated in a potential cluster system. The eight properties selected for cluster evaluation are either currently holding tanks or FTPG in nature. No more than eight properties were selected for evaluation because including more than eight properties in the cluster system will likely increase the permitting flow to above 5,000 gallons per day. If the permitting flow increases above 5,000 gallons per day, the permit would move from an ISTS to an MSTS permit, which translates into additional costs in design, construction, and maintenance of the system. However, the increase is not significant if other properties want to join.

Table 9 shows the overall cost and the cost per resident for the evaluated cluster system.

4.2.2 Woodland Beach Cluster Alternative Rationale

Nine potential properties were selected for inclusion in evaluating the cost of installing a cluster to serve residents of Woodland Lane. The nine potential properties selected for cost evaluation purposes were either FTPG or holding tank systems. Additional properties were not included in the cost estimate because including more in the cluster system will likely increase the permitting flow to above 5,000 gallons per day. If the permitting flow increases above 5,000 gallons per day, the permit would move from an ISTS to an MSTS permit, which translates into additional costs in design, construction, and maintenance of the system. However, the increase is not significant if other properties want to join.

Table 9 shows the overall cost and the cost per resident for the evaluated cluster system. Figure 5B shows the possible layout of the cluster collection and treatment/dispersal system as well as included parcels.

4.2.3 Pebble Beach Cluster Alternative

Eleven potential properties were selected for inclusion in evaluating the cost of installing a cluster to serve residents of Pebble Beach. The eleven potential properties selected for cost evaluation purposes were either FTPG or had expressed interest in being included in a cluster alternative. Because the permitting flow would be above 5,000 gallons per day for the proposed cluster, the permit would be an MSTS permit.

Table 9 shows the overall cost and the cost per resident for the evaluated cluster system. Figure 5C shows the possible layout of the cluster collection and treatment/dispersal system as well as parcels included in the design evaluation.

4.2.4 Barbara/Pebble Beach Cluster Alternative Rationale

In addition to the eleven potential properties selected for inclusion at Pebble Beach, two additional properties from the nearby Barbara Beach Service Area were selected for inclusion in evaluating the cost of installing a cluster to serve residents of both Barbara and Pebble Beach; providing flexibility in selection of an alternative for these residents. Because the permitting flow would be above 5,000 gallons per day for the proposed Barbara/Pebble cluster, the permit would be an MSTS permit.

Table 9 shows the overall cost and the cost per resident for the evaluated cluster system. Figure 5D shows the possible layout of the cluster collection and treatment/dispersal system.

4.3 SUMMARY OF CAPITAL COSTS

Sections 4.1 – 4.2 highlight the cost estimates for each of the two wastewater infrastructure alternatives. The cost estimates for the managed ISTS alternative assume the FTPG properties shown in Figure 4A-4D would be served by ISTS. The cost estimates for the cluster alternative assume the properties shown on Figures 5A-5D would be included in the cluster. Table 10 is a side by side comparison of the average per unit capital cost for each of the alternatives. Cluster system costs in Table 10 use the Woodland Cluster, the Pebble/Barbara Cluster, and the Fairhaven Cluster.

Table 10: Summary of Capital Costs

	Alternative 1 Managed ISTS Program	Alternative 2 Cluster SSTS*
Total Assessed System Costs	$ 217,400	$ 568,638
Average Cost/Dwelling	$ 8,000	$ 19,000

*Assuming cluster design layouts as shown in figures
*Does not include costs for pretreatment for nitrogen, if required.

Section 3.0 identifies the necessary components, advantages, and disadvantages of the two alternatives. While a managed ISTS program is least expensive alternative on an average per unit basis, other considerations such as operational costs and limited flexibility of lots 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* (28 Included Properties)	Alternative 2 Cluster SSTS* (30 Included Properties)
Total	**$ 9,900**	**$ 3,750**
Woodland	$ 2,400	$ 1,125
Fairhaven**	$ 6,000	$ 1,000
Barbara+Pebble	$ 1,500	$ 1,625
Total Average Cost/Property/Year	**$ 360**	**$ 125**
Woodland Average Cost/Property/Year	$ 350	$ 125
Fairhaven Average Cost/Property/Year**	$ 500	$ 125
Barbara+Pebble Average Cost/Property/Year	$ 170	$ 125

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: $500 (seasonal use); $3,600 (year-round use)
- Type 3: $200
- Type 4/5: $400

The largest expense in O & M of individual ISTS 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-$200 annual fee for maintenance, where as a holding tank system can run into the thousands of dollars annually if used year-round.

4.5 PRESENT WORTH ANALYSIS

All 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 12A summarizes a present worth analysis over a 25-year period.

Table 12A: Present Worth Analysis (25-year), All Service Areas

All Service Areas Combined	Alternative 1 Managed ISTS Program*	Alternative 2 Cluster SSTS*
Total System Costs	$ 217,400	$ 568,638
Annual Operation & Maintenance Costs (25 year present worth value)	$ 155,000	$ 59,000
Estimated Total Present Worth	$ 372,400	$ 627,638
Estimated Total Equivalent Annual Cost (annualized over a 25-year period, 2% interest)	$ 19,074	$ 32,148
Estimated Average Equivalent Annual Cost per Property	$ 690	$ 1,080

* Assumes holding tank properties are seasonal

The estimated Total Present Worth amounts (of the alternatives cost over a 25-year period) are tallied in Table 12A in the middle row. 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 Equivalent Annual Cost per Unit is simply the total annual cost divided by the number of participating units.

The Estimated Average Equivalent Annual Cost per Unit shown in the last row of Table 12A 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. 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.

The Total Present Worth Analysis for the three cluster systems over a 25-year period is shown in the following three tables.

Table 12B: Present Worth Analysis (25-year), Woodland Lane

Woodland Lane	Alternative 1 Managed ISTS Program* (7 properties)	Alternative 2 Cluster SSTS* (9 properties)
Total System Costs	$ 84,200	$ 173,325
Annual Operation & Maintenance Costs (25 year present worth value)	$ 38,000	$ 18,000
Estimated Total Present Worth	$ 122,200	$ 191,325
Estimated Total Equivalent Annual Cost (annualized over a 25-year period, 2% interest)	$ 6,259	$ 9,800
Estimated Average Equivalent Annual Cost per Property	$ 900	$ 1,090

Table 12C: Present Worth Analysis (25-year), Fairhaven Lane

Fairhaven Lane	Alternative 1 Managed ISTS Program* (12 properties)	Alternative 2 Cluster SSTS* (8 properties)
Total System Costs	$ 30,700	$ 113,109
Annual Operation & Maintenance Costs (25 year present worth value)	$ 94,000	$ 16,000
Estimated Total Present Worth	$ 124,700	$ 129,109
Estimated Total Equivalent Annual Cost (annualized over a 25-year period, 2% interest)	$ 6,387	$ 6,613
Estimated Average Equivalent Annual Cost per Property	$ 540	$ 830

Table 12D: Present Worth Analysis (25-year), Pebble and Barbara Beach

Barbara and Pebble	Alternative 1 Managed ISTS Program* (9 properties)	Alternative 2 Cluster + Individual SSTS* (13 properties)
Total System Costs	$ 129,500	$ 282,204
Annual Operation & Maintenance Costs (25 year present worth value)	$ 24,000	$ 26,000
Estimated Total Present Worth	$ 153,500	$ 308,204
Estimated Total Equivalent Annual Cost (annualized over a 25-year period, 2% interest)	$ 7,862	$ 15,786
Estimated Average Equivalent Annual Cost per Property	$ 880	$ 1,220

Table 13 repeats the analysis over a 50-year period. Certain infrastructure components can have an expected lifespan of up to 50 years. Repeating the Present Worth Analysis over a 50-year period provides a complete comparison over the life span of all improvements.

Table 13: Present Worth Analysis (50-year), All Service Areas

	Alternative 1 Managed ISTS Program*	Alternative 2 Cluster + Individual SSTS*
Total System Costs	$ 283,000	$ 740,000
Annual Operation & Maintenance Costs (50 year present worth value)	$ 213,000	$ 81,000
Estimated Total Present Worth	$ 496,000	$ 821,000
Estimated Total Equivalent Annual Cost (annualized over a 50-year period, 2% interest)	$ 15,784	$ 26,127
Estimated Equivalent Annual Cost per Property	$ 570	$ 880

This table accounts for ISTS and Cluster system component replacement after 25 years.

* Assumes holding tank properties are seasonal

The Total System Costs of ISTS and cluster systems increase from the 25-year analysis as certain capital costs need to be repeated in a 50-year timeframe. Present Worth operation and maintenance costs increase for all options as would be expected. The increases result in a closing of the gap between alternatives; however, Alternative 1 ISTS is still the least expensive alternative over the 50-year life cycle.

5.0 Summary and Recommendations

5.1 SUMMARY

This report estimates the compliance status for existing ISTS and provides the side by side comparison of the alternatives for long-term wastewater infrastructure for properties in the Fairhaven Beach, Woodland Beach, Pebble Beach, and Barbara Beach Service Areas adjacent to Lake Sallie in Lakeview Township (the CAR area). A summary of the findings:

- 28% of the total evaluated ISTS are likely in non-compliance and fail to protect groundwater
    - 32% of Fairhaven Beach
    - 37% of Woodland Beach
    - 32% of Pebble Beach
    - 10% of Barbara Beach
- At least 51% of the individual wells in the CAR area are known to be shallow wells that are likely susceptible to contaminated groundwater
    - At least 80% of wells are known to be shallow at Fairhaven Beach
    - At least 28% of wells are known to be shallow at Woodland Beach
    - At least 33% of wells are known to be shallow at Pebble Beach
    - At least 38% of wells are known to be shallow at Barbara Beach
- 60% of the currently compliant ISTS do not meet the 100 foot setback to a nearby shallow well
- 44% of the evaluated ISTS are holding tank systems
    - 61% of evaluated ISTS are holding tank systems at Fairhaven Beach
    - 53% of evaluated ISTS are holding tank systems at Woodland Beach
    - 32% of evaluated ISTS are holding tank systems at Pebble Beach

- 5% of evaluated ISTS are holding tank systems at Barbara Beach

- 39% of the wastewater generating properties needing ISTS upgrades will likely install a Type 1 or Type 3 mound system
- 46% of the ISTS upgrades would require or likely install a holding tank as the replacement ISTS option
- Estimated capital costs on average per property for the three alternatives:
  - Managed ISTS = $8,000
  - Cluster Systems = $19,000
- The CAR area is divided up into four Service Areas based on geography, average property size, land use, and current ISTS compliance status to further reduce costs per unit by providing the best wastewater treatment option for each area
- Based on 25 and 50-year present worth analysis, the community has a number of options for a combination of cluster and ISTS wastewater treatment that provide the best long term value in terms of cost per unit when both capital and annual operation and maintenance costs are taken into account with homeowner SSTS preferences.

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 CAR area be treated by Service Area, with the following recommendations:

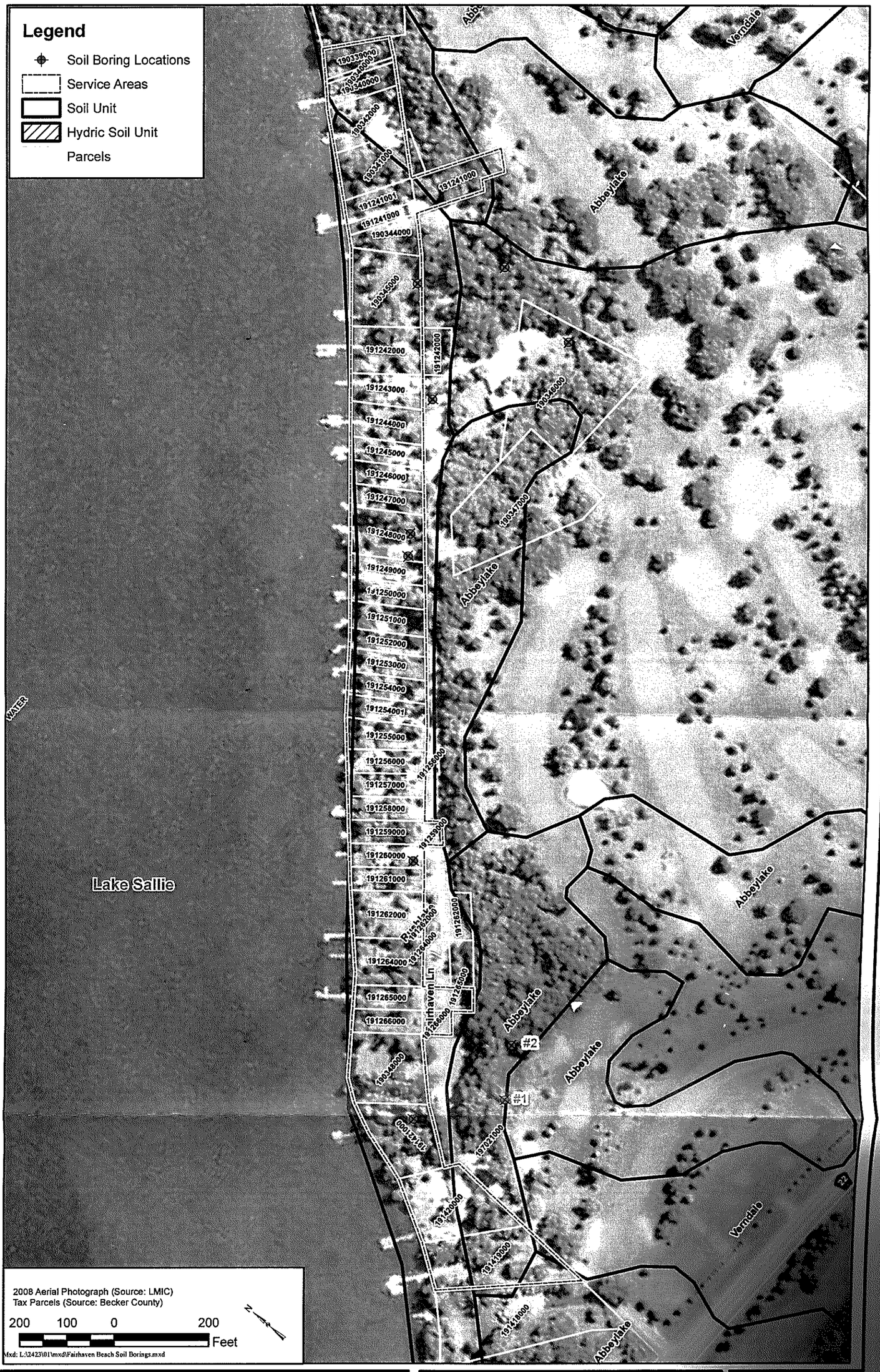
- Fairhaven Beach to remain on ISTS (especially holding tanks) with an option of adding a cluster system to serve residents on the south end of the Service Area. The majority of residents met by Wenck during field work indicated a desire to stay on holding tanks. A few residents on the south end of the Service Area indicated possible interest in a cluster SSTS to meet wastewater needs. In general, non-compliant system owners upgrade their own individual system while residents located on the south end of the Service Area decide whether to pursue a cluster SSTS or upgrade FTPG systems to compliant ISTS.

- Woodland Beach and Pebble Beach to consider ISTS or cluster MSTS based on homeowner preferences. A cluster MSTS has a larger capital cost, but creates more opportunities and flexibility of land use on individual lots. A cluster MSTS also provides significant operation and maintenance cost savings for any current or future full-time properties where holding tanks are the only option. Homeowners can consider cluster and ISTS options and determine interest in a cluster system alternative.
- Barbara Beach to stay on ISTS with the possible exception of the two most northern properties, who may choose to remain on ISTS or join with a potential Pebble Beach cluster MSTS.

5.3 NEXT STEPS

The following describes future actions that could be taken by Lakeview Township based on the CAR recommendations.

- As stated in this report, 28% of the existing septic systems are likely FTPG. Becker County will continue to enforce the ISTS regulations of Chapter 7080. Non-compliant systems will likely require upgrades in the near future and homeowners would be on their own to ensure their ISTS remains in compliance. The properties within the south end of Fairhaven Beach, the north end of Barbara Beach, and the whole of Woodland Lane and Pebble Beach have an opportunity to collectively construct a wastewater system to serve multiple residents. Homeowners with small lots and/or unsuitable onsite soils that require a holding tank or large mound system may stand to benefit the greatest from this option. The Township Board has an opportunity to assist these landowners by managing three potential new wastewater cluster systems.



LAKEVIEW TOWNSHIP

Fairhaven Beach Soils and Soil Boring Location Map

COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

DEC 2010

Figure 2A



LAKEVIEW TOWNSHIP

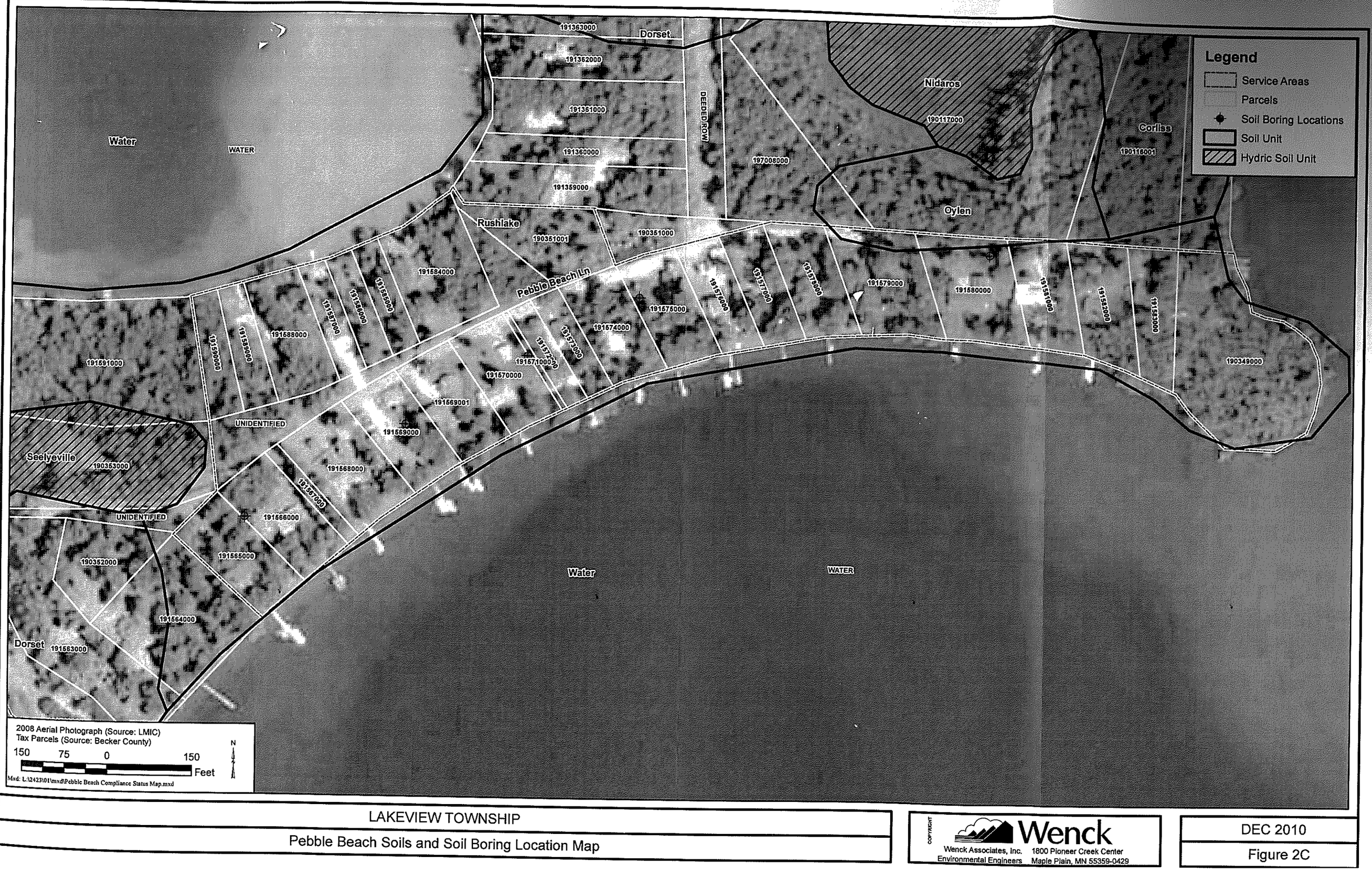
Woodland Beach Soils and Soil Boring Location Map

COPYRIGHT

Wenck
Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

DEC 2010

Figure 2B



LAKEVIEW TOWNSHIP

Pebble Beach Soils and Soil Boring Location Map

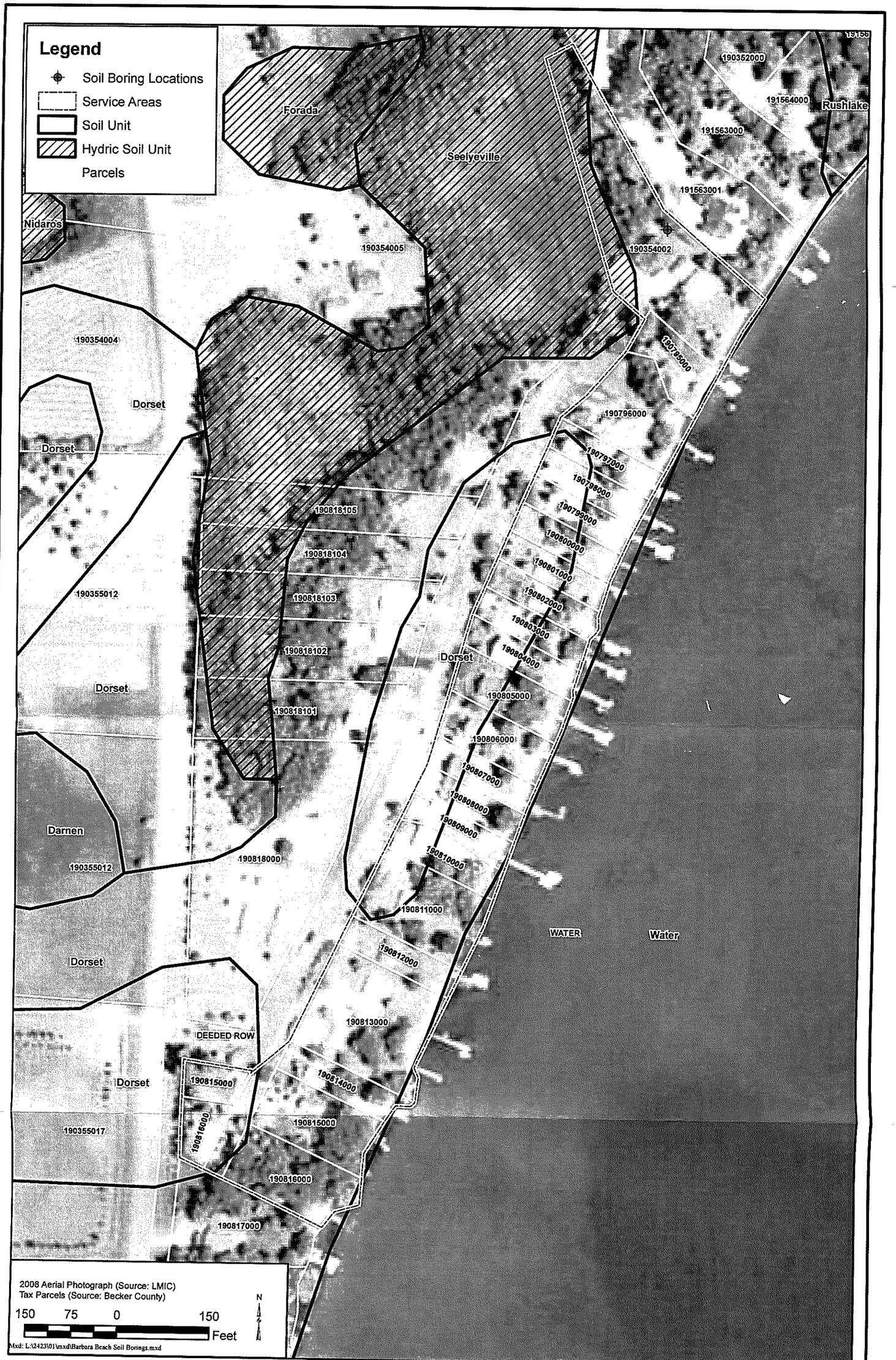
COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

DEC 2010

Figure 2C



LAKEVIEW TOWNSHIP

Barbara Beach Soils and Soil Boring Location Map

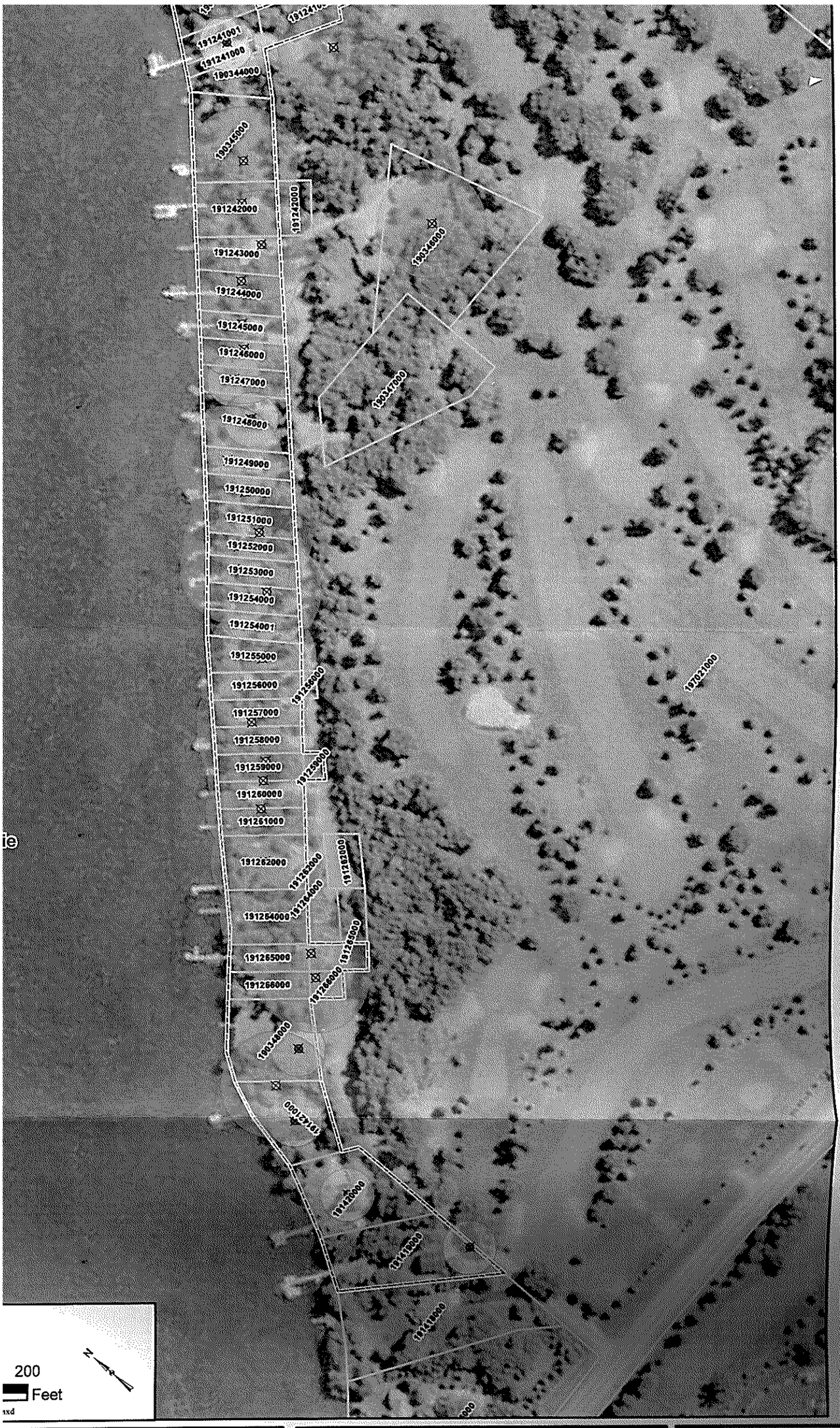
COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

DEC 2010

Figure 2D



200
Feet

N TOWNSHIP

h Well Location Map

COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

DEC 2010

Figure 3A



LAKEVIEW TOWNSHIP

Woodland Beach Well Location Map

COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

DEC 2010

Figure 3B



LAKEVIEW TOWNSHIP

Pebble Beach Well Location Map

COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

DEC 2010

Figure 3C



LAKEVIEW TOWNSHIP

Barbara Beach Well Location Map

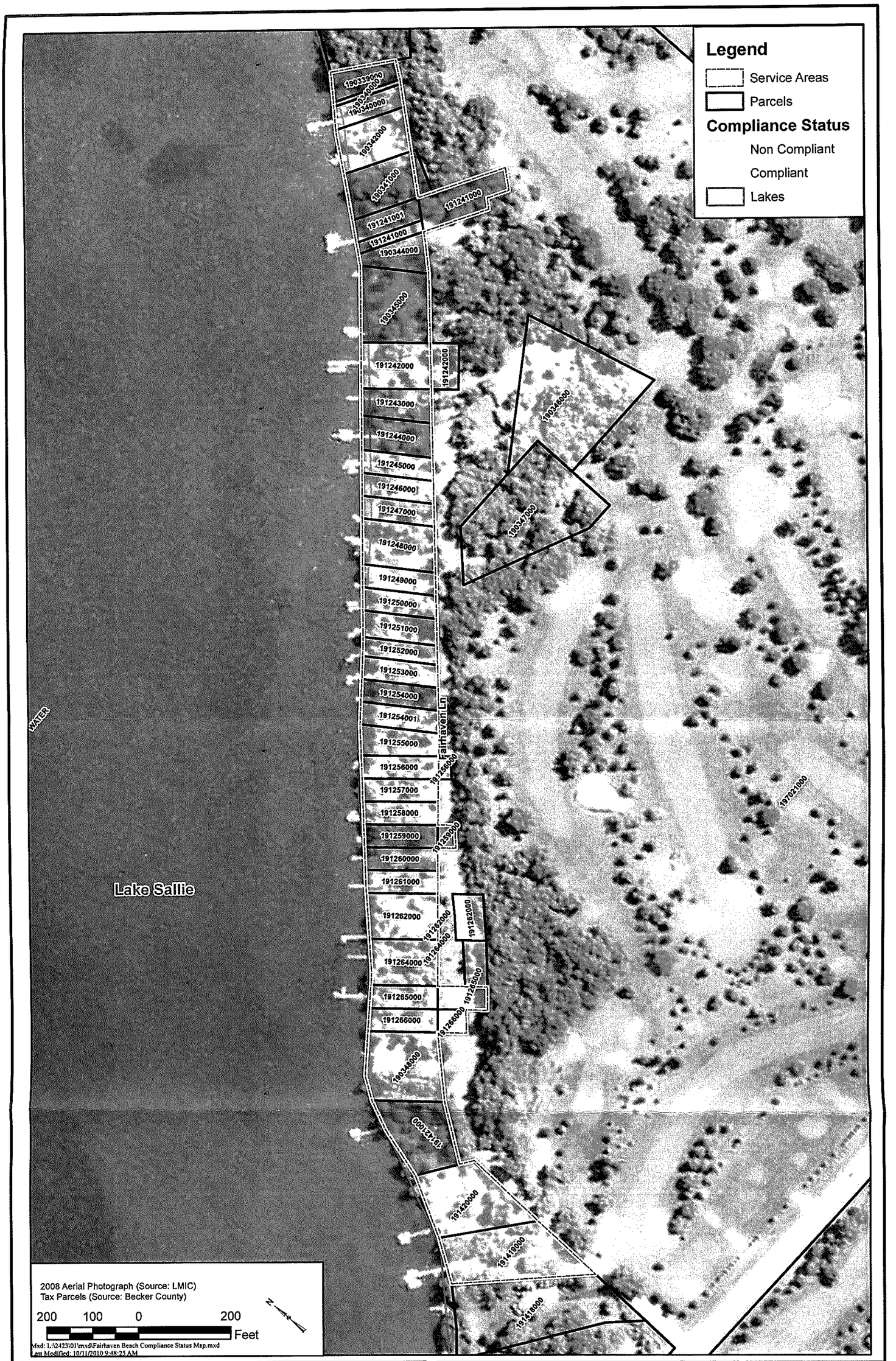
COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

DEC 2010

Figure 3D



LAKEVIEW TOWNSHIP

Fairhaven Beach Compliance Status Map

COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

OCT 2010

Figure 4A



LAKEVIEW TOWNSHIP

Woodland Beach Compliance Status Map

COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

OCT 2010

Figure 4B



LAKEVIEW TOWNSHIP

Pebble Beach Compliance Status Map

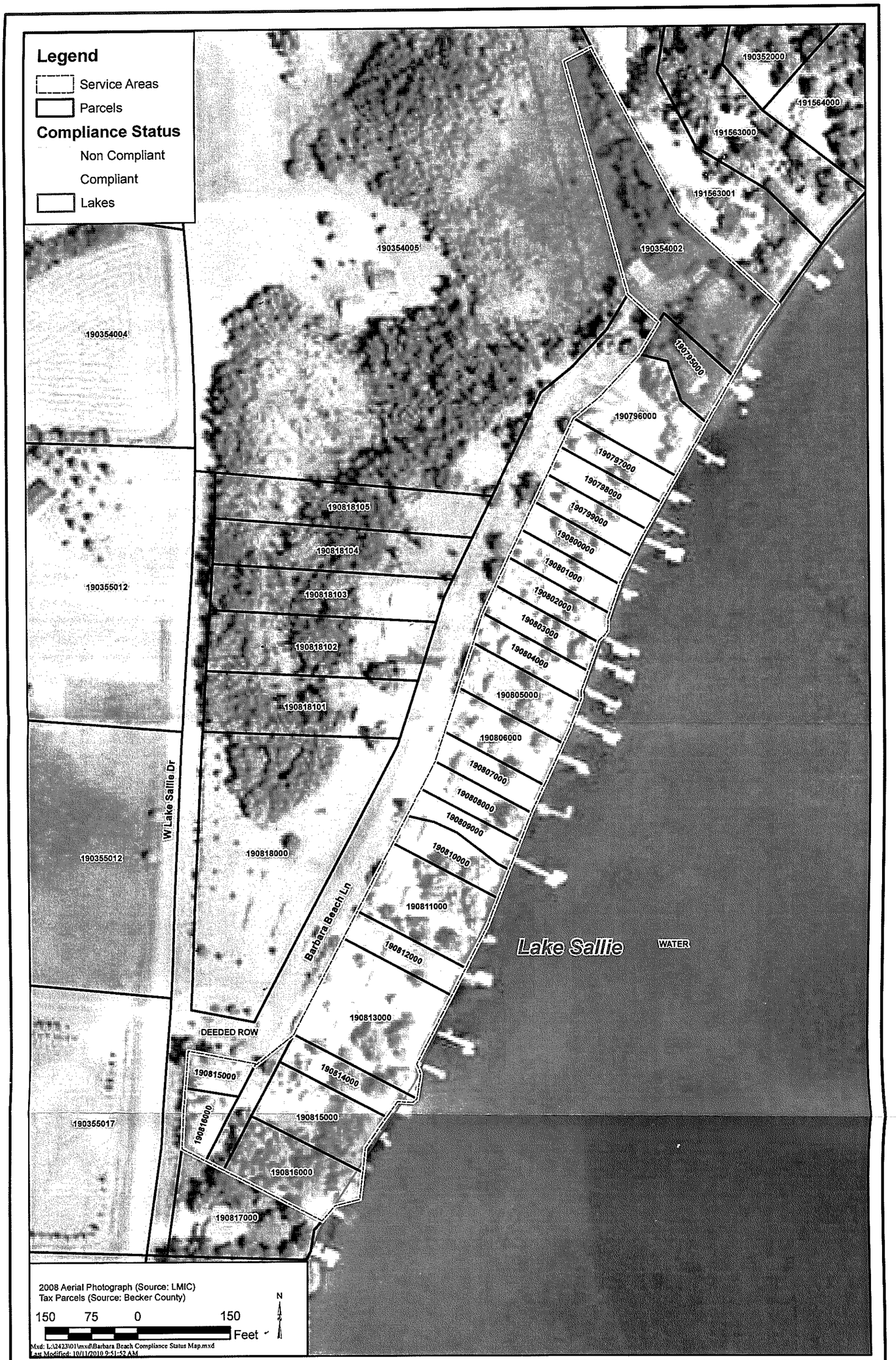
COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

OCT 2010

Figure 4C



LAKEVIEW TOWNSHIP

Barbara Beach Compliance Status Map

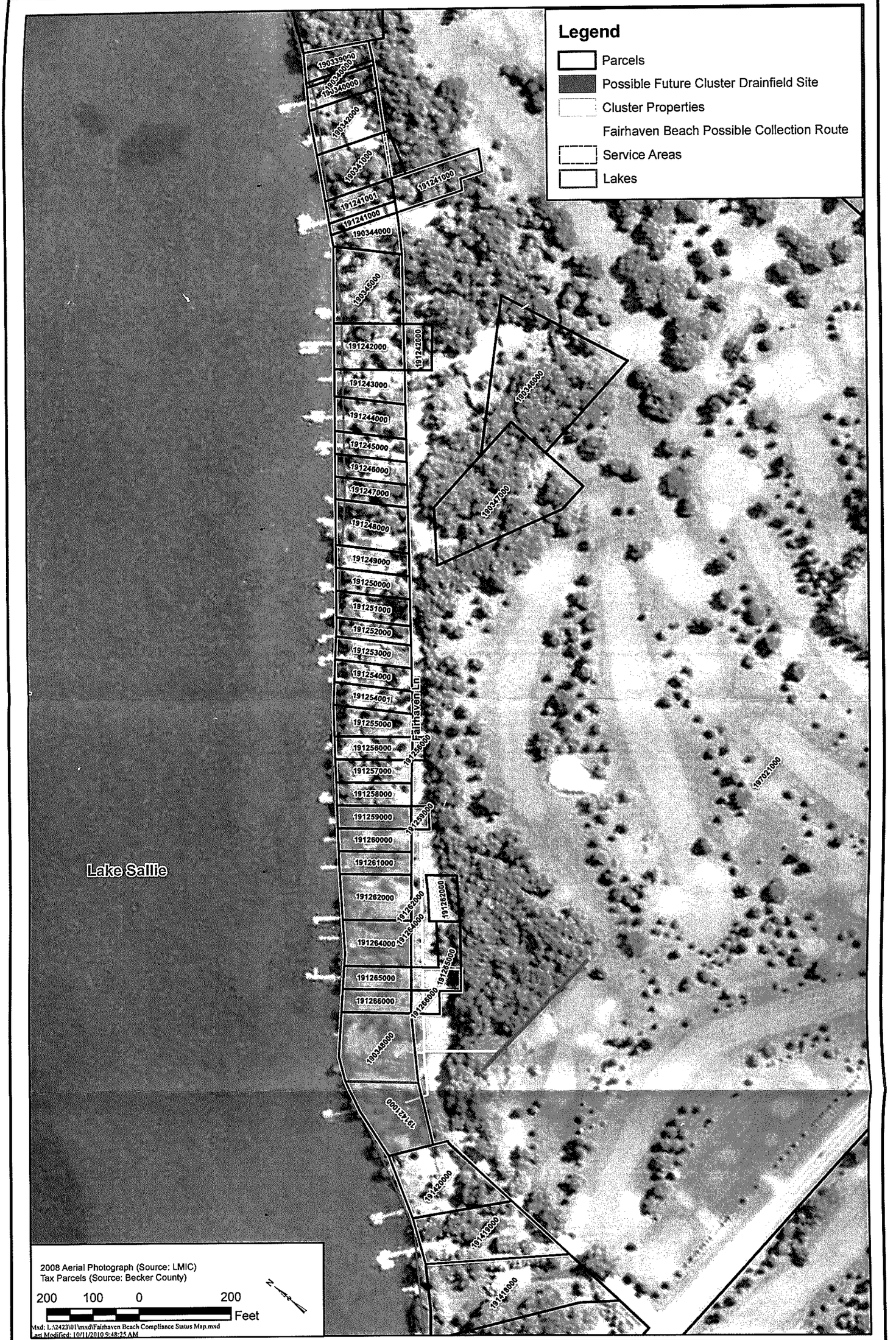
COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

OCT 2010

Figure 4D



LAKEVIEW TOWNSHIP

Fairhaven Beach Cluster Recommendation Map

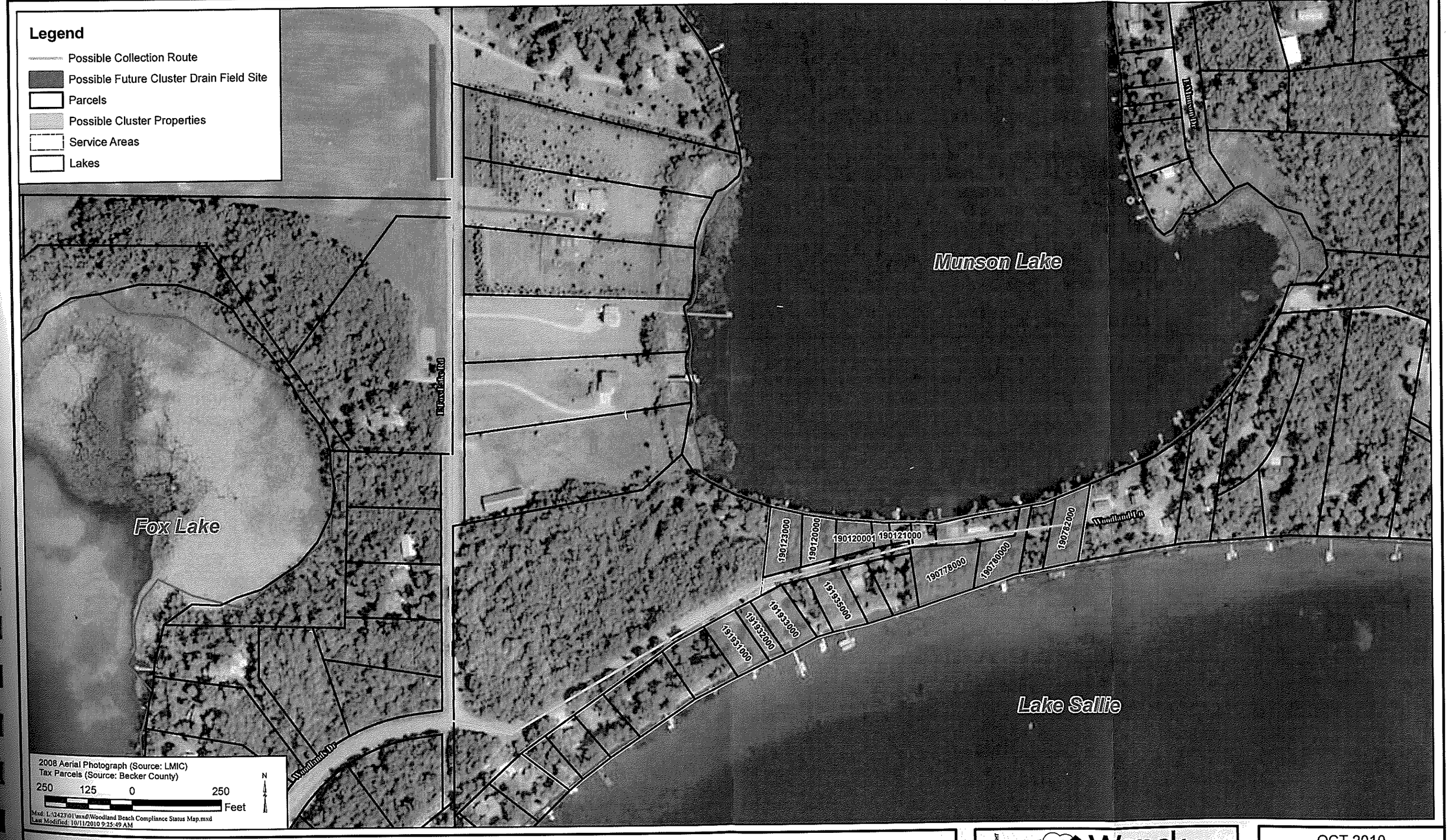
COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

OCT 2010

Figure 5A



LAKEVIEW TOWNSHIP

Woodland Beach Future Cluster Recommendation Map

COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

OCT 2010

Figure 5B



LAKEVIEW TOWNSHIP

Pebble Beach Cluster Recommendation Map

COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

OCT 2010

Figure 5C



LAKEVIEW TOWNSHIP

Pebble and Barbara Beach Cluster Recommendation Map

COPYRIGHT

Wenck
Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

OCT 2010

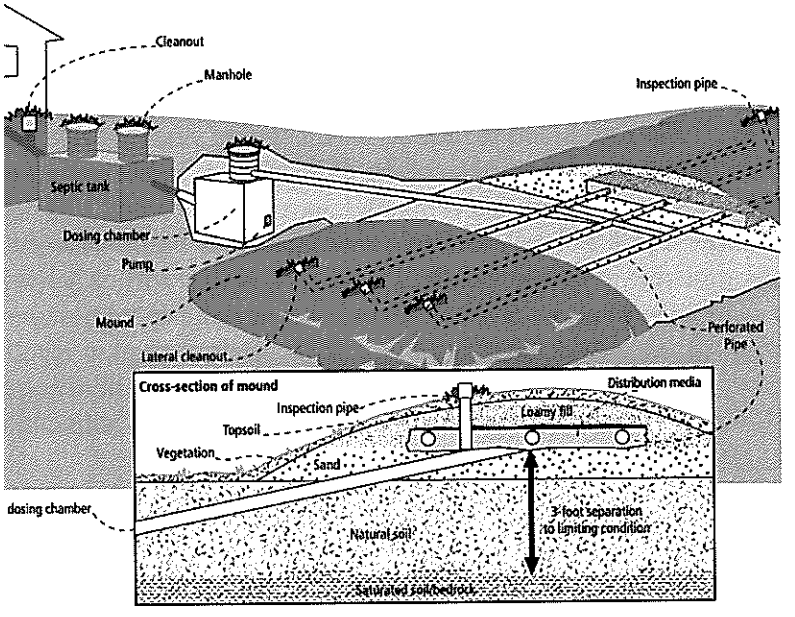
Figure 5D

nd Systems

Mound systems are defined in Chapter 7080.1100, Subp. 50, as "a soil treatment and dispersal esigned and installed such that all of the infiltrative surface is installed above grade, using clean ween the bottom of the infiltrative surface and the original ground elevation, utilizing pressure ion and capped with suitable soil material to stabilize the surface and encourage vegetative

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

Mound System and Components



A mound system is a two-stage process involving both effluent treatment and dispersal. ent is accomplished predominately by physical and biochemical processes within the clean sand l and native soil. The physical characteristics of the influent wastewater, influent loading rate ature, 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 nt treatment objectives accomplished under unsaturated conditions. Pathogens contained in the are eventually deactivated through filtering, retention, and adsorption by the fill material. In , 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 the needed vertical separation. By using uniform distribution and adequate vertical separation elected sand media, vertical unsaturated flow is maintained, thus ensuring the maximum ent permitted by this technology. On sites with slowly permeable soils, the mound system helps a known level of effluent treatment before effluent is discharged to the native soil. These soils ject to severe damage from smearing and compaction, especially during the construction of tional 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.

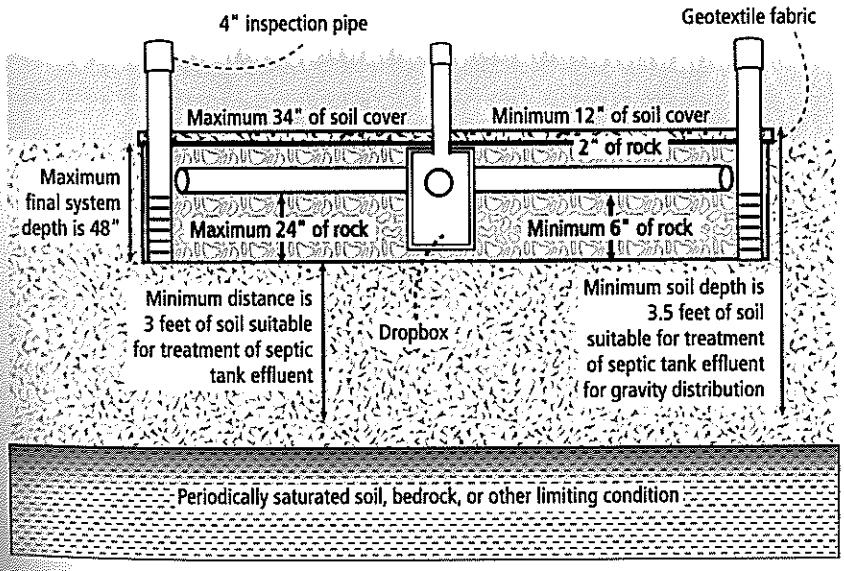
Below-Grade Systems

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 then 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



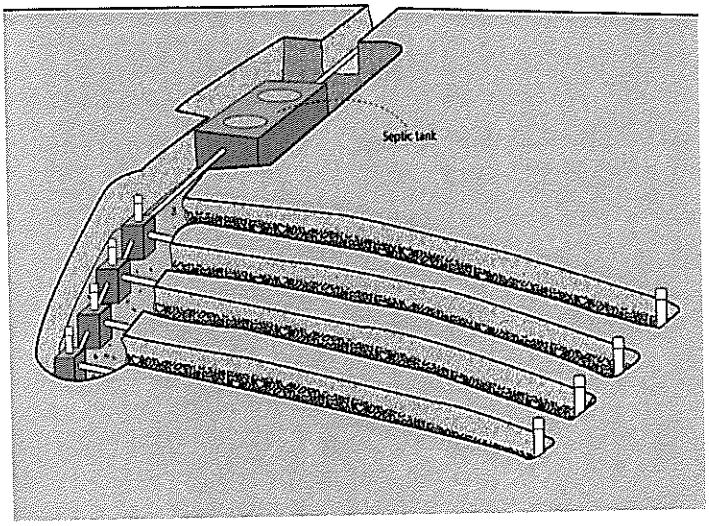
From MN Rules 7080.2260 Subp. 3. If the distribution media in a trench or a bed is in contact with soil texture group 2 through 4 (medium sand, fine sand, coarse and medium loamy sand) pressure distribution must be used.

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.

Existing Status Report for *Lakeview Township*

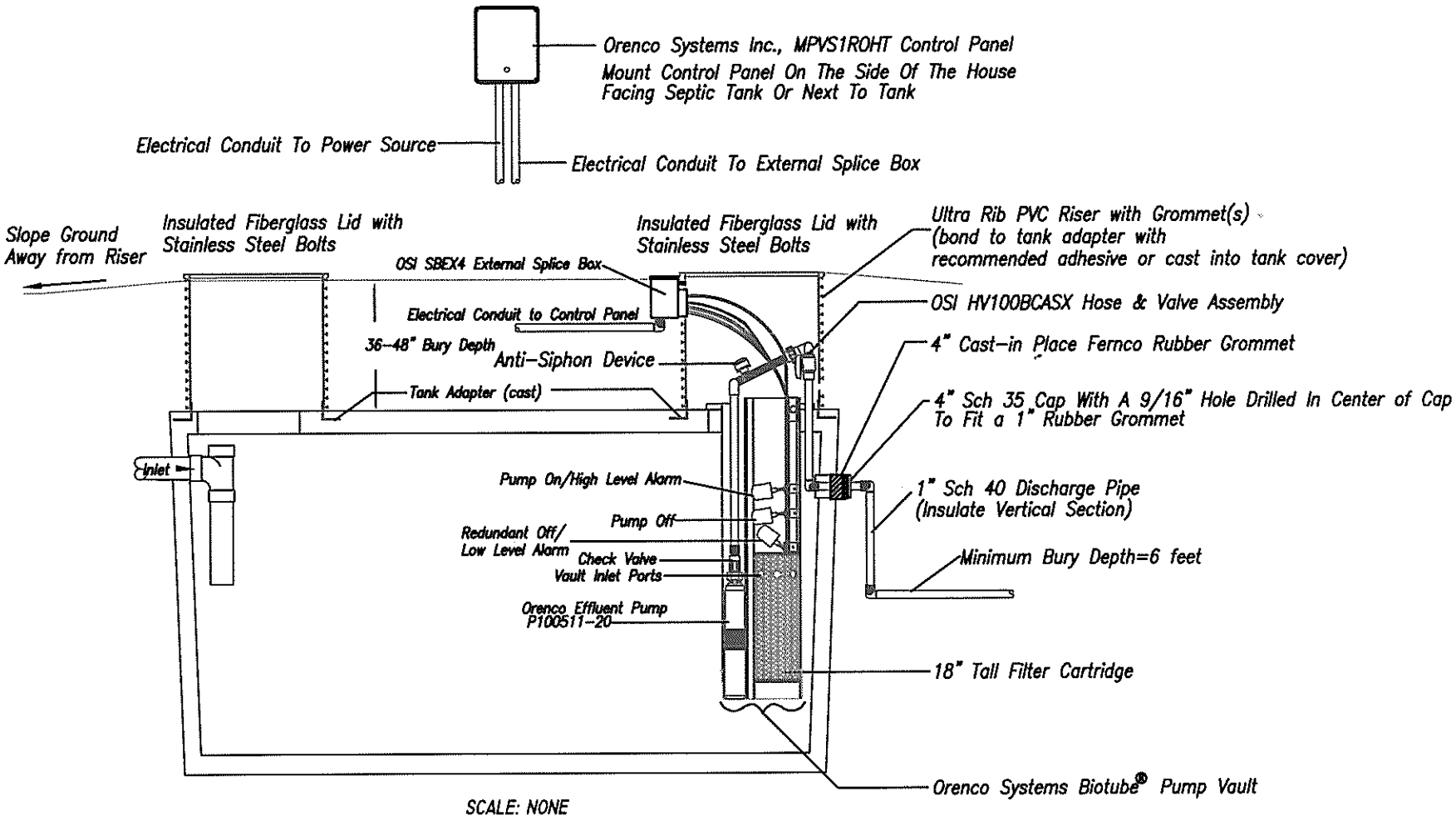
Property		System Information				PPL Unsewered Documentation															
						Likely Compliance status		Likely Non-compliant				Likely Setback Status X if in violation				Likely Future Replacement ISTS					
Parcel ID (Use unique # or parcel ID if privacy issues; hide this column if necessary)	House (H), Business (B), Vacant (V), Resort (R) Cabin (C) Community bldg (CB) (church, city hall, etc)	Permit on file? If Yes - year	Number of Bedrooms	Well: depth of casing, cased or shallow, *=assumed	Current Subsurface soil treatment type: * SSTS: drainfield, mound, holding tank, privy, straight pipe or unknown * Cluster * Community collector * Community straight pipe	Likely Compliant (X if Y)	Certificate of Compliance on file (N, date if Y)	ITPHS (X if Y)	Fail to protect groundwater (X if Y)	Reason: (lack of vertical separation, leaking tank, cesspool, seepage pit, etc.)	Drinking water supply - individual well or community supply	Buildings (house, garage, out)	Property lines	Surface waters	Type 1 (standard)	Type 2 (holding tank, privy, floodplain)	Type 3 (other, <12", problem soils, mp and replace)	Type 4,5	New Well with new ISTS?	IMMINENT UPGRADE COST (ISTS AND NEW WELL IF NEEDED)
R190351001	H	00/00/0000	U	D*	M				X	V					X					9000
R191565000	C	2010	U	U	M	X												X			
R191566000	C	1973	4	S	D				X	V	X				X				X	10000
R191588000	C	2008	2	S	M	X									X						
R191568000	C	2004	4	S	H	X					X						X		X		
R191569000	C	1996	3	D*	D				X	V					X					9000	
R191587000	C	2006	U	D*	H	X															
R191569001	C	1999	U	D*	D	X												X			
R191584000	C	2005	3	S	H	X					X				X						
R191570000	C	2008	3	D	D	X											X				
R191573000	C	2007	3	D	M	X												X			
R191574000	C	1986	4	S	D				X	V	X						X		X	15000	
R191575000	C	1978	U	S	D				X	V	X						X		X	15000	
R191576000	C	2000	6	D	H	X					X					X					
R191577000	C	2008	U	D*	H	X					X					X					
R191578000	C	2008	6	D*	D	X									X						
R191580000	H	2004	3	D	D				X	V								X		15000	
R191581000	C	2008	3	D	H	X									X						
R191582000	C	2008	3	D	H	X										X					
R190349000	C	2008	U	D	M	X									X					10500	
R191927000	C	2008	U	D	H	X										X					
R191928000	C	1998	U	D	D	X											X				
R191929000	C	2008	U	D	D	X									X						
R191930000	C	2008	3	D	H	X											X				
R191931000	H	2008	2	N	H	X										X					
R191932000	C	1977	3	D	M				X	V								X		15000	
R191933000	C	2008	4	D	M				X	V								X		15000	
R191934000	C	2007	2	S	H	X					X					X					
R190123000	C	1989	U	S	D				X	V					X					9000	
R190121000	C	1978	U	S	D				X	V	X				X				X	13500	
R191935000	H	2009	4	D	H	X					X					X					
R191936000	C	00/00/0000	1	D	H	X										X					
R191937000	C	2009	3	S	H	X					X					X					
R190777000	C	2008	U	S	H	X					X					X					
R190779000	C	2008	U	D	H	X										X					
R190778000	V	1984	U	D	D				X	V	X							X		15000	
R190780000	C	2008	U	D*	D				X	V						X				1200	
R190781000	C	2009	U	D*	H	X					X					X					
R190782000	C	1987	U	D	D				X	V						X				500	
R191419000	C	2007	U	D*	H	X										X					
R191420000	C	2001	U	D*	H	X										X					
R191421000	C	1976	3	D	D				X	V	X					X		X		500	
R191421000	C	1976	7	S	D				X	V	X					X		X		500	
R190348000	R	2008	4	D	H	X					X					X					
R191266000	C	2008	3	S	H	X					X					X					
R191265000	C	2008	3	S	H	X					X					X					
R191264000	C	2008	3	S	H	X					X										
R191261000	C	2008	2	S	H	X					X										
R191260000	H	1985	3	S	M				X	V	X		X				X			12000	
R191259000	C	1991	3	S	M				X	V	X					X				500	
R191258000	C	2008	2	S*	H	X					X										
R191255000	C	2008	2	S	H	X					X										
R191256000	C	2008	U	S*	H	X					X										
R191257000	C	2008	U	S	H	X					X										
R191254000	C	00/00/0000	3	S*	D				X	V	X					X	X			500	
R191253000	C	2008	4	S	H	X					X										
R191252000	C	2008	3	S	H	X					X										
R191251000	C	2008	4	S	H	X					X										
R191250000	C	2008	3	S	H	X					X										
R191249000	C	2008	4	S	H	X					X										
R191248000	R	2009	U	D	M	X							X					X			

Existing Status Report for *Lakeview Township*

Property		System Information				PPL Unsewered Documentation															
						Likely Compliance status		Likely Non-compliant				Likely Setback Status X if in violation				Likely Future Replacement ISTS					
Parcel ID (Use unique # or parcel ID if privacy issues; hide this column if necessary)	House (H), Business (B), Vacant (V), Resort (R) Cabin (C) Community bldg (CB) (church, city hall, etc)	Permit on file? If Yes - year	Number of Bedrooms	Well: depth of casing, cased or shallow, *=assumed	Current Subsurface soil treatment type: * SSTS: drainfield, mound, holding tank, privy, straight pipe or unknown * Cluster * Community collector * Community straight pipe	Likely Compliant (X if Y)	Certificate of Compliance on file (N, date if Y)	BTPHS (X if Y)	Fail to protect groundwater (X if Y)	Reason: (lack of vertical separation, leaking tank, cesspool, seepage pit, etc.)	Drinking water supply - individual well or community supply	Buildings (house, garage, out)	Property lines	Surface waters	Type 1 (standard)	Type 2 (holding tank, privy, floodplain)	Type 3 (other, <12", problem soils, rip and replace)	Type 4,5	New Well with new ISTS?	IMMINENT UPGRADE COST (ISTS AND NEW WELL IF NEEDED)
R191247000	C	2009	U	D	H	X					X									
R191246000	C	2008	2	S	H	X					X									
R191245000	C	2008	U	S*	H	X					X									
R191244000	C	2008	U	S	M				X	V	X					X	X		X	3500
R191243000	C	2008	2	S	M				X	V	X		X			X	X		X	3500
R190346000	H	#N/A	U	S	M	X					X				X					
R191242000	C	2008	U	S*	H	X					X					X				
R190345000	C	2006	3	S*	M				X	V	X					X	X			500
R191241000	C	2008	2	S*	D				X	V	X					X		X		500
R191241001	C	2008	U	D	M				X	V						X		X		500
R190342000	C	2008	U	S	H	X					X									
R190340000	C	2008	1	S	H	X					X									
R190339000	C	00/00/0000	U	N	P				X	P	X					X				1200
R190816000	H	1987	U	D*	D	X									X					
R190815000	H	2009	3	D	D	X									X					
R190814000	H	2008	U	D	D	X									X					
R190813000	H	2008	3	D	D	X														
R190812000	H	2010	U	D	D	X														
R190811000	C	2008	2	S	D	X					X									
R190810000	C	2008	3	D	H	X														
R190809000	V	00/00/0000																		
R190807000	H	2007	3	D	D	X														
R190806000	H	2008	3	D	D	X														
R190805000	H	2008	4	D	D	X														
R190804000	C	1999	2	D*	D	X					X									
R190803000	C	2008	2	S	D	X					X									
R190802000	C	2008	2	S	D	X					X				X					
R190801000	C	2008	2	S	D	X					X									
R190800000	C	00/00/0000	U	S	D	X					X									
R190799000	C	1990	U	S	D	X					X									
R190798000	C	2008	U	S	D	X					X									
R190797000	H	2008	3	D	D	X					X				X					
R190796000	C	2009	U	S	D	X					X				X					
R190795000	C	2008	3	D	D				X	V							X			12000
R190354002	H	2008	4	D	D				X	V					X					9000

STEP TANK - TYPICAL

Drawing provided by Orenco, Systems, Inc.



SCALE: NONE

Soil Profile Description

Date Completed: 8/24/2010
Completed By: RML
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Unidentified

Test Pit # 23835 Pebble
Equipment: 4" Bucket Auger
Highest Known Water: 54"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
20	10YR2/2	Loamy Sand			
54	10YR5/4	Medium/Coarse Sand			
66	10YR5/2	Sand			Saturated

Soil Profile Description

Date Completed: 8/24/2010
Completed By: RML
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Unidentified

Test Pit # 23929 Pebble
Equipment: 4" Bucket Auger
Highest Known Water: 40"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
32			Sandy Fill		
40	10YR5/2	Coarse Sand			Wet

Soil Profile Description

Date Completed: 8/25/2010
Completed By: RML
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Unidentified

Test Pit # 23803 Pebble
Equipment: 4" Bucket Auger
Highest Known Water: 48"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
18	10YR2/2	Loamy Sand			
34	10YR4/3	Sand			
48	10YR5/3	Medium/Coarse Sand			
54	10YR5/3	Medium/Coarse Sand			Saturated

Soil Profile Description

Date Completed: 8/25/2010
Completed By: RML
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Unidentified

Test Pit # 23747 Pebble
Equipment: 4" Bucket Auger
Highest Known Water: 50"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
18	10YR3/3	Loamy Sand			
24	10YR4/3	Sand			
50	10YR5/3	Medium/Coarse Sand			
54	10YR5/3	Medium/Coarse Sand			Saturated

Soil Profile Description

Date Completed: 9/28/2010
Completed By: RML
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Bygland

Test Pit # 24249 Woodland
Equipment: 4" Bucket Auger
Highest Known Water: 32"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
10	10YR3/2		Topsoil		
32	2.5Y5/3	Silty Clay Loam			
50	2.5Y6/3	Silty Clay Loam		Many, Coarse, Distinct 10YR5/1 and 7.5YR5/6	

Soil Profile Description

Date Completed: 9/28/2010
Completed By: RML
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Bygland

Test Pit # 24283 Woodland
Equipment: 4" Bucket Auger
Highest Known Water: 30"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
10	10YR3/2	Sandy Loam			
20	10YR3/2	Loam			
36	10YR4/3	Clay Loam		Many, Medium, Distinct 10YR6/1 and 7.5YR5/6 at 30"	

Soil Profile Description

Date Completed: 8/19/2008
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Bygland

Test Pit # 24235 Woodland
Equipment: 4" Bucket Auger
Highest Known Water: 24"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
8	10YR3/2	Clay Loam			
24	10YR4/3	Clay Loam			
50	10YR5/3	Sandy Loam		Many, Medium, Distinct 10YR5/2 and 7.5YR5/6	
60	2.5Y6/2	Loam		Many, Medium, Distinct 10YR5/6 and 7.5YR5/6	

Soil Profile Description

Date Completed: 8/19/2008
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Bygland

Test Pit # 24205 Woodland
Equipment: 4" Bucket Auger
Highest Known Water: 25"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
16	10YR2/2	Loamy Sand			
25	10YR3/4	Sand			Moist toward bottom
40	10YR5/2	Sand			Wet

Soil Profile Description

Date Completed: 8/19/2008
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Rushlake

Test Pit # 24137 Woodland
Equipment: 4" Bucket Auger
Highest Known Water: 23"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
18		Fill			
23	10YR2/1	Clay Loam			
36	10YR5/2	Sandy Clay Loam		Many, Fine, Distinct 7.5YR5/6	Moist

Soil Profile Description

Date Completed: 8/24/2010
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Rushlake

Test Pit # 13412 Fairhaven
Equipment: 4" Bucket Auger
Highest Known Water: 26"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
22		Sandy Fill			
26	10YR2/1	Sandy Loam			
36	10YR5/2	S.C.L.		Many, Fine, Distinct 7.5YR5/6	
42	10YR5/2	Sand			Saturated

Soil Profile Description

Date Completed: 8/24/2010
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Rushlake

Test Pit # 13444 Fairhaven
Equipment: 4" Bucket Auger
Highest Known Water: 0" (Filled Wetland)
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
6			Topsoil, Fill		
12		Sand	Fill		Moist
20	10YR2/1	Sandy Loam	Original Topsoil		
24	10YR4/2	Sand			Wet

Soil Profile Description

Date Completed: 8/24/2010
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Abbeylake

Test Pit # 13469 Fairhaven
Equipment: 4" Bucket Auger
Highest Known Water: 24"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
4	10YR2/1	Sandy Loam			
10	10YR3/2	Loamy Sand			
24	10YR4/3	Loamy Sand			
32	10YR5/2	Sand			Moist
39	10YR6/1	Loamy Coarse Sand			Saturated

Soil Profile Description

Date Completed: 8/24/2010
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Abbeylake

Test Pit # 13417 Fairhaven
Equipment: 4" Bucket Auger
Highest Known Water: >76"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
10	10YR2/2	Sandy Loam			
20	10YR 4/4	Coarse Sandy Loam			
30	10YR5/4	Sandy Loam			
42	10YR5/3	Medium/Coarse Sand			
64	10YR4/3	Sand			
76	10YR 5/2	Sand			Dry

Soil Profile Description

Date Completed: 8/24/2010
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Rush Lake

Test Pit # 13350 Fairhaven #2
Equipment: 4" Bucket Auger
Highest Known Water: 16"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
16			Sandy Fill		
20			Sandy Fill	Moist	
24			Sandy Fill	WET	

Soil Profile Description

Date Completed: 8/24/2010
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Rush Lake

Test Pit # 13350 Fairhaven #1
Equipment: 4" Bucket Auger
Highest Known Water: 14"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
14			Sandy Fill		
18			Sandy Fill	Moist	
24			Sandy Fill	WET	

Soil Profile Description

Date Completed: 8/19/2008
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Rush Lake

Test Pit # 13232 Fairhaven
Equipment: 4" Bucket Auger
Highest Known Water: 34"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
30			Sandy Fill		
34	10YR2/2	Loamy Sand			
44	10YR5/2	Sand		WET	

Soil Profile Description

Date Completed: 8/19/2008
Completed By: Peter Miller
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Rush Lake

Test Pit # 13078 Fairhaven
Equipment: 4" Bucket Auger
Highest Known Water: 36"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
20			Sandy Fill		
26	10YR2/1	Loamy Sand			
36	10YR4/3	Sand			
48	10YR5/2	Medium Sand		WET	

Soil Profile Description

Date Completed: 8/10/2010
Completed By: RML
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Dorset

Test Pit # 13740 Barbara Beach
Equipment: 4" Bucket Auger
Highest Known Water: 20"
Vegetation: Grass
Parent Material:

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
12	10YR3/1	Sandy Loam	FILL		
20	10YR3/2	Sandy Loam	FILL	WET	
38	10YR3/1	Loamy Sand	FILL	WET	
44	10YR5/1	Loamy Sand		WET, Grey	
58	10YR5/1	Sand		WET, Grey	

Soil Profile Description

Date Completed: 7/19/2010
Completed By: RML
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Abbeylake Loamy Sand

Test Pit # Golf Course #2
Equipment: 4" Bucket Auger
Highest Known Water: >120"
Vegetation: Trees
Parent Material: Sandy Outwash

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
55			FILL		
72	10YR3/2	Sandy Loam			Original Topsoil
97	10YR4/4	Medium Sand			2-4% Coarse Fragments
120	10YR6/4	Medium Sand			

Soil Profile Description

Date Completed: 7/19/2010
Completed By: Peter G. Miller, P.S.S. License No. 42636
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Abbeylake Loamy Sand

Test Pit # Golf Course #1
Equipment: 4" Bucket Auger
Highest Known Water: >120"
Vegetation: Grass
Parent Material: Sandy Outwash

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
24			FILL		
36	10YR3/2	Sandy Loam			Original Topsoil
72	10YR4/4	Medium Sand			2-4% Coarse Fragments
120	10YR6/4	Medium Sand			

Soil Profile Description

Date Completed: 9/28/2010
Completed By: RML
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Dorset-Corliss Complex

Test Pit # Woodland Cluster #2
Equipment: 4" Bucket Auger
Highest Known Water: >30"
Vegetation: Grass
Parent Material: Outwash

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
12	10YR3/1	Loam			
18	10YR3/2	Loam			
22	10YR4/3	Silty Clay Loam			
24	10YR4/3	Sandy Clay Loam			
30	10YR5/3	Sand			5% CF, Refusal at 30" from gravel

Soil Profile Description

Date Completed: 9/28/2010
Completed By: Peter G. Miller, P.S.S. License No. 42636
Project: Lakeview Township
Landscape Position: Shoulder
Mapped Soil Type: Dorset-Corliss Complex

Test Pit # Woodland Cluster #1
Equipment: 4" Bucket Auger
Highest Known Water: >32"
Vegetation: Grass
Parent Material: Outwash

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
8	10YR2/2	Loam			
15	10YR3/4	Loam			
22	10YR3/3	Sand			5% CF
32	10YR5/4	Fine Sand			Refusal at 32", gravel

Soil Profile Description

Date Completed: 9/28/2010
Completed By: RML
Project: Lakeview Township
Landscape Position: Side Slope
Mapped Soil Type: Dorset-Corliss Complex

Test Pit # Nelson #2
Equipment: 4" Bucket Auger
Highest Known Water: >46"
Vegetation: Alfalfa
Parent Material: Outwash

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
12	10YR3/2	Sandy Loam			
18	10YR4/3	Medium Sand			
46	10YR5/3	Coarse Sand			5% CF, Refusal at 46"

Soil Profile Description

Date Completed: 9/28/2010
Completed By: Peter G. Miller, P.S.S. License No. 42636
Project: Lakeview Township
Landscape Position: Foot Slope
Mapped Soil Type: Dorset-Corliss Complex

Test Pit # Nelson #1
Equipment: 4" Bucket Auger
Highest Known Water: >30"
Vegetation: Alfalfa
Parent Material: Outwash

HORIZON DEPTH END (INCHES)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER
11	10YR2/2	Loam			
22	10YR4/4	Sandy Clay Loam			
30	10YR4/6	Sandy Loam			Refusal at 30", becoming gravelly