# Septic System Risk Assessment
# Village of Ortonville, Michigan

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Enviro-Assist
SEPTIC SYSTEM INSPECTIONS, CONSULTING, ENGINEERING

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## Scope of Project

This project was designed to estimate sewage system failure risks levels in the Village of Ortonville, Michigan. Data from public records, acquired from Ortonville and the Oakland County Health Department, was compiled and assessed. Design and construction parameters that impact septic system reliability were used to establish risk categories that correspond to age and geographic area within the Village.

## Analytical Considerations and Methods

Septic system failure is generally defined as sewage surfacing on the ground, backing up into a structure, contaminating surface water, or passing directly into groundwater. For purposes of this assessment, a system is at risk of failure when there is a likelihood of near term failure if the residence is occupied to full capacity.

Data from evaluation of existing septic systems (1, 4) demonstrates that age by itself is not an accurate predictor of septic system reliability. Rather, design, construction, and ultimately user activities are the controlling factors of longevity. However, where design and construction can be correlated with age, it can be used to extrapolate risk.

The evolution of septic systems in Oakland County can be broken into four time frames based on design and construction. Consequently, those periods are amenable to comparative analysis. The first period, systems installed prior to 1971, was characterized by unregulated design, materials that are subject to decay and collapse, and bypasses for wash water. Construction during the period of 1971 – 1980 gradually changed to use of durable materials. Design became more standardized relative to soil porosity. From 1980 to 1995, materials were fully converted to durable components. However, design and/or installation practices did not adequately account for seasonal water tables or final cover depth. In the final time frame, 1995 to present, much more attention has been given to water tables. Use of special engineering practices has also increased dramatically. However, depth of final cover continues to be extreme, and a dramatic increase in automatic irrigation substantially diminishes the viability of septic systems.

The percentage of systems at risk for failure in each time frame was derived from published data(4), point of sale inspection programs in Michigan(1), and Enviro-Assist inspection results in Oakland County. Systems built under construction permits after 1971 were designed in recognition of soil drainage capacity. Such design considerations were rarely used prior to 1971. Systems were often developed with haphazard design, with band-aide type repairs as systems fail. Materials used were subject to decay and soil infiltration. Consequently, failure risk for those systems can exceed 70%. Site parameters considered in establishing rates of risk were:

- Materials of construction
- Construction permits
- Type of final disposal
- Size of septic tank
- Elevation of disposal area
- Special engineering
- High Seasonal Water Tables

Unlike residential septic systems, for which sewage strength and flow rates are relatively consistent, commercial septic systems must be designed and constructed in consideration of the type of facility, estimated number of patrons, and estimated number of employees. Septic system requirements change substantially as businesses change. Consequently, commercial systems were not included in this evaluation. It is generally understood in the Environmental Health profession that commercial septic systems should be re-evaluated with every business change.

Records were not available for 172 sites. Septic Systems for those homes were assumed to be built during the period in which the house was built.

## Data

469 sites were included in the assessment. Table 1 identifies the number of systems in each time category, the risk per category.

Table 1: Risk by year of septic system construction

| Period | Pre-1971 | 1971-1979 | 1980-1995 | 1996-2016 |
|---|---|---|---|---|
| Number | 131 | 50 | 181 | 107 |
| % at risk | 70 | 35 | 18 | 8 |
| # at risk | 92 | 17 | 33 | 9 |

Village wide, the estimated number of residential septic systems at risk of failure is 151, representing 32 % of the homes in the community.

The age distribution was notable, with 131 systems that are believed to be constructed with haphazard design practices and materials that tend to decay or otherwise become plugged with soil (those built prior to 1971). No septic system records were available for that period. The period with the greatest number of homes was 1980 to 1995. Only 20 of those systems were missing records.

Special attention was given to areas where the seasonal water table is within 24 inches of grade (Appendix A). Septic systems installed in those areas will directly contaminate shallow groundwater unless they are built substantially above grade. Thirty-six septic systems were identified in those areas. It is reasonable to suspect that these systems are routinely failing by way of groundwater contamination. In addition, those systems are at risk for sewage backing up into homes, surfacing on the ground, and flowing into surface water. These systems alone comprise 7 % of the residential sites on Ortonville.

## Discussion

Due to the definition of drainfield failure, the number of systems that are failing is in constant flux. A failing system can be returned to satisfactory function simply by reducing water use. Similarly, systems can fail and recover seasonally as water tables rise and fall. Consequently, this assessment was not intended to identify the number of septic systems that are currently failing. Rather, it was designed to identify the susceptibility of the community to sewage failures and assess the need for a management program to prevent failures.

In comparison to other regions of the state, Ortonville has a relatively high susceptibility to septic system failure. Washtenaw County reports 12% of systems failing or at risk of failure. Wayne County reports 15%. Some other communities in Michigan report up to 24% of the systems in need of repair. Anecdotally, Oakland County staff has referred to failure rates as high as 25%.

With 32% of the residential septic systems in Ortonville at risk for failure, it would seem prudent to develop a care and maintenance program for septic systems at this time. A management program should include methods to identify failing systems, identify individual system deficiencies, and estimate system capacities. Systems that are in high groundwater areas pose the most immediate health hazard risk and perhaps should be prioritized. Most importantly, the program should be educational for homeowners. Septic systems at risk for failure can usually be kept in good working order with proper care, but many homeowners exacerbate problems unknowingly.

## Resources


1. Michigan Annual Wastewater Conference, Point of Sale Roundtable Discussion, 2014 and 2017.
2. Onsite Wastewater Treatment Systems Manual, USEPA, February 2002.
3. Michigan Dept. of Environmental Quality, Causes of Septic System Failures, annual data.
4. Gregory, Randall. Assimilation and Practical Application of Field Data in Washtenaw County Michigan. In Proceedings of the American Society of Agricultural Engineers, Sacramento, CA, 2004
5. Recommended Standards for Wastewater Facilities, Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, 2004
6. Enviro-Assist, Ltd., Compiled septic system inspection records, 2005 - 2017.
7. US Soil Conservation Service, online soil mapping.
8. King, L. D., M. T. Hoover, T. H. Hinson, R.L. Polson, and R. W. Everett. Surface Failure Rates of Chamber and Traditional Aggregate-Laden Trenches in Oregon. Small Flows Quarterly. 3(4): 27-36. 2002

Appendix A
USSCS Soil map

# Appendix A
# (cont.)

## Map Unit Legend

| Oakland County, Michigan (MI125) | | | |
|---|---|---|---|
| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
| 10C | Marlette sandy loam, 6 to 12 percent slopes | 16.7 | 1.8% |
| 13B | Oshtemo-Boyer loamy sands, 0 to 6 percent slopes | 148.3 | 16.5% |
| 13C | Oshtemo-Boyer loamy sands, 6 to 12 percent slopes | 83.0 | 9.4% |
| 13E | Oshtemo-Boyer loamy sands, 12 to 40 percent slopes | 6.9 | 0.7% |
| 14B | Oshtemo fine sand, 0 to 6 percent slopes | 10.1 | 1.1% |
| 14C | Oshtemo fine sand, 6 to 18 percent slopes | 16.2 | 1.7% |
| 16B | Spinks loamy sand, 0 to 6 percent slopes | 16.7 | 1.8% |
| 16C | Spinks loamy sand, 6 to 12 percent slopes | 110.1 | 12.4% |
| 16E | Spinks loamy sand, 12 to 35 percent slopes | 16.2 | 1.7% |
| 17A | Wixom sandy loam, 0 to 3 percent slopes | 17.5 | 2.0% |
| 18C | Fox sandy loam, 6 to 12 percent slopes | 13.0 | 1.5% |
| 19 | Sebewa loam, disintegration moraine, 0 to 2 percent slopes | 27.3 | 3.1% |
| 26 | Brookston silt loam | 37.9 | 4.3% |
| 27 | Houghton and Adrian mucks | 222.6 | 25.2% |
| 35A | Thetford loamy fine sand, 0 to 3 percent slopes | 36.4 | 4.1% |
| 39 | Granby loamy sand | 18.7 | 2.1% |
| 41B | Aquents, sandy, loamy, undulating | 7.4 | 0.8% |
| 44C | Ruddles sandy loam, 6 to 12 percent slopes | 4.9 | 0.6% |
| 52B | Urban land-Spinks complex, 0 to 6 percent slopes | 73.7 | 8.3% |
| W | Water | 8.3 | 0.9% |
| Totals for Area of Interest | | 884.9 | 100.0% |

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|---|---|---|---|
| **Map Unit Symbol** | **Map Unit Name** | **Acres in AOI** | **Percent of AOI** |
| 10C | Marlette sandy loam, 6 to 12 percent slopes | 15.7 | 1.8% |
| 13B | Oshtemo-Boyer loamy sands, 0 to 6 percent slopes | 146.3 | 16.5% |
| 13C | Oshtemo-Boyer loamy sands, 6 to 12 percent slopes | 83.0 | 9.4% |
| 13E | Oshtemo-Boyer loamy sands, 12 to 40 percent slopes | 5.9 | 0.7% |
| 14B | Oakville fine sand, 0 to 6 percent slopes | 10.1 | 1.1% |
| 14C | Oakville fine sand, 6 to 18 percent slopes | 15.2 | 1.7% |
| 15B | Spinks loamy sand, 0 to 6 percent slopes | 15.7 | 1.8% |
| 15C | Spinks loamy sand, 6 to 12 percent slopes | 110.1 | 12.4% |
| 15E | Spinks loamy sand, 12 to 35 percent slopes | 15.2 | 1.7% |
| 17A | Wasepi sandy loam, 0 to 3 percent slopes | 17.5 | 2.0% |
| 18C | Fox sandy loam, 6 to 12 percent slopes | 13.0 | 1.5% |
| 19 | Sebewa loam, disintegration moraine, 0 to 2 percent slopes | 27.3 | 3.1% |
| 26 | Sloan silt loam | 37.9 | 4.3% |
| 27 | Houghton and Adrian mucks | 222.6 | 25.2% |
| 35A | Thetford loamy fine sand, 0 to 3 percent slopes | 36.4 | 4.1% |
| 39 | Granby loamy sand | 18.7 | 2.1% |
| 41B | Aquents, sandy, loamy, undulating | 7.4 | 0.8% |
| 44C | Riddles sandy loam, 6 to 12 percent slopes | 4.9 | 0.6% |
| 62B | Urban land-Spinks complex, 0 to 8 percent slopes | 73.7 | 8.3% |
| W | Water | 8.3 | 0.9% |
| **Totals for Area of Interest** | | **884.9** | **100.0%** |