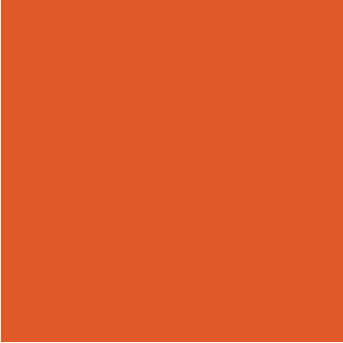
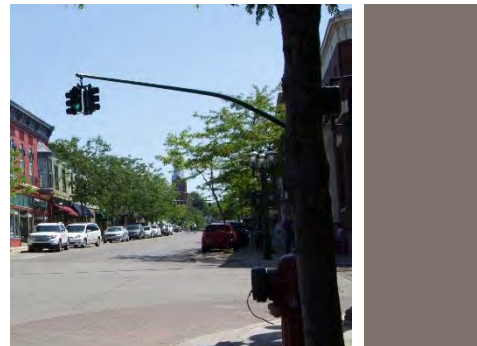




DWSRF PROJECT PLAN



PREPARED BY:

JUNE 2026



HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

1925 Breton Road SE, Suite 100
Grand Rapids, Michigan 49506

HRC Job Number 20260066

Versions:

Draft *May 5, 2026 (PUBLIC REVIEW)*

Draft

Final

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Appendix D: Detailed Cost Estimates
Appendix E: EGLE Site Contamination Online Mapper Tool
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1 Executive Summary

1.1 Summary

This Project Plan was prepared for the City of Traverse City to address Water Treatment Plant (WTP) and Water Distribution System deficiencies and aging facilities. This Project Plan, as prepared by Hubbell, Roth & Clark, describes the existing condition of various Drinking Water Distribution System components and the City's WTP with alternatives to meet those needs and the most cost-effective alternative.

The Project Plan will be submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) in order to qualify for possible Drinking Water State Revolving Fund (DWSRF) loan assistance. While the rates have not been set yet for FY2027, the rates in 2026 is 2.50% for 20-year loans (note 3% was used for cost estimates as a conservative approximation). The Project Plan has been prepared following the DWSRF Project Plan Preparation Guidance Outline administered by The Office of Drinking Water and Municipal Assistance. These rules call for compliance with the basic Federal Planning Requirements and the National Environmental Policy Act (NEPA). The Project Plan will also serve as the basis for project prioritization and must be submitted to EGLE by June 1, 2026, in order to be considered for funding on the project priority list for the fiscal year 2027. These projects below provide an initial framework for evaluation and assessment.

1.2 Conclusions

The following is a summary of the existing issues identified in the Water Reliability Study and recommended by the City.

- ≡ Water Treatment Plant Improvements
 - WTP High Service Pump Station Improvements
 - WTP Electrical Improvements and WTP Generator Replacement
 - WTP Sodium Hypochlorite Storage Tank and Building Improvements
 - WTP Freight Elevator
 - WTP Low Service PS Improvements including Generator and Raw Water Main
 - Other facility and administrative improvements
- ≡ Distribution System Improvements
 - Watermain Replacements (multiple locations throughout City)
 - Galvanized Service Line replacements

1.3 Recommendations

The City of Traverse City should pass a resolution formally adopting the Project Plan and agree to implement the Drinking Water Distribution System and Water Treatment Plant Improvements outlined herein.

The City should submit this report to EGLE in order to attempt to qualify for a low-interest loan through the DWSRF Loan Program.

2 Project Background

2.1 Summary of Project Need

In an effort to meet various recently revised State requirements, improve system reliability, and address aging infrastructure that has reached its useful life, The City of Traverse City is proposing various projects within their Drinking Water Distribution System seeking financial assistance for this work through a low-interest rate loan offered by EGLE. This Project Plan identifies projects that will include improvements to both the water treatment plant and the distribution system on a fiscal year basis.

2.2 Study Area Description

2.2.1 Delineation of Study Area

The City of Traverse City is located in Grand Traverse County in the northwest Lower Peninsula. The City is situated on the southern shores of Grand Traverse Bay. The City maintains great pride in ensuring high-quality drinking water and reliability to its residents as well as protecting the clean waters of Grand Traverse Bay.

The City supplies potable drinking water to the City and three surrounding townships through bulk water agreements with Garfield Township (6 mgd maximum), Elmwood Township (0.75 mgd maximum), and Peninsula Township (1 mgd maximum). An emergency connection is also provided with the East Bay Township water distribution system which operates at a higher system pressure and a dissimilar water quality (groundwater source).

Figure 2-1 depicts the water system service area and Figure 2-2 depicts the City's water distribution system

The City's raw water supply is from an intake structure from the east arm of Grand Traverse Bay (East Bay). The City's original water supply was located near the City in West Bay in the 1890s and was relocated to East Bay, which is more protected from runoff and potential contamination sources, in 1965. Treatment is provided by a 20 million gallon per day (mgd) Water Treatment Plant (WTP) located in the City near the intake in East Bay. The WTP was converted to direct filtration in 1993 and is equipped with four low service pumps (raw water), two flocculators, five rapid sand filters, two clear wells, finished water storage, and five high service pumps (finished water).

The City's water distribution system provides water service for water use and fire flows throughout the City's service area. The City's system comprises 660,340 feet (125 miles) of water main and two booster pumping stations. Approximately two-thirds of the piping is cast iron and the majority of the water mains were constructed in the 1960s and prior. New ductile iron mains have been installed since the 1980s.

2.2.2 Land Use

The largest land use types within the City of Traverse City (excluding open spaces and utilities) are residential and commercial. A map with the current zoning districts within the City of Traverse City can be seen in the attached Figure 2-3. In addition, a map of the future land use within the City of Traverse City can be seen in the attached Figure 2-4. Future land use for the City was obtained from the City of Traverse City Master Plan.



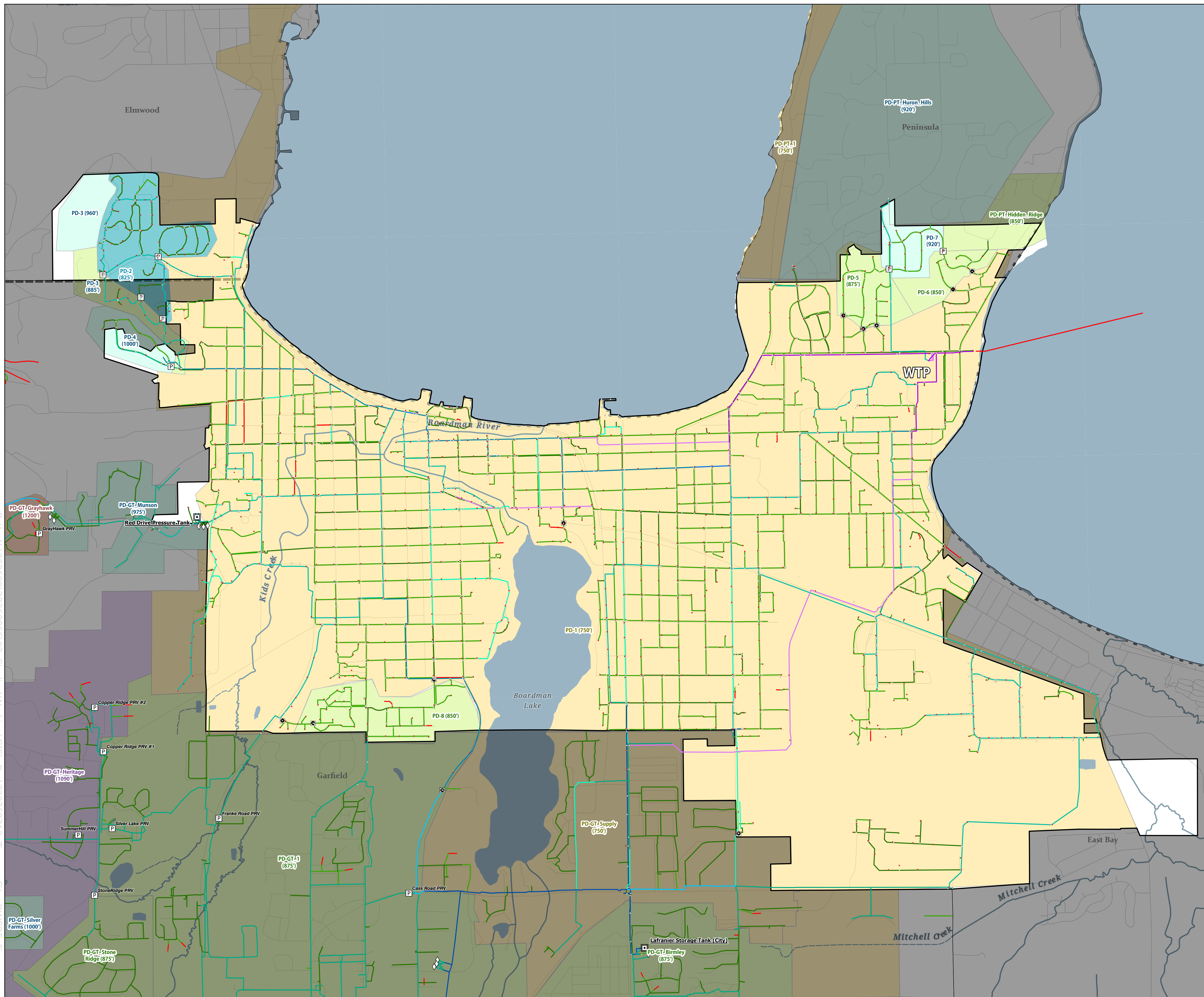
1925 Breton Road SE Suite 100
Grand Rapids, MI 49506

WEBSITE: <http://www.hrcengr.com>

- CHECKED: DIU

SCALE: AS SHOWN

FIGURE 2.2



City of Traverse City Zoning Map

Street Classification

- Arterial
- Collector

Zoning Districts

- C-1 Office Service
 - C-2 Neighborhood Center
 - C-3 Community Center
 - C-4a Regional Center
 - C-4b Regional Center
 - C-4c Regional Center
 - D-1 Development
 - D-2 Development
 - D-3 Development
 - GP Government/Public
 - H-1 Hospital
 - H-2 Hospital
 - HR Hotel Resort
 - I Industrial
 - R1/b Mixed Use
 - NMC-1 University
 - NMC-2 University
 - OS Open Space
 - GTC Grand Traverse Commons
 - R-15 Multi Family Dwelling
 - R-1a Single Family Dwelling
 - R-1b Single Family Dwelling
 - R-2 Two Family Dwelling
 - R-29 Multi Family Dwelling
 - R-9 Multi Family Dwelling
 - RC Residential Conservation
 - T Transportation
- (A) - Zoning Agreement

Planning Department
Zoning Administrator - Dave Weston
231-922-4464



0 1,000 2,000 Feet

5/24/2019 GWS
This map is based on digital databases from the City of Traverse City. Traverse City cannot accept any responsibility for errors, omissions or positional accuracy. There are no warranties expressed or implied.

Document Path: Z:\GIS\Planning\Zoning Master Map Editing\Information\Zoning_Master_Update103.mxd

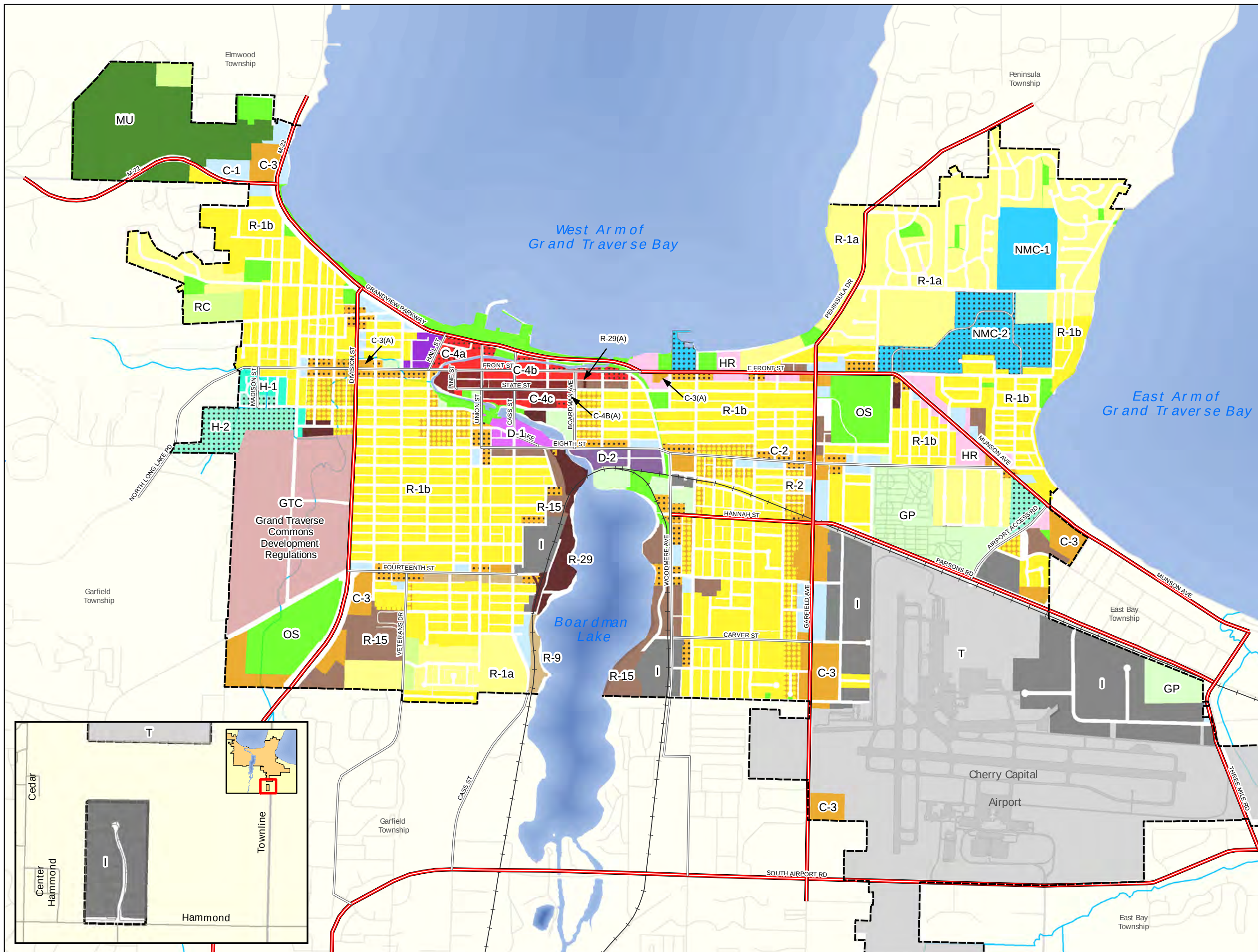


Figure 2-3 City of Traverse City Current Zoning Districts

*Courtesy of City of Traverse City

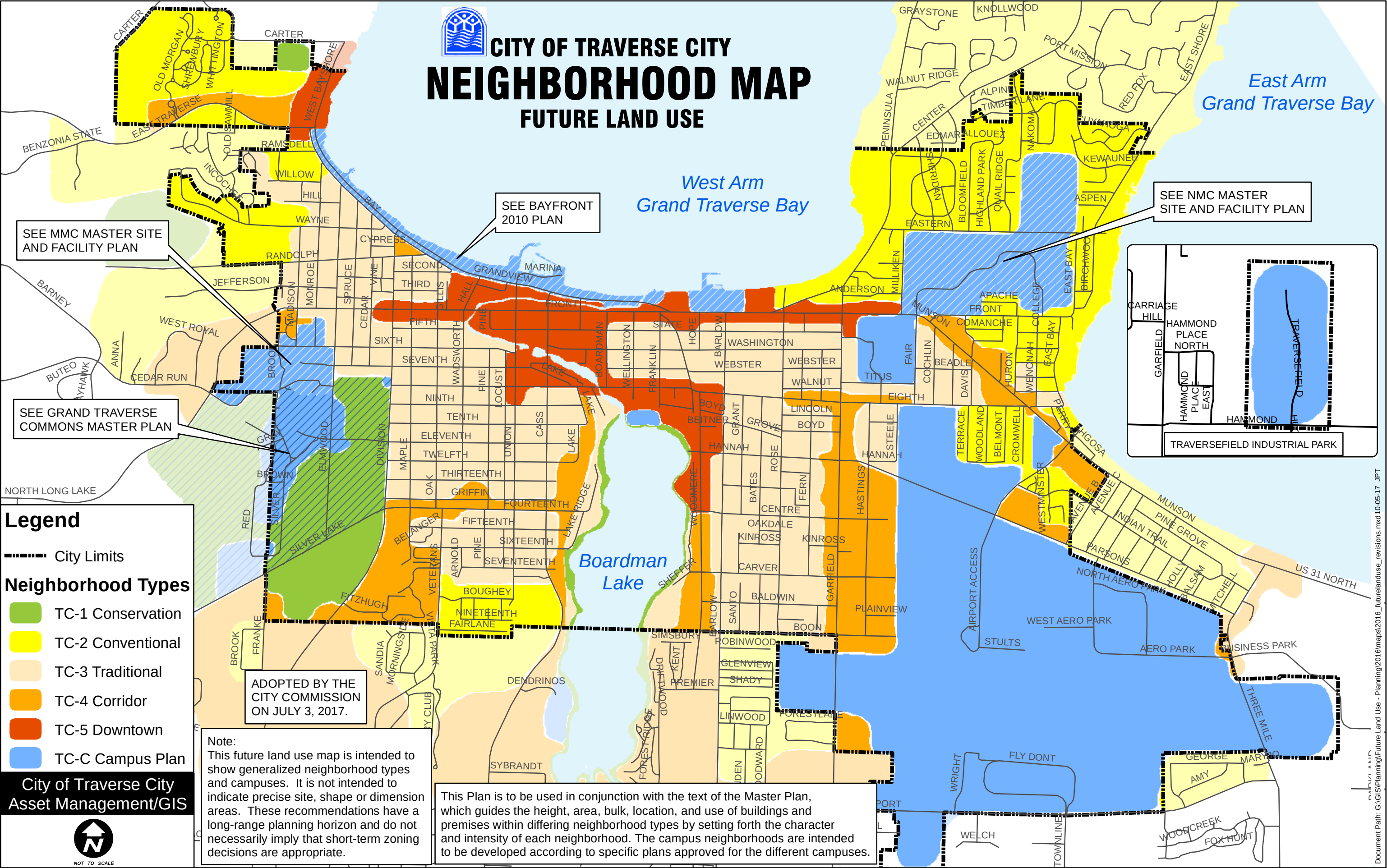


Figure 2-4 City of Traverse City Future Land Use

*Courtesy of City of Traverse City

2.2.3 Water Demands

The water consumption data was provided by the City and is provided in Table 2-1 provides a summary of the water use records in the City and each customer community.

Table 2-1. Water System Demands

Fiscal Year	Total Supplied (mgd)	Traverse City (mgd)	Garfield Township (mgd)	Peninsula Township (mgd)	Elmwood Township (mgd)	Total Billed (mgd)	Unaccounted Water (mgd)	Loss (as % of Supplied)
2015	5.71	2.17	1.41	0.16	0.041	3.74	1.93	33.8%
2016	5.83	2.32	1.63	0.19	0.031	4.18	1.66	28.4%
2017	5.34	2.39	1.68	0.17	0.031	4.26	1.08	20.2%
2018	5.19	2.06	1.80	0.18	0.032	4.07	1.12	21.6%
2019	5.41	2.47	1.69	0.17	0.028	4.35	1.06	19.6%
2020	4.85	1.94	1.79	0.20	0.039	3.97	0.88	18.1%
2021	5.37	2.24	1.84	0.20	0.043	4.32	1.05	19.56%
2022	5.16	2.24	1.72	0.18	0.047	4.18	0.98	18.97%
2023	5.52	3.10	1.78	0.19	0.045	5.12	0.40	7.29%
2024	5.51	2.71	1.76	0.17	0.047	4.68	0.82	14.95%
2025	5.89	3.28	1.95	0.19	0.044	5.46	0.43	7.31%

Notes:

1. From City's Water Output and Financial History Report
2. Community demands from Township meter records

Unaccounted for water or water loss in the system from unmetered losses were determined by tabulating the water pumped and comparing the billed amount for the City and each Township. Water loss estimates before 2017 are less accurate as the new high service pump station flow meters were installed in November 2015. Since 2017, the unaccounted water comprises approximately 16.4% of the total water supplied. The typical goal of unaccounted water in municipal water systems is 10%. The estimated losses are not adjusted for seasonal flushing and fire flows which can comprise up to 2% of the water loss.

2.3 Population Data

Population numbers and projections for Grand Traverse County and the City of Traverse City came from the United States Census Bureau database. The U.S. 2020 Census Bureau data estimated the average household size in the City at 2.06 people per household. The population projections for the City of Traverse City and Grand Traverse County are shown below in Table 2-2.

Table 2-2. Population Projections

Year	Grand Traverse County	City of Traverse City		Garfield Township		Elmwood Township		Peninsula Township		Total
	Total	Total	Service	Total	Service	Total	Service	Total	Service	Service
1990	64,273	15,115	15,115	10,516	NA	3,427	NA	4,340	NA	NA
2000	77,654	14,532	14,532	13,840	9,985	4,264	321	5,265	1,570	26,408
2010	86,986	14,674	14,674	16,526	11,923	4,503	339	5,433	1,620	28,556
2015	91,541	15,323	15,323	16,953	12,231	4,500	339	5,696	1,699	29,591
2020	95,249	15,669	15,669	20,028	14,450	4,762	358	5,609	1,673	31,155
2025	96,429	15,782	15,782	22,049	15,907	4,897	369	5,699	1,700	32,649
2030	100,756	15,917	15,917	24,273	17,512	5,036	379	5,790	1,727	34,292
2040	108,035	16,190	16,190	29,417	21,223	5,325	401	5,978	1,783	38,081
2050	115,840	16,468	16,468	35,649	25,954	5,631	424	6,172	1,841	44,687
Growth Rate	0.70%	0.17%		1.94%		0.56%		0.32%		0.81%

Notes:

1. Population data from the US Census Bureau, Networks Northwest, and City of Traverse City
2. 5-year planning period will be 2030 and the 20-year planning period will be 2050
3. Correspondence with City

2.4 Economic Characteristics

The major industries in the City of Traverse City are Health Care & Social Assistance (2,782 people), Retail Trade (2,178 people), and Accommodation & Food Services (1,478 people). The median household income for the City of Traverse City was \$47,087 in 2024. The median household income is approximately 0.02% higher than the median Michigan household income and 8.97% less than the U.S. median household income. Table 2-3 shows the City of Traverse City, Grand Traverse County, and Leelanau County median household income comparison below.

Table 2-3. Study Area Household Income

Municipality	Median Annual Household Income
City of Traverse City	\$74,087
Grand Traverse County	\$81,647
Leelanau County	\$99,422

*Source: <https://www.census.gov/quickfacts/fact/table/MI,traversecitycitymichigan,grandtraversecountymichigan/PST045219>

2.5 Cultural and Environmental Settings

2.5.1 Cultural Setting

The City of Traverse City has 4 historical districts and 5 historical properties listed under the National Register of Historic Places. The State Historic Preservation Office (SHPO) is to be contacted for proposed work within the affected Historic Districts. The relatively shallow excavations needed to complete the proposed work will be contained within public right-of-way and on private properties. All the proposed work will occur at the same location as existing facilities and lines. Restoration of surface features disturbed by this construction will match existing conditions as much as practicable. Therefore, there is no anticipated permanent impacts on any historical, archeological, geological, cultural, or recreational areas due to this construction. EGLE will be coordinating with the SHPO for final determination of historic properties impacted.

2.5.2 The Natural Environment

Climate

The project area's climate is controlled by its location with respect to major storm tracks that pass through the Midwest and by the influence of Lake Michigan and the Grand Traverse Bay. Lake Michigan tends to moderate and smooth out most climate extremes. Consequently, the City generally experiences warm, mild summers and severe winters. The summer high is around 80 degrees Fahrenheit, and the winter low is around 16 degrees Fahrenheit. Precipitation is distributed through all months of the year. Lake-effect snowfall constitutes a large percentage of the total annual snow accumulation, which averages around 118 inches. Periods of snowfall typically last from November to April, although light snow as late as May or as early as late September sometimes occur. Rain averages around 33 inches annually.

The growing season averages 152 days in length. Average date of the last freezing is May 27; average date of the first freezing temperature is October 1.

Climatological data is collected by the National Oceanic and Atmospheric Administration (NOAA). This project, and the alternatives discussed, will have no impact on the climate of the project.

Air Quality:

Mobile source emissions, mainly from automobiles, are the primary source of outdoor air pollution in this area. The area has the noise pollution characteristics of a typical, tourist-driven community. No noise pollution problems exist in residential areas, other than from traffic noise from adjacent major roadways. Commercial and business areas experience only normal traffic noise.

Air quality is not anticipated to be an issue for this project, apart from temporary dust and debris from construction and minimal odors from the Cured-in-Place-Pipe curing material. All necessary notifications will be distributed to the public when this occurs and all regulations for this odor will be followed.

Wetlands:

There are no localized wetlands associated within the existing project footprint where the work is anticipated. For final design, any wetlands that may be impacted would be flagged and the appropriate EGLE and USACE permits will be applied for. However, it is not anticipated to be an issue for this project. Wetland maps are shown in Figure 2-5.

Great Lake Coastal Zones:

The major body of water north of the City of Traverse City is Grand Traverse Bay, which is approximately 0.25 miles from the WTP. The WTP is located on southeast sector of the peninsula jutting out into the Bay. For this project plan, no impacts will be made to the Bay or tributary areas.

Floodplains & Surface Waters:

The study area is located entirely in the Grand Traverse Bay Watershed. The watershed encompasses 976 square miles with nine sub watersheds that drain directly into the Grand Traverse Bay.

The City of Traverse City is located along the Grand Traverse Bay. Area groundwater is not used as a source of drinking water within the City. Water supply for the City is obtained via the City of Traverse City Water Treatment Plant from Lake Michigan. There will be no major impacts to the great lake coastal zones, floodplains, and surface waters, however, proper permits will be acquired, and steps will be taken to avoid any damage or permanent disruption which could affect the nearby floodplain. Any work which impacts the floodplain will only be undertaken after first contacting EGLE and obtaining the appropriate permits.

FEMA floodplain maps are shown in Figure 2-6.

Natural or Wild and Scenic Rivers:

The scope of this project is throughout the City of Traverse City and associated townships. Kids Creek and the Boardman River are located within the City. The location of these improvements and construction will be planned to not occur or impact the nearby rivers. See Appendix B for the attached documentation of the Nationwide Rivers Inventory correspondence.

Recreation Facilities:

The City of Traverse City owns 34 parks and recreational properties, ranging from a small downtown parcel to the larger Hickory Hills Ski Area, Grand Traverse Commons and Brown Bridge Quite Area. Much of the park land is heavily concentrated along the Boardman River and along the shoreline of the West Grand Traverse Bay. In total, over 1,600 City-owned acres are currently dedicated to the recreational pursuits including Hickory Hills Ski Area and Grand Traverse Commons that are each approximately 125 acres and Brown Bridge Quite Area, located 10 miles southeast of the City, has nearly two square miles (1,310 acres) of natural area along the Boardman River. In 2023, the City was presented the opportunity to acquire 528 acres of land adjacent to the Brown Bridge Quiet Area. The City acquired a Michigan Natural Resources Trust Fund (MNRTF) Grant to help purchase this property. The purchase transaction is being finalized to expand the Brown Bridge Quiet Area to 1,838 acres for extended quiet recreation opportunities. No parks or other publicly owned facilities will be impacted by the proposed work.

National Natural Landmarks:

There are no registered natural landmarks in Grand Traverse county, therefore no National Natural Landmarks will be affected.

Topography:

The terrain within the City of Traverse City is characterized as relatively flat but has relative low spots near the Grand Traverse Bay. The lowest point at about 600 feet above sea level is in the north region of the City on the bay along the shoreline. The highest point is about 800 feet above sea level on the outskirts of the City.

A set of United States Geological Survey (USGS) topography maps of the city and surrounding townships are shown in Figure 2-7 through Figure 2-11.

Geology:

The City of Traverse City is typified by eolian, lake, and glacial deposits. The lake sand deposits make up the larger portion of the City of Traverse City. Two types of bedrock make up the bedrock surface in the City of Traverse City, Ellsworth Shale and Coldwater Shale.

Soils:

According to the USDA Natural Resources Conservation Service Web Soil Survey, the City of Traverse City the 3 main soils located within the City are Loamy Sand (27.53%), Sandy Loam (14.78%), and Sand (39.73%). See Appendix C for documentation of the Web Soil Survey results.

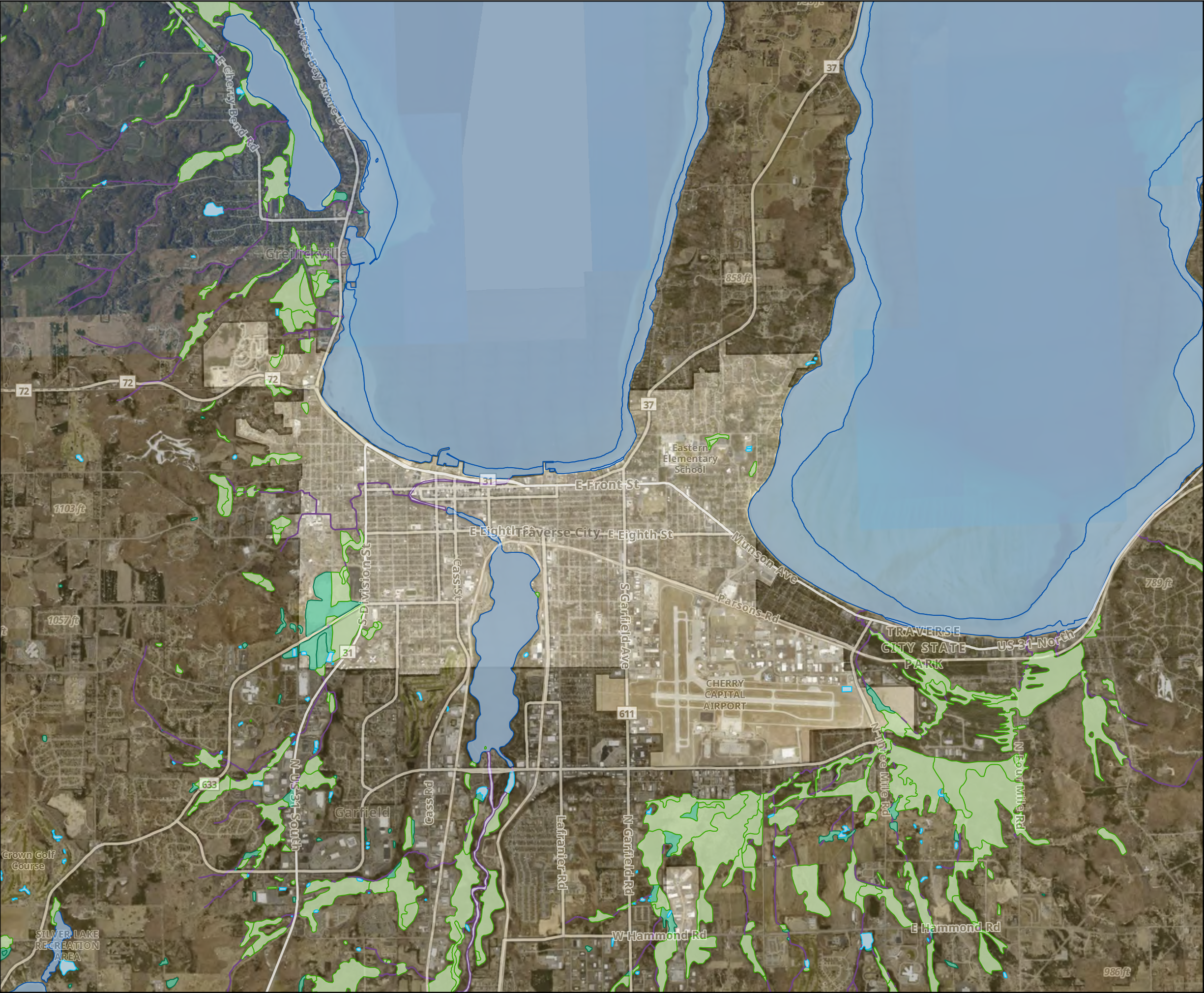
As part of the final design process, soil borings will be taken near the proposed work areas to determine if any special construction methods will be needed.

Agricultural Resources:

There is no agricultural land located within the project limits. The project area is within developed and human use land cover; therefore, no agricultural resources will be impacted by the proposed work.

Existing Plant and Animal Communities:

Wildlife within the study area includes animals and birds normally associated with urban or agricultural environments. Because this project will be contained in an urban area where no suitable wildlife habitat is present as well as limited to existing structures, it is not necessary to contact U.S. Fish and Wildlife (USFW) to confirm that there will be no effect to endangered or threatened species. A list of all endangered and threatened species generated by the Michigan Natural Features Inventory can be seen in Appendix D.



CITY OF
TRAVERSE CITY



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Legend

0 0.38 0.75 1.5 Miles



-  Freshwater Emergent Wetland
-  Freshwater Forested/Shrub Wetland
-  Freshwater Pond
-  Lake
-  Riverine
-  Other

DRAWN: KLH

CHECKED: DIU

DWSRF Project Plan City of Traverse City Wetlands Map

HRC Job No.
20260066

SCALE: AS SHOWN

June 2026

FIGURE 2.5

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was provided in digital format by the National Agricultural Imagery Program (NAIP). This information was photogrammetrically compiled at a scale of 1:12,000 from aerial photography dated 2007 or later.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

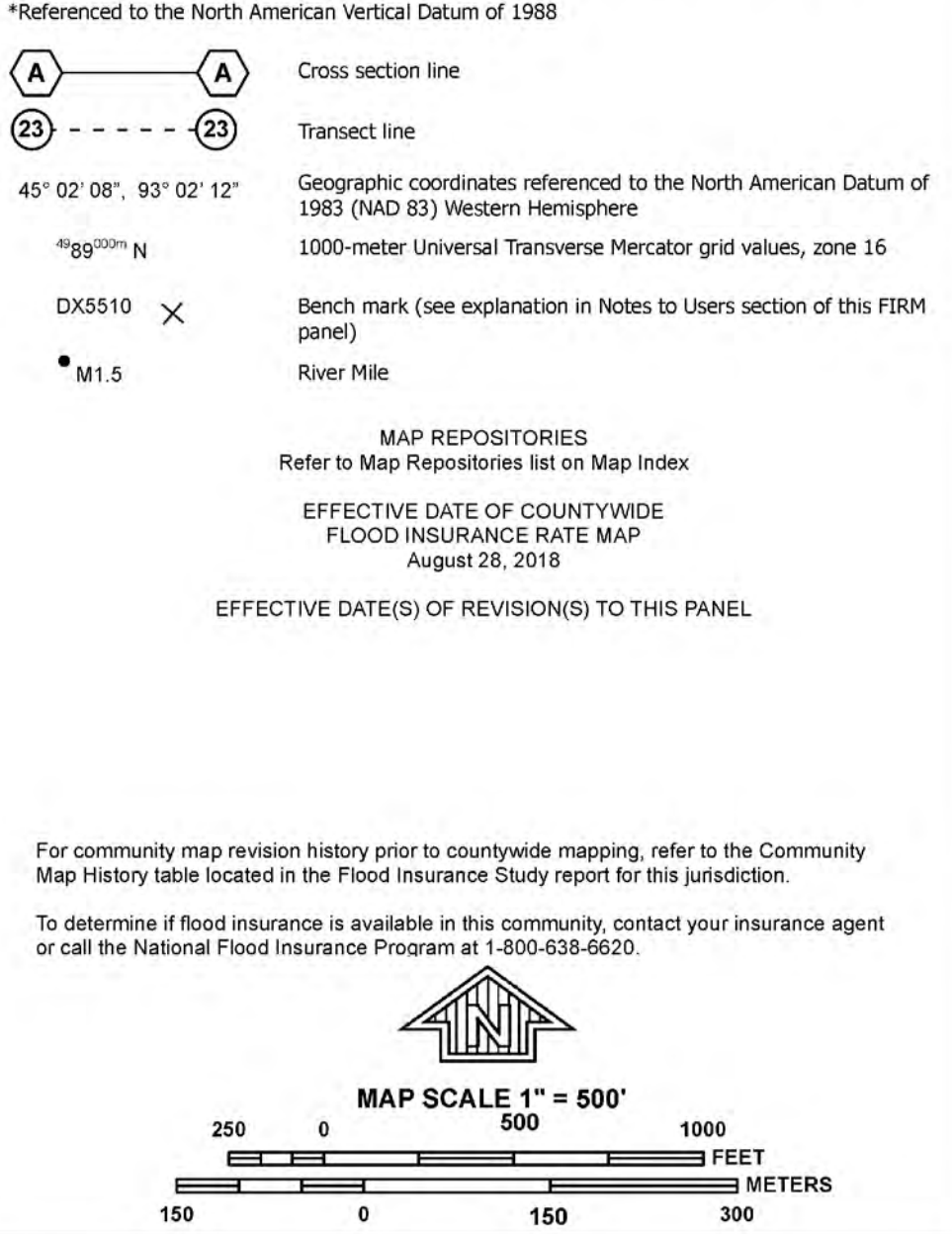
For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfip>.



LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**
The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.
- ZONE A** No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently deteriorated. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
- FLOODWAY AREAS IN ZONE AE**
- The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.
- OTHER FLOOD AREAS**
- ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
OTHER AREAS
ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**
OTHERWISE PROTECTED AREAS (OPAs)
- CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- 1% Annual Chance Floodplain Boundary
0.2% Annual Chance Floodplain Boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
Base Flood Elevation line and value; elevation in feet*
Base Flood Elevation value where uniform within zone; elevation in feet*
- *Referenced to the North American Vertical Datum of 1988
- Cross section line**
Transect line
Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
1000-meter Universal Transverse Mercator grid values, zone 16
Bench mark (see explanation in Notes to Users section of this FIRM panel)
River Mile
- MAP REPOSITORIES**
Refer to Map Repositories list on Map Index
EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
August 28, 2018
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL



NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0113C

FIRM
FLOOD INSURANCE RATE MAP
GRAND TRAVERSE
COUNTY, MICHIGAN
(ALL JURISDICTIONS)

PANEL 113 OF 425
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PENINSULA, TOWNSHIP OF	260747	0113	C
TRAVERSE CITY, CITY OF	260082	0113	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
26055C0113C
EFFECTIVE DATE
AUGUST 28, 2018
Federal Emergency Management Agency

Figure 2-6 FEMA Floodplain Map

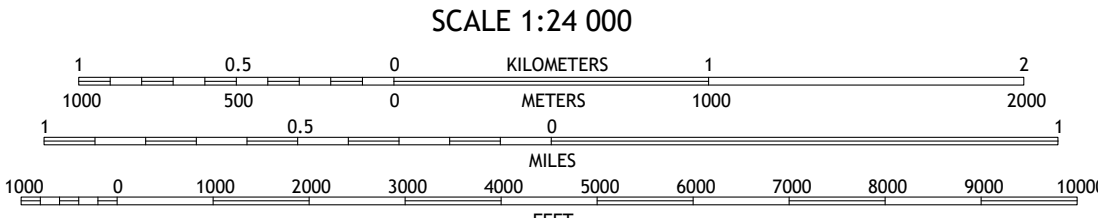
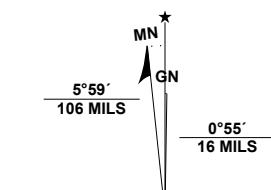


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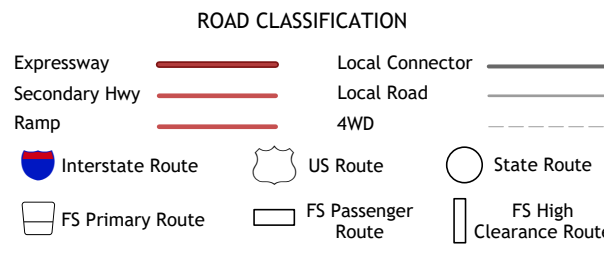
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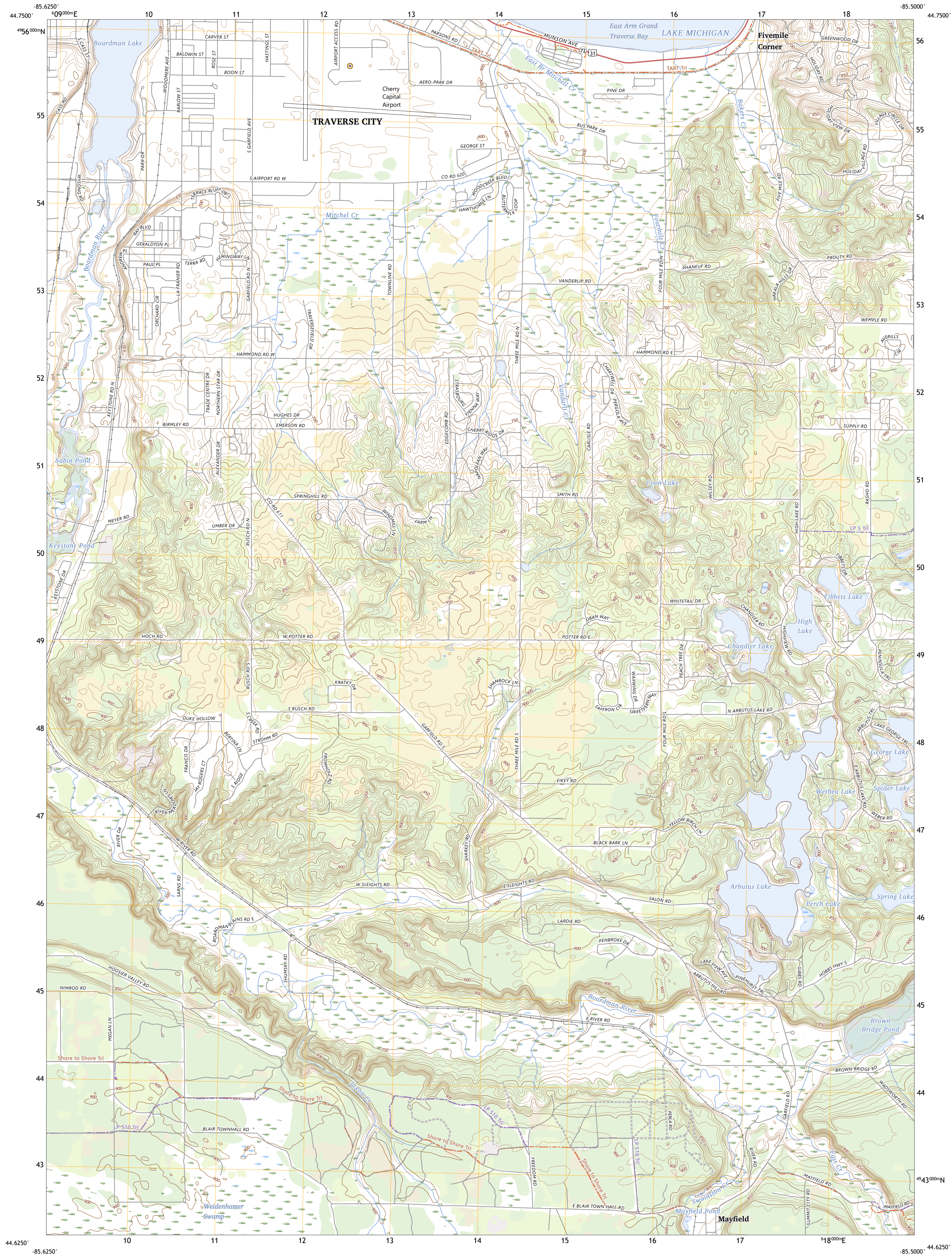


Maple City	Traverse City SW	Traverse City SE
Lake Ann	Grawn	Mayfield
Karlin	Buckley	Kingsley



GRAWN, MI
2026

ADJOINING QUADRANGLES

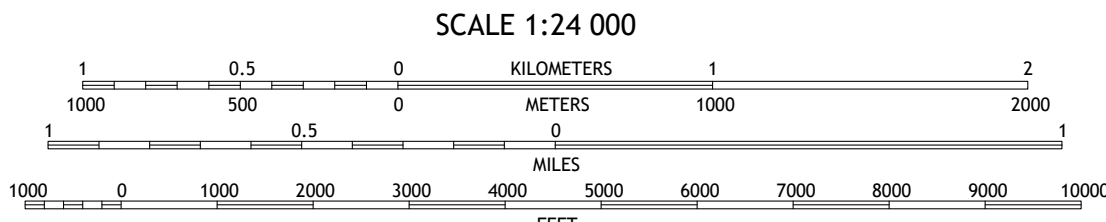
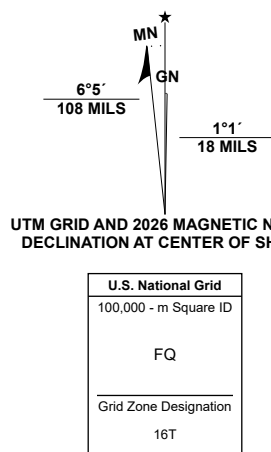


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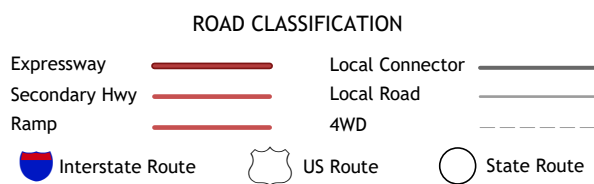
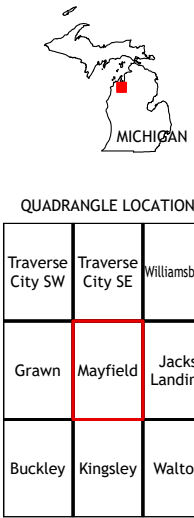
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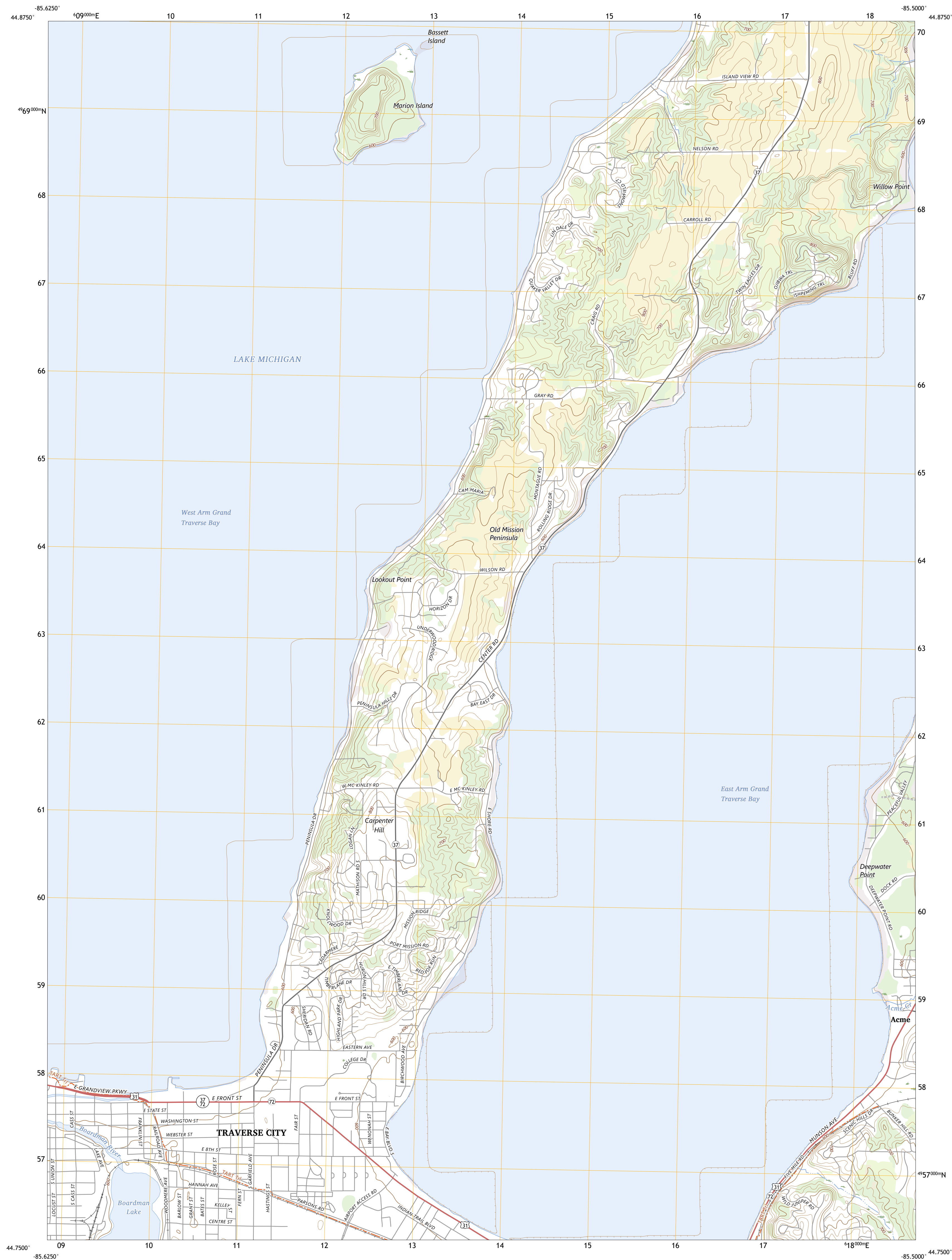
CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR SMOOTHNESS = Medium

USER DEFINED CONTENT



MAYFIELD, MI
2026

ADJOINING QUADRANGLES

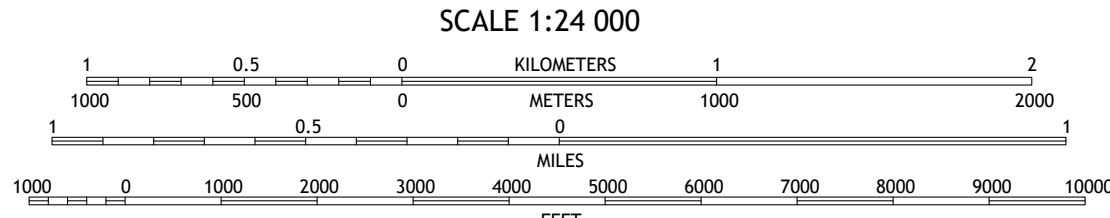
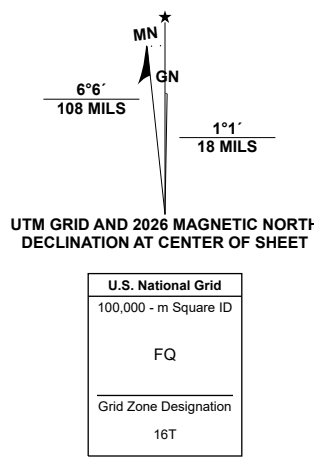


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NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR SMOOTHNESS = Medium

USER DEFINED CONTENT



Suttons Bay	Mapleton	Elk Rapids
Traverse City SW	Traverse City SE	Williamsburg
Grawn	Mayfield	Jacks Landing

ADJOINING QUADRANGLE

ROAD CLASSIFICATION

Expressway Local Connector
 Secondary Hwy Local Road
 Ramp 4WD
 Interstate Route  US Route  State Route

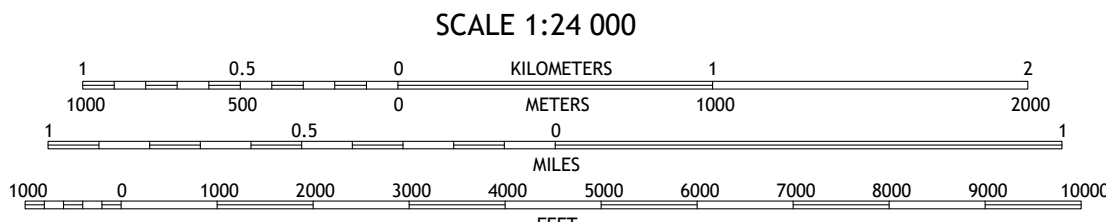
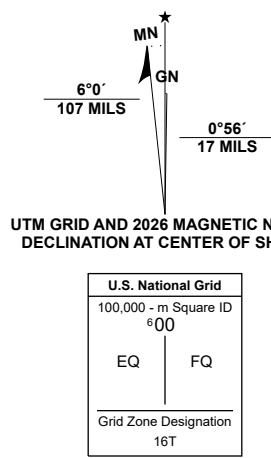
TRAVERSE CITY SE, MI
2026



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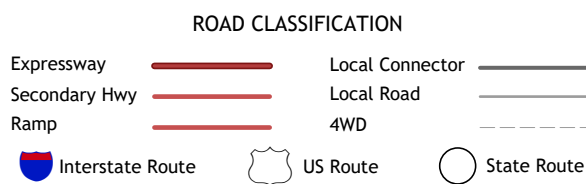


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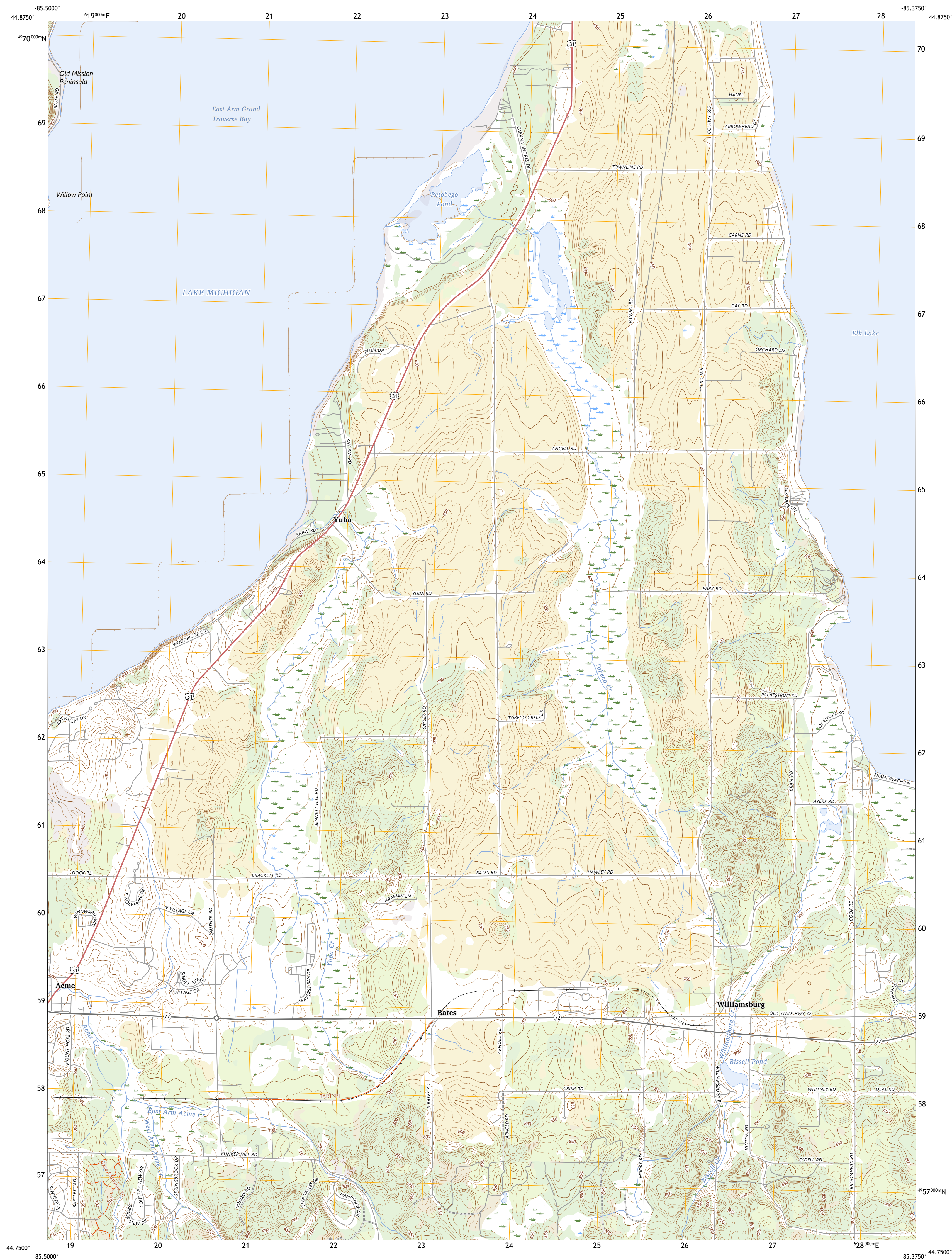


Good Harbor Bay	Suttons Bay	Mapleton
Maple City	Traverse City SW	Traverse City SE
Lake Ann	Grawn	Mayfield

ADJOINING QUADRANGLES



TRAVERSE CITY SW, MI
2026

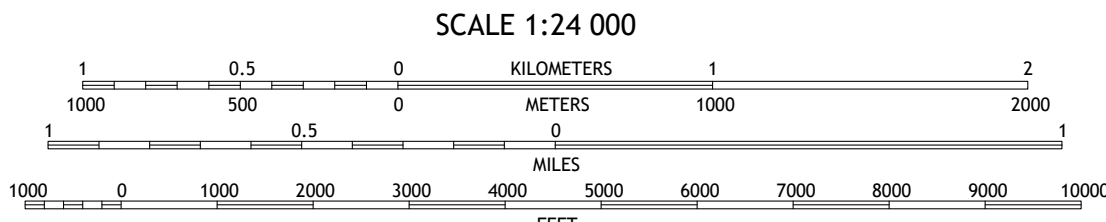
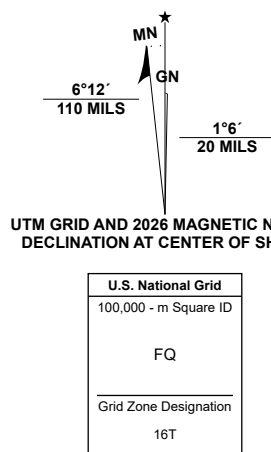


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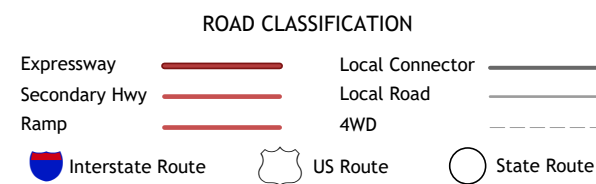
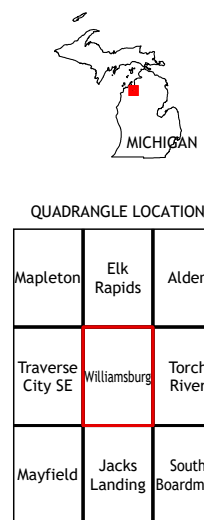
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NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR SMOOTHNESS = Medium

USER DEFINED CONTENT



WILLIAMSBURG, MI
2026

ADJOINING QUADRANGLES

2.6 Existing Water Supply System

2.6.1 Water Supply and Treatment

2.6.1.1 Raw Water Pumping and Intake

The City treats water from the east arm of Grand Traverse Bay in Lake Michigan. The Low Service Pump Station (LSPS) is located on Eastern Avenue pumps water from a 36-inch diameter raw water intake pipe and crib structure (located 4,000 feet offshore) to the Water Treatment Plant. The station is a 38-ft diameter circular caisson with a split wet well and a total of four vertical turbine pumps. Low Service Pumps No. 1, 2, and 4 are constant speed pumps, and pump No. 3 motor was replaced in 2019 and operates on a VFD and the speed is controlled to vary the raw water flow rate to the WTP. The pumps discharge to a single 30-inch cast-iron raw water main along Eastern Avenue.

2.6.1.2 Rapid Mix and Flocculation

Raw water entering the treatment plant flows through the 30-inch pipe in the lower level. Raw water is measured by a single 18-inch magnetic flow meter installed in 2015. The single 30-inch line splits into two 24-inch pipes that are installed in parallel, each equipped with inline mixers. Ferric sulfate is applied before each of the mixers. The water then flows to two flocculation basins each having a center draft tube and variable speed flocculator (mixer). The flocculation tanks provide 27 minutes of detention time at their rated capacity of 10 mgd each (20 mgd total). A circular weir launder controls the water surface within the tanks and discharges the flow to a 36-inch pipe before it is applied to the filters.

2.6.1.3 Filtration

Filtration is provided by five filters and each is rated for 4 mgd at a filtration rate of 4 gallons per minute (gpm) per square foot (sf). Each filter is comprised of two 14-ft by 25-ft cells configured for simultaneous normal operation and individual surface wash and backwash. Filters 4 and 5 were rehabilitated in 2014 and equipped with HDPE underdrains with four layers of gravel for an overall depth of 9-inches for media support. 30 inches of dual media is comprised of 18-inches of sand and 12-inches of anthracite. Each cell contains two rotating surface wash assemblies. Filters 1, 2, and 3 currently have clay block and gravel for media support, and the underdrains are scheduled to be inspected and rehabilitated in 2021-2022. The gravel and sand media and the influent, surface wash, backwash drain, filter effluent, and backwash supply valves for Filters 1, 2, and 3 were replaced in 2021-2022.

The filtered water production is monitored and controlled by a dedicated rate of flow controller connected to SCADA. Individual filter effluent turbidity is monitored, and each filter console provides monitoring and control for washing of its associated filter(s). Three filter consoles are located on the filter operating level. The original consoles were constructed in 1964 for Filters 1 and 2. Filter 3 console was installed in 1973 and Filter 4 and 5 consoles were constructed in 1993 and replaced in 2024.

A surface wash pump provides suitable supply and pressure to rotate the pair of surface washers in each bay. The surface wash pump is rated at 225 gpm at 176 feet TDH. There is no redundant supply, but the pump was replaced in 2024.

The filters are backwashed by closing the filter effluent valve and opening the wash water supply and backwash drain valves for each cell. The backwash water is supplied by the filter backwash pump, which is rated at 8,000 gpm at 40-ft TDH. Backwash water can also be supplied by a 14-inch line from the high service pump station efflux using the filter backwash control valve located in the basement level. The filters are backwashed when the filter head loss is at 8.5 to 10 feet. Filters are typically washed for 10 to 15 minutes at 3,000 to 4,000 gpm. The average run time between backwashes is 80 to 100 hours in the winter and 40-60 hours in the summer. Typically, up to 75,000 gallons are used per filter backwash. The monthly average backwash volume ranges from 71,928 gal during low demand periods up to 275,374 gal during higher demand summer months.

Filter piping is in the filter gallery on the lower level of the WTP. Each filter is served by a total of nine (9) valves; one modulating valve for filter rate control and eight that are in either the open or closed position. Pneumatic valve actuators serve Filters 1, 2, and 3 and electric valve actuators serve Filters 4 and 5. Filters are flow-paced based on magnetic flow meter information. Filter-to-waste capability is provided for Filters 4 and 5. There is no filter-to-waste currently available on Filters 1, 2, and 3.

2.6.1.4 Clear Wells and Treated Water Reservoir

Filtered water flows to two clear wells located beneath Filters 1, 2, and 3. One clear well is below Filters 1 and 2 and the other clear well is below Filter 3. Filters 4 and 5 can be piped to either of the clear wells. From the clear wells, the water passes through piping where fluoride is applied before entering the 1.5-million-gallon rectangular storage reservoir which is partially below grade and located south of the WTP building. Chlorine can also be applied near the fluoride application point. The reservoir is baffled to provide suitable contact time to achieve satisfactory disinfection contact time. Water exiting the treated water storage reservoir flows through a 36-inch finished water main to the high service pump suction well. A separate 12-inch finished water main feeds the Huron Hills Pump Station suction well.

2.6.1.5 Chemical Feed

Coagulant

The WTP uses ferric sulfate as its primary coagulant which replaced the original equipment which fed aluminum sulfate (alum). This system, which was installed in 2017, is equipped with three 1000-gallon double-walled fiberglass storage tanks, three metering pumps, and a 100-gallon day tank and scale. The ferric bulk storage provides sufficient storage for a minimum of 30 days at maximum daily demand. The storage tank valves are manually opened to fill the 100-gallon day tank. Coagulant aids such as polymers are not used.

Fluoride

The WTP feeds hydrofluosilicic acid using a feed system that consists of two 1000-gallon double-walled fiberglass storage tanks, one transfer pump, one 100-gallon day tank, and a metering pump. The storage tank and day tank have sufficient storage for maximum daily demands.

Disinfection

The WTP feeds sodium hypochlorite using a feed system including two 8,200-gallon bulk storage tanks, two transfer pumps, a 450-gallon day tank with scale, and three metering pumps. Chlorine is fed to several locations in the WTP including the raw water intake for zebra mussel control.

Antiscalant

The WTP adds sodium hexametaphosphate to prevent calcification within the disinfection feed piping. The sodium hexametaphosphate feed system is comprised of a batch tank and chemical pump located in the chlorine room.

2.6.1.6 Wash Water and Sludge Lagoons

Two lagoons are used for wash water and sludge waste from the filter backwash and flocculation tank drain water. The two lagoons are approximately 61,000 cubic feet and 66,000 cubic feet respectively. The water is decanted and the decant drains by gravity through an 8-inch drain to a 5-ft diameter sump in the WTP basement. There are two sump pumps which return discharge to the storm sewer on Eastern Avenue with an NPDES permitted outfall to East Bay. These sump pumps were replaced in 2015 and 2017 and are each rated for 500 gpm. Sodium thiosulfate is added to dechlorinate the discharge per the NPDES permit.

2.6.1.7 High Service Pumping

The High Service Pump Station (HSPS) pumps treated water from the WTP to the distribution system from two wet wells which are connected to the Finished Water Storage Reservoir. The HSPS has five vertical turbine pumps which discharge to two 24-inch water mains that connect to the 30-inch water main on Eastern Avenue. A surge relief valve is provided on the discharge main for surge protection. The flows in each water main are measured using 18-inch magnetic flow meters which were installed in November 2015.

2.6.1.8 Plant Capacities and Redundancy

A summary of the current unit processes is provided in Table 2-4.

Table 2-4. Unit Process Capacities

Unit Process	Total Capacity (mgd)	Firm Capacity (mgd)	Basis of Capacity
Intake	24.0	24.0	Max head loss
Low Service Pump Station	27.6	19.7	Pump test (2020)
Flocculation Tanks	20.0	20.0	30 min residence time
Filters	20.2	20.2	Filter rate 4 gpm/sf
Clearwell/Reservoir	38.2	38.2	Capacity to maintain $C \cdot T = 61$
High Service Pump Station	27.4	19.9	Pump test (2015)
Lagoons	32.0	32.0	3% of Design Flow (0.95 mgd)

2.6.2 Storage Facilities

The City's water system includes four ground level finished water storage tanks. These include the one water storage tank at the WTP having a total of 1.5 million gallons (mgal) of storage, two water storage tanks located on LaFranier Road south of South Airport Road with a total of 6.0 mgal of storage, and Wayne Hill tank with 1.3 mgal of storage. The recent 2024-25 Wayne Hill booster pump suction upgrades added the foot valve in the tank to allow additional draw down to less than 7 foot tank depth, possibly to 2 foot, the available volume in the Wayne Hill tank is now increased to about 1.1 mgal from 0.67 mgal. The Barlow and Wayne Hill tanks are located at higher elevations within the City and essentially function as elevated tanks, providing the required pressure of the Central PD-1 distribution system. Several other tanks provide storage for separate pressure districts in the City, Garfield Township, and Peninsula Township. The total available storage in the City is 7.17 mgal.

2.6.3 Water Distribution Piping

The City's water distribution system provides water service for potable use and fire flow throughout the City's service area. The system comprises 660,340 feet (125 miles) of water main and approximately two-thirds of the system is cast iron and the majority of the water mains were constructed in the 1960s and prior. New ductile iron mains have been installed since the 1980s.

2.6.4 Pressure Districts and PRVs

The City's water system operates in eight pressure districts with several incorporated into the surrounding Township's pressure districts. The pressure districts are controlled by the ground storage tanks, booster pump stations, and various pressure reducing valves (PRVs). These districts are summarized in Table 2-5.

Table 2-5. City Pressure Districts

District ID	District Name	HGL (ft)	Controlled by:
PD-1	Central	750	Barlow and Wayne Hill Tanks
PD-2	Morgan Farms/Incochee	825	Control Valves WCV-1341, WCV-1328, WCV-1329
PD-3	Incochee Upper	875	PRV at Wayne Hill Booster Station, WCV-1300
PD-4	Wayne Hills Upper	1000	Wayne Hill Booster Pumps
PD-5	Huron Hills Lower	850	Huron Hills PRV WCV-7
PD-6	Timber Lane	875	Timber Lane PRV WCV-8
PD-7	Huron Hills Upper	920	Huron Hills Booster Station
PD-8	Veterans Drive (from Garfield)	875	McRae Hill PRV (Garfield Township)

Pressure District PD-1 is the main pressure district in the City and encompasses most of the service area within the City limits as well as lower elevations of Elmwood, Garfield, and Peninsula Townships. This district's pressure is maintained by the Barlow and Wayne Hill ground storage facilities and has an operating hydraulic grade line (HGL) of 750 feet. Three other pressure districts are maintained by the Wayne Hill Booster Station (described below). PD-4 is maintained at an HGL of 1000 feet to service customers on Wayne Hill. Pressure District 3 (PD-3) is currently maintained at an HGL of 885 feet using a pressure sustaining valve (PSV) that down-feeds from PD-4 located at the Wayne Hill Booster Station (WCV-1300). The lower pressure district, PD-2, is maintained at

an HGL of 825 feet using PSVs: WCV-1328, WCV-1329, and WCV 1341 that are down-fed from PD-3 through. A Pressure Regulating Valve (PRV) located at M-72 (WCV 1340) is also used to supplement fire flows to the City's main pressure district PD-1 for the far northwest portion of this district.

Three higher pressure districts in the City limits are controlled by the Huron Hill Booster Station system. This station feeds the intermediate pressure district in the southern portion of Peninsula Township (HGL = 920 feet) as well as higher elevations in the City adjacent to the Township including Pressure District PD-7 (HGL = 920 feet), PD-6 (HGL=875 feet), and PD-5 (HGL=850 feet). Two City PRVs downfeed from PD-7 to maintain pressures in districts PD-5 and PD-6. Pressure District PD-6 is maintained by WCV-7 (HGL = 875 feet) and Pressure district PD-5 is controlled by WCV-8 (HGL = 850 feet). Check valves in the lower elevations of these districts are installed at the boundaries of district PD-1 to maintain minimum system pressures in these districts during extreme conditions or during interruptions of supply in the higher elevation districts.

One pressure district (PD-8) is back-fed from Garfield Township (Veteran's Drive Pressure District) to the City, east and west of Veterans Dr. south of Boughey Drive and operates at an HGL of 875 feet. Check valves in the lower elevations of PD-8 are installed near the boundaries of district PD-1 to maintain minimum system pressures in PD-8 during extreme conditions or during interruptions of supply from the higher districts.

2.6.5 Booster Stations

The City operates two major booster stations, the Huron Hill Booster Station at the WTP and the Wayne Hill Booster Station located adjacent to the Wayne Hill Storage Tank.

2.6.5.1 Huron Hills Booster Station

The Huron Hills Booster Station is located at the WTP and consists of three vertical turbine pumps that draw from the WTP storage reservoir. Backup power is provided by the 700 kW WTP generator. Two 720-gallon pressurized bladder tanks are installed on the pump discharge piping and are set to 100 psi.

This booster station feeds the southern portion of the Peninsula Township intermediate district including the Peninsula Booster Station that draws from the adjacent 0.3 mgal Peninsula Storage Tank. This station and tank are owned and operated by Peninsula Township. This tank has a 6-inch actuated valve that opens and closes to regulate the tank level and four pumps (one jockey, two larger pumps, and one large fire pump) that are used to boost the pressures to the upper-pressure district in Peninsula Township. A 2-inch hydraulically actuated valve is used to back feed from the upper district to PD-7 if the pressure falls below 40 psi. The 6-inch fill valve to the tank is controlled such that the 2-inch back feed valve does not open simultaneously and overflow the tank.

2.6.5.2 Wayne Hills Booster Station

The Wayne Hill reservoir and pump station were originally constructed in 1945. This 1.3 mgal reinforced concrete reservoir is maintained approximately 5-10 feet lower than the two Barlow Tanks of PD-1. Accordingly, the fill line contains an electrically actuated control valve to limit the tank from over-filling. The tank was originally constructed to provide additional fire flow storage for the western portion of PD-1. In the early 1960s, the reservoir fill valve vault was enlarged, and a building was constructed. Booster pumps were installed in the building on the suction side of the reservoir drain line to provide pressure to a relatively high portion of the northwestern section of the City that was too high to be served by PD-1. This initial upper-pressure district was

also provided with a steel hydro-pneumatic storage tank including a compressor to provide some storage for this small pressure district.

In 2006, this district was expanded to the north to provide service to some additional areas within the City and neighboring Elmwood Township which were still too high to be serviced by the main pressure district (PD-1) but were lower than the initial area serviced by the Booster Pumps and hydropneumatics tank. Since these areas of the upper district were slightly lower, pressure reducing valves were provided to drop the pressure from the original Wayne Hill district down into the lower districts. This area is broken into three distinct pressure districts designated as PD-2, PD-3, and PD-4.

When the Wayne Hill District was first expanded, the original booster pumps and the hydro-pneumatic tank were demolished. The current pumping station includes a prefabricated skid-mounted pump station with three vertical multistage centrifugal booster pumps and two bladder tanks to provide a storage cushion between pump cycles. All the flow from the station is pumped to the pressure of PD-4 (HGL = 1000 feet) before splitting to the lower pressure districts. A pressure reducing valve down feeds a portion of the flow from PD-4 to PD-3 (HGL = 875 feet) within the station. PD-2 (HGL = 825 feet) is down-fed from PD-3 using remote PRVs located in the system. Backup power is provided by a 275-kW generator.

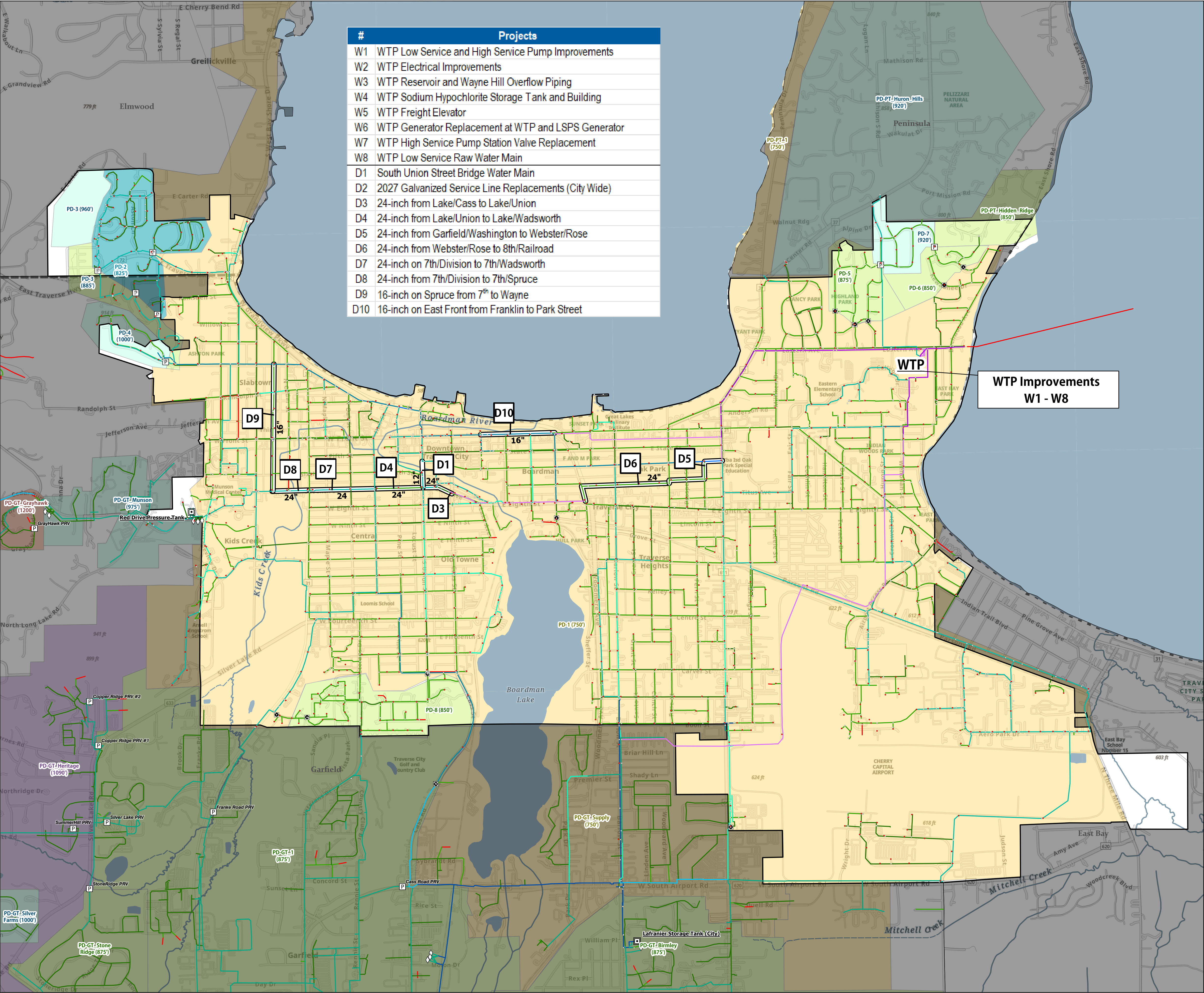
As part of the 2006 improvements, a 12-inch main was added along Wayne Street to provide a loop in this pressure district (now PD-4). This 12-inch main has been alleged to be causing some of the difficulties in the loss of pressure when hydrants are opened since water can more rapidly flow to the hydrant. The higher-pressure district service area (PD-4) supplied by this station experiences pressure issues at the highest elevations of Wayne Hill during hydrant openings that include temporary pressure drops in system pressure (to near atmospheric). To minimize the potential for these transient pressure issues, EGLE recommended that the City partially close many of the hydrant isolation gate valves to limit the hydrant flow in this service area.

The pumps were replaced in 2024 to provide better fireflow at the required system head pressure. A combination pressure/sustaining valve was installed to ensure the pressure in PD-4 is maintained above the pressure setpoint which reduces a pressure loss scenario during fireflow in the lower pressure districts. Other improvements included the installation of a foot valve to allow for use of the reservoir at lower water elevations than the centerline of the new pumps.

3 *Alternative Analysis*

3.1 *Alternatives Considered*

Each project was assessed to follow one of the following alternate classifications. Each upgrade or rehabilitative method was chosen on a technical basis and cost comparisons are presented for each alternative analysis, where applicable. Figure 3-1 shows the overall locations of these projects in the City and Figure 3-2 depicts the scope of work for the proposed projects at the WTP.



#	Projects
W1	WTP Low Service and High Service Pump Improvements
W2	WTP Electrical Improvements
W3	WTP Reservoir and Wayne Hill Overflow Piping
W4	WTP Sodium Hypochlorite Storage Tank and Building
W5	WTP Freight Elevator
W6	WTP Generator Replacement at WTP and LSPS Generator
W7	WTP High Service Pump Station Valve Replacement
W8	WTP Low Service Raw Water Main
D1	South Union Street Bridge Water Main
D2	2027 Galvanized Service Line Replacements (City Wide)
D3	24-inch from Lake/Cass to Lake/Union
D4	24-inch from Lake/Union to Lake/Wadsworth
D5	24-inch from Garfield/Washington to Webster/Rose
D6	24-inch from Webster/Rose to 8th/Railroad
D7	24-inch on 7th/Division to 7th/Wadsworth
D8	24-inch from 7th/Division to 7th/Spruce
D9	16-inch on Spruce from 7 th to Wayne
D10	16-inch on East Front from Franklin to Park Street



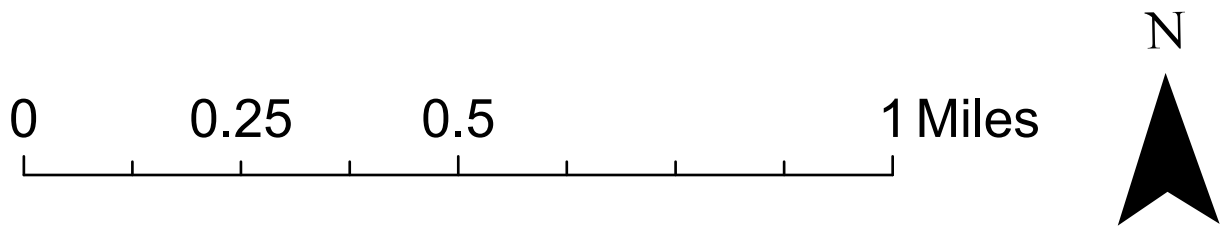
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

1925 Breton Road SE Suite 100
Grand Rapids, MI 49506

Phone: (616) 454-4286

WEBSITE: <http://www.hrcengr.com>

Legend



- Traverse City Boundary

Outside City Limits

County Boundary

Water Pump

Water Tank

PRV

Hydrant

System Valve

Recommended Project

6"

Water Main

8"

WM Diameter

10"

12"

14"

16"

18"

20"

24"

30"

No Data

750

Pressure Districts

751-825

HGL

826-884

885-1000

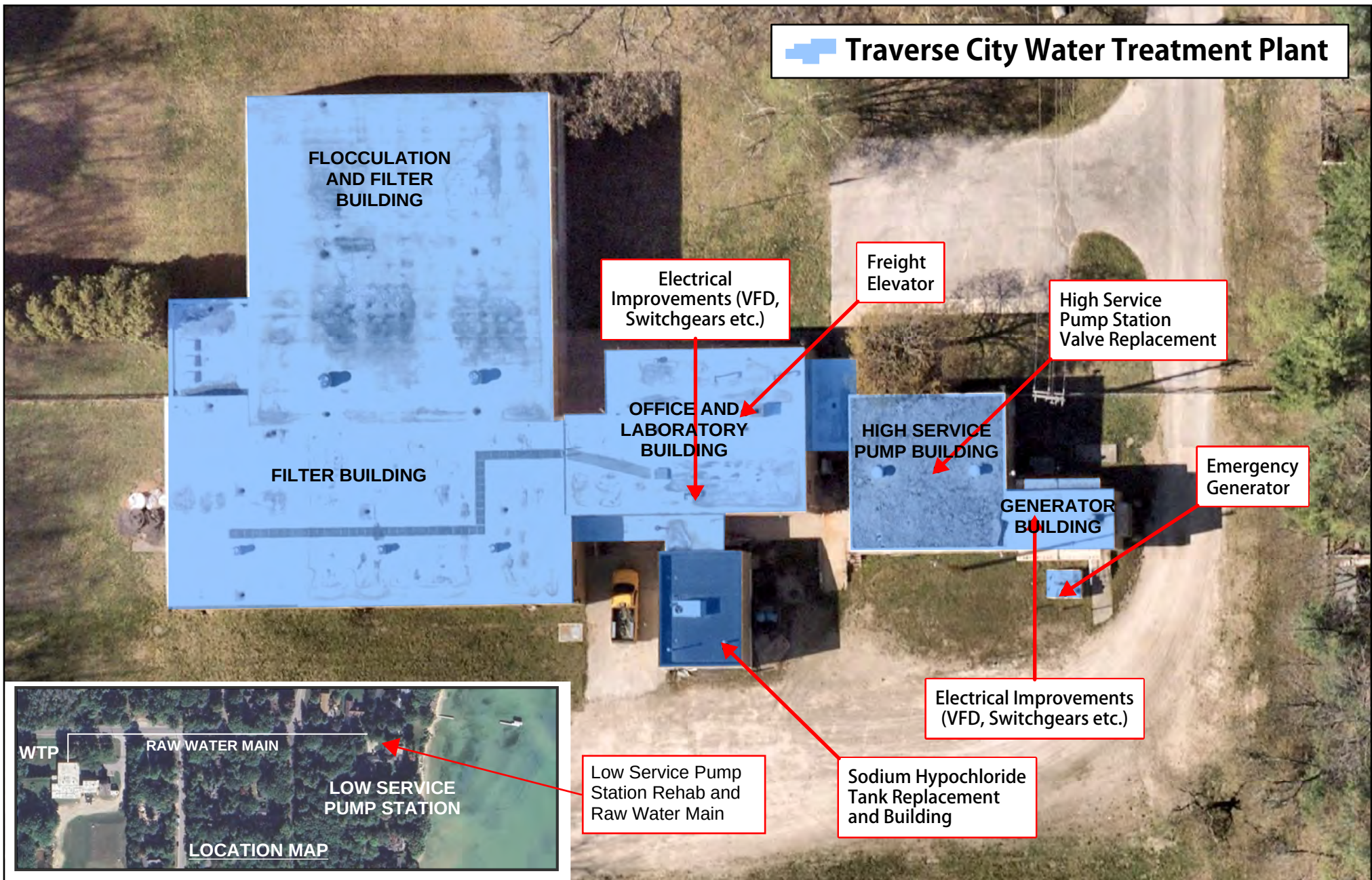
1001-1090

1090-1200
- DRAWN: KLH CHECKED: DIU
- DWSRF Project Plan
City of Traverse City
Recommended Improvements
- HRC Job No.
20260066

SCALE: AS SHOWN

June 2026

FIGURE 3.1



Traverse City

2026 DWSRF Project Plan

Water Treatment Plant Proposed Improvements

June 2026
HRC Job No. 20260066
FIGURE 3.2

HRC
HUBBELL, ROTH & CLARK, INC
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3.2 No Action

The “No-Action” alternative is not an option as it fails to meet the requirements of the Michigan Safe Drinking Water Act (MI-SDWA) and the mission and goals of the City to provide safe and clean water to its customers.

3.3 Regional Alternatives

The Regionalization alternative examines the feasibility of connecting the City’s Drinking Water Distribution System to a regional water supply to service the existing water demands of the study area. The Traverse City WTP service area includes the City as well as customer communities for Garfield Township, Peninsula Township, and Elmwood Township. The adjacent East Bay Township is already served by a water treatment plant that is at higher hydraulic grade line (pressure) and different quality than Traverse City with a groundwater source. Incorporating this community is therefore not feasible. The City’s water is currently supplied by Grand Traverse Bay and provides the City of Traverse City with sufficient capacity to meet the City’s water needs and all nearby facilities also obtain their water supply from Grand Traverse Bay. Additionally, the work proposed as part of this Project Plan is addressing site specific issues in which regional solutions are not necessary or applicable. Whether the water services to be replaced or material verified are supplied by the current system or an alternative system is irrelevant. Thus, there are no regional alternatives to be evaluated.

3.4 Water Treatment Plant Improvements

3.4.1 WTP Pump Rehabilitation/Replacement

The existing Low Service and High Service Pumps are reaching the end of their service lives. Pump rehabilitation or full replacement is required to ensure the pumps can provide the required system flows. This will improve the pump efficiencies and therefore reduce the required electrical loads.

3.4.2 WTP Electrical Improvements

The existing starters at both the HSPS and LSPS variable frequency drives (VFDs) would be replaced with VFDs to allow for variable speed operation and better electrical efficiency, high service pump station, and low service pump station electrical switchgears need to be replaced to ensure reliability for the operation and control of the WTP.

Replacing LSPS pumps number 1 and 2 with higher capacity pumps and operating on VFDs would provide additional capacity while allowing the pumps to vary the raw water flow rate for lower demand conditions. This includes the construction of a new 750 kW generator for the WTP as well as an automatic transfer switch.

3.4.3 WTP Reservoir and Wayne Hill Overflow Construction

This alternative includes the construction of overflow piping at the existing WTP Reservoir and the Wayne Hill Reservoir. In both reservoirs, a new overflow pipe would be installed inside the tanks using an elbow in the vertical and discharge to a buried overflow pipe. The pipes would discharge through an overflow structure equipped with a flap gate and screen or duckbill type outlet. This project addresses the Deficiency Violation Notice from the Sanitary Survey dated November 29, 2024.

3.4.4 WTP Sodium Hypochlorite Storage Tank and Building Improvements

This project includes the replacement existing sodium hypochlorite storage tanks as well as the transfer pumps, piping, and fill lines. The existing fiberglass bulk storage tanks have reached the end of life and require frequent repairs. Leakage beneath the tank has caused damage to the concrete tank pads which increases the safety risks associated with sodium hypochlorite. Two new 8,100 gallon polyethylene tanks would be installed and the new concrete pads and floor would be coated with a high performance chemically resistant coating.

3.4.5 WTP Freight Elevator

The existing freight elevator at the WTP provides the ability to transport bulk items within the WTP main building. This project would include the replacement of the existing car and hydraulics.

3.4.6 WTP Generator Replacements and LSPS Generator

This includes the construction of a new 750 kW generator for the WTP as well as an automatic transfer switch. Included in this construction are the concrete pads and site work associated with the new generator which will replace the current 750 kW generator at the WTP. Additionally, a new standby generator (approximately 350 kW) would be installed at the Low Service Pump Station. Standby power at this station is provided by a portable generator and a permanent installation would ensure higher reliability of pumping raw water to the WTP during power failures.

3.4.7 WTP High Service Pump Station Valve Replacement

The four existing high service pump station control valves are cone valves with associated hydraulic controls that are experiencing mechanical failures due to the equipment age. The existing control valve for pump #5 is an actuated plug valve that is operating effectively. Four new control valves and isolation butterfly valves would be replaced with this project.

3.4.8 WTP Low Service Pump Station Raw Water Main Replacement

The Low Service Pump Station capacity represents the limiting factor to the City's water supply capacity. HRC evaluated the installation of a secondary 30-inch water line parallel to the existing 30-inch water line from the LSPS to the raw water flow meter. The second raw water line would also provide a redundant raw water supply to the WTP.

3.5 *Distribution System Improvements*

3.5.1 LCR Service Line Replacement

Due to the changes implemented in June of 2018 to the Michigan Lead and Copper Rule (LCR) within the Safe Drinking Water Act 399 of 1976, the City of Traverse City is required to complete full water service line replacements where lead and galvanized water services exist from the existing water main or newly installed water main into the existing dwelling for each property regardless if the service line is on public or private property.

The changes to the LCR requirements effective in June of 2018 require communities to replace all lead and galvanized service lines at an average of 5-percent per year beginning in 2021, not to exceed 20 years, or in accordance with an alternative schedule incorporated into a drinking water asset management plan and approved by EGLE.

As of May 2026, the City has completed the replacement of 591 service lines with 118 service lines to be replaced in 2026. An estimated 50 service lines are remaining to be replaced in 2027.

3.5.2 Water Main Construction

The evaluation of the existing water system capacity concludes that redundancy and reliability improvements are recommended to replace aging and undersized water mains through the following projects over the next five years.

1. South Union Street Bridge Water Main
2. 2027 Galvanized Service Line Replacements
3. 24-inch from Lake/Cass to Lake/Union (Installed in 1965, 8-inch and 12-inch cast iron)
4. 24-inch from Lake/Union to Lake/Wadsworth (Installed in 1965, 6-inch cast iron)
5. 24-inch from Webster/Rose to 8th/Railroad (Installed in 1954, 16-inch cast iron)
6. 24-inch from Garfield/Washington to Webster/Rose (Installed in 1954-1964, 18-inch cast iron)
7. 24-inch from 7th from Wadsworth to Division (Installed in 1998, 12-inch ductile iron to remain)
8. 24-inch from 7th/Division to 7th/Spruce (Installed in 1930, 6 to 12-inch cast iron)
9. 16-inch on Spruce from 7th to Wayne (Installed in 1966, 6-inch cast iron)
10. 16-inch on East Front from Franklin to Park Street (Installed in 1930, 18-inch cast iron)

There is no practical alternative to accomplish the same outcome. Replacing and upsizing the above-mentioned distribution mains advances the proper resolution of the pressure and reliability problems throughout the distribution system. The occurrence of improved fire protection capabilities because of these water main replacements is a secondary benefit.

3.6 Cost of Alternatives

The costs of the improvements detailed previously are shown in Table 3-1 by Fiscal Year.

Table 3-1. Summary of SRF Projects (by Fiscal Year)

Projects	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031
WTP Low Service and High Service Pump Improvements	\$1,260,000				
WTP Electrical Improvements	\$2,290,000				
WTP Reservoir and Wayne Hill Overflow Piping	\$500,000				
WTP Sodium Hypochlorite Storage Tank and Building Improvements		\$510,000			
WTP Freight Elevator		\$450,000			
WTP Generator Replacement at WTP and LSPS Generator		\$1,020,000			
WTP High Service Pump Station Valve Replacement			\$455,000		
WTP Low Service Raw Water Main			\$1,275,000		
South Union Street Bridge Water Main	\$700,000				
2027 Galvanized Service Line Replacements (City Wide)	\$530,000				
24-inch from Lake/Cass to Lake/Union		\$860,000			
24-inch WM Lake/Union to Lake/Wadsworth		\$1,460,000			
24-inch WM Garfield/Washington to Webster/Rose			\$2,460,000		
24-inch WM Webster/Rose to 8th/Railroad				\$3,950,000	
24-inch WM 7th/Division to 7th/Wadsworth					\$1,480,000
24-inch WM 7th/Division to 7th/Spruce					\$1,140,000
16-inch WM Spruce/7th to Spruce/Wayne					\$2,280,000
16-inch WM East Front: Franklin to Park					\$1,380,000
TOTAL ALL PROJECTS	\$24,000,000				

3.7 Impacts of Alternatives

The recommended alternatives include improvements listed in the above projects which are a mixture of work at the Water Treatment Plant (WTP) and Distribution System. The long and short-term impacts of the alternatives are described in Section 5.

4 Selected Alternatives

4.1 Proposed Improvements

4.1.1 Proposed Water Treatment Plant Improvements

The following projects noted in Table 4-1 are the proposed WTP improvements under this Project Plan.

Table 4-1. Fiscal Year of WTP Projects

Project	Fiscal Year
WTP Electrical Improvements	2027
WTP Low Service and High Service Pump Improvements	2027
WTP Reservoir and Wayne Hill Reservoir Overflow Piping	2027
WTP Sodium Hypochlorite Tank and Building Improvements	2028
WTP Freight Elevator	2028
WTP Generator Replacement	2028
WTP High Service Pump Station Valve Replacement	2029
WTP Low Service Raw Water Main	2029

The design period of each project phase is estimated start in the year prior to the project fiscal year. The projects would be advertised and bid upon receipt of all the necessary permits. The general schedule would follow the consecutive phases, and specific, dates would be adjusted to meet the DWSRF Financing and Milestone Schedules adopted for each year of the project.

4.1.2 Proposed Distribution System Improvements

The following projects noted in Table 4-2 are the proposed distribution system improvements under this Project Plan.

Table 4-2. Fiscal Year of Distribution System Projects

Project	Fiscal Year
South Union Street Bridge Water Main	2027
2027 Galvanized Service Line Replacements (City Wide)	2027-2031
24-inch from Lake/Cass to Lake/Union	2028
24-inch on Lake/Union to Lake/Wadsworth	2028
24-inch from Garfield/Washington to Webster/Rose, (Phase 5A)	2029
24-inch from Webster/Rose to 8 th /Railroad, (Phase 5B)	2030
24-inch from 7 th St between Division and Wadsworth	2031
24-inch from 7th/Division to 7th/Spruce	2031
16-inch from Spruce from 7 th to Wayne St.	2031
16-inch from East Front from Franklin to Park Street	2031

The water main replacement projects could be designed and constructed as individual projects or combined into one phase of projects for each fiscal year. The City has an approximately 16.4% water loss in its system and much of the older cast iron mains are over 60 years old. These older pipes contribute to the risk of water reliability concerns and water mains breaks which can compromise system water quality. Areas of low flow due to smaller pipe size and reduced friction factors associated with older pipe can cause safety concerns from reduced fire flows. Implementing the water main replacements recommended in the 2020 Water System Reliability Study will address the reliability, quality, and safety concerns. The hydraulic modeling of the water system demonstrates that the new 16-inch and 24-inch water mains will improve system flows especially to maintain the storage levels of the Wayne Hill Reservoir.

4.2 Design Parameters

The proposed WTP improvements will be installed to meet the Michigan Safe Drinking Water Act 399 requirements as well as the City's design standards and Recommended Standards for WaterWorks (Ten States Standards).

The proposed water mains will be installed to meet the Act 399 requirements and the City of Traverse City design standards for water distribution system.

4.3 Water Main Installation and Materials

The installation methods for the water main replacement projects will primarily be completed using open cut methods. The site conditions may dictate other methods of replacement to accommodate the public and environment and construction efficiencies. Open-cut methods will be implemented to coordinate with street paving activities. Horizontal directional drilling (HDD) may be used in applications with the appropriate clearances to underground utilities is provided and where there are limited service connections, tees, bends and other fittings along a particular length of main.

New water mains will be AWWA C151 ductile iron pipe, Thickness Class 52 or Pressure Class 250 or 350 in accordance the City's standards. If used, pipe installed by HDD methods would be AWWA C906 HDPE with a minimum DR11 wall thickness.

4.4 LCR Service Line Replacement

Due to the changes implemented in June of 2018 to the Michigan Lead and Copper Rule (LCR) within the Safe Drinking Water Act 399 of 1976, the City of Traverse City is required to complete full water service line replacements where lead and galvanized water services exist from the existing water main or newly installed water main into the existing dwelling for each property regardless if the service line is on public or private property. Based upon analysis of the water mains service lines required to be replaced as they are identified according to the EGLE guidance and regulations for the full replacement of the service line.

The changes to the LCR requirements effective in June of 2018 require communities to replace all lead and galvanized service lines at an average of 5-percent per year beginning in 2021, not to exceed 20 years, or in accordance with an alternative schedule incorporated into a drinking water asset management plan and approved by EGLE. The majority of the service lines in the City required to be replaced are galvanized.

4.5 Proposed Schedule

Table 4-3 below shows the completed Project Plan submittal task dates.

Table 4-3. Project Plan Task Schedule

Project Plan Task	Scheduled Date
Draft Project Plan to EGLE	May 5, 2026
Public Hearing Notice	May 7, 2026
Formal Public Hearing	May 18, 2026
City Commission Resolution of Project Plan Adoption	May 18, 2026
Submit Final Project Plan to EGLE	June 1, 2026

4.6 Cost Estimate

The estimated total project cost for the proposed SRF projects is \$24,000,000. Detailed cost estimates for the distribution system improvements and WTP improvements are both shown in Appendix E. The estimated project costs do not incorporate any potential principal forgiveness the projects may be eligible for.

4.7 User Costs and Cost Sharing

The City of Traverse City Water Treatment Plant provides residential connections to City residents as well as residents from Elmwood, Garfield, and Peninsula Township. Table 4-4 denotes the number of residential connections for each that make up the total of 9,366 residential water connections.

Table 4-4. Residential Water Connections

Community	Residential Water Connections
City of Traverse City	6,621
Elmwood Township	46
Garfield Township	2,472
Peninsula Township	587
Total	9,366

The estimated costs for all proposed projects and fiscal years are presented below. User charges are developed and adopted by the City annually and these charges vary based on:

1. Actual operational maintenance costs
2. Future increases in water pricing
3. Allocation of funding for future capital improvements and system replacement

Table 4-5 presents a summary of the estimated user costs by Fiscal year which were developed based on the estimated capital costs for the proposed project costs over the next five fiscal years. The entire debt retirement will be allocated based on the water consumed. Fixed charges and other non-flow related fees may be adjusted based on the results of the project. The annual equivalent costs for the project are provided below. The estimated cost per resident was allocated as the proportion of the project impact on the residential connections in the townships

Table 4-5. Estimated User Cost Summary by Phase

Descriptions	FY2022	FY2023	FY2024	FY2025	FY2026	Total
Total Phase Project Cost	\$5,280,000	\$4,300,000	\$4,190,000	\$3,950,000	\$6,280,000	\$24,000,000
Interest Rate	3.0%	3.0%	3.0%	3.0%	3.0%	
Term (years)	20	20	20	20	20	
No. of Residential Connections	9,366	9,366	9,366	9,366	9,366	
Total Annual Debt Repayment	\$354,900	\$289,100	\$281,700	\$265,600	\$422,200	\$1,613,500
Total Annual Debt Repayment, Residential*	\$230,685	\$187,915	\$183,105	\$172,640	\$274,430	\$1,048,775
Total Monthly Cost for Project per Residential Connection	\$2.05	\$1.67	\$1.63	\$1.54	\$2.44	\$9.33
Total Cost of Loan	\$7,098,000	\$5,782,000	\$5,634,000	\$5,312,000	\$8,444,000	\$32,270,000
Interest Paid	\$1,818,000	\$1,482,000	\$1,444,000	\$1,362,000	\$2,164,000	\$8,270,000

*Notes:

1. Assumes interest rate of 3.0%, pricing in 2026 dollars with 30% contingency
2. Assumes 65% residential contribution to fund (estimated per water billing records)
3. As of April 2026, 6,261 residential connections in Traverse City and 3,105 residential connections from Townships

4.8 Authority to Implement Selected Alternative

Implementation of the proposed project assumes that the project will be financed by a low-interest loan from the SRF program. The City of Traverse City has the necessary legal, institutional, financial, and managerial resources available to ensure the construction, operation, and maintenance of the proposed facilities.

Most of the water main replacements will occur in the City road right-of-way but portions of the proposed project will occur in the road right-of-way under the jurisdiction of the Michigan Department of Transportation (MDOT). MDOT jurisdiction includes US-31 and during the construction plan development the necessary MDOT permits will be acquired.

5 *Environmental Impacts*

5.1 *General*

The anticipated environmental impacts resulting from the construction of the selected plan include beneficial & adverse, short term & long term, and irreversible impacts. The following is a discussion of the environmental impacts of the selected plan.

5.1.1 Beneficial and Adverse Impacts

The WTP is the City of Traverse City's drinking water treatment facility. The WTP provides drinking water to all commercial and domestic (residential) residents. Drinking water to homes and businesses is conveyed from the WTP after being treated from the City's raw water supply from an intake structure from the east arm of Grand Traverse Bay (East Bay). Without the diligent work of WTP employees to operate and maintain the facilities, the clean water would not be distributed throughout the City and associated townships.

Construction activities associated with the proposed WTP improvements and Drinking Water Distribution System improvements will take place on the existing facilities. Construction and equipment manufacturing related jobs would be generated, and local contractors would have an equal opportunity to bid on the construction contracts.

The environmental impacts for each alternative are expected to be minimal to none. All elements of improvement efforts in this project aim to have the least impact possible on the community and environment. No long-lasting impacts are expected for any alternative. Implementation of the Project Plan would create temporary disruption due to required construction. This includes noise and dust generated by the work and possible erosion of soils from open excavation. The assessment of alternate solutions and sites for the proposed project included identification of any important resources of either historic or environmental value which are protected by law and should be avoided.

No registered contamination sites were found within the WTP projects using the EGLE site contamination online mapper tool. One site may be impacted with the construction of water main on East Front Street. Documentation of the research of the can be found in Appendix F.

5.1.2 Short-Term and Long-Term Impacts

The short-term adverse impacts associated with construction activities would be minimal, and mitigatable, in comparison to the resulting long-term beneficial impacts. Impacts from the Drinking Water Distribution System and WTP improvements include temporary site disturbance, temporary damage to surface vegetation, and temporary water shut-off for residents. All restoration required post-replacement should return the impacted area to existing conditions. No long-term negative impacts are anticipated.

The long-term positive impacts include upgrading failing infrastructure, compliance with MI-SDWA, improved efficiency at the plant, and the ability to continue providing adequate clean water throughout the City and associated townships. These impacts also include improved processing at the plant and reduced wear on the plant equipment.

5.1.3 Irreversible Impacts

The investment in non-recoverable resources committed to the Project Plan would be traded off for the improved performance of the facilities during the life of the system. The commitment of resources includes public capital,

energy, labor, and unsalvageable materials. These non-recoverable resources would be foregone for the provision of the proposed improvements.

Construction accidents associated with this project may cause irreversible bodily injuries or death. Accidents may also cause damage to or destruction of equipment and other resources.

5.2 *Analysis of Impacts*

5.2.1 Direct Impacts

Local Air Quality

There will be minimal direct impacts on local air quality during the construction phases of these projects. Any effects on air quality will be due to dust and emissions from construction equipment.

Archeological, Historical, or Cultural Resources

There are no impacts on archaeological, tribal, historical, or cultural resources due to this project. However, the appropriate affiliates will be contacted and informed about the project upon any changes in conditions.

Impacts Upon the Existing or Future Quality of Local Groundwater and Surface Waters

Construction will occur of the WTP site as well as throughout the Drinking Water Distribution System. No impact will be made to Grand Traverse Bay and surrounding waterways, but appropriate measures will be taken during construction to avoid impact to these neighboring bodies of water. All necessary permits will be obtained before the proposed activities. There are no impacts anticipated to the local groundwater.

Impacts Upon Sensitive Features

Since the work is expected to take place within the existing Drinking Water Distribution System and WTP facilities, the construction will take place outside of the designated floodplain, wetland areas, or other sensitive areas. Any work that takes place within floodplain limits, proper mitigation measures, and permits will be obtained before the proposed activities.

Impacts Upon People and The Local Economy

Short-term impacts on people will occur during the construction phase. Increased construction traffic will occur in the localized area of the WTP. The City of Traverse City and associated townships water users will experience beneficial long-term impacts due to the level of service to which they expect to be maintained by these improvements.

The local economy will be stimulated for contractors and suppliers of the materials, labor, and equipment necessary to construct the project.

Operational Impacts

The proposed projects will improve the operation efficiency of the WTP and lower future operation and maintenance (O&M) costs for the Drinking Water Distribution System.

5.2.1 Indirect Impacts

Changes in Rate, Density, Or Type of Residential, Commercial, or Industrial Development and the Associated Transportation Changes

No changes are anticipated to the above.

Changes in Land Use

No changes are anticipated to the above. All improvements to the WTP and the Drinking Water Distribution System will be completed on the existing WTP site and existing system facilities.

Changes in Air or Water Quality Due to Facilitated Development

There will be no changes to air quality due to development.

Changes to The Natural Setting or Sensitive Features Resulting from Secondary Growth

There should be no changes to the natural setting or sensitive features resulting from secondary growth.

Impacts on Cultural, Human, Social and Economic Resources

No changes are anticipated to the above.

Impacts of Area Aesthetics

All the proposed WTP work will be completed on the existing site which is largely isolated from public view and the Drinking Water Distribution System will be completed on existing structures which are mainly underground.

Resource Consumption Over the Useful Life of the Treatment Works, Especially the Generation of Solid Wastes

No changes are anticipated to the above.

5.2.1 Cumulative Impacts

Siltation

Siltation may occur during the construction phase of the project. Proper soil erosion and sedimentation control practices will be followed to reduce the impacts of siltation on surrounding areas.

Water Quality Impacts from Direct Discharges and Non-Point Sources

There should not be any impacts to the above as a result of this project.

Indirect Impacts from Development

There should not be development as a result of this project.

The Impacts from Multiple Public Works Projects Occurring in the Same Vicinity

There will only be short-term traffic impacts during the construction phase of this project and proper traffic control measures will be followed.

6 Mitigation

6.1 Short-Term, Construction Related Mitigation

Environmental disruption will occur during construction. Guidelines will be established for cover vegetation removal, dust control, traffic control and accident prevention. Once construction is completed those short-term effects will stop and the area will be returned to the original conditions.

The soil erosion impact would be mitigated through the contractor's required compliance with a program for control of soil erosion and sedimentation as specified in Part 91 of Michigan Act 451, P.A. of 1994. The use of soil erosion and sedimentation controls (i.e., straw bales, sedimentation basins, catch basin inserts, silt fencing, etc.) will protect the Boardman River, Boardman Lake, Kids Creek, and the Grand Traverse Bay.

Careful considerations will be taken during the construction planning process to ensure that the plant remains in service while the improvements are underway. Construction equipment will be maintained in good condition to decrease noise. All access roads will be swept as necessary to avoid tracking sediment onto public roads.

6.2 Mitigation of Long-Term Impacts

General construction activities will prohibit the disposal of soils in wetlands, floodplains, or other sensitive areas. Catch basins will be protected where earth-changing activities will take place.

6.3 Mitigation of Indirect Impacts

The current trend in Grand Traverse County and the City of Traverse City is that the land use is largely dominated by residential properties. According to the City of Traverse City's master planning for land use, this will not change. Considering that a vast majority of the residents within the City limits are connected to the water system, a substantial increase in flow is not expected from within the City limits.

The City of Traverse City's Master Plan and ordinances can also be found on their websites.

7 Public Participation

7.1 General

The Project Plan will be advertised in the local newspaper before May 7, 2026 (refer to Appendix G for all public participation documentation.) A copy of the Project Plan will be placed at the following location for review:

- City Hall
- Online at the City of Traverse City's Website

A formal public hearing will be held on May 18, 2026 to review the work associated with the proposed Project Plan. The hearing will review the information presented in the Project Plan, including estimated user costs and to receive comments and views of interested persons. Copies of correspondence related to agency notifications, as well as other relevant correspondence, will also be included in Appendix G.

7.2 Public Hearing

Appendix G will include a transcribed copy of the public hearing, commission members attendance list, the Project Plan resolution, comments received and answered, and a photocopy of the slides presented at the hearing.

7.3 Resolution

The City Commission made a formal resolution regarding this Plan at a Commission meeting following the public hearing scheduled for May 18, 2026. The resolution is included in Appendix G.



May 1, 2026

NESHAP Asbestos Program
Department of Environment, Great Lakes & Energy – Air Quality Division
P.O. Box 30260
Lansing, MI 48909-7760

Attn: Ms. Tammy Bell, Program Manager

Re: Impact Review
Drinking Water Improvements Program
City of Traverse City, Michigan

HRC Job No. 20260066

Dear Ms. Bell:

The City of Traverse City is submitting a Project Plan to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for acceptance into the Drinking Water State Revolving Fund (DWSRF) Loan Program. The Project plan requires a review to determine any potential impacts in the vicinity of the project.

On behalf of the City of Traverse City, we are requesting information regarding the impacts of the above referenced proposed project upon National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations. The project work will involve the following:

- ≡ Water Treatment Plan Improvements
 - WTP High Service Pump Station Improvements
 - WTP Electrical Improvements and WTP Generator Replacement
 - WTP Sodium Hypochlorite Storage Tank and Building Improvements
 - WTP Freight Elevator
 - WTP Low Service PS Improvements including Generator and Raw Water Main
 - Other facility and administrative improvements
- ≡ Distribution System Improvements
 - Watermain Replacements (multiple locations throughout City)
 - Galvanized Service Line replacements

The City's raw water supply is from an intake structure from the east arm of Grand Traverse Bay (East Bay). The City's original water supply was located near the City in West Bay in the 1890s and was relocated to East Bay, which is more protected from runoff and potential contamination sources, in 1965. Treatment is provided by a 20 million gallon per day (mgd) Water Treatment Plant (WTP) located in the City near the intake in East Bay. The WTP was converted to direct filtration in 1993 and is equipped with four low service pumps (raw water), two flocculators, five rapid sand filters, two clear wells, finished water storage, and five high service pumps (finished water). The service area location of the WTP is provided in the attached figures.

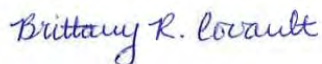
The proposed project site covers primarily commercial and residential areas. Excavations will be made in paved areas, primarily where water mains are preexisting. All land will be returned to pre-construction condition.

Since the proposed project does not plan for the removal of any building materials containing asbestos, no impacts are expected from the proposed project upon any NESHAP regulations. Should any asbestos or other hazardous material be encountered, proper precautions in accordance with State and Federal Regulation will be taken for handling and disposal. On behalf of the City of Traverse City, we are requesting a review to confirm that the above referenced project will not cause an impact to NESHAP regulations in the project vicinity.

We request, on behalf of the City of Traverse City, your concurrence with this determination. We appreciate your review and would be grateful for a response as soon as possible so that we may meet program deadlines. If you have any questions or require any additional information, please contact the undersigned.

Very truly yours,

HUBBELL, ROTH & CLARK, INC.

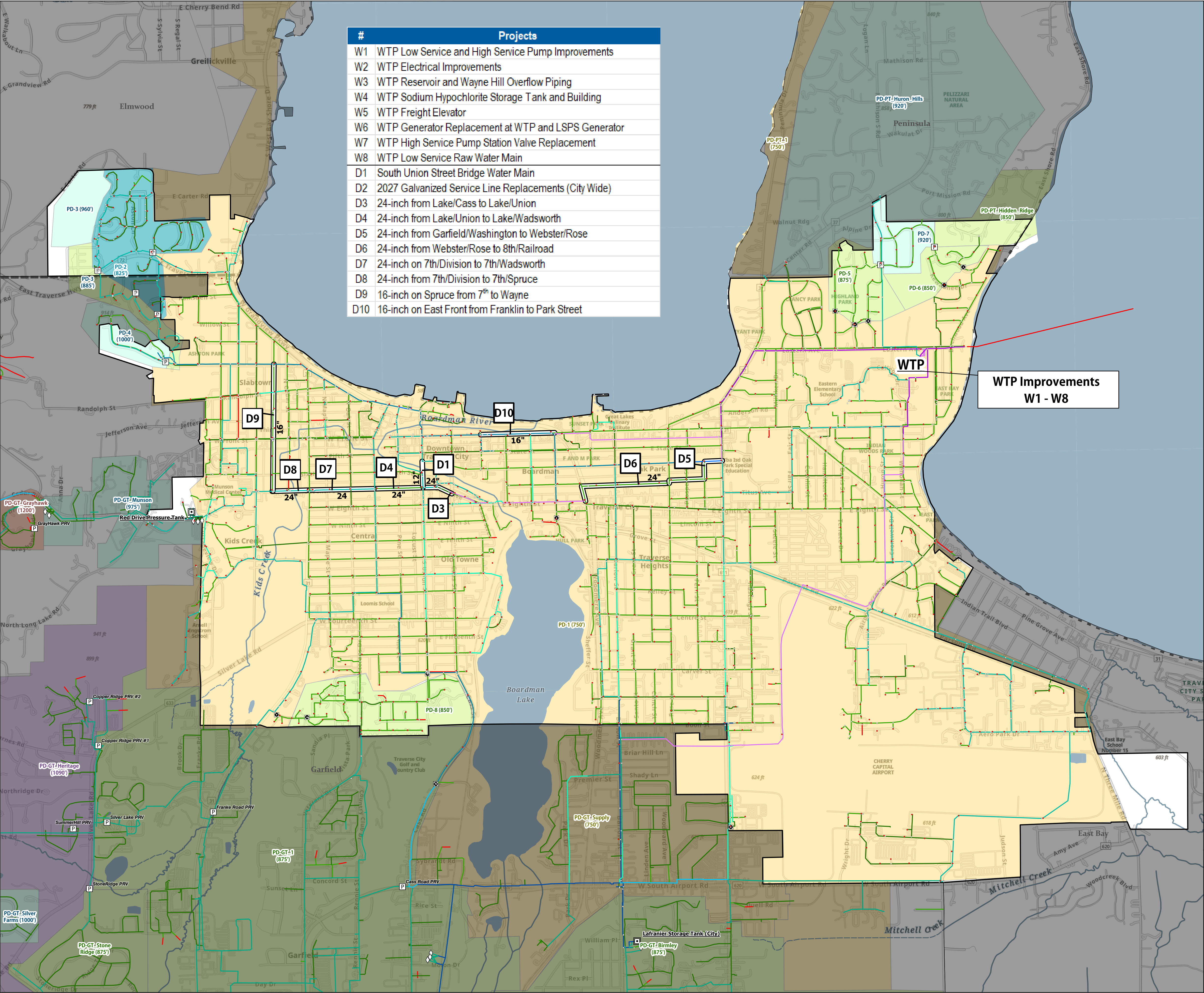


Brittany R. Covault, E.I.T.
Senior Project Analyst

Attachment

Recommended Improvements

Water Treatment Plant Proposed Improvements



#	Projects
W1	WTP Low Service and High Service Pump Improvements
W2	WTP Electrical Improvements
W3	WTP Reservoir and Wayne Hill Overflow Piping
W4	WTP Sodium Hypochlorite Storage Tank and Building
W5	WTP Freight Elevator
W6	WTP Generator Replacement at WTP and LSPS Generator
W7	WTP High Service Pump Station Valve Replacement
W8	WTP Low Service Raw Water Main
D1	South Union Street Bridge Water Main
D2	2027 Galvanized Service Line Replacements (City Wide)
D3	24-inch from Lake/Cass to Lake/Union
D4	24-inch from Lake/Union to Lake/Wadsworth
D5	24-inch from Garfield/Washington to Webster/Rose
D6	24-inch from Webster/Rose to 8th/Railroad
D7	24-inch on 7th/Division to 7th/Wadsworth
D8	24-inch from 7th/Division to 7th/Spruce
D9	16-inch on Spruce from 7 th to Wayne
D10	16-inch on East Front from Franklin to Park Street



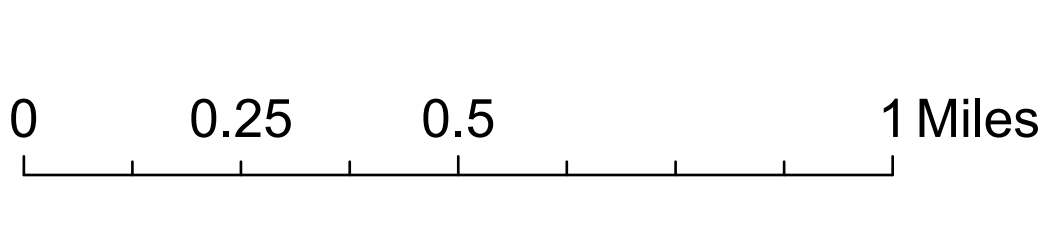
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

1925 Breton Road SE Suite 100
Grand Rapids, MI 49506

Phone: (616) 454-4286

WEBSITE: <http://www.hrcengr.com>

Legend



- Traverse City Boundary

Outside City Limits

County Boundary

Water Pump

Water Tank

PRV

Hydrant

System Valve

Recommended Project
- Water Main
WM Diameter
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24"
- 30"
- No Data

Pressure Districts
HGL750751-825826-884885-10001001-10901090-1200

DRAWN: KLH CHECKED: DIU

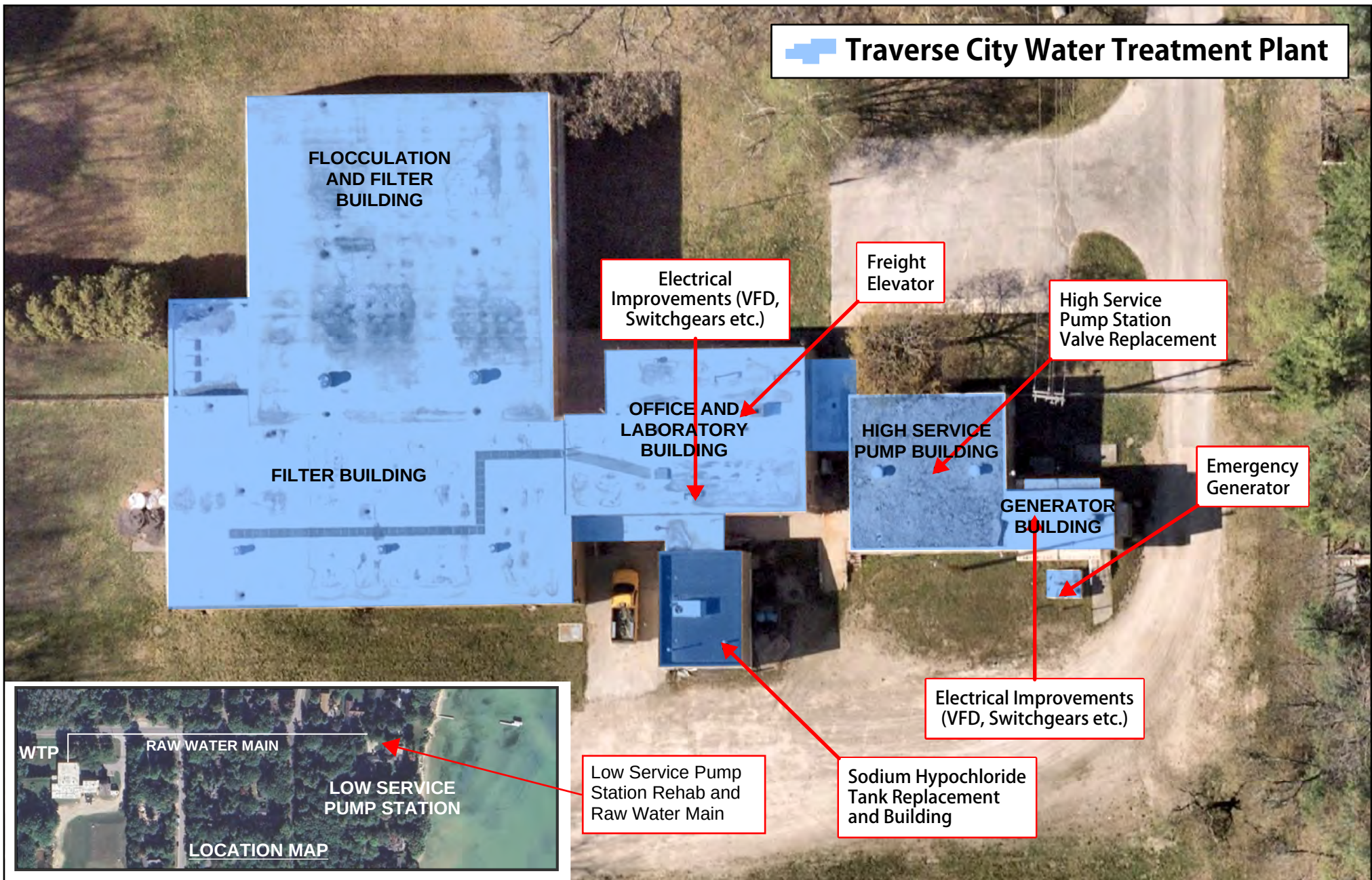
DWSRF Project Plan
City of Traverse City
Recommended Improvements

HRC Job No.
20260066

SCALE: AS SHOWN

June 2026

FIGURE 3.1



Traverse City

2026 DWSRF Project Plan

Water Treatment Plant Proposed Improvements

June 2026
HRC Job No. 20260066
FIGURE 3.2

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915



May 1, 2026

Michigan Department of Environment, Great Lakes, and Energy (EGLE)
Cadillac District Office
120 West Chapin Street
Cadillac, MI 49601-2158

Re: Regional Environmental Planning Review
Drinking Water Improvements Program
City of Traverse City, Michigan

HRC Job No. 20260066

To Whom it May Concern:

The City of Traverse City is submitting a Project Plan to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for acceptance into the Drinking Water State Revolving Fund (DWSRF) Loan Program. The Project plan requires a review to determine any potential impacts on land-water interfaces, including Inland Lakes and Streams, Floodplains, Wetlands, Great Lakes Shorelands, Navigable Waters and Army Corps of Engineers (ACE) Regulated Activities.

On behalf of the City of Traverse City, we are requesting information regarding the impacts of the above referenced proposed project upon the previously detailed land-water interfaces in the vicinity of the project. The project work will involve the following:

- ≡ Water Treatment Plan Improvements
 - WTP High Service Pump Station Improvements
 - WTP Electrical Improvements and WTP Generator Replacement
 - WTP Sodium Hypochlorite Storage Tank and Building Improvements
 - WTP Freight Elevator
 - WTP Low Service PS Improvements including Generator and Raw Water Main
 - Other facility and administrative improvements
- ≡ Distribution System Improvements
 - Watermain Replacements (multiple locations throughout City)
 - Galvanized Service Line replacements

The City's raw water supply is from an intake structure from the east arm of Grand Traverse Bay (East Bay). The City's original water supply was located near the City in West Bay in the 1890s and was relocated to East Bay, which is more protected from runoff and potential contamination sources, in 1965. Treatment is provided by a 20 million gallon per day (mgd) Water Treatment Plant (WTP) located in the City near the intake in East Bay. The WTP was converted to direct filtration in 1993 and is equipped with four low service pumps (raw water), two flocculators, five rapid sand filters, two clear wells, finished water storage, and five high service pumps (finished water). The service area location of the WTP is provided in the attached figures.

The proposed project plan site encompasses pre-existing water mains beneath paved roadways or along bridges. In addition to this, construction will take place within the existing water treatment plant.

Based on the attached FEMA Floodplain Maps, it can be concluded that no construction is expected to be within floodplains. All proper permits and precautions will be implemented during this construction. On behalf of the City of Traverse City, we are requesting a review to confirm that the above referenced project will not cause any long-term impacts to any floodplains in the project vicinity.

The proposed project locations are mainly within previously attained easements. Since the work will be primarily within existing structures in these easements, no impacts to any existing wetland areas are expected. However, if project work is required within an existing wetland, necessary mitigation measures will be undertaken to protect the wetlands influenced by the project. On behalf of the City of Traverse City, we are requesting a review to confirm that the above referenced project will not cause an impact to any wetlands in the project vicinity.

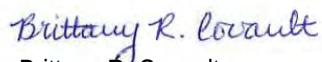
Since the proposed project involves improvements to existing facilities, no impacts are expected from the proposed project upon Great Lakes Shorelands, Navigable Waters or ACE Regulated Activities. On behalf of the City of Traverse City, we are requesting a review to confirm that the above referenced project will not cause an impact to any Great Lakes Shorelands, Navigable Waters or ACE Regulated Activities.

If not already obtained, the appropriate joint permit applications will be completed, and the necessary permits obtained prior to any construction activities in this project area.

We request, on behalf of the City of Traverse City, your concurrence with this determination. We appreciate your review and would be grateful for a response as soon as possible so that we may meet program deadlines. If you have any questions or require any additional information, please contact the undersigned.

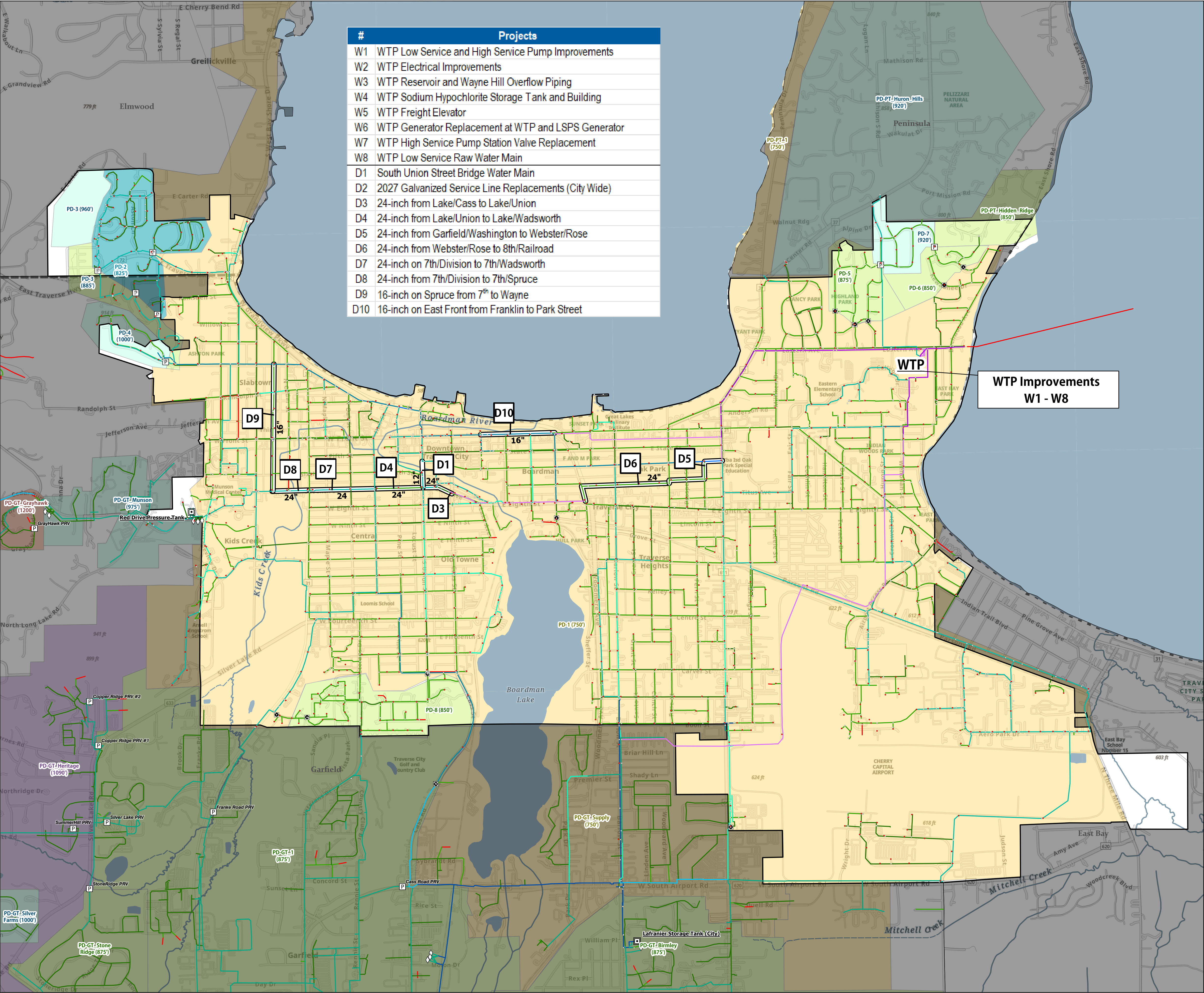
Very truly yours,

HUBBELL, ROTH & CLARK, INC.



Brittany R. Covault
Senior Project Analyst

Attachment
Recommended Improvements
Water Treatment Plant Proposed Improvements
FEMA Floodplain



#	Projects
W1	WTP Low Service and High Service Pump Improvements
W2	WTP Electrical Improvements
W3	WTP Reservoir and Wayne Hill Overflow Piping
W4	WTP Sodium Hypochlorite Storage Tank and Building
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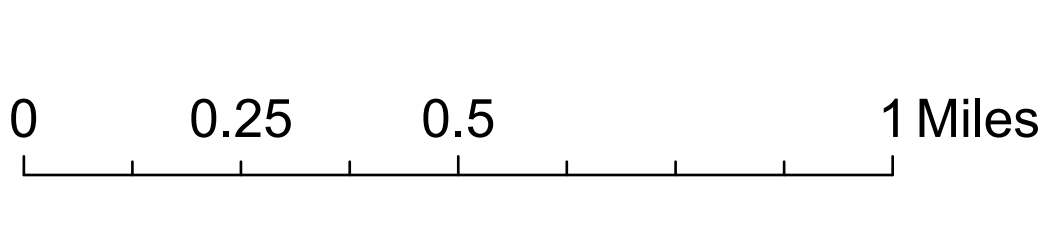
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

1925 Breton Road SE Suite 100
Grand Rapids, MI 49506

Phone: (616) 454-4286

WEBSITE: <http://www.hrcengr.com>

Legend



- Traverse City Boundary

Outside City Limits

County Boundary

Water Pump

Water Tank

PRV

Hydrant

System Valve

Recommended Project
- Water Main
WM Diameter
- 6"
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Pressure Districts
HGL750751-825826-884885-10001001-10901090-1200

DRAWN: KLH CHECKED: DIU

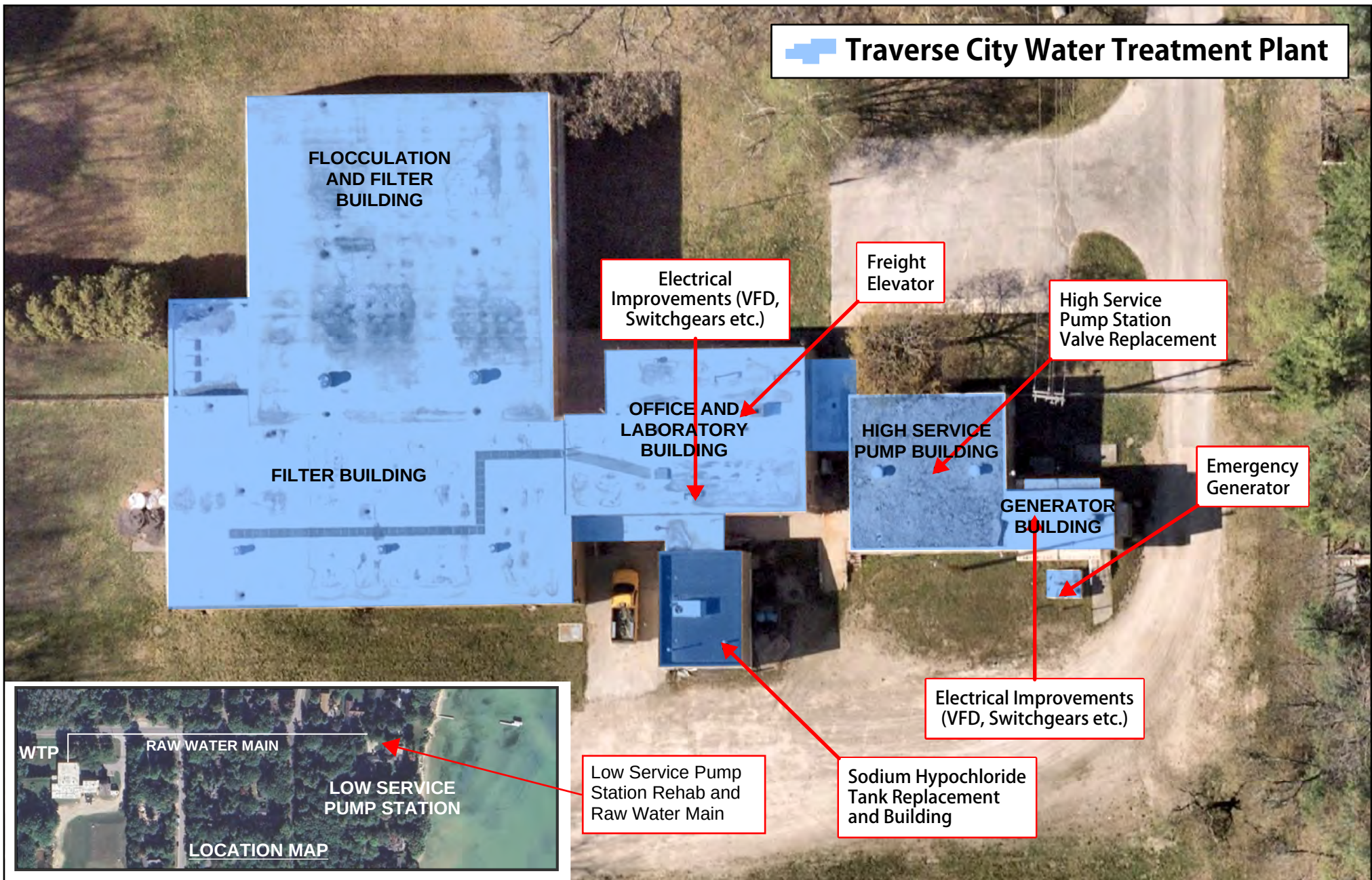
DWSRF Project Plan
City of Traverse City
Recommended Improvements

HRC Job No.
20260066

SCALE: AS SHOWN

June 2026

FIGURE 3.1



Traverse City

2026 DWSRF Project Plan

Water Treatment Plant Proposed Improvements

June 2026
HRC Job No. 20260066
FIGURE 3.2

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was provided in digital format by the National Agricultural Imagery Program (NAIP). This information was photogrammetrically compiled at a scale of 1:12,000 from aerial photography dated 2007 or later.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfip>.



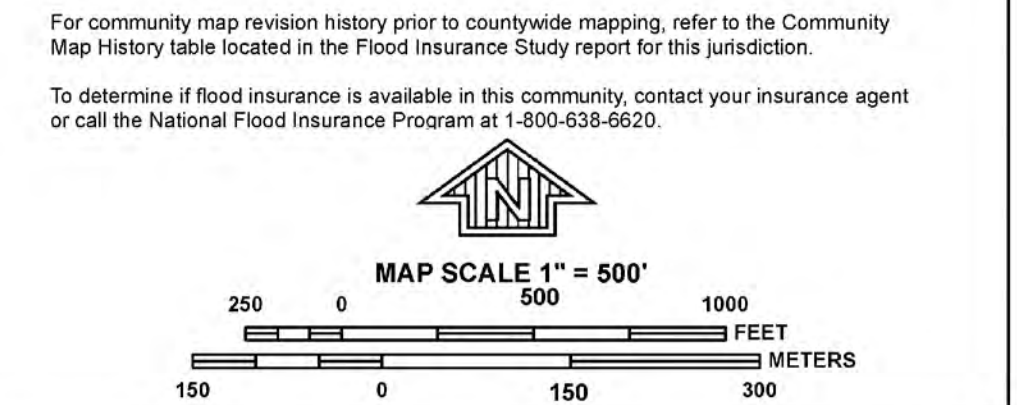
LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**
The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.
- ZONE A** No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently deteriorated. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE
The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

- OTHER FLOOD AREAS**
ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
OTHER AREAS
ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.
COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
OTHERWISE PROTECTED AREAS (OPAs)
CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
1% Annual Chance Floodplain Boundary
0.2% Annual Chance Floodplain Boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
Base Flood Elevation line and value; elevation in feet*
Base Flood Elevation value where uniform within zone; elevation in feet*

- *Referenced to the North American Vertical Datum of 1988
Cross section line
Transect line
Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
1000-meter Universal Transverse Mercator grid values, zone 16
Bench mark (see explanation in Notes to Users section of this FIRM panel)
River Mile
MAP REPOSITORIES
Refer to Map Repositories list on Map Index
EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
August 28, 2018
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL



NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0113C

FIRM
FLOOD INSURANCE RATE MAP
GRAND TRAVERSE
COUNTY, MICHIGAN
(ALL JURISDICTIONS)

PANEL 113 OF 425
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PENINSULA, TOWNSHIP OF	260747	0113	C
TRAVERSE CITY, CITY OF	260082	0113	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
26055C0113C
EFFECTIVE DATE
AUGUST 28, 2018
Federal Emergency Management Agency

Figure 2-6 FEMA Floodplain Map



May 1, 2026

Michigan Department of Environment, Great Lakes, & Energy
Office of Waste Management and Radiological Protection Division
P.O. Box 30473
Lansing, MI 48909-7973

Re: Impact Review
Drinking Water Improvements Program
City of Traverse City, Michigan

HRC Job No. 20260066

To Whom it May Concern:

The City of Traverse City is submitting a Project Plan to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for acceptance into the Drinking Water State Revolving Fund (DWSRF) Loan Program. The Project plan requires a review to determine any potential impacts due to the disposal of waste materials in accordance with Michigan's Natural Resources and Environmental Protection Act (NREPA) as a result of the project.

On behalf of the City of Traverse City, we are requesting information regarding the potential impacts of the above referenced project based on Part 111, Part 115 and Part 121 of Michigan's Natural Resources and Environmental Protection Act (NREPA) and the Hazardous Materials Transportation Act. The project work will involve the following:

- ≡ Water Treatment Plan Improvements
 - WTP High Service Pump Station Improvements
 - WTP Electrical Improvements and WTP Generator Replacement
 - WTP Sodium Hypochlorite Storage Tank and Building Improvements
 - WTP Freight Elevator
 - WTP Low Service PS Improvements including Generator and Raw Water Main
 - Other facility and administrative improvements
- ≡ Distribution System Improvements
 - Watermain Replacements (multiple locations throughout City)
 - Galvanized Service Line replacements

The City's raw water supply is from an intake structure from the east arm of Grand Traverse Bay (East Bay). The City's original water supply was located near the City in West Bay in the 1890s and was relocated to East Bay, which is more protected from runoff and potential contamination sources, in 1965. Treatment is provided by a 20 million gallon per day (mgd) Water Treatment Plant (WTP) located in the City near the intake in East Bay. The WTP was converted to direct filtration in 1993 and is equipped with four low service pumps (raw water), two flocculators, five rapid sand filters, two clear wells, finished water storage, and five high service pumps (finished water). The service area location of the WTP is provided in the attached figures.

The proposed project involves replacement of existing facilities. No removal or disposal of building materials which contain lead, mercury, PCBs, or similar contaminants is expected. There may be existing facilities that were constructed during a period when lead paint was being used. However, in any case contaminants are discovered on the premises during construction, precaution and proper disposal will be implemented to follow regulations. We are requesting a review to confirm that the above referenced project will not impact Part 111, Part 115, or Part 121 of the NREPA.

We request, on behalf of the City of Traverse City, your concurrence with this determination. We appreciate your review and would be grateful for a response as soon as possible so that we may meet program deadlines. If you have any questions or require any additional information, please contact the undersigned.

Very truly yours,

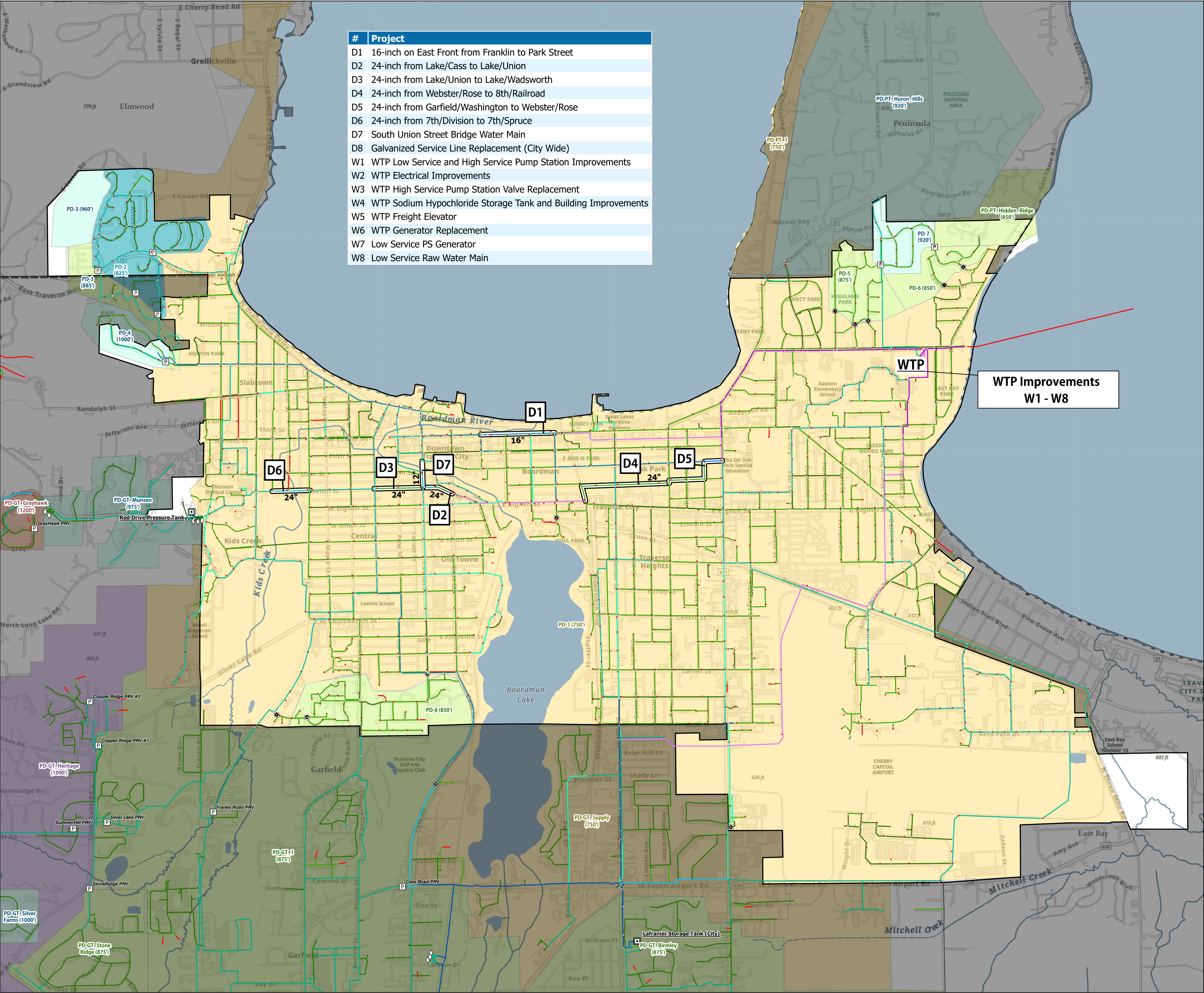
HUBBELL, ROTH & CLARK, INC.



Brittany R. Covault
Senior Project Analyst

Attachment

Recommended Improvements
Proposed WTP Improvements
EGLE RRD Listed Facilities Map



HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

1925 Breton Road SE Suite 100
Grand Rapids, MI 49506

Phone: (616) 454-4286

WEBSITE: <http://www.hrcengr.com>

Legend

0

0.25

0.5

1 Miles

N

□

 Traverse City Boundary

■

 Outside City Limits

▤

 County Boundary

◇

 Water Pump

⊠

 Water Tank

⊞

 PRV

●

 Hydrant

●

 System Valve

▬

 Recommended Project

—

 6"

—

 8"

—

 10"

—

 12"

—

 14"

—

 16"

—

 18"

—

 20"

—

 24"

—

 30"

—

 No Data

■

 750

■

 751-825

■

 826-884

■

 885-1000

■

 1001-1090

■

 1090-1200

DRAWN: KLH CHECKED: DIU

DWSRF Project Plan
City of Traverse City
Recommended Improvements

HRC Job No. 20260066	SCALE: AS SHOWN
June 2026	FIGURE 3.1



Traverse City Water Treatment Plant



Traverse City

2026 DWSRF Project Plan

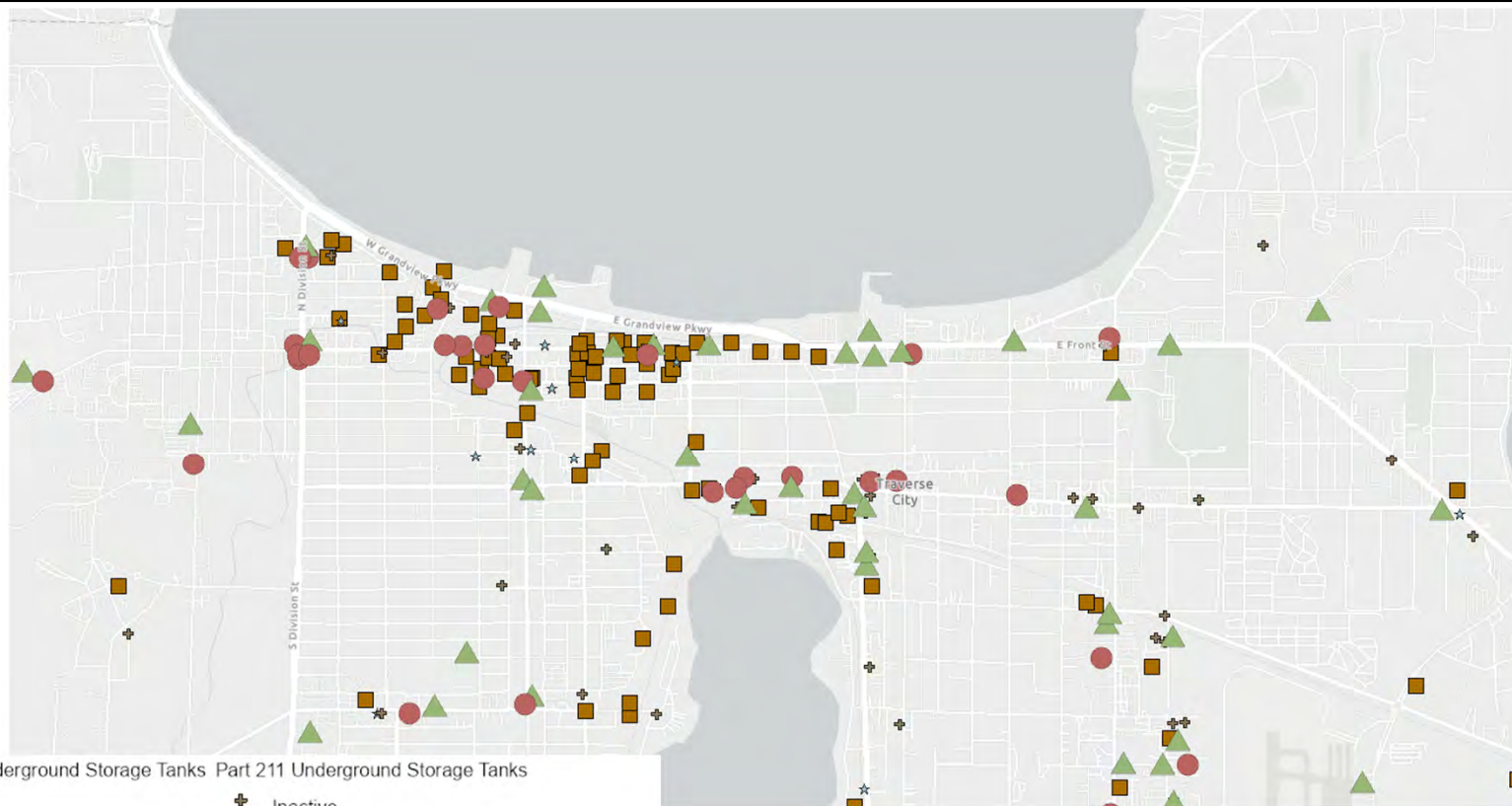
Water Treatment Plant Proposed Improvements

June 2026

HRC Job No. 20260066

FIGURE 3.2





Traverse City Drinking Water Improvements

EGLE RRD Listed Facilities Map

Date
4/13/2026

Figure No.
3.3



May 1, 2026

Networks Northwest
600 East Front Street, Suite 104
PO Box 506
Traverse City, MI 49685-0506

Re: Regional Environmental Planning Review
Drinking Water Improvements Project
City of Traverse City, Michigan

HRC Job No. 20260066

To Whom It May Concern:

The City of Traverse City is submitting a Project Plan to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for acceptance into the Drinking Water State Revolving Fund (DWSRF) Loan Program. The Project Plan requires a review to determine any potential impacts on any local development plans, area wide waste treatment management plans and/or regional water quality management plans.

On behalf of the City of Traverse City, we are requesting information regarding the impacts of the above referenced proposed project upon any local development plans, area wide waste treatment management plans and/or regional water quality management plans in the vicinity of the project. The project work will involve the following:

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All population figures and projections referenced in the project plan will be collected from the Networks Northwest Website.

We request, on behalf of the City of Traverse City, notification if an alternative source for the population data is recommended.

Since the proposed project involves improvements to existing facilities, no impacts are expected from the proposed project upon local development plans, area wide waste treatment management plans and/or regional water quality management plans. On behalf of the City of Traverse City, we are requesting a review to confirm that the above referenced project will

not cause an impact to any local development plans, area wide waste treatment management plans and/or regional water quality management plans.

We request, on behalf of the City of Traverse City, your concurrence with this determination. We appreciate your review and would be grateful for a response as soon as possible so that we may meet program deadlines. If you have any questions or require any additional information, please contact the undersigned.

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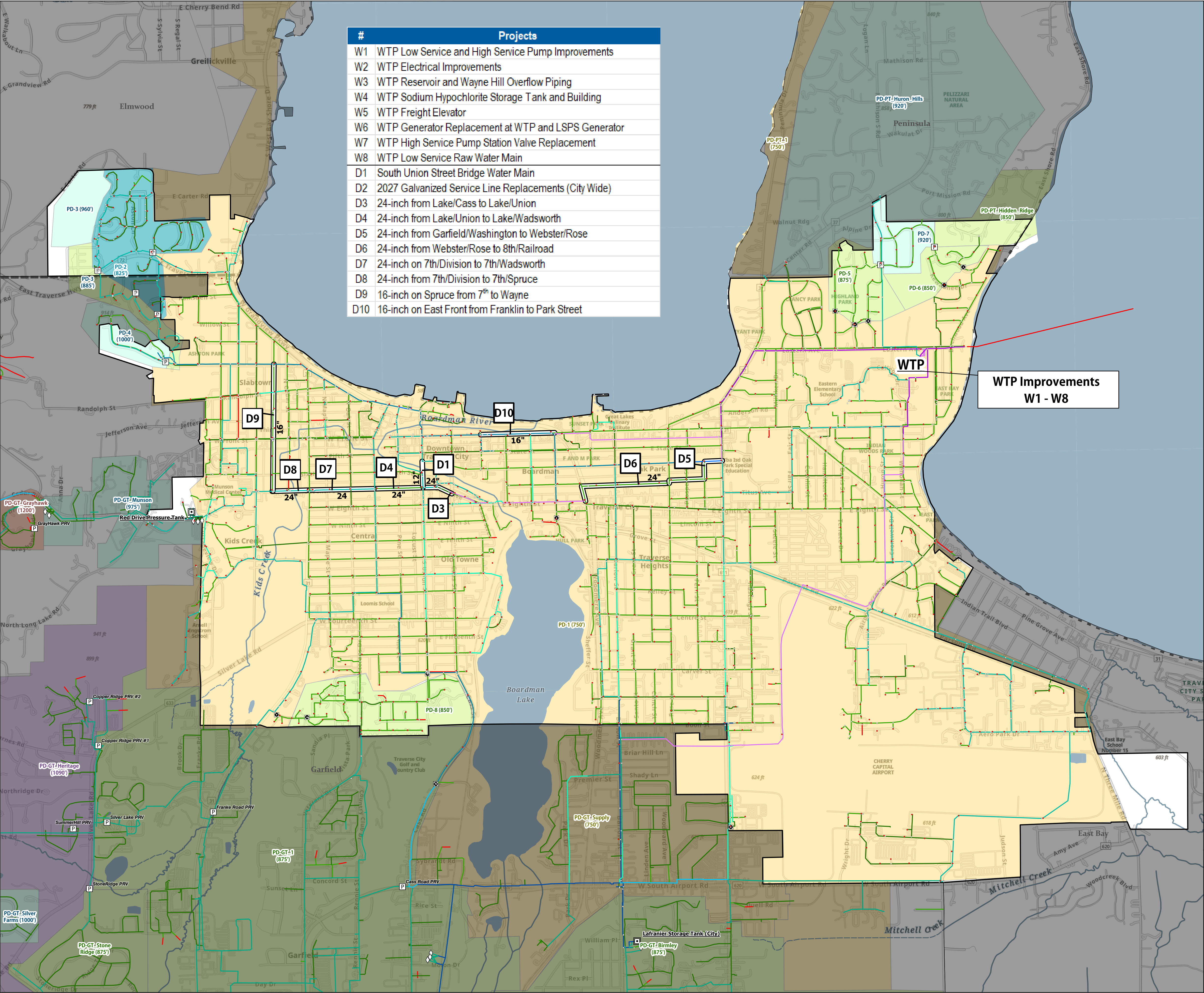
HUBBELL, ROTH & CLARK, INC.



Brittany R. Covault
Senior Project Analyst

Attachment

Recommended Improvements
Proposed WTP Improvements



#	Projects
W1	WTP Low Service and High Service Pump Improvements
W2	WTP Electrical Improvements
W3	WTP Reservoir and Wayne Hill Overflow Piping
W4	WTP Sodium Hypochlorite Storage Tank and Building
W5	WTP Freight Elevator
W6	WTP Generator Replacement at WTP and LSPS Generator
W7	WTP High Service Pump Station Valve Replacement
W8	WTP Low Service Raw Water Main
D1	South Union Street Bridge Water Main
D2	2027 Galvanized Service Line Replacements (City Wide)
D3	24-inch from Lake/Cass to Lake/Union
D4	24-inch from Lake/Union to Lake/Wadsworth
D5	24-inch from Garfield/Washington to Webster/Rose
D6	24-inch from Webster/Rose to 8th/Railroad
D7	24-inch on 7th/Division to 7th/Wadsworth
D8	24-inch from 7th/Division to 7th/Spruce
D9	16-inch on Spruce from 7 th to Wayne
D10	16-inch on East Front from Franklin to Park Street



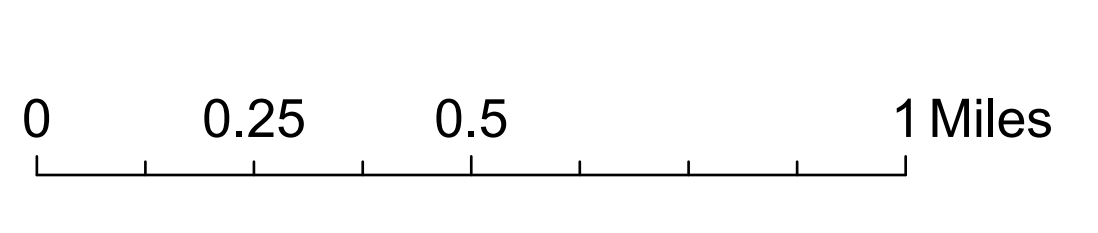
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

1925 Breton Road SE Suite 100
Grand Rapids, MI 49506

Phone: (616) 454-4286

WEBSITE: <http://www.hrcengr.com>

Legend

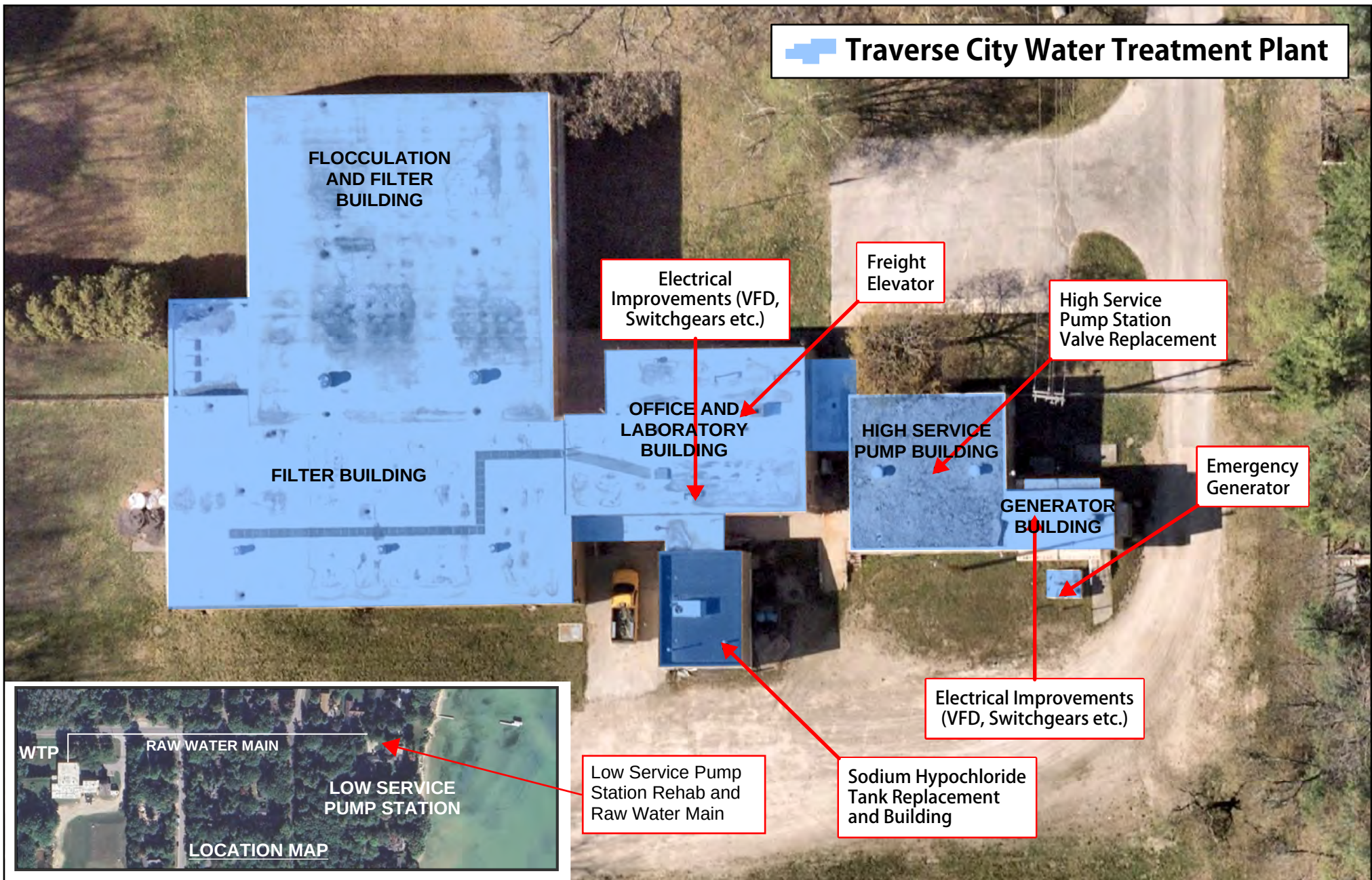


Traverse City Boundary	Water Main	Pressure Districts
Outside City Limits	WM Diameter	HGL
County Boundary	6"	750
Water Pump	8"	751-825
Water Tank	10"	826-884
PRV	12"	885-1000
Hydrant	14"	1001-1090
System Valve	16"	1090-1200
Recommended Project	18"	
	20"	
	24"	
	30"	
	No Data	

DRAWN: KLH CHECKED: DIU

DWSRF Project Plan City of Traverse City Recommended Improvements

HRC Job No. 20260066	SCALE: AS SHOWN
June 2026	FIGURE 3.1



Traverse City

2026 DWSRF Project Plan

Water Treatment Plant Proposed Improvements

June 2026
HRC Job No. 20260066
FIGURE 3.2

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915



May 1, 2026

Farmland Preservation Program
USDA Natural Resources Conversation Service
3001 Coolidge Road, Suite 250
East Lansing, MI 48823-6362

Re: Impact Review
Drinking Water Improvements Project
City of Traverse City, Michigan

HRC Job No. 20260066

To Whom it May Concern:

The City of Traverse City is submitting a Project Plan to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for acceptance into the Drinking Water State Revolving Fund (DWSRF) Loan Program. The Project Plan requires a review to determine any potential impacts on prime and unique farmland in the vicinity of the project.

On behalf of the City of Traverse City, we are requesting information regarding the impacts of the above referenced proposed project upon the Farmland Protection Policy Act regulations. The project work will involve the following:

- ≡ Water Treatment Plan Improvements
 - WTP High Service Pump Station Improvements
 - WTP Electrical Improvements and WTP Generator Replacement
 - WTP Sodium Hypochlorite Storage Tank and Building Improvements
 - WTP Freight Elevator
 - WTP Low Service PS Improvements including Generator and Raw Water Main
 - Other facility and administrative improvements
- ≡ Distribution System Improvements
 - Watermain Replacements (multiple locations throughout City)
 - Galvanized Service Line replacements

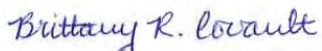
The City's raw water supply is from an intake structure from the east arm of Grand Traverse Bay (East Bay). The City's original water supply was located near the City in West Bay in the 1890s and was relocated to East Bay, which is more protected from runoff and potential contamination sources, in 1965. Treatment is provided by a 20 million gallon per day (mgd) Water Treatment Plant (WTP) located in the City near the intake in East Bay. The WTP was converted to direct filtration in 1993 and is equipped with four low service pumps (raw water), two flocculators, five rapid sand filters, two clear wells, finished water storage, and five high service pumps (finished water). The service area location of the WTP is provided in the attached figures.

The proposed project site covers only urban areas, mainly zoned as single family residential or commercial. All excavated land will be restored to pre-construction condition. Since the proposed project involves improvements to existing facilities, no conversions of farmland to nonagricultural uses are expected. Please see attached map which shows a lack of existing significant farmlands in the project area. On behalf of the City of Traverse City, we are requesting a review to confirm that the above referenced project will not cause an impact to any significant farmland or agricultural lands in the project vicinity.

We request, on behalf of the City of Traverse City, your concurrence with this determination. We appreciate your review and would be grateful for a response as soon as possible so that we may meet program deadlines. If you have any questions or require any additional information, please contact the undersigned.

Very truly yours,

HUBBELL, ROTH & CLARK, INC.



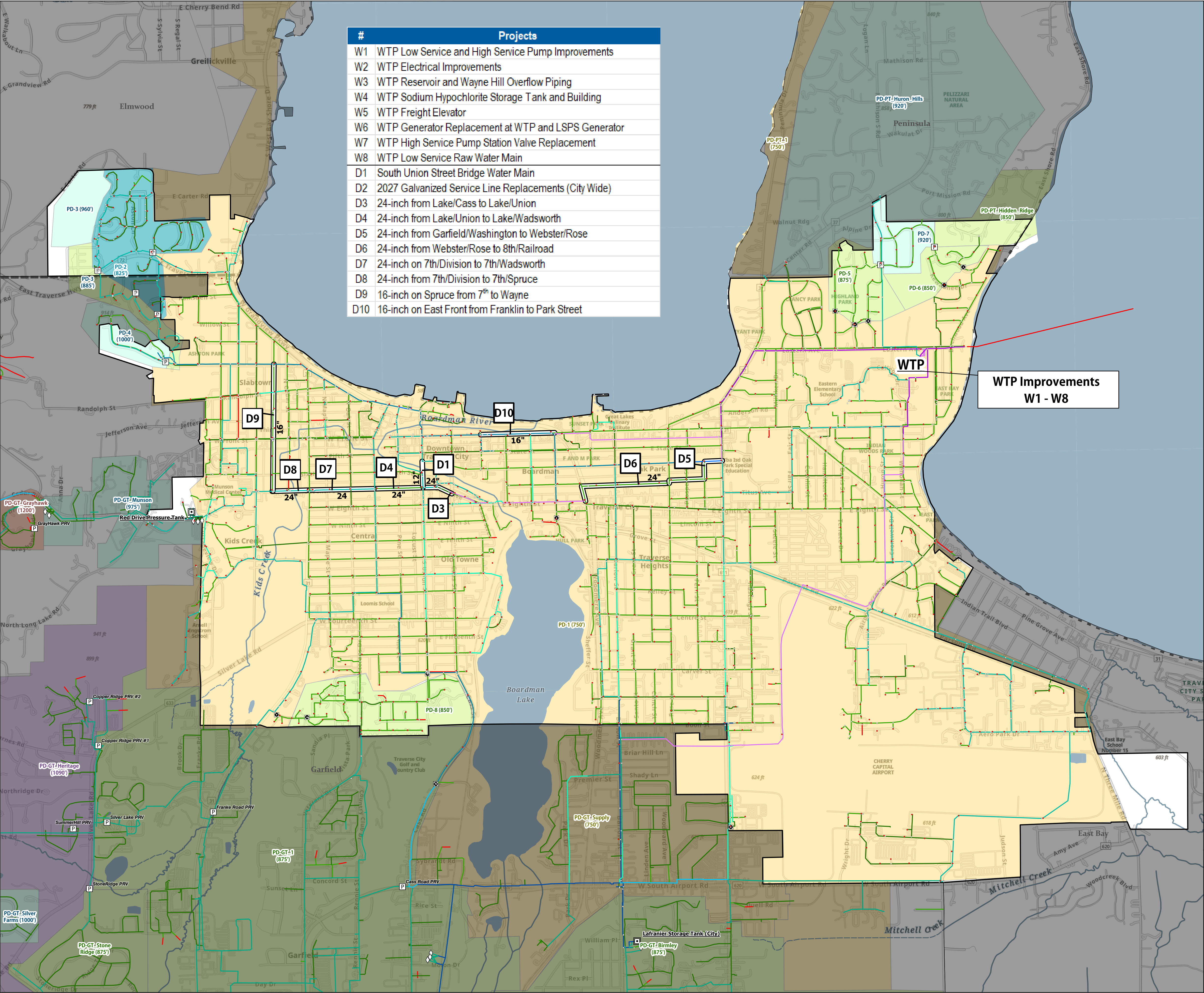
Brittany R. Covault
Senior Project Analyst

Attachment

Recommended Improvements

Water Treatment Plant Proposed Improvements

Agriculture Map



#	Projects
W1	WTP Low Service and High Service Pump Improvements
W2	WTP Electrical Improvements
W3	WTP Reservoir and Wayne Hill Overflow Piping
W4	WTP Sodium Hypochlorite Storage Tank and Building
W5	WTP Freight Elevator
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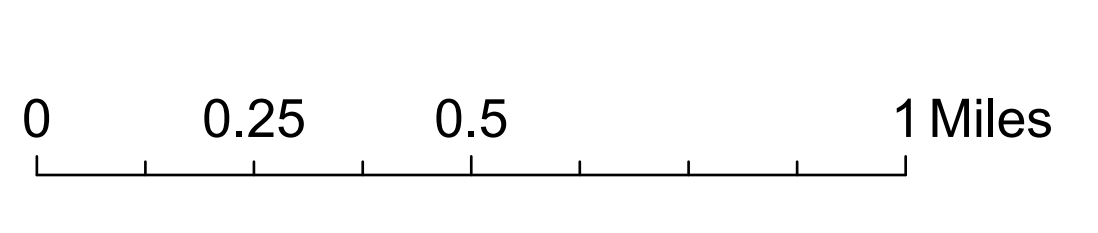
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CONSULTING ENGINEERS SINCE 1915

1925 Breton Road SE Suite 100
Grand Rapids, MI 49506

Phone: (616) 454-4286

WEBSITE: <http://www.hrcengr.com>

Legend



Traverse City Boundary	Water Main	Pressure Districts
Outside City Limits	WM Diameter	HGL
County Boundary	6"	750
Water Pump	8"	751-825
Water Tank	10"	826-884
PRV	12"	885-1000
Hydrant	14"	1001-1090
System Valve	16"	1090-1200
Recommended Project	18"	
	20"	
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	30"	
	No Data	

DRAWN: KLH

CHECKED: DIU

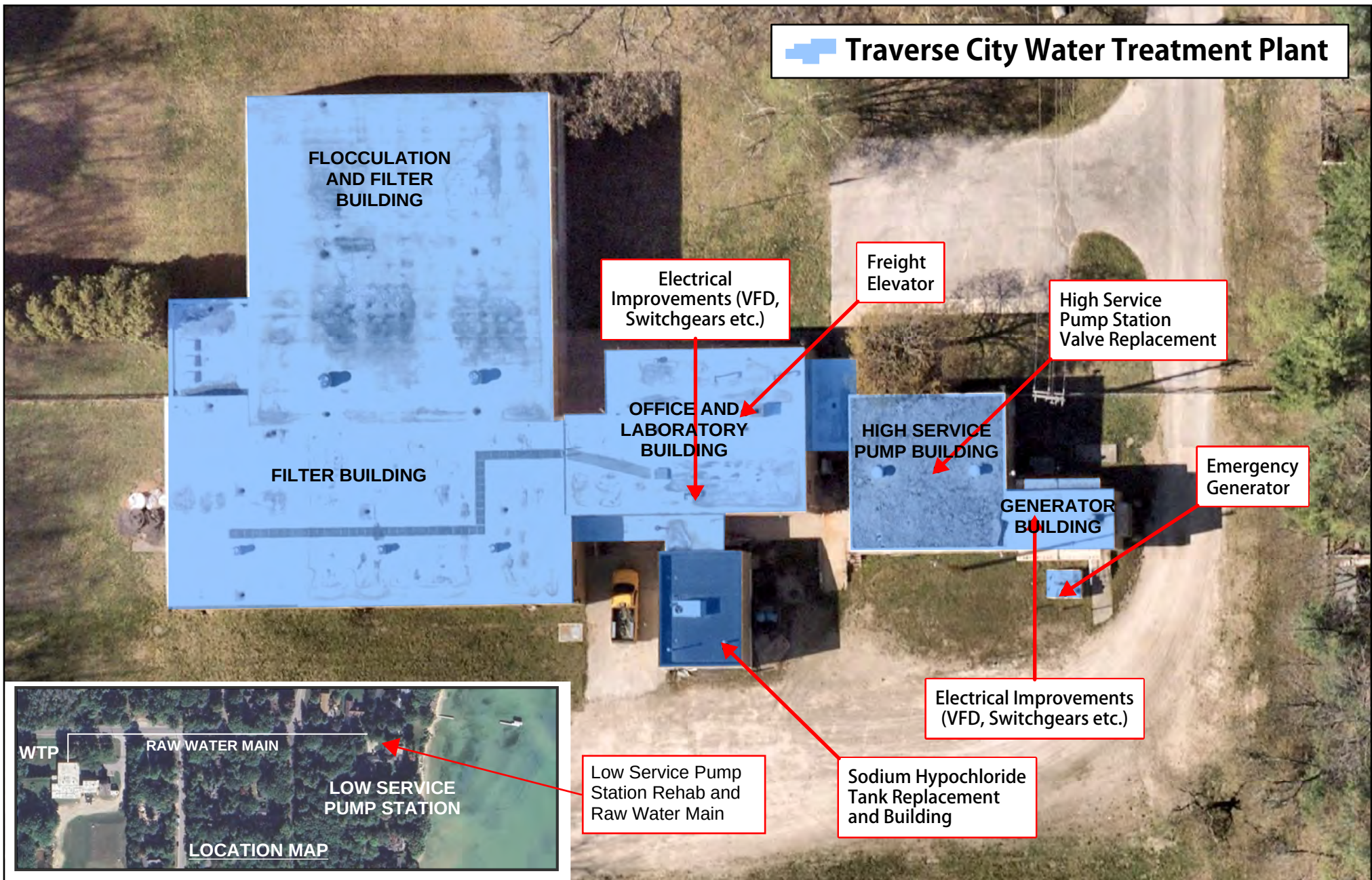
DWSRF Project Plan City of Traverse City Recommended Improvements

HRC Job No.
20260066

SCALE: AS SHOWN

June 2026

FIGURE 3.1



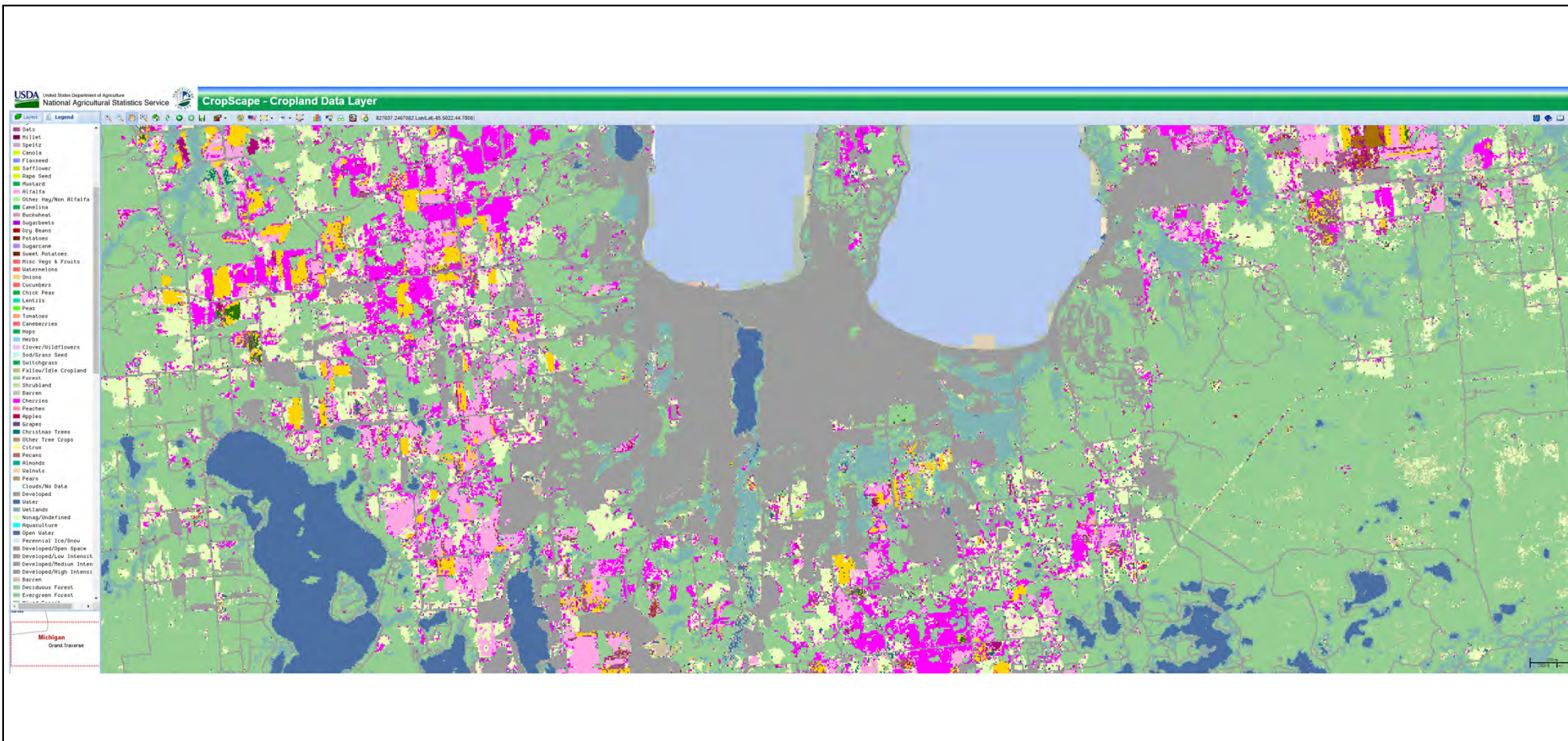
Traverse City

2026 DWSRF Project Plan

Water Treatment Plant Proposed Improvements

June 2026
HRC Job No. 20260066
FIGURE 3.2

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915



	Traverse City Drinking Water Improvements		Date 5/14/2021
	Agriculture Map		Figure No. 3.3

Covault, Brittany R.

From: Rosek, Martin - FPAC-NRCS, MI <martin.rosek@usda.gov>
Sent: Monday, May 4, 2026 6:48 AM
To: Covault, Brittany R.
Cc: Burke, Kelly - FPAC-NRCS, MI; Drumm, Davis - FPAC-NRCS, MI
Subject: RE: [External Email]City of Traverse City - DWSRF

Brittany,

Subpart B of Part 523 of the Farmland Protection Policy Act states that 'Lands identified as "urbanized area" (UA) on the Census Bureau maps' are not covered by the act. Since the project is UA on the 2020 Census Bureau Reference Map for Traverse City, MI, we have concluded that this proposal will have no negative impact on prime and/or unique farmland.

Should the scope of the project change to where expansion will occur, please resubmit the proposal for our review.

Thanks,

Marty

Martin Rosek, Ph.D.
State Soil Scientist
FPAC/NRCS



U.S. DEPARTMENT OF AGRICULTURE

Natural Resources Conservation Service

3001 Coolidge Road, Suite 250, East Lansing, Michigan 48823

p: (517) 324-5241 | c: (517) 582-3636

From: Drumm, Davis - FPAC-NRCS, MI <davis.drumm@usda.gov>
Sent: Friday, May 1, 2026 1:45 PM
To: Rosek, Martin - FPAC-NRCS, MI <martin.rosek@usda.gov>
Cc: Burke, Kelly - FPAC-NRCS, MI <kelly.burke@usda.gov>
Subject: FW: [External Email]City of Traverse City - DWSRF

Marty here is a request for FPPA looking at the attached map and where they say they are doing the work it looks like it is all urban area.

Thanks

Davis Drumm

Area1 & 2 Resource Soil Scientist
Gaylord Area Office



U.S. DEPARTMENT OF AGRICULTURE

Natural Resources Conservation Service

c: (216)924-4102

From: Burke, Kelly - FPAC-NRCS, MI <kelly.burke@usda.gov>
Sent: Friday, May 1, 2026 1:23 PM
To: Drumm, Davis - FPAC-NRCS, MI <davis.drumm@usda.gov>
Subject: FW: [External Email]City of Traverse City - DWSRF

Hi Davis,

We have a prime and Unique farmland request for Traverse City.

Sincerely,
Kelly Burke
Area Conservationist
Marquette, MI Area Office



U.S. DEPARTMENT OF AGRICULTURE
Natural Resources Conservation Service
780 Commerce Dr Suite D, Marquette, MI 49855
p: (906) 251-3064 | c: (906) 236-4237

From: Covault, Brittany R. <BCovault@hrcengr.com>
Sent: Friday, May 1, 2026 1:20 PM
To: Burke, Kelly - FPAC-NRCS, MI <kelly.burke@usda.gov>
Subject: [External Email]City of Traverse City - DWSRF

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[External Email]

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Please send any concerns or suspicious messages to: Spam.Abuse@usda.gov

Good afternoon, Kelly,

Attached is a letter on behalf of the City of Traverse City requesting information regarding the impacts of the Drinking Water Improvement Projects proposed for Traverse City to determine any potential impacts on prime and unique farmland in the vicinity of the project. We appreciate your review and would be grateful for a response by Friday, May 15, 2026, so that we may meet program deadlines.

Thanks,

Brittany R. Covault | Senior Project Analyst
[HUBBELL, ROTH & CLARK, INC](#)
2101 Aurelius Road, Suite 2, Holt, MI 48842
O: 517-292-1936 | M: 574-520-3788



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May 1, 2026

Natural River Administrator
DNR Fisheries Division
PO Box 30446
Lansing, MI 48909-7946

Re: Wild and Scenic Rivers Review
DWSRF Project Plan
City of Traverse City, Michigan

HRC Job No. 20260066

To Whom it May Concern:

The City of Traverse City is submitting a Project Plan to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for acceptance into the Drinking Water State Revolving Fund (DWSRF) Loan Program. The Project Plan requires a review to determine any potential impacts on state or federally designated wild, scenic, or natural rivers or tributaries in the vicinity of the project.

On behalf of the City of Traverse City, we are requesting information regarding the impacts of the above referenced proposed project upon protected state or federally designated wild, scenic, natural rivers, or tributaries. The project work will involve the following:

- ≡ Water Treatment Plan Improvements
 - WTP High Service Pump Station Improvements
 - WTP Electrical Improvements and WTP Generator Replacement
 - WTP Sodium Hypochlorite Storage Tank and Building Improvements
 - WTP Freight Elevator
 - WTP Low Service PS Improvements including Generator and Raw Water Main
 - Other facility and administrative improvements
- ≡ Distribution System Improvements
 - Watermain Replacements (multiple locations throughout City)
 - Galvanized Service Line replacements

The City's raw water supply is from an intake structure from the east arm of Grand Traverse Bay (East Bay). The City's original water supply was located near the City in West Bay in the 1890s and was relocated to East Bay, which is more protected from runoff and potential contamination sources, in 1965. Treatment is provided by a 20 million gallon per day (mgd) Water Treatment Plant (WTP) located in the City near the intake in East Bay. The WTP was converted to direct filtration in 1993 and is equipped with four low service pumps (raw water), two flocculators, five rapid sand filters, two clear wells, finished water storage, and five high service pumps (finished water). The service area location of the WTP is provided in the attached figures.

The proposed project site covers primarily commercial and residential areas. Excavations will be made in paved areas, primarily where water mains are preexisting. All land will be returned to pre-construction condition.

The project scope will cover only preexisting water treatment sites and water distribution sites, thus it is not anticipated that it will interfere with any wild, scenic, or natural river. Therefore, we are requesting on behalf of the City of Traverse City for a review to confirm that the above referenced project will not cause an impact to any state or federally designated wild, scenic, or natural rivers or tributaries.

We request, on behalf of the City of Traverse City, your concurrence with this determination. We appreciate your review and would be grateful for a response as soon as possible so that we may meet program deadlines.

If you have any questions or require any additional information, please contact the undersigned.

Very truly yours,

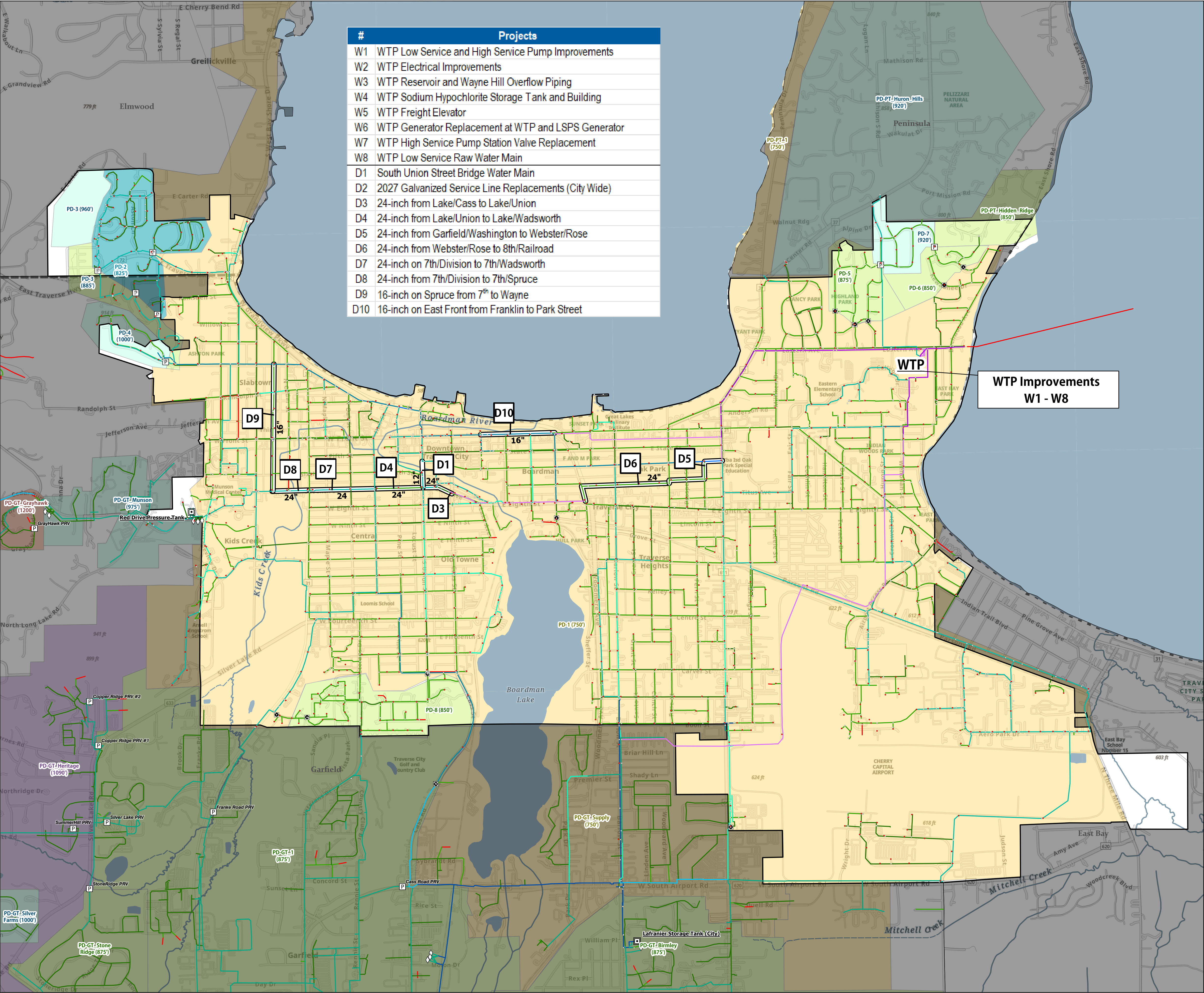
HUBBELL, ROTH & CLARK, INC.



Brittany R. Covault
Senior Project Analyst

Attachments:

Recommended Improvements
Water Treatment Plant Proposed Improvements
National Wild and Scenic Rivers System with Project Location
Nationwide Rivers Inventory with Site Location



#	Projects
W1	WTP Low Service and High Service Pump Improvements
W2	WTP Electrical Improvements
W3	WTP Reservoir and Wayne Hill Overflow Piping
W4	WTP Sodium Hypochlorite Storage Tank and Building
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CONSULTING ENGINEERS SINCE 1915

1925 Breton Road SE Suite 100
Grand Rapids, MI 49506

Phone: (616) 454-4286

WEBSITE: <http://www.hrcengr.com>

Legend

Traverse City Boundary

Outside City Limits

County Boundary

Water Pump

Water Tank

PRV

Hydrant

System Valve

Recommended Project

Water Main

WM Diameter

6"

8"

10"

12"

14"

16"

18"

20"

24"

30"

No Data

Pressure Districts

HGL

750

751-825

826-884

885-1000

1001-1090

1090-1200

0

0.25

0.5

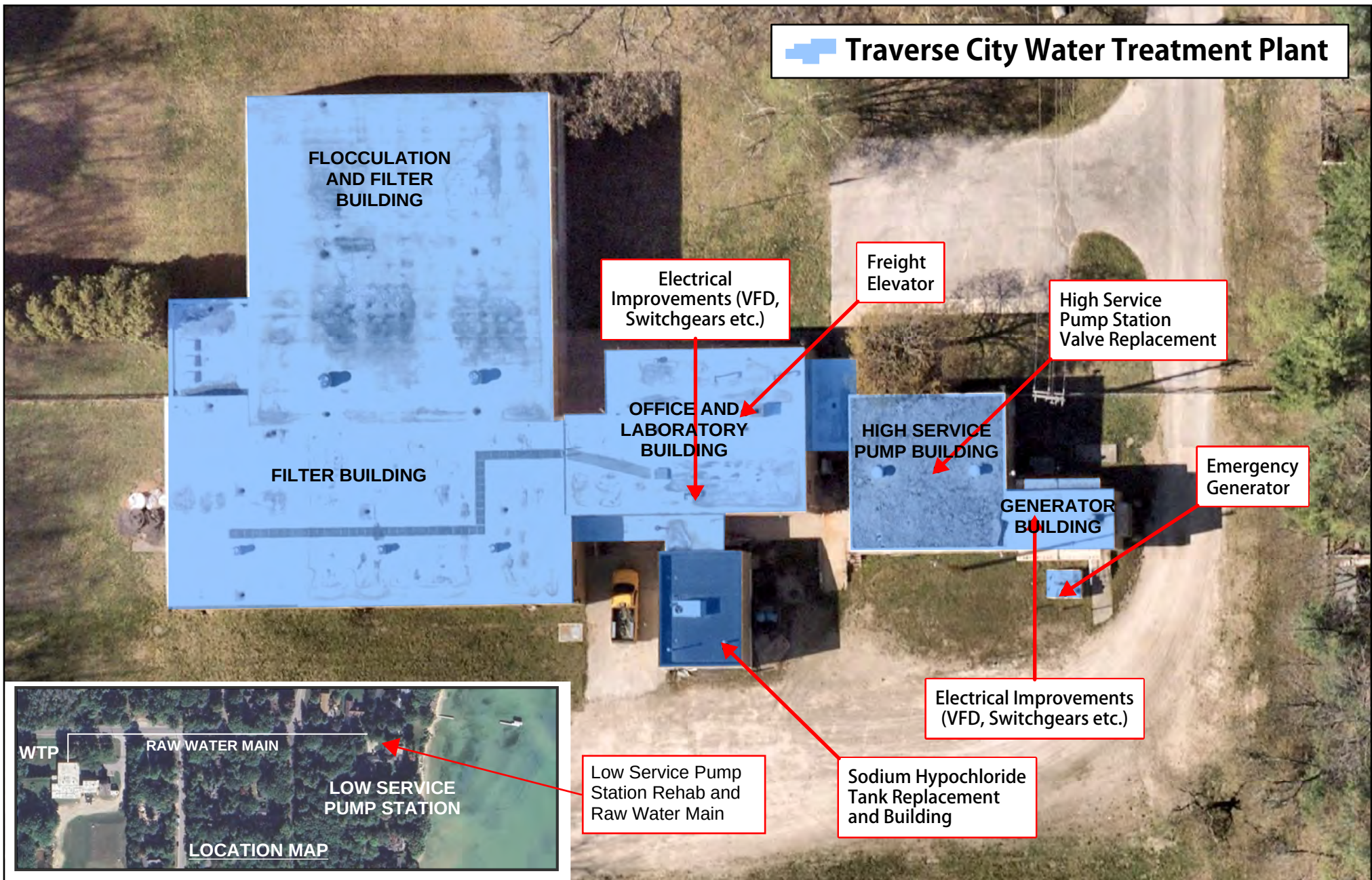
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DWSRF Project Plan
City of Traverse City
Recommended Improvements

HRC Job No. 20260066	SCALE: AS SHOWN
June 2026	FIGURE 3.1



Traverse City

2026 DWSRF Project Plan

Water Treatment Plant Proposed Improvements

June 2026
HRC Job No. 20260066
FIGURE 3.2

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Nationwide Rivers Inventory

This is a listing of more than 1,200 free-flowing river segments in the U.S. that are believed to possess one or more "outstandingly remarkable" values.

National Park Service
U.S. Department of the Interior

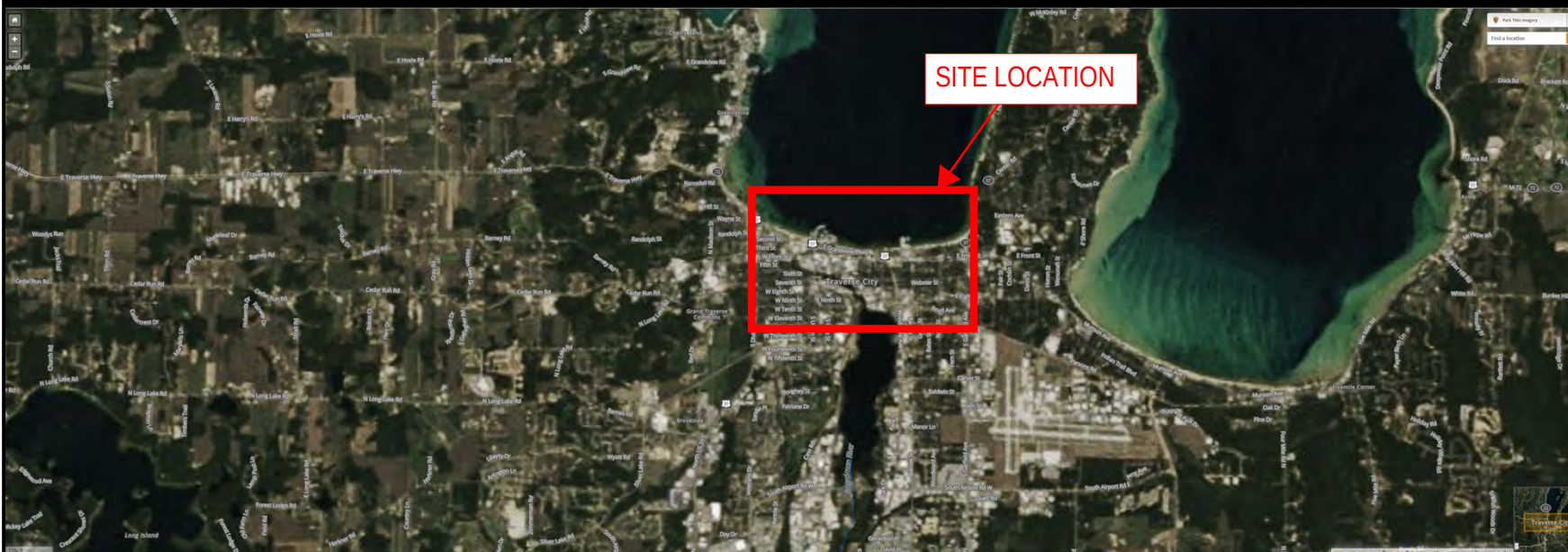


FIGURE 1

NATIONWIDE RIVERS
INVENTORY

2026 DWSRF
PROJECT PLAN

JUNE 2026

HRC#: 20260066

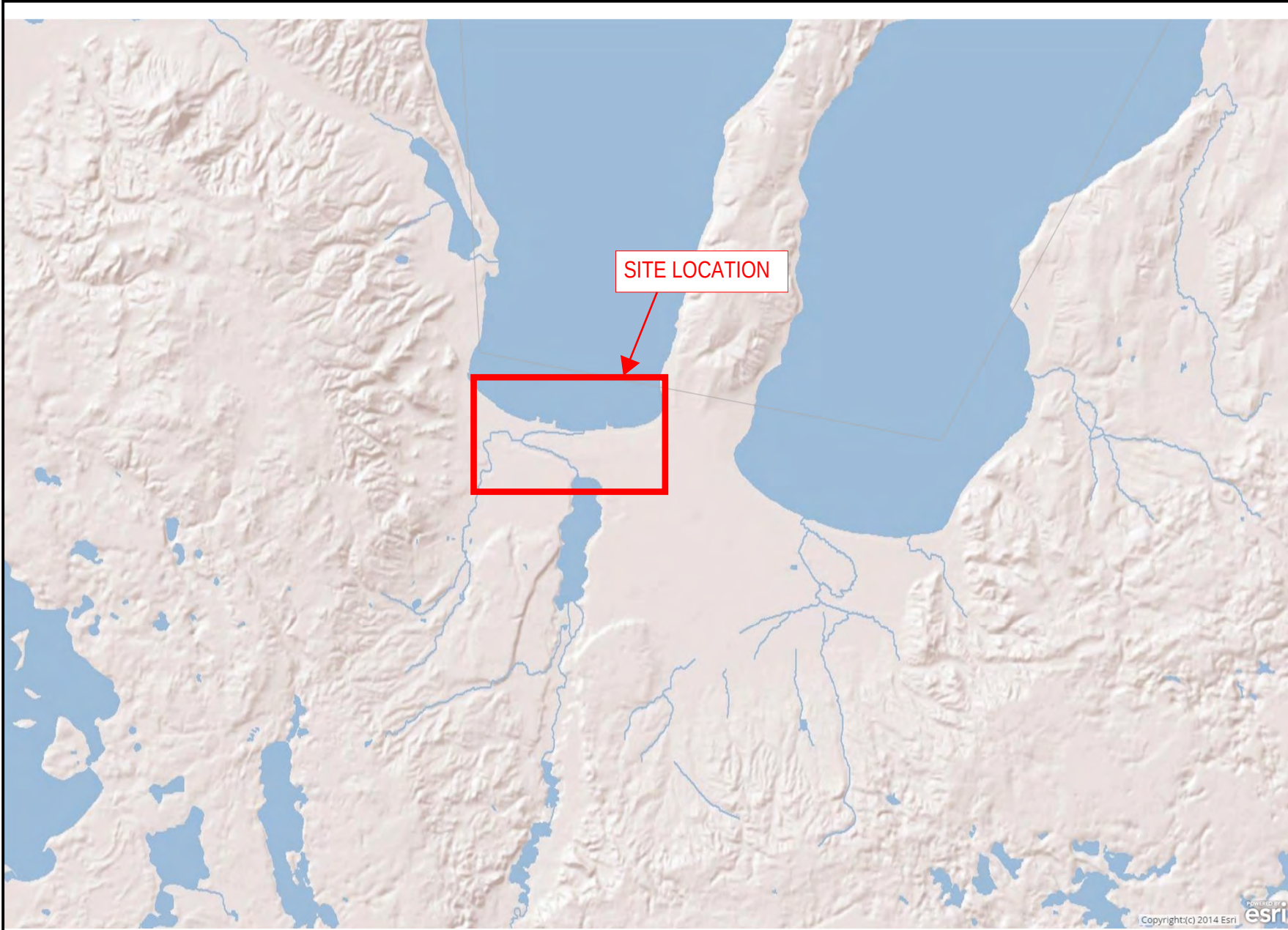


FIGURE 1
NATIONAL WILD AND SCENIC
RIVERS MAP

2026 DWSRF
PROJECT PLAN

Covault, Brittany R.

From: Heintzelman, Scott (DNR) <HeintzelmanS@michigan.gov>
Sent: Thursday, May 7, 2026 9:48 AM
To: Covault, Brittany R.
Cc: Hettinger, Heather (DNR)
Subject: RE: City of Traverse City - DWSRF

Hi Brittany,

We have reviewed the project and concur this will have no impact on the Boardman River. The described project boundaries are also outside of Natural Rivers designation and not subject to the conditions of the program. Let me know if you need anything else.

Thanks, and have a great day,

Scott Heintzelman
MDNR Fisheries Division
Central Lake Michigan Unit Manager
Ph. 231-433-9782 or heintzelmans@michigan.gov

From: Covault, Brittany R. <BCovault@hrcengr.com>
Sent: Friday, May 1, 2026 1:25 PM
To: Heintzelman, Scott (DNR) <HeintzelmanS@michigan.gov>
Subject: City of Traverse City - DWSRF

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Good afternoon, Scott,

Attached is a letter on behalf of the City of Traverse City requesting information regarding the impacts of the Drinking Water Improvement Projects proposed for Traverse City upon state or federally-designated wild, scenic, or natural rivers or tributaries. We appreciate your review and would be grateful for a response by Friday, May 15, 2026, so that we may meet program deadlines.

Thanks,

Brittany R. Covault | Senior Project Analyst
[HUBBELL, ROTH & CLARK, INC](#)
2101 Aurelius Road, Suite 2, Holt, MI 48842
O: 517-292-1936 | M: 574-520-3788



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APPENDIX B: NATIONWIDE RIVERS INVENTORY

Nationwide Rivers Inventory

This is a listing of more than 1,200 free-flowing river segments in the U.S. that are believed to possess one or more "outstandingly remarkable" values.

National Park Service
U.S. Department of the Interior

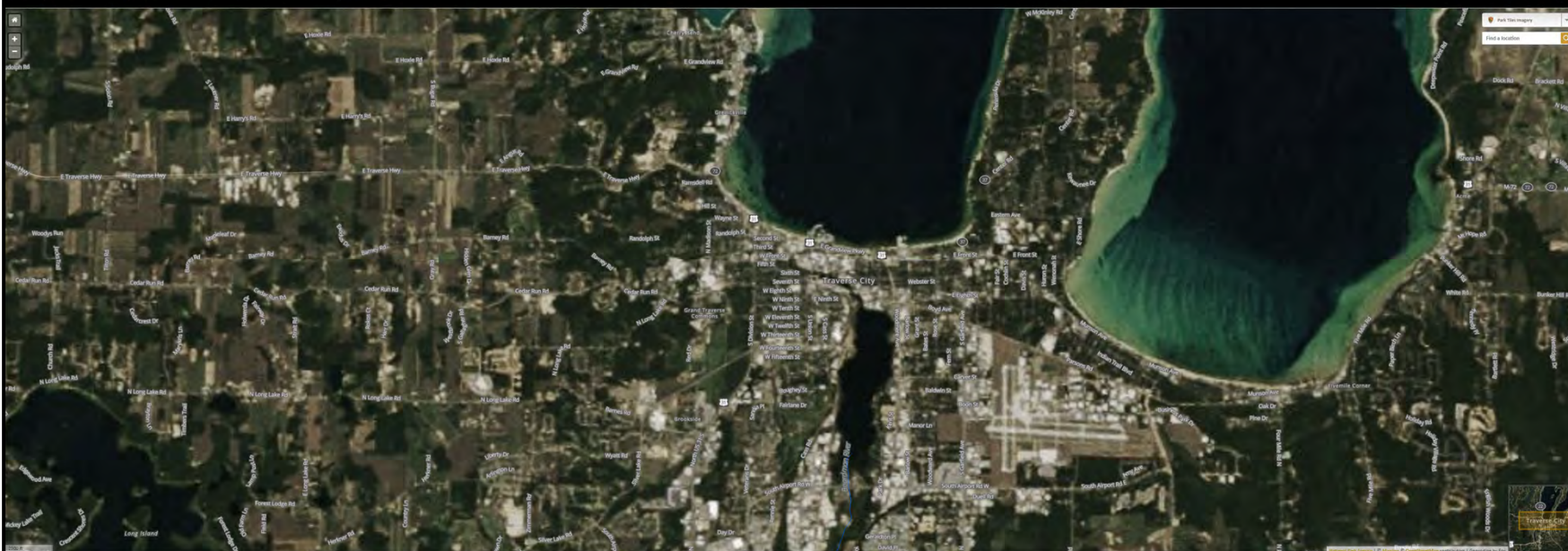


FIGURE 1

**NATIONWIDE RIVERS
INVENTORY**

2026 DWSRF
PROJECT PLAN

JUNE 2026

HRC#: 20260066



FIGURE 1
NATIONAL WILD AND SCENIC
RIVERS MAP

2026 DWSRF
PROJECT PLAN

APPENDIX C: WEB SOILS SURVEY RESULTS



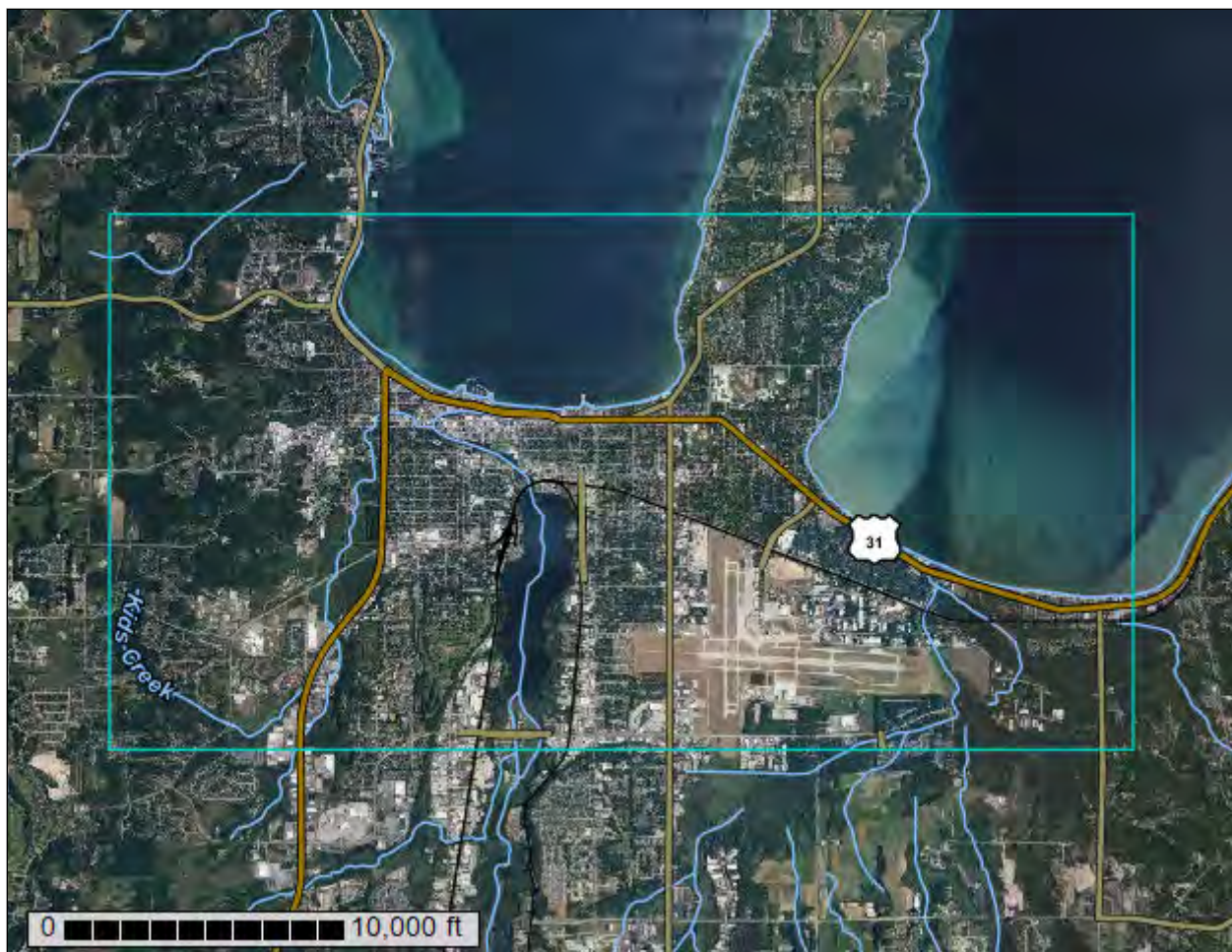
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Grand Traverse County, Michigan, and Leelanau County, Michigan



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



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MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,800 to 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grand Traverse County, Michigan

Survey Area Data: Version 19, Sep 3, 2025

Soil Survey Area: Leelanau County, Michigan

Survey Area Data: Version 19, Sep 4, 2025

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 2, 2020—May 28, 2023

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AdracA	Adrian muck, lake moderated snowy, 0 to 1 percent slopes	1.7	0.0%
AeA	Alpena-East Lake gravelly loamy sands, 0 to 2 percent slopes	2.7	0.0%
AeB	Alpena-East Lake gravelly loamy sands, 2 to 6 percent slopes	15.7	0.1%
AeC	Alpena-East Lake gravelly loamy sands, 6 to 12 percent slopes	3.9	0.0%
AsA	Au Gres-Saugatuck sands, 0 to 2 percent slopes	18.2	0.1%
CaraeA	Carlisle muck, lake moderated snowy, 0 to 2 percent slopes	273.7	1.7%
CoA	Croswell loamy sands, 0 to 2 percent slopes, overwash	86.0	0.5%
CoB	Croswell loamy sands, 2 to 6 percent slopes, overwash	12.0	0.1%
CpA	Croswell loamy sands, 0 to 2 percent slopes	61.0	0.4%
CpB	Croswell loamy sands, 2 to 6 percent slopes	6.9	0.0%
CrA	Croswell-Rubicon sands, 0 to 2 percent slopes	598.2	3.7%
EdwaaA	Edwards muck, lake moderated snowy, 0 to 1 percent slopes	285.3	1.8%
EmA	East Lake-Mancelona loamy sands, 0 to 2 percent slopes	701.8	4.4%
EmB	East Lake-Mancelona loamy sands, 2 to 6 percent slopes	327.0	2.0%
EmC	East Lake-Mancelona loamy sands, 6 to 12 percent slopes	46.9	0.3%
EmE	East Lake-Mancelona loamy sands, 18 to 25 percent slopes	28.7	0.2%
ErA	Eastport-Roscommon sands, 0 to 2 percent slopes	219.7	1.4%
ExA	Emmet gravelly sandy loam, 0 to 2 percent slopes	28.8	0.2%
ExB	Emmet gravelly sandy loam, 2 to 6 percent slopes	175.5	1.1%
ExC	Emmet gravelly sandy loam, 6 to 12 percent slopes	144.8	0.9%

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Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ExD	Emmet gravelly sandy loam, 12 to 18 percent slopes	64.2	0.4%
ExD2	Emmet gravelly sandy loam, 12 to 18 percent slopes, moderately eroded	31.4	0.2%
ExE	Emmet gravelly sandy loam, 18 to 25 percent slopes	71.3	0.4%
ExE2	Emmet gravelly sandy loam, 18 to 25 percent slopes, moderately eroded	17.1	0.1%
ExF	Emmet gravelly sandy loam, 25 to 45 percent slopes	266.5	1.7%
ExF2	Emmet gravelly sandy loam, 25 to 45 percent slopes, moderately eroded	265.5	1.7%
EyA	Emmet sandy loam, 0 to 2 percent slopes	7.5	0.0%
EyB	Emmet sandy loam, 2 to 6 percent slopes	55.5	0.3%
EyC	Emmet sandy loam, 6 to 12 percent slopes	95.7	0.6%
EyC2	Emmet sandy loam, 6 to 12 percent slopes, moderately eroded	21.0	0.1%
EyD	Emmet sandy loam, 12 to 18 percent slopes	17.7	0.1%
EyD2	Emmet sandy loam, 12 to 18 percent slopes, moderately eroded	3.6	0.0%
EyE	Emmet sandy loam, 18 to 25 percent slopes	11.6	0.1%
EyE2	Emmet sandy loam, 18 to 25 percent slopes, moderately eroded	36.2	0.2%
EyF	Emmet sandy loam, 25 to 45 percent slopes	44.9	0.3%
EyF2	Emmet sandy loam, 25 to 45 percent slopes, moderately eroded	53.1	0.3%
Fm	Fresh water marsh	7.3	0.0%
GrA	Gladwin-Richter gravelly sandy loams, 0 to 2 percent slopes	8.0	0.0%
GrB	Gladwin-Richter gravelly sandy loams, 2 to 6 percent slopes	26.3	0.2%
GsE	Gravelly land, moderately steep	7.4	0.0%
GsF	Gravelly land, steep	11.1	0.1%
Gt	Gravel pits	15.0	0.1%
GxA	Guelph-Nester loams, 0 to 2 percent slopes	2.5	0.0%

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Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
GxB2	Guelph-Nester loams, 2 to 6 percent slopes, moderately eroded	3.3	0.0%
GxC2	Guelph-Nester loams, 6 to 12 percent slopes, moderately eroded	7.3	0.0%
GxD2	Guelph-Nester loams, 12 to 18 percent slopes, moderately eroded	6.2	0.0%
GxE2	Guelph-Nester loams, 18 to 25 percent slopes, moderately eroded	4.8	0.0%
GxF2	Guelph-Nester loams, 25 to 35 percent slopes, moderately eroded	4.3	0.0%
Gy	Gullied land	0.7	0.0%
HgtaaA	Houghton muck, lake moderated snowy, 0 to 1 percent slopes	33.5	0.2%
IIB	Iosco loamy sand, 2 to 6 percent slopes	19.0	0.1%
IIC	Iosco loamy sand, 6 to 12 percent slopes	7.6	0.0%
IsA	Iosco-Ogemaw loamy sands, 0 to 2 percent slopes	44.1	0.3%
IsB	Iosco-Ogemaw loamy sands, 2 to 6 percent slopes	10.6	0.1%
KaA	Kalkaska loamy sand, 0 to 2 percent slopes	371.0	2.3%
KaB	Kalkaska loamy sand, 2 to 6 percent slopes	90.8	0.6%
KaC	Kalkaska loamy sand, 6 to 12 percent slopes	107.7	0.7%
KaD	Kalkaska loamy sand, 12 to 18 percent slopes	16.7	0.1%
KaE	Kalkaska loamy sand, 18 to 25 percent slopes	74.8	0.5%
KaE2	Kalkaska loamy sand, 18 to 25 percent slopes, moderately eroded	59.1	0.4%
KaF	Kalkaska loamy sand, 25 to 45 percent slopes	37.9	0.2%
KaF2	Kalkaska loamy sand, 25 to 45 percent slopes, moderately eroded	11.6	0.1%
KbB	Kalkaska sand, 0 to 6 percent slopes	34.8	0.2%
KbD	Kalkaska sand, 6 to 18 percent slopes	3.4	0.0%
KbF	Kalkaska sand, 35 to 60 percent slopes	157.3	1.0%

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Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KIC	Karlin loamy sand, 6 to 12 percent slopes	0.0	0.0%
KIF	Karlin loamy sand, 25 to 45 percent slopes	31.8	0.2%
Kt	Kerston muck	169.8	1.1%
LeB	Lake beach and Eastport sand, 0 to 6 percent slopes	534.9	3.3%
LkA	Leelanau-Kalkaska loamy sands, 0 to 2 percent slopes	1.5	0.0%
LkB	Leelanau-Kalkaska loamy sands, 2 to 6 percent slopes	60.5	0.4%
LkC	Leelanau-Kalkaska loamy sands, 6 to 12 percent slopes	131.5	0.8%
LkD	Leelanau-Kalkaska loamy sands, 12 to 18 percent slopes	24.9	0.2%
LkD2	Leelanau-Kalkaska loamy sands, 12 to 18 percent slopes, moderately eroded	0.7	0.0%
LkE	Leelanau-Kalkaska loamy sands, 18 to 25 percent slopes	238.7	1.5%
LkE2	Leelanau-Kalkaska loamy sands, 18 to 25 percent slopes, moderately eroded	39.1	0.2%
LkF	Leelanau-Kalkaska loamy sands, 25 to 45 percent slopes	140.6	0.9%
LkF2	Leelanau-Kalkaska loamy sands, 25 to 45 percent slopes, moderately eroded	96.9	0.6%
MaA	Mancelona gravelly sandy loam, 0 to 2 percent slopes	1.0	0.0%
MaC	Mancelona gravelly sandy loam, 6 to 12 percent slopes	2.9	0.0%
MaC2	Mancelona gravelly sandy loam, 6 to 12 percent slopes, moderately eroded	3.1	0.0%
MaD	Mancelona gravelly sandy loam, 12 to 18 percent slopes	1.0	0.0%
MeA	Mancelona-East Lake loamy sands, 0 to 2 percent slopes	90.4	0.6%
MeB	Mancelona-East Lake loamy sands, 2 to 6 percent slopes	0.4	0.0%
MeE	Mancelona-East Lake loamy sands, 18 to 25 percent slopes	19.2	0.1%
RcA	Richter loams, 0 to 2 percent slopes, overwash	75.7	0.5%
RcB	Richter loams, 2 to 6 percent slopes, overwash	33.5	0.2%

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Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
RhA	Richter loams, 0 to 2 percent slopes	82.7	0.5%
RpA	Richter, Tonkey, and Pinconning loams, 0 to 2 percent slopes, overwash	18.9	0.1%
RrA	Richter, Tonkey, and Pinconning loams, 0 to 2 percent slopes	145.6	0.9%
RrC	Richter, Tonkey, and Pinconning loams, 6 to 12 percent slopes	5.0	0.0%
Rs	Rifle peat	99.0	0.6%
Ru	Roscommon mucky loamy sand	129.7	0.8%
RwA	Rubicon sand, 0 to 2 percent slopes	2,431.5	15.2%
RwB	Rubicon sand, 0 to 6 percent slopes	222.9	1.4%
SrB	Sanilac-Richter loams, 0 to 6 percent slopes	1.5	0.0%
Ta	Tawas-Roscommon complex	33.2	0.2%
Tm	Tonkey mucky sandy loam	6.9	0.0%
Tn	Tonkey sandy loam, overwash	7.9	0.0%
To	Tonkey sandy loam	38.8	0.2%
Tp	Tonkey-Hettinger-Pickford loams, overwash	15.9	0.1%
Tr	Tonkey-Hettinger-Pickford loams	6.1	0.0%
UnA	Ubyl-Nester complex, 0 to 2 percent slopes	0.8	0.0%
UnB	Ubyl-Nester complex, 2 to 6 percent slopes	9.1	0.1%
UnD2	Ubyl-Nester complex, 12 to 18 percent slopes, moderately eroded	3.1	0.0%
UnE	Ubyl-Nester complex, 18 to 25 percent slopes	3.9	0.0%
UnE2	Ubyl-Nester complex, 18 to 25 percent slopes, moderately eroded	0.0	0.0%
UnF	Ubyl-Nester complex, 25 to 35 percent slopes	0.1	0.0%
W	Water	347.7	2.2%
WdD	Wind eroded land, strongly sloping	77.8	0.5%
Subtotals for Soil Survey Area		10,672.1	66.5%
Totals for Area of Interest		16,048.4	100.0%

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Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ArA	Alcona-Richter sandy loams, 0 to 2 percent slopes	13.1	0.1%
ArB	Alcona-Richter sandy loams, 2 to 6 percent slopes	1.6	0.0%
EdB	Eastport sand, 0 to 6 percent slopes	30.6	0.2%
EnB	Emmet-Leelanau complex, 2 to 6 percent slopes	6.0	0.0%
EnC	Emmet-Leelanau complex, 6 to 12 percent slopes	2.1	0.0%
EnD	Emmet-Leelanau complex, 12 to 18 percent slopes	1.6	0.0%
EnE	Emmet-Leelanau complex, 18 to 25 percent slopes	2.4	0.0%
EnF	Emmet-Leelanau complex, 25 to 50 percent slopes	11.3	0.1%
EoC	Emmet-Mancelona gravelly sandy loams, 4 to 12 percent slopes	19.8	0.1%
EoE	Emmet-Mancelona gravelly sandy loams, 18 to 35 percent slopes	2.5	0.0%
Hm	Hettinger-Muck complex	1.3	0.0%
KaB	Kaleva sand, 0 to 6 percent slopes	20.5	0.1%
KaC	Kaleva sand, 6 to 12 percent slopes	10.6	0.1%
KeB	Kalkaska-East Lake loamy sands, 0 to 6 percent slopes, lake moderated	0.2	0.0%
LIB	Leelanau-East Lake loamy sands, 0 to 6 percent slopes	23.5	0.1%
LIC	Leelanau-East Lake loamy sands, 6 to 12 percent slopes	45.1	0.3%
LID	Leelanau-East Lake loamy sands, 12 to 18 percent slopes, lake moderated	24.4	0.2%
LIE	Leelanau-East Lake loamy sands, 18 to 25 percent slopes, lake moderated	25.9	0.2%
LIF	Leelanau-East Lake loamy sands, 25 to 45 percent slopes	230.5	1.4%
Lm	Lupton-Markey mucks	128.1	0.8%
MrB	Mancelona-Richter gravelly sandy loams, 0 to 6 percent slopes	6.8	0.0%
NtF3	Nester silty clay loam, 20 to 50 percent slopes, severely eroded	3.6	0.0%

Custom Soil Resource Report

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PpskaB	Pipestone-Kaleva sands, 0 to 4 percent slopes	10.1	0.1%
Pt	Pits, gravel	1.5	0.0%
TmA	Tonkey-Munuscong-Iosco sandy loams, 0 to 2 percent slopes	2.6	0.0%
TmB	Tonkey-Munuscong-Iosco sandy loams, 2 to 6 percent slopes	5.3	0.0%
WID	Wind eroded land, steep	19.0	0.1%
Subtotals for Soil Survey Area		650.1	4.1%
Totals for Area of Interest		16,048.4	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Grand Traverse County, Michigan

AdracA—Adrian muck, lake moderated snowy, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2zdlg
Landscape: Till plains
Elevation: 610 to 760 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 110 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Adrian and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Adrian

Setting

Landscape: Till plains
Landform: Depressions on outwash plains, Depressions on moraines on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Herbaceous organic material over sandy glaciofluvial deposits

Typical profile

Oa1 - 0 to 12 inches: muck
Oa2 - 12 to 34 inches: muck
Cg - 34 to 80 inches: sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline (0.3 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 0.2
Available water supply, 0 to 60 inches: Very high (about 15.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F096XA014MI - Snowy Mucky Depression

Custom Soil Resource Report

Hydric soil rating: Yes

Minor Components

Kingsville

Percent of map unit: 3 percent

Landscape: Outwash plains, lake plains

Landform: Outwash plains, Nearshore zones (relict)

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F096XA011MI - Snowy Wet Sandy Depression

Hydric soil rating: Yes

Edwards

Percent of map unit: 2 percent

Landscape: Till plains

Landform: Depressions on outwash plains, Depressions on moraines on outwash plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope, dip

Down-slope shape: Concave, linear

Across-slope shape: Linear

Ecological site: F096XA014MI - Snowy Mucky Depression

Hydric soil rating: Yes

Houghton

Percent of map unit: 2 percent

Landscape: Till plains

Landform: Depressions on outwash plains, Depressions on moraines on outwash plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope, dip

Down-slope shape: Concave

Across-slope shape: Linear

Ecological site: F096XA014MI - Snowy Mucky Depression

Hydric soil rating: Yes

Gilford, gravelly subsoil

Percent of map unit: 1 percent

Landscape: Outwash plains, till plains

Landform: Glacial drainage channels, Glacial drainage channels

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F096XA011MI - Snowy Wet Sandy Depression

Hydric soil rating: Yes

AeA—Alpena-East Lake gravelly loamy sands, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c25
Elevation: 600 to 1,000 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Alpena and similar soils: 60 percent
East lake and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alpena

Setting

Landform: Outwash plains, Glacial lakeshores, Kames
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 4 to 10 inches of sandy and loamy material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 12 inches: gravelly loamy sand
H2 - 12 to 60 inches: very gravelly sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Description of East Lake

Setting

Landform: Outwash plains, Beach ridges, Lake terraces

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: gravelly loamy sand

H2 - 8 to 24 inches: loamy sand

H3 - 24 to 60 inches: stratified gravelly sand to sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

AeB—Alpena-East Lake gravelly loamy sands, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c26

Elevation: 600 to 1,000 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 43 to 45 degrees F

Frost-free period: 120 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Alpena and similar soils: 60 percent

East lake and similar soils: 40 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alpena

Setting

Landform: Outwash plains, Glacial lakeshores, Kames

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 4 to 10 inches of sandy and loamy material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 12 inches: gravelly loamy sand

H2 - 12 to 60 inches: very gravelly sand

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Description of East Lake

Setting

Landform: Outwash plains, Beach ridges, Lake terraces

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: gravelly loamy sand

H2 - 8 to 24 inches: loamy sand

H3 - 24 to 60 inches: stratified gravelly sand to sand

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

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Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

AeC—Alpena-East Lake gravelly loamy sands, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6c27
Elevation: 600 to 1,000 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Alpena and similar soils: 60 percent
East lake and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alpena

Setting

Landform: Outwash plains, Kames, Glacial lakeshores
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex, linear
Parent material: 4 to 10 inches of sandy and loamy material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 12 inches: gravelly loamy sand
H2 - 12 to 60 inches: very gravelly sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)

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Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Description of East Lake

Setting

Landform: Outwash plains, Beach ridges, Lake terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: gravelly loamy sand
H2 - 8 to 24 inches: loamy sand
H3 - 24 to 60 inches: stratified gravelly sand to sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

AsA—Au Gres-Saugatuck sands, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c2b
Elevation: 600 to 1,800 feet
Mean annual precipitation: 22 to 40 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Au gres and similar soils: 55 percent
Saugatuck and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Au Gres

Setting

Landform: Outwash plains, Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 4 inches: sand
H2 - 4 to 22 inches: sand
H3 - 22 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Ecological site: F094AA007MI - Snowy Acidic Sandy Depression, F096XA008MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

Description of Saugatuck

Setting

Landform: Till plains, Outwash plains, Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy glaciofluvial deposits cemented with ortstein

Typical profile

H1 - 0 to 2 inches: sand

H2 - 2 to 12 inches: sand

H3 - 12 to 26 inches: sand

H4 - 26 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Very low (about 0.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4w

Hydrologic Soil Group: B/D

Ecological site: F094AA007MI - Snowy Acidic Sandy Depression, F096XA008MI - Snowy Acidic Sandy Depression

Hydric soil rating: No

Minor Components

Roscommon

Percent of map unit: 5 percent

Landform: Depressions on lake plains, Depressions on outwash plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

CaraeA—Carlisle muck, lake moderated snowy, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 30n5c

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Landscape: Till plains
Elevation: 580 to 1,000 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 110 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Carlisle and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Carlisle

Setting

Landscape: Till plains
Landform: Depressions on moraines, Depressions on glacial drainage channels,
Depressions on outwash plains, Depressions on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Woody organic material

Typical profile

Oa1 - 0 to 13 inches: muck
Oa2 - 13 to 37 inches: muck
Oa3 - 37 to 80 inches: muck

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.14 to 14.17 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 0.6
Available water supply, 0 to 60 inches: Very high (about 23.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F096XA014MI - Snowy Mucky Depression
Hydric soil rating: Yes

Minor Components

Adrian

Percent of map unit: 5 percent
Landscape: Till plains, ice-margin complexes
Landform: Drainageways on moraines, Depressions on moraines, Drainageways
on moraines, Drainageways on glacial drainage channels, Drainageways on

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outwash plains, Depressions on outwash plains, Depressions on outwash plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave

Across-slope shape: Linear

Ecological site: F096XA014MI - Snowy Mucky Depression

Hydric soil rating: Yes

Kingsville

Percent of map unit: 3 percent

Landscape: Outwash plains, lake plains

Landform: Outwash plains, Nearshore zones (relict)

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F096XA011MI - Snowy Wet Sandy Depression

Hydric soil rating: Yes

Wallkill

Percent of map unit: 2 percent

Landscape: Till plains

Landform: Depressions on glacial drainage channels, Depressions on moraines, Depressions on till plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave, linear

Across-slope shape: Concave, linear

Ecological site: F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

CoA—Croswell loamy sands, 0 to 2 percent slopes, overwash

Map Unit Setting

National map unit symbol: 6c2h

Elevation: 600 to 1,600 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Croswell and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Croswell

Setting

Landform: Lake plains, Outwash plains

Landform position (three-dimensional): Rise

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Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 5 inches: loamy sand
H2 - 5 to 12 inches: sand
H3 - 12 to 30 inches: sand
H4 - 30 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA008MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

CoB—Croswell loamy sands, 2 to 6 percent slopes, overwash

Map Unit Setting

National map unit symbol: 6c2j
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 90 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Croswell and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Croswell

Setting

Landform: Lake plains, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 5 inches: loamy sand
H2 - 5 to 12 inches: sand
H3 - 12 to 30 inches: sand
H4 - 30 to 60 inches: sand

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA008MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

CpA—Croswell loamy sands, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c2k
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 90 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Croswell and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Croswell

Setting

Landform: Lake plains, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 5 inches: loamy sand
H2 - 5 to 12 inches: sand
H3 - 12 to 30 inches: sand

H4 - 30 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: About 24 to 42 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F096XA008MI - Snowy Acidic Sandy Depression

Hydric soil rating: No

CpB—Croswell loamy sands, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c2m

Elevation: 600 to 1,600 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Croswell and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Croswell

Setting

Landform: Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 5 inches: loamy sand

H2 - 5 to 12 inches: sand

H3 - 12 to 30 inches: sand

H4 - 30 to 60 inches: sand

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Custom Soil Resource Report

Drainage class: Moderately well drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: About 24 to 42 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F094AA007MI - Snowy Acidic Sandy Depression, F096XA008MI - Snowy Acidic Sandy Depression

Hydric soil rating: No

CrA—Croswell-Rubicon sands, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c2p

Elevation: 600 to 1,800 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 80 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Croswell and similar soils: 50 percent

Rubicon and similar soils: 35 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Croswell

Setting

Landform: Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 5 inches: sand

H2 - 5 to 12 inches: sand

H3 - 12 to 30 inches: sand

H4 - 30 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Custom Soil Resource Report

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: About 24 to 42 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F096XA008MI - Snowy Acidic Sandy Depression

Hydric soil rating: No

Description of Rubicon

Setting

Landform: Beach ridges, Moraines, Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 5 inches: sand

H2 - 5 to 34 inches: sand

H3 - 34 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Eastport

Percent of map unit: 5 percent

Landform: Beach ridges, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

East lake

Percent of map unit: 5 percent
Landform: Beach ridges, Lake terraces, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Au gres

Percent of map unit: 5 percent
Landform: Lake plains, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

EdwaaA—Edwards muck, lake moderated snowy, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2zdl4
Landscape: Till plains
Elevation: 590 to 760 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 110 to 160 days
Farmland classification: Farmland of local importance

Map Unit Composition

Edwards and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Edwards

Setting

Landscape: Till plains
Landform: Lakebeds (relict) on glacial drainage channels, Lakebeds (relict) on outwash plains, Lakebeds (relict) on moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Herbaceous organic material over marl

Typical profile

Oa1 - 0 to 9 inches: muck
Oa2 - 9 to 26 inches: muck
Lma - 26 to 80 inches: marly silt loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 100 percent
Gypsum, maximum content: 4 percent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Very high (about 20.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F096XA014MI - Snowy Mucky Depression
Hydric soil rating: Yes

Minor Components

Adrian

Percent of map unit: 3 percent
Landscape: Till plains
Landform: Lakebeds (relict) on moraines, Lakebeds (relict) on glacial drainage channels, Lakebeds (relict) on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F096XA014MI - Snowy Mucky Depression
Hydric soil rating: Yes

Houghton

Percent of map unit: 3 percent
Landscape: Till plains, outwash plains
Landform: Lakebeds (relict) on glacial drainage channels, Lakebeds (relict) on outwash plains, Lakebeds (relict) on moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F096XA014MI - Snowy Mucky Depression
Hydric soil rating: Yes

Gilford

Percent of map unit: 2 percent
Landscape: Till plains, outwash plains
Landform: Lakebeds (relict) on moraines, Lakebeds (relict) on glacial drainage channels, Lakebeds (relict) on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, talf

Custom Soil Resource Report

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F096XA005MI - Snowy Wet Loamy Depression
Hydric soil rating: Yes

Palms

Percent of map unit: 2 percent
Landscape: Till plains, ice-margin complexes, outwash plains
Landform: Drainageways on moraines, Depressions on moraines, Drainageways on glacial drainage channels, Drainageways on outwash plains, Depressions on outwash plains, Depressions on outwash plains, Drainageways on moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F096XA014MI - Snowy Mucky Depression
Hydric soil rating: Yes

EmA—East Lake-Mancelona loamy sands, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c2s
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 90 to 150 days
Farmland classification: Farmland of unique importance

Map Unit Composition

East lake and similar soils: 55 percent
Mancelona and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of East Lake

Setting

Landform: Outwash plains, Beach ridges, Lake terraces
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 24 inches: loamy sand
H3 - 24 to 60 inches: stratified gravelly sand to sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Description of Mancelona

Setting

Landform: Beach ridges, Outwash plains, Moraines, Kames, Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 13 inches: loamy sand
H3 - 13 to 20 inches: sandy clay loam
H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Minor Components

Croswell

Percent of map unit: 5 percent
Landform: Outwash plains, Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

EmB—East Lake-Mancelona loamy sands, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c2t
Elevation: 600 to 1,000 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 100 to 150 days
Farmland classification: Farmland of unique importance

Map Unit Composition

East lake and similar soils: 60 percent
Mancelona and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of East Lake

Setting

Landform: Outwash plains, Beach ridges, Lake terraces
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 24 inches: loamy sand
H3 - 24 to 60 inches: stratified gravelly sand to sand

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

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Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Description of Mancelona

Setting

Landform: Beach ridges, Outwash plains, Moraines, Kames, Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 13 inches: loamy sand
H3 - 13 to 20 inches: sandy clay loam
H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

EmC—East Lake-Mancelona loamy sands, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6c2v

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Elevation: 600 to 1,000 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 100 to 150 days
Farmland classification: Farmland of unique importance

Map Unit Composition

East lake and similar soils: 60 percent
Mancelona and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of East Lake

Setting

Landform: Outwash plains, Beach ridges, Lake terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 24 inches: loamy sand
H3 - 24 to 60 inches: stratified gravelly sand to sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Description of Mancelona

Setting

Landform: Beach ridges, Outwash plains, Moraines, Kames, Lake plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Custom Soil Resource Report

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand

H2 - 6 to 13 inches: loamy sand

H3 - 13 to 20 inches: sandy clay loam

H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

EmE—East Lake-Mancelona loamy sands, 18 to 25 percent slopes

Map Unit Setting

National map unit symbol: 6c2y

Elevation: 600 to 1,000 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 100 to 150 days

Farmland classification: Farmland of unique importance

Map Unit Composition

East lake and similar soils: 60 percent

Mancelona and similar soils: 40 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of East Lake

Setting

Landform: Outwash plains, Beach ridges, Lake terraces

Custom Soil Resource Report

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 24 inches: loamy sand

H3 - 24 to 60 inches: stratified gravelly sand to sand

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Description of Mancelona

Setting

Landform: Beach ridges, Outwash plains, Moraines, Kames, Lake plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand

H2 - 6 to 13 inches: loamy sand

H3 - 13 to 20 inches: sandy clay loam

H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Custom Soil Resource Report

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

ErA—Eastport-Roscommon sands, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c31

Elevation: 600 to 1,800 feet

Mean annual precipitation: 22 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Eastport and similar soils: 50 percent

Roscommon and similar soils: 40 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eastport

Setting

Landform: Dunes, Beach ridges

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy eolian deposits

Typical profile

H1 - 0 to 5 inches: sand

H2 - 5 to 26 inches: sand

H3 - 26 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Description of Roscommon

Setting

Landform: Depressions on lake plains, Depressions on outwash plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 3 inches: sand

H2 - 3 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6w

Hydrologic Soil Group: A/D

Ecological site: F096XA011MI - Snowy Wet Sandy Depression

Hydric soil rating: Yes

Minor Components

Au gres

Percent of map unit: 5 percent

Landform: Outwash plains, Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Croswell

Percent of map unit: 5 percent
Landform: Outwash plains, Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

ExA—Emmet gravelly sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c33
Elevation: 600 to 1,200 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 100 to 140 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Emmet and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 30 inches: sandy loam
H3 - 30 to 38 inches: sandy clay loam
H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

ExB—Emmet gravelly sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c34
Elevation: 600 to 1,200 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 100 to 150 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Emmet and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 30 inches: sandy loam
H3 - 30 to 38 inches: sandy clay loam
H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

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Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Minor Components

Mancelona

Percent of map unit: 10 percent
Landform: Beach ridges, Lake plains, Outwash plains, Kames, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

ExC—Emmet gravelly sandy loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6c35
Elevation: 600 to 1,200 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 100 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Emmet and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 30 inches: sandy loam
H3 - 30 to 38 inches: sandy clay loam
H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches

Custom Soil Resource Report

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Mancelona

Percent of map unit: 10 percent

Landform: Beach ridges, Lake plains, Outwash plains, Kames, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

ExD—Emmet gravelly sandy loam, 12 to 18 percent slopes

Map Unit Setting

National map unit symbol: 6c36

Elevation: 600 to 1,200 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 100 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Emmet and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines

Custom Soil Resource Report

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Mancelona

Percent of map unit: 10 percent

Landform: Beach ridges, Lake plains, Outwash plains, Kames, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

ExD2—Emmet gravelly sandy loam, 12 to 18 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c37

Elevation: 600 to 1,200 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 100 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Emmet, moderately eroded, and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Custom Soil Resource Report

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Mancelona

Percent of map unit: 10 percent

Landform: Beach ridges, Lake plains, Outwash plains, Kames, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

ExE—Emmet gravelly sandy loam, 18 to 25 percent slopes

Map Unit Setting

National map unit symbol: 6c38

Elevation: 600 to 1,200 feet

Mean annual precipitation: 28 to 32 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 100 to 140 days

Farmland classification: Not prime farmland

Map Unit Composition

Emmet and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 18 to 25 percent

Custom Soil Resource Report

Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

ExE2—Emmet gravelly sandy loam, 18 to 25 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c39
Elevation: 600 to 1,200 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 100 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Emmet, moderately eroded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet, Moderately Eroded

Setting

Landform: Till plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 30 inches: sandy loam
H3 - 30 to 38 inches: sandy clay loam
H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Minor Components

Mancelona

Percent of map unit: 10 percent
Landform: Beach ridges, Lake plains, Outwash plains, Kames, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

ExF—Emmet gravelly sandy loam, 25 to 45 percent slopes

Map Unit Setting

National map unit symbol: 6c3b
Elevation: 600 to 1,200 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Emmet and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 25 to 45 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

ExF2—Emmet gravelly sandy loam, 25 to 45 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c3c

Elevation: 600 to 1,200 feet

Mean annual precipitation: 28 to 32 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 100 to 140 days

Farmland classification: Not prime farmland

Map Unit Composition

Emmet, moderately eroded, and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 25 to 45 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

EyA—Emmet sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c3d

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 90 to 140 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Emmet and similar soils: 90 percent

Custom Soil Resource Report

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 10 percent

Landform: Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

EyB—Emmet sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c3f
Elevation: 600 to 1,400 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 90 to 140 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Emmet and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 30 inches: sandy loam
H3 - 30 to 38 inches: sandy clay loam
H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 10 percent
Landform: Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

EyC—Emmet sandy loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6c3h
Elevation: 600 to 1,400 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 90 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Emmet and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 30 inches: sandy loam
H3 - 30 to 38 inches: sandy clay loam
H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Custom Soil Resource Report

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 10 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

EyC2—Emmet sandy loam, 6 to 12 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c3j
Elevation: 600 to 1,400 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 90 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Emmet, moderately eroded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet, Moderately Eroded

Setting

Landform: Till plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear

Custom Soil Resource Report

Across-slope shape: Convex, linear

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 10 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

EyD—Emmet sandy loam, 12 to 18 percent slopes

Map Unit Setting

National map unit symbol: 6c3k

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Emmet and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Beach ridges, Lake terraces, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

EyD2—Emmet sandy loam, 12 to 18 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c3l

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Emmet, moderately eroded, and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Beach ridges, Lake terraces, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

EyE—Emmet sandy loam, 18 to 25 percent slopes

Map Unit Setting

National map unit symbol: 6c3m

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Farmland of unique importance

Map Unit Composition

Emmet and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Beach ridges, Lake terraces, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

EyE2—Emmet sandy loam, 18 to 25 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c3n

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Farmland of unique importance

Map Unit Composition

Emmet, moderately eroded, and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Beach ridges, Lake terraces, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

EyF—Emmet sandy loam, 25 to 45 percent slopes

Map Unit Setting

National map unit symbol: 6c3q

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Emmet and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 25 to 45 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Beach ridges, Lake terraces, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

EyF2—Emmet sandy loam, 25 to 45 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c3r

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 45 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Emmet, moderately eroded, and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 38 inches: sandy clay loam

H4 - 38 to 60 inches: sandy loam

Properties and qualities

Slope: 25 to 45 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Beach ridges, Lake terraces, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Leelanau

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Fm—Fresh water marsh

Map Unit Composition

Fresh water marsh: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fresh Water Marsh

Interpretive groups

Land capability classification (irrigated): None specified

Ecological site: R096XY002MI - Great Lakes Marsh

Hydric soil rating: Unranked

GrA—Gladwin-Richter gravelly sandy loams, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c3v
Elevation: 600 to 1,400 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 160 days
Farmland classification: Farmland of local importance

Map Unit Composition

Gladwin and similar soils: 60 percent
Richter and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gladwin

Setting

Landform: Beach ridges, Lake plains, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 40 inches of sandy material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 14 inches: loamy sand
H3 - 14 to 20 inches: sandy loam
H4 - 20 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Ecological site: F096XA008MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

Description of Richter

Setting

Landform: Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 39 inches: very fine sandy loam

H3 - 39 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: B/D

Ecological site: F096XA004MI - Snowy Loamy Depression

Hydric soil rating: No

GrB—Gladwin-Richter gravelly sandy loams, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c3w

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 33 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 160 days

Farmland classification: Farmland of local importance

Map Unit Composition

Gladwin and similar soils: 60 percent

Richter and similar soils: 40 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gladwin

Setting

Landform: Beach ridges, Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of sandy material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam

H2 - 8 to 14 inches: loamy sand

H3 - 14 to 20 inches: sandy loam

H4 - 20 to 60 inches: gravelly sand

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: A/D

Ecological site: F096XA008MI - Snowy Acidic Sandy Depression

Hydric soil rating: No

Description of Richter

Setting

Landform: Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 39 inches: very fine sandy loam

H3 - 39 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: B/D

Ecological site: F096XA004MI - Snowy Loamy Depression

Hydric soil rating: No

GsE—Gravelly land, moderately steep

Map Unit Composition

Gravelly land: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

GsF—Gravelly land, steep

Map Unit Composition

Gravelly land: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Gt—Gravel pits

Map Unit Composition

Gravel pits: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

GxA—Guelph-Nester loams, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c43

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 100 to 140 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Guelph and similar soils: 60 percent

Custom Soil Resource Report

Nester and similar soils: 40 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Guelph

Setting

Landform: Till plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loamy till

Typical profile

H1 - 0 to 6 inches: loam

H2 - 6 to 21 inches: clay loam

H3 - 21 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Nester

Setting

Landform: Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 14 inches: silty clay loam

H3 - 14 to 28 inches: clay loam

H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: High

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

GxB2—Guelph-Nester loams, 2 to 6 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c45

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 100 to 140 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Guelph, moderately eroded, and similar soils: 60 percent

Nester, moderately eroded, and similar soils: 40 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Guelph, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loamy till

Typical profile

H1 - 0 to 6 inches: loam

H2 - 6 to 21 inches: clay loam

H3 - 21 to 60 inches: silt loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Custom Soil Resource Report

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Description of Nester, Moderately Eroded

Setting

Landform: Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 14 inches: silty clay loam
H3 - 14 to 28 inches: clay loam
H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

GxC2—Guelph-Nester loams, 6 to 12 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c46

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 100 to 140 days

Farmland classification: Farmland of local importance

Map Unit Composition

Guelph, moderately eroded, and similar soils: 60 percent

Nester, moderately eroded, and similar soils: 40 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Guelph, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: Loamy till

Typical profile

H1 - 0 to 6 inches: loam

H2 - 6 to 21 inches: clay loam

H3 - 21 to 60 inches: silt loam

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Nester, Moderately Eroded

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 14 inches: silty clay loam

H3 - 14 to 28 inches: clay loam

H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

GxD2—Guelph-Nester loams, 12 to 18 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c48

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 100 to 140 days

Farmland classification: Farmland of local importance

Map Unit Composition

Guelph, moderately eroded, and similar soils: 60 percent

Nester, moderately eroded, and similar soils: 40 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Guelph, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: Loamy till

Typical profile

H1 - 0 to 6 inches: loam

H2 - 6 to 21 inches: clay loam

H3 - 21 to 60 inches: silt loam

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Nester, Moderately Eroded

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 14 inches: silty clay loam
H3 - 14 to 28 inches: clay loam
H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 12 to 18 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

GxE2—Guelph-Nester loams, 18 to 25 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c49
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 90 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Guelph, moderately eroded, and similar soils: 50 percent
Nester, moderately eroded, and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Guelph, Moderately Eroded

Setting

Landform: Till plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Custom Soil Resource Report

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Loamy till

Typical profile

H1 - 0 to 6 inches: loam
H2 - 6 to 21 inches: clay loam
H3 - 21 to 60 inches: silt loam

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Description of Nester, Moderately Eroded

Setting

Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 14 inches: silty clay loam
H3 - 14 to 28 inches: clay loam
H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Custom Soil Resource Report

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Minor Components

Iosco

Percent of map unit: 5 percent
Landform: Outwash plains, Till plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, side slope, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Ubly

Percent of map unit: 5 percent
Landform: Till plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

GxF2—Guelph-Nester loams, 25 to 35 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c4b
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 90 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Guelph, moderately eroded, and similar soils: 50 percent

Custom Soil Resource Report

Nester, moderately eroded, and similar soils: 40 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Guelph, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: Loamy till

Typical profile

H1 - 0 to 6 inches: loam

H2 - 6 to 21 inches: clay loam

H3 - 21 to 60 inches: silt loam

Properties and qualities

Slope: 25 to 35 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Nester, Moderately Eroded

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 14 inches: silty clay loam

Custom Soil Resource Report

H3 - 14 to 28 inches: clay loam

H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 25 to 35 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

losco

Percent of map unit: 5 percent

Landform: Outwash plains, Till plains

Landform position (two-dimensional): Footslope, toeslope

Landform position (three-dimensional): Side slope, base slope

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Ubly

Percent of map unit: 5 percent

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Gy—Gullied land

Map Unit Composition

Gullied land: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

HgtaaA—Houghton muck, lake moderated snowy, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2zdlb
Landscape: Till plains
Elevation: 710 to 960 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 110 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Houghton and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Houghton

Setting

Landscape: Till plains
Landform: Depressions on outwash plains, Depressions on moraines on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Herbaceous organic material

Typical profile

Oa1 - 0 to 12 inches: muck
Oa2 - 12 to 35 inches: muck
Oa3 - 35 to 80 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 3 percent
Maximum salinity: Nonsaline to very slightly saline (0.4 to 2.7 mmhos/cm)
Sodium adsorption ratio, maximum: 0.8
Available water supply, 0 to 60 inches: Very high (about 23.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F096XA014MI - Snowy Mucky Depression

Custom Soil Resource Report

Hydric soil rating: Yes

Minor Components

Adrian

Percent of map unit: 4 percent

Landscape: Till plains

Landform: Depressions on outwash plains, Depressions on moraines on outwash plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope, dip

Down-slope shape: Concave

Across-slope shape: Linear

Ecological site: F096XA014MI - Snowy Mucky Depression

Hydric soil rating: Yes

Edwards

Percent of map unit: 3 percent

Landscape: Till plains

Landform: Depressions on outwash plains, Depressions on moraines on outwash plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope, dip

Down-slope shape: Concave, linear

Across-slope shape: Linear

Ecological site: F096XA014MI - Snowy Mucky Depression

Hydric soil rating: Yes

Palms

Percent of map unit: 2 percent

Landscape: Till plains, outwash plains

Landform: Drainageways on moraines, Drainageways on outwash plains, Depressions on outwash plains, Depressions on till plains, Swamps on outwash plains, Swamps on till plains, Depressions on moraines, Swamps on moraines, Drainageways on till plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave, linear

Across-slope shape: Concave, linear

Ecological site: F096XA014MI - Snowy Mucky Depression

Hydric soil rating: Yes

Gilford, gravelly subsoil

Percent of map unit: 1 percent

Landscape: Outwash plains, till plains

Landform: Glacial drainage channels, Glacial drainage channels

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F096XA011MI - Snowy Wet Sandy Depression

Hydric soil rating: Yes

II B—losco loamy sand, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c4h
Elevation: 600 to 1,400 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 90 to 140 days
Farmland classification: Prime farmland if drained

Map Unit Composition

losco and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of losco

Setting

Landform: Till plains, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 40 inches of sandy glaciofluvial deposits over loamy till or glacialacustrine deposits

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 24 inches: loamy sand
H3 - 24 to 37 inches: sandy clay loam
H4 - 37 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F094AA007MI - Snowy Acidic Sandy Depression, F096XA008MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

IIc—losco loamy sand, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6c4j

Elevation: 600 to 1,600 feet

Mean annual precipitation: 27 to 33 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 90 to 140 days

Farmland classification: Farmland of local importance

Map Unit Composition

losco and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of losco

Setting

Landform: Till plains, Outwash plains

Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: 20 to 40 inches of sandy glaciofluvial deposits over loamy till or glacialacustrine deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 24 inches: loamy sand

H3 - 24 to 37 inches: sandy clay loam

H4 - 37 to 60 inches: silty clay loam

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: About 30 to 48 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: A

Custom Soil Resource Report

Ecological site: F094AA007MI - Snowy Acidic Sandy Depression, F096XA008MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

Minor Components

Montcalm

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Ubly

Percent of map unit: 5 percent
Landform: Moraines, Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

IsA—Iosco-Ogemaw loamy sands, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c4l
Elevation: 600 to 1,500 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 80 to 140 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Iosco and similar soils: 60 percent
Ogemaw and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Iosco

Setting

Landform: Outwash plains, Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear

Custom Soil Resource Report

Parent material: 20 to 40 inches of sandy glaciofluvial deposits over loamy till or glacialacustrine deposits

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 24 inches: loamy sand
H3 - 24 to 37 inches: sandy clay loam
H4 - 37 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F096XA008MI - Snowy Acidic Sandy Depression, F094AA007MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

Description of Ogemaw

Setting

Landform: Lake plains, Outwash plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 40 inches of sandy material with ortstein over loamy till

Typical profile

H1 - 0 to 10 inches: loamy sand
H2 - 10 to 20 inches: loamy sand
H3 - 20 to 26 inches: loamy sand
H4 - 26 to 60 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Very low (about 1.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: B/D

Ecological site: F094AA007MI - Snowy Acidic Sandy Depression, F096XA008MI - Snowy Acidic Sandy Depression

Hydric soil rating: No

IsB—Iosco-Ogemaw loamy sands, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c4m

Elevation: 600 to 1,500 feet

Mean annual precipitation: 27 to 33 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 80 to 140 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Iosco and similar soils: 60 percent

Ogemaw and similar soils: 40 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Iosco

Setting

Landform: Till plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of sandy glaciofluvial deposits over loamy till or glacialacustrine deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 24 inches: loamy sand

H3 - 24 to 37 inches: sandy clay loam

H4 - 37 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Custom Soil Resource Report

Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: C/D

Ecological site: F094AA007MI - Snowy Acidic Sandy Depression, F096XA008MI -
Snowy Acidic Sandy Depression

Hydric soil rating: No

Description of Ogemaw

Setting

Landform: Lake plains, Moraines, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of sandy material with ortstein over loamy till

Typical profile

H1 - 0 to 10 inches: loamy sand

H2 - 10 to 20 inches: loamy sand

H3 - 20 to 26 inches: loamy sand

H4 - 26 to 60 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to
moderately high (0.06 to 0.57 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Available water supply, 0 to 60 inches: Very low (about 1.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: B/D

Ecological site: F094AA007MI - Snowy Acidic Sandy Depression, F096XA008MI -
Snowy Acidic Sandy Depression

Hydric soil rating: No

KaA—Kalkaska loamy sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c4n

Elevation: 600 to 1,900 feet

Custom Soil Resource Report

Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Moraines, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent
Landform: Beach ridges, Lake terraces, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

KaB—Kalkaska loamy sand, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c4q
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Moraines, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent

Landform: Beach ridges, Lake terraces, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

KaC—Kalkaska loamy sand, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6c4s

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 95 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Moraines, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand

H2 - 6 to 8 inches: sand

H3 - 8 to 36 inches: sand

H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Custom Soil Resource Report

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent
Landform: Beach ridges, Lake terraces, Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

KaD—Kalkaska loamy sand, 12 to 18 percent slopes

Map Unit Setting

National map unit symbol: 6c4w
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Moraines, Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex

Custom Soil Resource Report

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand

H2 - 6 to 8 inches: sand

H3 - 8 to 36 inches: sand

H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent

Landform: Beach ridges, Lake terraces, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

KaE—Kalkaska loamy sand, 18 to 25 percent slopes

Map Unit Setting

National map unit symbol: 6c4y

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 95 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Moraines, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand

H2 - 6 to 8 inches: sand

H3 - 8 to 36 inches: sand

H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent

Landform: Beach ridges, Lake terraces, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

KaE2—Kalkaska loamy sand, 18 to 25 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c4z
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska, moderately eroded, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska, Moderately Eroded

Setting

Landform: Moraines, Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A

Custom Soil Resource Report

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent

Landform: Beach ridges, Lake terraces, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

KaF—Kalkaska loamy sand, 25 to 45 percent slopes

Map Unit Setting

National map unit symbol: 6c50

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 95 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Moraines, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand

H2 - 6 to 8 inches: sand

H3 - 8 to 36 inches: sand

H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 25 to 45 percent

Custom Soil Resource Report

Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F094AA005MI - Snowy Rich Sandy Drift, F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent
Landform: Beach ridges, Lake terraces, Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

KaF2—Kalkaska loamy sand, 25 to 45 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c51
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska, moderately eroded, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska, Moderately Eroded

Setting

Landform: Moraines, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand

H2 - 6 to 8 inches: sand

H3 - 8 to 36 inches: sand

H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 25 to 45 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent

Landform: Beach ridges, Lake terraces, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

KbB—Kalkaska sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2zgp3

Landscape: Outwash plains, till plains, ice-margin complexes

Elevation: 580 to 1,680 feet

Mean annual precipitation: 28 to 36 inches

Mean annual air temperature: 41 to 48 degrees F

Frost-free period: 90 to 160 days

Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 95 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landscape: Outwash plains, till plains, ice-margin complexes

Landform: Flats, Moraines, Lake plains, Valley trains

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Interfluvium, nose slope, side slope

Down-slope shape: Convex, linear

Across-slope shape: Linear, convex

Parent material: Sandy outwash

Typical profile

O_i - 0 to 1 inches: slightly decomposed plant material

A - 1 to 2 inches: sand

E - 2 to 9 inches: sand

B_{hs} - 9 to 15 inches: sand

B_s - 15 to 31 inches: sand

BC - 31 to 56 inches: sand

C - 56 to 80 inches: sand

Properties and qualities

Slope: 0 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (K_{sat}): Moderately high to high (1.42 to 14.17 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Sodium adsorption ratio, maximum: 1.0

Available water supply, 0 to 60 inches: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F094AA005MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

Blue lake

Percent of map unit: 3 percent
Landscape: Outwash plains, till plains, ice-margin complexes
Landform: Moraines, Lake plains, Flats, Valley trains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Ecological site: F094AA006MI - Snowy Sandy Drift
Hydric soil rating: No

Au gres

Percent of map unit: 1 percent
Landscape: Outwash plains, till plains, ice-margin complexes
Landform: Flats, Moraines, Lake plains, Valley trains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear
Ecological site: F094AA007MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

Halfaday

Percent of map unit: 1 percent
Landscape: Outwash plains, till plains, ice-margin complexes
Landform: Moraines, Lake plains, Flats, Valley trains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F094AA007MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

KbD—Kalkaska sand, 6 to 18 percent slopes

Map Unit Setting

National map unit symbol: 2zgp4
Landscape: Till plains, ice-margin complexes, outwash plains
Elevation: 580 to 1,710 feet
Mean annual precipitation: 28 to 36 inches
Mean annual air temperature: 41 to 48 degrees F

Custom Soil Resource Report

Frost-free period: 90 to 160 days

Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 98 percent

Minor components: 2 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landscape: Till plains, ice-margin complexes, outwash plains

Landform: Moraines, Valley trains, Rises

Landform position (two-dimensional): Shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope

Down-slope shape: Convex, linear

Across-slope shape: Linear, convex

Parent material: Sandy drift

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material

A - 1 to 2 inches: sand

E - 2 to 9 inches: sand

Bhs - 9 to 15 inches: sand

Bs - 15 to 31 inches: sand

BC - 31 to 56 inches: sand

C - 56 to 80 inches: sand

Properties and qualities

Slope: 6 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Sodium adsorption ratio, maximum: 1.0

Available water supply, 0 to 60 inches: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F094AA005MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Minor Components

Blue lake

Percent of map unit: 2 percent

Landscape: Till plains, ice-margin complexes, outwash plains

Landform: Moraines, Valley trains, Rises

Landform position (two-dimensional): Shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope

Custom Soil Resource Report

Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Ecological site: F094AA006MI - Snowy Sandy Drift
Hydric soil rating: No

KbF—Kalkaska sand, 35 to 60 percent slopes

Map Unit Setting

National map unit symbol: 2zgp6
Landscape: Ice-margin complexes
Elevation: 580 to 1,690 feet
Mean annual precipitation: 28 to 36 inches
Mean annual air temperature: 41 to 48 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landscape: Ice-margin complexes
Landform: Moraines, Glacial drainage channels
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Sandy drift

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 2 inches: sand
E - 2 to 9 inches: sand
Bhs - 9 to 15 inches: sand
Bs - 15 to 31 inches: sand
BC - 31 to 56 inches: sand
C - 56 to 80 inches: sand

Properties and qualities

Slope: 35 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Custom Soil Resource Report

Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F094AA005MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

Blue lake

Percent of map unit: 5 percent
Landscape: Ice-margin complexes
Landform: Glacial drainage channels on moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Ecological site: F094AA006MI - Snowy Sandy Drift
Hydric soil rating: No

KIC—Karlin loamy sand, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6c5g
Elevation: 600 to 1,950 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 36 to 46 degrees F
Frost-free period: 90 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Karlin and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Karlin

Setting

Landform: Moraines, Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear

Custom Soil Resource Report

Parent material: Loamy and/or sandy surface over sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand

H2 - 7 to 32 inches: loamy fine sand

H3 - 32 to 60 inches: sand

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Beach ridges, Lake terraces

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

Mancelona

Percent of map unit: 5 percent

Landform: Beach ridges, Lake plains, Outwash plains, Moraines, Kames

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

KIF—Karlin loamy sand, 25 to 45 percent slopes

Map Unit Setting

National map unit symbol: 6c5n
Elevation: 600 to 1,950 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 36 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Karlin and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Karlin

Setting

Landform: Moraines, Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Loamy and/or sandy surface over sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand
H2 - 7 to 32 inches: loamy fine sand
H3 - 32 to 60 inches: sand

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Kalkaska

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Newaygo

Percent of map unit: 5 percent

Landform: Outwash plains, Lake terraces

Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, nose slope, side slope, base slope

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

Mancelona

Percent of map unit: 3 percent

Landform: Beach ridges, Lake plains, Outwash plains, Moraines, Kames

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Coventry

Percent of map unit: 2 percent

Landform: Outwash plains, Lake terraces

Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Kt—Kerston muck

Map Unit Setting

National map unit symbol: 6c5t

Elevation: 670 to 1,600 feet

Custom Soil Resource Report

Mean annual precipitation: 22 to 33 inches
Mean annual air temperature: 36 to 45 degrees F
Frost-free period: 88 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Kerston and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kerston

Setting

Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 16 to 40 inches of organic deposits over stratified mineral alluvium

Typical profile

Oa - 0 to 5 inches: muck
C - 5 to 10 inches: stratified sand to fine sandy loam
O'a - 10 to 21 inches: muck
C' - 21 to 60 inches: stratified sand to muck

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: F096XA013MI - Snowy Wet Floodplain
Hydric soil rating: Yes

LeB—Lake beach and Eastport sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c5v
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F

Custom Soil Resource Report

Frost-free period: 70 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Eastport and similar soils: 50 percent

Lake beach: 40 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eastport

Setting

Landform: Beach ridges, Dunes

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy eolian deposits

Typical profile

H1 - 0 to 5 inches: sand

H2 - 5 to 26 inches: sand

H3 - 26 to 60 inches: sand

Properties and qualities

Slope: 0 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Description of Lake Beach

Interpretive groups

Land capability classification (irrigated): None specified

Ecological site: R096XY001MI - Coastal Dune Complex

Hydric soil rating: Unranked

Minor Components

Alpena

Percent of map unit: 5 percent

Landform: Outwash plains, Kames, Glacial lakeshores

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Kalkaska

Percent of map unit: 5 percent

Landform: Moraines, Outwash plains, Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

LkA—Leelanau-Kalkaska loamy sands, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c5w

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Leelanau and similar soils: 55 percent

Kalkaska and similar soils: 40 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand

H2 - 7 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Custom Soil Resource Report

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Description of Kalkaska

Setting

Landform: Outwash plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent
Landform: Outwash plains, Beach ridges, Lake terraces, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

LkB—Leelanau-Kalkaska loamy sands, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c5y

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Leelanau and similar soils: 55 percent

Kalkaska and similar soils: 40 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand

H2 - 7 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: A

Custom Soil Resource Report

Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Description of Kalkaska

Setting

Landform: Outwash plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent
Landform: Outwash plains, Beach ridges, Lake terraces, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

LkC—Leelanau-Kalkaska loamy sands, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6c60

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Leelanau and similar soils: 55 percent

Kalkaska and similar soils: 35 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand

H2 - 7 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Description of Kalkaska

Setting

Landform: Outwash plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

Mancelona

Percent of map unit: 5 percent
Landform: Beach ridges, Lake plains, Outwash plains, Kames, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Beach ridges, Lake terraces, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

LkD—Leelanau-Kalkaska loamy sands, 12 to 18 percent slopes

Map Unit Setting

National map unit symbol: 6c62

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Farmland of unique importance

Map Unit Composition

Leelanau and similar soils: 50 percent

Kalkaska and similar soils: 35 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand

H2 - 7 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Custom Soil Resource Report

Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Description of Kalkaska

Setting

Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 12 to 18 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

Mancelona

Percent of map unit: 10 percent

Landform: Beach ridges, Lake plains, Outwash plains, Kames, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Beach ridges, Lake terraces, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

LkD2—Leelanau-Kalkaska loamy sands, 12 to 18 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c63

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Farmland of unique importance

Map Unit Composition

Leelanau, moderately eroded, and similar soils: 50 percent

Kalkaska, moderately eroded, and similar soils: 35 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau, Moderately Eroded

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Custom Soil Resource Report

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand

H2 - 7 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of Kalkaska, Moderately Eroded

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand

H2 - 6 to 8 inches: sand

H3 - 8 to 36 inches: sand

H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Very low

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Minor Components

Mancelona

Percent of map unit: 10 percent

Landform: Beach ridges, Lake plains, Outwash plains, Kames, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Beach ridges, Lake terraces, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

LkE—Leelanau-Kalkaska loamy sands, 18 to 25 percent slopes

Map Unit Setting

National map unit symbol: 6c64

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Farmland of unique importance

Map Unit Composition

Leelanau and similar soils: 55 percent

Kalkaska and similar soils: 40 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand

H2 - 7 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of Kalkaska

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent
Landform: Outwash plains, Beach ridges, Lake terraces, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

LkE2—Leelanau-Kalkaska loamy sands, 18 to 25 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c65
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Farmland of unique importance

Map Unit Composition

Leelanau, moderately eroded, and similar soils: 55 percent

Kalkaska, moderately eroded, and similar soils: 40 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau, Moderately Eroded

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand

H2 - 7 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of Kalkaska, Moderately Eroded

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent
Landform: Outwash plains, Beach ridges, Lake terraces, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

LkF—Leelanau-Kalkaska loamy sands, 25 to 45 percent slopes

Map Unit Setting

National map unit symbol: 6c66
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Leelanau and similar soils: 55 percent

Kalkaska and similar soils: 40 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand

H2 - 7 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 25 to 40 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of Kalkaska

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent
Landform: Outwash plains, Beach ridges, Lake terraces, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

LkF2—Leelanau-Kalkaska loamy sands, 25 to 45 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c67
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Leelanau, moderately eroded, and similar soils: 55 percent

Kalkaska, moderately eroded, and similar soils: 40 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau, Moderately Eroded

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand

H2 - 7 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 25 to 40 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of Kalkaska, Moderately Eroded

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 8 inches: sand
H3 - 8 to 36 inches: sand
H4 - 36 to 60 inches: sand

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent
Landform: Outwash plains, Beach ridges, Lake terraces, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

MaA—Mancelona gravelly sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c69
Elevation: 600 to 1,200 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 90 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Mancelona and similar soils: 95 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mancelona

Setting

Landform: Beach ridges, Lake plains, Outwash plains, Kames, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: gravelly sandy loam

H2 - 6 to 13 inches: loamy sand

H3 - 13 to 20 inches: sandy clay loam

H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: A

Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy

Sandy Drift

Hydric soil rating: No

Minor Components

Newaygo

Percent of map unit: 5 percent

Landform: Outwash plains, Lake terraces, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

MaC—Mancelona gravelly sandy loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6c6c
Elevation: 600 to 1,200 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 90 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Mancelona and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mancelona

Setting

Landform: Beach ridges, Lake plains, Moraines, Kames, Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: gravelly sandy loam
H2 - 6 to 13 inches: loamy sand
H3 - 13 to 20 inches: sandy clay loam
H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Custom Soil Resource Report

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Newaygo

Percent of map unit: 5 percent

Landform: Lake terraces, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

MaC2—Mancelona gravelly sandy loam, 6 to 12 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c6d

Elevation: 600 to 1,200 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Mancelona, moderately eroded, and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mancelona, Moderately Eroded

Setting

Landform: Beach ridges, Lake plains, Moraines, Kames, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: gravelly sandy loam

H2 - 6 to 13 inches: loamy sand

H3 - 13 to 20 inches: sandy clay loam

Custom Soil Resource Report

H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Newaygo

Percent of map unit: 5 percent

Landform: Lake terraces, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

Alpena

Percent of map unit: 5 percent

Landform: Kames, Glacial lakeshores, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear, convex

Across-slope shape: Convex, linear, concave

Hydric soil rating: No

MaD—Mancelona gravelly sandy loam, 12 to 18 percent slopes

Map Unit Setting

National map unit symbol: 6c6f

Elevation: 600 to 1,200 feet

Custom Soil Resource Report

Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 90 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Mancelona and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mancelona

Setting

Landform: Beach ridges, Lake plains, Moraines, Kames, Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: gravelly sandy loam
H2 - 6 to 13 inches: loamy sand
H3 - 13 to 20 inches: sandy clay loam
H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 12 to 18 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Minor Components

Newaygo

Percent of map unit: 5 percent
Landform: Lake terraces, Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Custom Soil Resource Report

Landform position (three-dimensional): Interfluve, nose slope, side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

MeA—Mancelona-East Lake loamy sands, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c6l
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Mancelona and similar soils: 55 percent
East lake and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mancelona

Setting

Landform: Beach ridges, Lake plains, Moraines, Kames, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 13 inches: loamy sand
H3 - 13 to 20 inches: sandy clay loam
H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Description of East Lake

Setting

Landform: Beach ridges, Lake terraces, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 24 inches: loamy sand
H3 - 24 to 60 inches: stratified gravelly sand to sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Minor Components

Kalkaska

Percent of map unit: 5 percent
Landform: Moraines, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

MeB—Mancelona-East Lake loamy sands, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c6m
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Mancelona and similar soils: 55 percent
East lake and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mancelona

Setting

Landform: Beach ridges, Lake plains, Outwash plains, Moraines, Kames
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 13 inches: loamy sand
H3 - 13 to 20 inches: sandy clay loam
H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A

Custom Soil Resource Report

Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Description of East Lake

Setting

Landform: Outwash plains, Beach ridges, Lake terraces
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 24 inches: loamy sand
H3 - 24 to 60 inches: stratified gravelly sand to sand

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Minor Components

Kalkaska

Percent of map unit: 5 percent
Landform: Moraines, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

MeE—Mancelona-East Lake loamy sands, 18 to 25 percent slopes

Map Unit Setting

National map unit symbol: 6c6r

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Mancelona and similar soils: 55 percent

East lake and similar soils: 40 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mancelona

Setting

Landform: Beach ridges, Lake plains, Outwash plains, Moraines, Kames

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand

H2 - 6 to 13 inches: loamy sand

H3 - 13 to 20 inches: sandy clay loam

H4 - 20 to 60 inches: Error

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Description of East Lake

Setting

Landform: Outwash plains, Beach ridges, Lake terraces

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 24 inches: loamy sand

H3 - 24 to 60 inches: stratified gravelly sand to sand

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: A

Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Kalkaska

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

RcA—Richter loams, 0 to 2 percent slopes, overwash

Map Unit Setting

National map unit symbol: 6c7k
Elevation: 600 to 1,400 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Richter and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Richter

Setting

Landform: Lake plains, Outwash plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 35 inches: very fine sandy loam
H3 - 35 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D

Custom Soil Resource Report

Ecological site: F096XA004MI - Snowy Loamy Depression

Hydric soil rating: No

RcB—Richter loams, 2 to 6 percent slopes, overwash

Map Unit Setting

National map unit symbol: 6c7l

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 33 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Richter and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Richter

Setting

Landform: Lake plains, Outwash plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 35 inches: very fine sandy loam

H3 - 35 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: B/D

Ecological site: F096XA004MI - Snowy Loamy Depression

Hydric soil rating: No

RhA—Richter loams, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c7m
Elevation: 600 to 1,400 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Richter and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Richter

Setting

Landform: Outwash plains, Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 35 inches: very fine sandy loam
H3 - 35 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F096XA004MI - Snowy Loamy Depression
Hydric soil rating: No

RpA—Richter, Tonkey, and Pinconning loams, 0 to 2 percent slopes, overwash

Map Unit Setting

National map unit symbol: 6c7p
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Richter and similar soils: 40 percent
Tonkey and similar soils: 30 percent
Pinconning and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Richter

Setting

Landform: Lake plains, Outwash plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 35 inches: very fine sandy loam
H3 - 35 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F096XA004MI - Snowy Loamy Depression
Hydric soil rating: No

Description of Tonkey

Setting

Landform: Depressions on lake plains, Depressions on outwash plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 60 inches: stratified sand to loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: A/D

Ecological site: F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

Description of Pinconning

Setting

Landform: Depressions on lake plains, Depressions on moraines

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of sandy material over calcareous clayey lacustrine deposits

Typical profile

H1 - 0 to 6 inches: sandy loam

H2 - 6 to 26 inches: loamy sand

H3 - 26 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 0 inches

Custom Soil Resource Report

Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 26 percent
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F096XA005MI - Snowy Wet Loamy Depression
Hydric soil rating: Yes

RrA—Richter, Tonkey, and Pinconning loams, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c7q
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Richter and similar soils: 40 percent
Tonkey and similar soils: 30 percent
Pinconning and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Richter

Setting

Landform: Lake plains, Outwash plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 35 inches: very fine sandy loam
H3 - 35 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Custom Soil Resource Report

Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F094AA003MI - Snowy Loamy Depression, F096XA004MI -
Snowy Loamy Depression
Hydric soil rating: No

Description of Tonkey

Setting

Landform: Depressions on lake plains, Depressions on outwash plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 30 inches: sandy loam
H3 - 30 to 60 inches: stratified sand to loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F094AA004MI - Snowy Wet Loamy Depression, F096XA005MI -
Snowy Wet Loamy Depression
Hydric soil rating: Yes

Description of Pinconning

Setting

Landform: Depressions on lake plains, Depressions on moraines
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Custom Soil Resource Report

Parent material: 20 to 40 inches of sandy material over calcareous clayey lacustrine deposits

Typical profile

H1 - 0 to 6 inches: sandy loam

H2 - 6 to 26 inches: loamy sand

H3 - 26 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 26 percent

Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: C/D

Ecological site: F094AA004MI - Snowy Wet Loamy Depression, F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

RrC—Richter, Tonkey, and Pinconning loams, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6c7s

Elevation: 600 to 1,600 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Richter and similar soils: 40 percent

Tonkey and similar soils: 30 percent

Pinconning and similar soils: 30 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Richter

Setting

Landform: Lake plains, Outwash plains, Moraines

Landform position (three-dimensional): Rise

Custom Soil Resource Report

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 35 inches: very fine sandy loam

H3 - 35 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 1 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: B/D

Ecological site: F096XA004MI - Snowy Loamy Depression

Hydric soil rating: No

Description of Tonkey

Setting

Landform: Depressions on lake plains, Depressions on outwash plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 60 inches: stratified sand to loam

Properties and qualities

Slope: 1 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F096XA005MI - Snowy Wet Loamy Depression
Hydric soil rating: Yes

Description of Pinconning

Setting

Landform: Depressions on lake plains, Depressions on moraines
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 40 inches of sandy material over calcareous clayey lacustrine deposits

Typical profile

H1 - 0 to 6 inches: sandy loam
H2 - 6 to 26 inches: loamy sand
H3 - 26 to 60 inches: silty clay

Properties and qualities

Slope: 1 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 26 percent
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F096XA005MI - Snowy Wet Loamy Depression
Hydric soil rating: Yes

Rs—Rifle peat

Map Unit Setting

National map unit symbol: 6c7t
Elevation: 600 to 1,500 feet
Mean annual precipitation: 22 to 35 inches
Mean annual air temperature: 39 to 46 degrees F

Custom Soil Resource Report

Frost-free period: 60 to 140 days

Farmland classification: Not prime farmland

Map Unit Composition

Rifle and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rifle

Setting

Landform: Depressions on moraines, Depressions on outwash plains,

Depressions on lake plains

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: > 51 inches of organic material

Typical profile

Oi - 0 to 2 inches: peat

Oe - 2 to 60 inches: mucky peat

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Available water supply, 0 to 60 inches: Very high (about 24.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6w

Hydrologic Soil Group: A/D

Ecological site: F094AA013MI - Snowy Mucky Depression, F096XA014MI - Snowy Mucky Depression

Hydric soil rating: Yes

Minor Components

Roscommon

Percent of map unit: 5 percent

Landform: Depressions on lake plains, Depressions on outwash plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Tawas

Percent of map unit: 5 percent

Landform: Depressions on lake plains, Depressions on moraines, Depressions on outwash plains

Landform position (three-dimensional): Dip

Custom Soil Resource Report

Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Lupton

Percent of map unit: 5 percent
Landform: Depressions on lake plains, Depressions on outwash plains,
Depressions on till plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Ru—Roscommon mucky loamy sand

Map Unit Setting

National map unit symbol: 6c7w
Elevation: 600 to 1,500 feet
Mean annual precipitation: 22 to 35 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Roscommon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Roscommon

Setting

Landform: Depressions on lake plains, Depressions on outwash plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 3 inches: mucky loamy sand
H2 - 3 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent

Custom Soil Resource Report

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6w

Hydrologic Soil Group: A/D

Ecological site: F096XA011MI - Snowy Wet Sandy Depression

Hydric soil rating: Yes

Minor Components

Tawas

Percent of map unit: 5 percent

Landform: Depressions on lake plains, Depressions on moraines, Depressions on outwash plains

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

RwA—Rubicon sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c7y

Elevation: 600 to 1,800 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 80 to 140 days

Farmland classification: Not prime farmland

Map Unit Composition

Rubicon and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rubicon

Setting

Landform: Beach ridges, Moraines, Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 5 inches: sand

H2 - 5 to 34 inches: sand

H3 - 34 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent

Custom Soil Resource Report

Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

RwB—Rubicon sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2qz6l
Landscape: Till plains, outwash plains
Elevation: 580 to 1,500 feet
Mean annual precipitation: 28 to 36 inches
Mean annual air temperature: 41 to 48 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Rubicon and similar soils: 93 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rubicon

Setting

Landscape: Till plains, outwash plains
Landform: Moraines, Broad flats, Low knolls, Large heads-of-outwash, Glacial drainageways
Landform position (two-dimensional): Summit, footslope, backslope, toeslope
Landform position (three-dimensional): Interfluvium, base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 1 inches: sand
E - 1 to 6 inches: sand
Bs - 6 to 18 inches: sand
C - 18 to 80 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.56 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 0.1 mmhos/cm)
Sodium adsorption ratio, maximum: 0.1
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F094AA006MI - Snowy Sandy Drift, F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Minor Components

Croswell

Percent of map unit: 4 percent
Landscape: Lake plains, till plains
Landform: Sandy till-floored lake plains, Deltas, Glacial drainageways, Moraines
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Base slope, interfluvium
Down-slope shape: Linear, concave
Across-slope shape: Linear
Hydric soil rating: No

Au gres

Percent of map unit: 2 percent
Landscape: Outwash plains
Landform: Broad flats, Glacial drainageways
Microfeatures of landform position: Swales
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: No

Kinross

Percent of map unit: 1 percent
Landscape: Outwash plains
Landform: Broad flats, Glacial drainageways
Microfeatures of landform position: Closed depressions
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear
Hydric soil rating: Yes

SrB—Sanilac-Richter loams, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c8f
Elevation: 600 to 1,400 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Sanilac and similar soils: 50 percent
Richter and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sanilac

Setting

Landform: Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty lacustrine deposits and/or eolian deposits

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 42 inches: silt loam
H3 - 42 to 60 inches: stratified very fine sand to silt loam

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B/D
Ecological site: F096XA004MI - Snowy Loamy Depression
Hydric soil rating: No

Description of Richter

Setting

Landform: Outwash plains, Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 35 inches: very fine sandy loam

H3 - 35 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 0 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: B/D

Ecological site: F096XA004MI - Snowy Loamy Depression

Hydric soil rating: No

Minor Components

Alpena

Percent of map unit: 10 percent

Landform: Outwash plains, Kames, Glacial lakeshores

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Ta—Tawas-Roscommon complex

Map Unit Setting

National map unit symbol: 6c8g

Custom Soil Resource Report

Elevation: 600 to 1,800 feet
Mean annual precipitation: 22 to 35 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 60 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Tawas and similar soils: 50 percent
Roscommon and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tawas

Setting

Landform: Depressions on lake plains, Depressions on moraines, Depressions on outwash plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 16 to 51 inches of organic material over sandy glaciofluvial deposits

Typical profile

Oa - 0 to 24 inches: muck
H2 - 24 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 12.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: F096XA014MI - Snowy Mucky Depression
Hydric soil rating: Yes

Description of Roscommon

Setting

Landform: Depressions on lake plains, Depressions on outwash plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 3 inches: mucky sand

Custom Soil Resource Report

H2 - 3 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6w

Hydrologic Soil Group: A/D

Ecological site: F096XA011MI - Snowy Wet Sandy Depression

Hydric soil rating: Yes

Minor Components

Croswell

Percent of map unit: 5 percent

Landform: Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Au gres

Percent of map unit: 5 percent

Landform: Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Lupton

Percent of map unit: 5 percent

Landform: Depressions on lake plains, Depressions on outwash plains, Depressions on till plains

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Tm—Tonkey mucky sandy loam

Map Unit Setting

National map unit symbol: 6c8h
Elevation: 600 to 1,600 feet
Mean annual precipitation: 22 to 35 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Tonkey and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tonkey

Setting

Landform: Depressions on lake plains, Depressions on outwash plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: mucky sandy loam
H2 - 8 to 30 inches: sandy loam
H3 - 30 to 60 inches: stratified sand to loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F096XA005MI - Snowy Wet Loamy Depression
Hydric soil rating: Yes

Minor Components

Roscommon

Percent of map unit: 5 percent

Landform: Depressions on lake plains, Depressions on outwash plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Tawas

Percent of map unit: 5 percent

Landform: Depressions on lake plains, Depressions on moraines, Depressions on outwash plains

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Richter

Percent of map unit: 5 percent

Landform: Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Tn—Tonkey sandy loam, overwash

Map Unit Setting

National map unit symbol: 6c8j

Elevation: 600 to 1,600 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 100 to 140 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Tonkey and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tonkey

Setting

Landform: Depressions on lake plains, Depressions on outwash plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 30 inches: sandy loam
H3 - 30 to 60 inches: stratified sand to loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F096XA005MI - Snowy Wet Loamy Depression
Hydric soil rating: Yes

To—Tonkey sandy loam

Map Unit Setting

National map unit symbol: 6c8k
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Tonkey and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tonkey

Setting

Landform: Depressions on lake plains, Depressions on outwash plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 30 inches: sandy loam

Custom Soil Resource Report

H3 - 30 to 60 inches: stratified sand to loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: A/D

Ecological site: F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

Minor Components

Richter

Percent of map unit: 5 percent

Landform: Lake plains, Outwash plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Tp—Tonkey-Hettinger-Pickford loams, overwash

Map Unit Setting

National map unit symbol: 6c8l

Elevation: 600 to 1,600 feet

Mean annual precipitation: 26 to 34 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 70 to 140 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Tonkey and similar soils: 45 percent

Hettinger and similar soils: 30 percent

Pickford and similar soils: 25 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tonkey

Setting

Landform: Depressions on lake plains, Depressions on outwash plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 30 inches: sandy loam

H3 - 30 to 60 inches: stratified sand to loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: A/D

Ecological site: F096XA005MI - Snowy Wet Loamy Depression, F094AA004MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

Description of Hettinger

Setting

Landform: Depressions on lake plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 12 to 36 inches of fine-loamy material over stratified, calcareous silty and clayey glaciolacustrine deposits

Typical profile

H1 - 0 to 7 inches: loam

H2 - 7 to 12 inches: clay loam

H3 - 12 to 20 inches: clay loam

H4 - 20 to 60 inches: stratified clay loam to silt loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: High

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 35 percent

Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: C/D

Ecological site: F094AA004MI - Snowy Wet Loamy Depression, F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

Description of Pickford

Setting

Landform: Depressions on lake plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 14 to 30 inches of loamy and clayey material over calcareous clayey lacustrine deposits

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 20 inches: silty clay

H3 - 20 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: D

Ecological site: F094AA004MI - Snowy Wet Loamy Depression, F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

Tr—Tonkey-Hettinger-Pickford loams

Map Unit Setting

National map unit symbol: 6c8m
Elevation: 600 to 1,600 feet
Mean annual precipitation: 26 to 34 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 70 to 140 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Tonkey and similar soils: 45 percent
Hettinger and similar soils: 30 percent
Pickford and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tonkey

Setting

Landform: Depressions on lake plains, Depressions on outwash plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 30 inches: very fine sandy loam
H3 - 30 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F096XA005MI - Snowy Wet Loamy Depression
Hydric soil rating: Yes

Description of Hettinger

Setting

Landform: Depressions on lake plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 12 to 36 inches of fine-loamy material over stratified, calcareous silty and clayey glaciolacustrine deposits

Typical profile

H1 - 0 to 7 inches: loam

H2 - 7 to 12 inches: clay loam

H3 - 12 to 20 inches: clay loam

H4 - 20 to 60 inches: stratified clay loam to silt loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 35 percent

Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: C/D

Ecological site: F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

Description of Pickford

Setting

Landform: Depressions on lake plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 14 to 30 inches of loamy and clayey material over calcareous clayey lacustrine deposits

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 20 inches: silty clay

H3 - 20 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Very high

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: D

Ecological site: F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

UnA—Ubly-Nester complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6c91

Elevation: 600 to 1,600 feet

Mean annual precipitation: 27 to 33 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 90 to 150 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Ubly and similar soils: 55 percent

Nester and similar soils: 40 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ubly

Setting

Landform: Till plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 30 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 24 inches: loamy sand

H3 - 24 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Nester

Setting

Landform: Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: silt loam

H2 - 8 to 14 inches: silty clay loam

H3 - 14 to 28 inches: clay loam

H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Mcbride

Percent of map unit: 5 percent

Landform: Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

UnB—Ubly-Nester complex, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6c92
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 90 to 150 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Ubly and similar soils: 55 percent
Nester and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ubly

Setting

Landform: Till plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 30 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 24 inches: loamy sand
H3 - 24 to 60 inches: clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e

Custom Soil Resource Report

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till, F094AA002MI - Snowy Loamy Till

Hydric soil rating: No

Description of Nester

Setting

Landform: Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: silt loam

H2 - 8 to 14 inches: silty clay loam

H3 - 14 to 28 inches: clay loam

H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: C

Ecological site: F094AA002MI - Snowy Loamy Till, F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Mcbride

Percent of map unit: 5 percent

Landform: Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

UnD2—Ubly-Nester complex, 12 to 18 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c95

Elevation: 600 to 1,600 feet

Mean annual precipitation: 27 to 33 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Ubly, moderately eroded, and similar soils: 50 percent

Nester, moderately eroded, and similar soils: 40 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ubly, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 30 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 24 inches: loamy sand

H3 - 24 to 60 inches: clay loam

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Nester, Moderately Eroded

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: silt loam

H2 - 8 to 14 inches: silty clay loam

H3 - 14 to 28 inches: clay loam

H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Montcalm

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

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Across-slope shape: Concave, convex

Hydric soil rating: No

Mcbride

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

UnE—Ubly-Nester complex, 18 to 25 percent slopes

Map Unit Setting

National map unit symbol: 6c96

Elevation: 600 to 1,600 feet

Mean annual precipitation: 27 to 33 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Ubly and similar soils: 50 percent

Nester and similar soils: 40 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ubly

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 30 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 24 inches: loamy sand

H3 - 24 to 60 inches: clay loam

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

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Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Nester

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: silt loam

H2 - 8 to 14 inches: silty clay loam

H3 - 14 to 28 inches: clay loam

H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Mcbride

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Montcalm

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

UnE2—Ubly-Nester complex, 18 to 25 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 6c97

Elevation: 600 to 1,600 feet

Mean annual precipitation: 27 to 33 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Ubly, moderately eroded, and similar soils: 50 percent

Nester, moderately eroded, and similar soils: 40 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ubly, Moderately Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

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Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: 30 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 24 inches: loamy sand
H3 - 24 to 60 inches: clay loam

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Description of Nester, Moderately Eroded

Setting

Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 14 inches: silty clay loam
H3 - 14 to 28 inches: clay loam
H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

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Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Minor Components

Montcalm

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

Mcbride

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

UnF—Ubly-Nester complex, 25 to 35 percent slopes

Map Unit Setting

National map unit symbol: 6c98
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 90 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Ubly and similar soils: 50 percent

Custom Soil Resource Report

Nester and similar soils: 40 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ubly

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 30 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 24 inches: loamy sand

H3 - 24 to 60 inches: clay loam

Properties and qualities

Slope: 25 to 35 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Nester

Setting

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 8 inches: silt loam

H2 - 8 to 14 inches: silty clay loam

Custom Soil Resource Report

H3 - 14 to 28 inches: clay loam

H4 - 28 to 60 inches: clay loam

Properties and qualities

Slope: 25 to 35 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Montcalm

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Mcbride

Percent of map unit: 5 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

W—Water

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

WdD—Wind eroded land, strongly sloping

Map Unit Composition

Wind eroded land: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Leelanau County, Michigan

ArA—Alcona-Richter sandy loams, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6dj3
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Alcona and similar soils: 55 percent
Richter and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alcona

Setting

Landform: Lake plains, Outwash plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified sandy and loamy glaciofluvial deposits and/or glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 12 inches: loamy fine sand
H3 - 12 to 18 inches: loamy sand
H4 - 18 to 24 inches: sandy loam
H5 - 24 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 30 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F096XA008MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

Description of Richter

Setting

Landform: Lake plains, Glacial drainageways, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 27 inches: fine sandy loam

H3 - 27 to 60 inches: stratified loamy fine sand to sandy loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: B/D

Ecological site: F096XA004MI - Snowy Loamy Depression

Hydric soil rating: No

Minor Components

Hettinger

Percent of map unit: 15 percent

Landform: Depressions on lake plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

ArB—Alcona-Richter sandy loams, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6dj4

Custom Soil Resource Report

Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Alcona and similar soils: 65 percent
Richter and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alcona

Setting

Landform: Lake plains, Outwash plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified sandy and loamy glaciofluvial deposits and/or glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 12 inches: loamy fine sand
H3 - 12 to 18 inches: loamy sand
H4 - 18 to 24 inches: sandy loam
H5 - 24 to 60 inches: stratified loamy sand to sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 30 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F096XA008MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

Description of Richter

Setting

Landform: Lake plains, Glacial drainageways, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 27 inches: fine sandy loam

H3 - 27 to 60 inches: stratified loamy fine sand to sandy loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: B/D

Ecological site: F096XA004MI - Snowy Loamy Depression

Hydric soil rating: No

Minor Components

Kalkaska

Percent of map unit: 5 percent

Landform: Outwash plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

EdB—Eastport sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6djK

Elevation: 600 to 700 feet

Mean annual precipitation: 27 to 31 inches

Custom Soil Resource Report

Mean annual air temperature: 43 to 46 degrees F

Frost-free period: 130 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Eastport and similar soils: 93 percent

Minor components: 7 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eastport

Setting

Landform: Beach ridges, Dunes, Lake terraces

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy eolian deposits

Typical profile

H1 - 0 to 3 inches: sand

H2 - 3 to 26 inches: sand

H3 - 26 to 60 inches: sand

Properties and qualities

Slope: 0 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Alpena

Percent of map unit: 7 percent

Landform: Lake terraces, Beach ridges, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

EnB—Emmet-Leelanau complex, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6djn
Elevation: 600 to 1,600 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 90 to 150 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Emmet and similar soils: 60 percent
Leelanau and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Drumlins, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 26 inches: sandy loam
H3 - 26 to 32 inches: sandy clay loam
H4 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Description of Leelanau

Setting

Landform: Drumlins, Till plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 28 inches: loamy sand
H3 - 28 to 36 inches: sandy loam
H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 4 percent
Landform: Outwash plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Alcona

Percent of map unit: 3 percent
Landform: Lake plains, Outwash plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Nester

Percent of map unit: 3 percent
Landform: Till plains, Moraines

Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

EnC—Emmet-Leelanau complex, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6djp
Elevation: 600 to 1,400 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 90 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Emmet and similar soils: 60 percent
Leelanau and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Drumlins, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 26 inches: sandy loam
H3 - 26 to 32 inches: sandy clay loam
H4 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Custom Soil Resource Report

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Leelanau

Setting

Landform: Drumlins, Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Minor Components

Nester

Percent of map unit: 5 percent

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Custom Soil Resource Report

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

East lake

Percent of map unit: 5 percent
Landform: Outwash plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

EnD—Emmet-Leelanau complex, 12 to 18 percent slopes

Map Unit Setting

National map unit symbol: 6djg
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Emmet and similar soils: 50 percent
Leelanau and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Drumlins, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 26 inches: sandy loam
H3 - 26 to 32 inches: sandy clay loam

Custom Soil Resource Report

H4 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Leelanau

Setting

Landform: Drumlins, Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Custom Soil Resource Report

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent

Landform: Outwash plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Kalkaska

Percent of map unit: 5 percent

Landform: Outwash plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Nester

Percent of map unit: 3 percent

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Wallace

Percent of map unit: 3 percent

Landform: Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

Alcona

Percent of map unit: 2 percent

Landform: Lake plains, Outwash plains, Moraines

Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope

Down-slope shape: Linear

Custom Soil Resource Report

Across-slope shape: Convex, linear

Hydric soil rating: No

Richter

Percent of map unit: 2 percent

Landform: Moraines, Glacial drainageways, Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

EnE—Emmet-Leelanau complex, 18 to 25 percent slopes

Map Unit Setting

National map unit symbol: 6djr

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Farmland of unique importance

Map Unit Composition

Emmet and similar soils: 50 percent

Leelanau and similar soils: 30 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Moraines, Drumlins, Till plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 26 inches: sandy loam

H3 - 26 to 32 inches: sandy clay loam

H4 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Leelanau

Setting

Landform: Moraines, Till plains, Drumlins

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 10 percent

Landform: Moraines, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Nester

Percent of map unit: 10 percent

Landform: Moraines, Till plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

EnF—Emmet-Leelanau complex, 25 to 50 percent slopes

Map Unit Setting

National map unit symbol: 6djt

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Emmet and similar soils: 45 percent

Leelanau and similar soils: 30 percent

Minor components: 25 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Drumlins, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Custom Soil Resource Report

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 26 inches: sandy loam

H3 - 26 to 32 inches: sandy clay loam

H4 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 25 to 50 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Leelanau

Setting

Landform: Drumlins, Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 25 to 50 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Custom Soil Resource Report

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 13 percent
Landform: Outwash plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

Nester

Percent of map unit: 12 percent
Landform: Till plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

EoC—Emmet-Mancelona gravelly sandy loams, 4 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6djw
Elevation: 600 to 1,400 feet
Mean annual precipitation: 27 to 32 inches
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 100 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Emmet and similar soils: 70 percent
Mancelona and similar soils: 25 percent

Custom Soil Resource Report

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Till plains, Drumlins, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam

H2 - 8 to 26 inches: sandy loam

H3 - 26 to 32 inches: sandy clay loam

H4 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 4 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Description of Mancelona

Setting

Landform: Beach ridges, Lake plains, Valley trains, Outwash plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam

H2 - 8 to 25 inches: loamy sand

Custom Soil Resource Report

H3 - 25 to 30 inches: gravelly sandy loam

H4 - 30 to 60 inches: very gravelly coarse sand

Properties and qualities

Slope: 4 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Nester

Percent of map unit: 3 percent

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

Kiva

Percent of map unit: 2 percent

Landform: Moraines, Lake plains, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

EoE—Emmet-Mancelona gravelly sandy loams, 18 to 35 percent slopes

Map Unit Setting

National map unit symbol: 6djy

Custom Soil Resource Report

Elevation: 600 to 1,400 feet
Mean annual precipitation: 22 to 44 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 60 to 150 days
Farmland classification: Farmland of unique importance

Map Unit Composition

Emmet and similar soils: 60 percent
Mancelona and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Emmet

Setting

Landform: Drumlins, Till plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 26 inches: sandy loam
H3 - 26 to 32 inches: sandy clay loam
H4 - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 18 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: F096XA003MI - Snowy Loamy Till
Hydric soil rating: No

Description of Mancelona

Setting

Landform: Moraines, Outwash plains, Valley trains, Lake plains, Beach ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Custom Soil Resource Report

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam

H2 - 8 to 25 inches: loamy sand

H3 - 25 to 30 inches: gravelly sandy loam

H4 - 30 to 60 inches: very gravelly coarse sand

Properties and qualities

Slope: 18 to 35 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Lupton

Percent of map unit: 2 percent

Landform: Moraines, Depressions, Depressions, Depressions, Till plains, Lake terraces

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Markey

Percent of map unit: 2 percent

Landform: Depressions on moraines, Depressions on lake plains, Depressions on outwash plains

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Nester

Percent of map unit: 2 percent

Landform: Moraines, Till plains

Custom Soil Resource Report

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Alpena

Percent of map unit: 2 percent

Landform: Moraines, Lake terraces, Beach ridges

Landform position (two-dimensional): Backslope, footslope, toeslope

Landform position (three-dimensional): Nose slope, side slope, base slope

Down-slope shape: Linear

Across-slope shape: Linear, convex

Hydric soil rating: No

Kiva

Percent of map unit: 2 percent

Landform: Moraines, Lake plains, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Hm—Hettinger-Muck complex

Map Unit Setting

National map unit symbol: 6dk6

Elevation: 600 to 1,600 feet

Mean annual precipitation: 19 to 44 inches

Mean annual air temperature: 36 to 46 degrees F

Frost-free period: 60 to 172 days

Farmland classification: Not prime farmland

Map Unit Composition

Hettinger and similar soils: 45 percent

Muck: 30 percent

Minor components: 25 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hettinger

Setting

Landform: Depressions on lake plains

Landform position (three-dimensional): Talf

Custom Soil Resource Report

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 12 to 36 inches of fine-loamy material over stratified, calcareous silty and clayey glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: loam

H2 - 8 to 23 inches: silty clay loam

H3 - 23 to 60 inches: stratified clay loam to silty clay loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: C/D

Ecological site: F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

Description of Muck

Setting

Landform: Depressions

Parent material: Organic material

Typical profile

Oa1 - 0 to 11 inches: muck

Oa2 - 11 to 23 inches: muck

2C - 23 to 60 inches: loam

Properties and qualities

Slope: 0 to 2 percent

Drainage class: Very poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)

Depth to water table: About 0 inches

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Very high (about 15.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6w

Ecological site: F096XA014MI - Snowy Mucky Depression

Hydric soil rating: Yes

Minor Components

Lupton

Percent of map unit: 5 percent

Landform: Lake terraces, Moraines, Till plains, Depressions, Depressions, Depressions

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Kiva

Percent of map unit: 5 percent

Landform: Lake plains, Moraines, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Mancelona

Percent of map unit: 5 percent

Landform: Moraines, Beach ridges, Valley trains, Outwash plains, Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Markey

Percent of map unit: 3 percent

Landform: Depressions on outwash plains, Depressions on lake plains, Depressions on moraines

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Tonkey

Percent of map unit: 3 percent

Landform: Depressions on depressions on lake plains, Depressions on glacial drainageways, Outwash plains

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Edwards

Percent of map unit: 2 percent

Landform: Depressions on moraines, Depressions on outwash plains

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Roscommon

Percent of map unit: 2 percent

Landform: Depressions on outwash plains, Depressions on lake plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear
Hydric soil rating: Yes

KaB—Kaleva sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2w5mq
Landscape: Till plains, lake plains, ice-margin complexes, outwash plains
Elevation: 580 to 1,110 feet
Mean annual precipitation: 30 to 41 inches
Mean annual air temperature: 41 to 52 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Kaleva and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kaleva

Setting

Landscape: Till plains, lake plains, ice-margin complexes, outwash plains
Landform: Moraines, Lake plains, Outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy outwash

Typical profile

A - 0 to 3 inches: sand
E - 3 to 9 inches: sand
Bhs - 9 to 12 inches: sand
Bs1 - 12 to 19 inches: sand
Bs2 - 19 to 30 inches: sand
BC - 30 to 35 inches: sand
C - 35 to 80 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Custom Soil Resource Report

Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 0.1 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

Pipestone

Percent of map unit: 5 percent
Landscape: Lake plains, ice-margin complexes, till plains, outwash plains
Landform: Lake plains, Moraines, Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear
Hydric soil rating: No

Nessen

Percent of map unit: 3 percent
Landscape: Till plains, lake plains, ice-margin complexes, outwash plains
Landform: Lake plains, Moraines, Outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Fern

Percent of map unit: 2 percent
Landscape: Till plains
Landform: Moraines, Till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

KaC—Kaleva sand, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 2w5mr
Landscape: Till plains, outwash plains, ice-margin complexes, lake plains

Custom Soil Resource Report

Elevation: 590 to 1,330 feet
Mean annual precipitation: 30 to 41 inches
Mean annual air temperature: 41 to 52 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Kaleva and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kaleva

Setting

Landscape: Till plains, outwash plains, ice-margin complexes, lake plains
Landform: Lake plains, Outwash plains, Moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Sandy drift

Typical profile

A - 0 to 3 inches: sand
E - 3 to 9 inches: sand
Bhs - 9 to 12 inches: sand
Bs1 - 12 to 19 inches: sand
Bs2 - 19 to 30 inches: sand
BC - 30 to 35 inches: sand
C - 35 to 80 inches: sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 0.1 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F094AA005MI - Snowy Rich Sandy Drift, F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

Nessen

Percent of map unit: 5 percent

Landscape: Till plains, outwash plains, ice-margin complexes, lake plains
Landform: Lake plains, Outwash plains, Moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

KeB—Kalkaska-East Lake loamy sands, 0 to 6 percent slopes, lake moderated

Map Unit Setting

National map unit symbol: 6dkg
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Farmland of unique importance

Map Unit Composition

Kalkaska and similar soils: 55 percent
East lake and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Moraines, Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand
H2 - 7 to 15 inches: sand
H3 - 15 to 32 inches: sand
H4 - 32 to 60 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Custom Soil Resource Report

Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of East Lake

Setting

Landform: Moraines, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 26 inches: loamy sand

H3 - 26 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 2 percent

Landform: Drumlins, Till plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Leelanau

Percent of map unit: 2 percent

Landform: Moraines, Drumlins, Till plains

Landform position (three-dimensional): Rise

Custom Soil Resource Report

Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Mancelona

Percent of map unit: 2 percent
Landform: Moraines, Outwash plains, Valley trains, Lake plains, Beach ridges
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Alcona

Percent of map unit: 2 percent
Landform: Moraines, Outwash plains, Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Richter

Percent of map unit: 2 percent
Landform: Moraines, Glacial drainageways, Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

LIB—Leelanau-East Lake loamy sands, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6dkp
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Leelanau and similar soils: 60 percent
East lake and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Drumlins, Till plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear

Custom Soil Resource Report

Across-slope shape: Linear

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of East Lake

Setting

Landform: Outwash plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 26 inches: loamy sand

H3 - 26 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Alcona

Percent of map unit: 4 percent

Landform: Lake plains, Outwash plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Kalkaska

Percent of map unit: 3 percent

Landform: Outwash plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Mancelona

Percent of map unit: 3 percent

Landform: Beach ridges, Lake plains, Valley trains, Outwash plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

LIC—Leelanau-East Lake loamy sands, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6dkq

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Leelanau and similar soils: 65 percent

East lake and similar soils: 25 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Drumlins, Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of East Lake

Setting

Landform: Outwash plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 26 inches: loamy sand

H3 - 26 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Minor Components

Mancelona

Percent of map unit: 3 percent
Landform: Beach ridges, Lake plains, Valley trains, Outwash plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Kalkaska

Percent of map unit: 2 percent
Landform: Outwash plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Alcona

Percent of map unit: 2 percent
Landform: Lake plains, Outwash plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Tonkey

Percent of map unit: 1 percent

Landform: Depressions on lake plains, Depressions on glacial drainageways, Outwash plains

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Richter

Percent of map unit: 1 percent

Landform: Moraines, Glacial drainageways, Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Nester

Percent of map unit: 1 percent

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

LID—Leelanau-East Lake loamy sands, 12 to 18 percent slopes, lake moderated

Map Unit Setting

National map unit symbol: 6dkr

Elevation: 600 to 1,900 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Farmland of unique importance

Map Unit Composition

Leelanau and similar soils: 65 percent

East lake and similar soils: 25 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Drumlins, Till plains, Moraines

Custom Soil Resource Report

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of East Lake

Setting

Landform: Moraines, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 26 inches: loamy sand

H3 - 26 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 12 to 18 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

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Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Alcona

Percent of map unit: 3 percent

Landform: Lake plains, Outwash plains, Moraines

Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope

Down-slope shape: Linear

Across-slope shape: Linear, convex

Hydric soil rating: No

Kalkaska

Percent of map unit: 3 percent

Landform: Outwash plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Mancelona

Percent of map unit: 2 percent

Landform: Beach ridges, Lake plains, Valley trains, Outwash plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Nester

Percent of map unit: 2 percent

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

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Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

LIE—Leelanau-East Lake loamy sands, 18 to 25 percent slopes, lake moderated

Map Unit Setting

National map unit symbol: 6dks
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Farmland of unique importance

Map Unit Composition

Leelanau and similar soils: 50 percent
East lake and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Drumlins, Till plains, Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 28 inches: loamy sand
H3 - 28 to 36 inches: sandy loam
H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

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Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of East Lake

Setting

Landform: Moraines, Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 26 inches: loamy sand

H3 - 26 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 18 to 25 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Mancelona

Percent of map unit: 4 percent

Landform: Beach ridges, Lake plains, Valley trains, Outwash plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

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Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

Nester

Percent of map unit: 4 percent
Landform: Moraines, Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

Kalkaska

Percent of map unit: 4 percent
Landform: Moraines, Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

Alcona

Percent of map unit: 3 percent
Landform: Moraines, Outwash plains, Lake plains
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, nose slope, side slope, base slope
Down-slope shape: Linear
Across-slope shape: Linear, convex
Hydric soil rating: No

LIF—Leelanau-East Lake loamy sands, 25 to 45 percent slopes

Map Unit Setting

National map unit symbol: 6dkt
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 36 inches
Mean annual air temperature: 39 to 50 degrees F
Frost-free period: 70 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Leelanau and similar soils: 50 percent

East lake and similar soils: 35 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Drumlins, Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 28 inches: loamy sand

H3 - 28 to 36 inches: sandy loam

H4 - 36 to 60 inches: loamy sand

Properties and qualities

Slope: 25 to 45 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: A

Ecological site: F096XA006MI - Snowy Rich Sandy Drift

Hydric soil rating: No

Description of East Lake

Setting

Landform: Outwash plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvium, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Custom Soil Resource Report

Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 26 inches: loamy sand

H3 - 26 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 25 to 45 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 25 percent

Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: A

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: No

Minor Components

Kalkaska

Percent of map unit: 3 percent

Landform: Outwash plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Mancelona

Percent of map unit: 3 percent

Landform: Beach ridges, Lake plains, Valley trains, Outwash plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Alcona

Percent of map unit: 3 percent

Landform: Lake plains, Outwash plains, Moraines

Landform position (two-dimensional): Backslope, footslope, toeslope

Custom Soil Resource Report

Landform position (three-dimensional): Interfluve, nose slope, side slope, base slope

Down-slope shape: Linear

Across-slope shape: Convex, linear

Hydric soil rating: No

Nester

Percent of map unit: 3 percent

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Wind eroded land

Percent of map unit: 3 percent

Hydric soil rating: Unranked

Lm—Lupton-Markey mucks

Map Unit Setting

National map unit symbol: 6dkv

Elevation: 600 to 1,500 feet

Mean annual precipitation: 19 to 44 inches

Mean annual air temperature: 36 to 46 degrees F

Frost-free period: 60 to 172 days

Farmland classification: Not prime farmland

Map Unit Composition

Lupton and similar soils: 60 percent

Markey and similar soils: 30 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lupton

Setting

Landform: Lake terraces, Moraines, Till plains, Depressions, Depressions, Depressions

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Greater than 51 inches of organic material

Typical profile

Oa1 - 0 to 10 inches: muck

Oa2 - 10 to 60 inches: muck

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 23.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: F096XA014MI - Snowy Mucky Depression
Hydric soil rating: Yes

Description of Markey

Setting

Landform: Depressions on outwash plains, Depressions on lake plains, Depressions on moraines
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 16 to 51 inches of organic material over sandy glaciofluvial deposits

Typical profile

Oa - 0 to 20 inches: muck
2C - 20 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F096XA014MI - Snowy Mucky Depression
Hydric soil rating: Yes

Minor Components

Roscommon

Percent of map unit: 5 percent

Landform: Depressions on outwash plains, Depressions on lake plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Edwards

Percent of map unit: 5 percent

Landform: Depressions on moraines, Depressions on outwash plains

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

MrB—Mancelona-Richter gravelly sandy loams, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6dl3

Elevation: 600 to 1,600 feet

Mean annual precipitation: 27 to 34 inches

Mean annual air temperature: 39 to 46 degrees F

Frost-free period: 70 to 150 days

Farmland classification: Farmland of local importance

Map Unit Composition

Mancelona and similar soils: 70 percent

Richter and similar soils: 25 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mancelona

Setting

Landform: Moraines, Beach ridges, Valley trains, Outwash plains, Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam

H2 - 8 to 25 inches: loamy sand

H3 - 25 to 30 inches: gravelly sandy loam

H4 - 30 to 60 inches: very gravelly coarse sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Hydrologic Soil Group: A
Ecological site: F096XA007MI - Snowy Sandy Drift
Hydric soil rating: No

Description of Richter

Setting

Landform: Valley trains, Glacial drainageways, Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 25 to 40 inches of sandy and/or loamy material over stratified, calcareous sandy and silty glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 27 inches: fine sandy loam
H3 - 27 to 60 inches: stratified loamy fine sand to sandy loam

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B/D
Ecological site: F096XA004MI - Snowy Loamy Depression
Hydric soil rating: No

Minor Components

Tonkey

Percent of map unit: 2 percent

Landform: Depressions on depressions on lake plains, Depressions on glacial drainageways, Outwash plains

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Epoufette

Percent of map unit: 2 percent

Landform: Depressions on lake plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

Wallace

Percent of map unit: 1 percent

Landform: Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Convex

Hydric soil rating: No

NtF3—Nester silty clay loam, 20 to 50 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 6dl9

Elevation: 600 to 1,400 feet

Mean annual precipitation: 27 to 32 inches

Mean annual air temperature: 41 to 46 degrees F

Frost-free period: 90 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Nester, severely eroded, and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nester, Severely Eroded

Setting

Landform: Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Custom Soil Resource Report

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Parent material: 20 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Typical profile

H1 - 0 to 6 inches: silty clay loam

H2 - 6 to 28 inches: silty clay loam

H3 - 28 to 60 inches: silty clay loam

Properties and qualities

Slope: 20 to 50 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: C

Ecological site: F096XA003MI - Snowy Loamy Till

Hydric soil rating: No

Minor Components

Emmet

Percent of map unit: 4 percent

Landform: Till plains, Drumlins, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Leelanau

Percent of map unit: 3 percent

Landform: Drumlins, Till plains, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluvial, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

Omena

Percent of map unit: 3 percent

Landform: Drumlins, Moraines

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Concave, convex

Hydric soil rating: No

PpskaB—Pipestone-Kaleva sands, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 31gtn

Landscape: Lake plains, ice-margin complexes

Elevation: 580 to 720 feet

Mean annual precipitation: 30 to 35 inches

Mean annual air temperature: 45 to 46 degrees F

Frost-free period: 110 to 160 days

Farmland classification: Not prime farmland

Map Unit Composition

Pipestone and similar soils: 45 percent

Kaleva and similar soils: 35 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pipestone

Setting

Landscape: Lake plains, ice-margin complexes

Landform: Lakebeds (relict), Drumlins

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope, tal

Down-slope shape: Concave, linear

Across-slope shape: Linear

Parent material: Sandy glaciolacustrine deposits

Typical profile

A - 0 to 4 inches: sand

E - 4 to 9 inches: sand

Bhs - 9 to 17 inches: sand

Bs - 17 to 31 inches: sand

C - 31 to 79 inches: sand

Properties and qualities

Slope: 0 to 4 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)

Custom Soil Resource Report

Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 11.0
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Ecological site: F096XA008MI - Snowy Acidic Sandy Depression
Hydric soil rating: No

Description of Kaleva

Setting

Landscape: Outwash plains, ice-margin complexes, lake plains
Landform: Depressions, Drumlins, Lakebeds (relict)
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluvium, nose slope, side slope, rise
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Sandy outwash

Typical profile

A - 0 to 3 inches: sand
E - 3 to 9 inches: sand
Bhs - 9 to 12 inches: sand
Bs1 - 12 to 19 inches: sand
Bs2 - 19 to 30 inches: sand
BC - 30 to 35 inches: sand
C - 35 to 79 inches: sand

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 0.1 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F096XA006MI - Snowy Rich Sandy Drift
Hydric soil rating: No

Minor Components

Adrian

Percent of map unit: 10 percent
Landscape: Ice-margin complexes, lake plains
Landform: Drumlins, Lakebeds (relict)
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F096XA014MI - Snowy Mucky Depression
Hydric soil rating: Yes

Kingsville

Percent of map unit: 10 percent
Landscape: Ice-margin complexes, lake plains
Landform: Drumlins, Lakebeds (relict)
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F096XA011MI - Snowy Wet Sandy Depression
Hydric soil rating: Yes

Pt—Pits, gravel

Map Unit Composition

Pits, gravel: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

TmA—Tonkey-Munuscong-Iosco sandy loams, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 6dlh
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Tonkey and similar soils: 40 percent
Iosco and similar soils: 25 percent
Munuscong and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tonkey

Setting

Landform: Depressions on depressions on lake plains, Depressions on glacial drainageways, Outwash plains

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: sandy loam

H2 - 8 to 20 inches: fine sandy loam

H3 - 20 to 60 inches: stratified sand to sandy loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 10 percent

Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: A/D

Ecological site: F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

Description of Munuscong

Setting

Landform: Depressions on lake plains, Depressions on outwash plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of loamy material over clayey lacustrine deposits

Typical profile

H1 - 0 to 10 inches: sandy loam

H2 - 10 to 24 inches: fine sandy loam

H3 - 24 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Custom Soil Resource Report

Frequency of ponding: Frequent

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: C/D

Ecological site: F096XA005MI - Snowy Wet Loamy Depression

Hydric soil rating: Yes

Description of losco

Setting

Landform: Lake plains, Outwash plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of sandy glaciofluvial deposits over loamy till or glacialacustrine deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 27 inches: sand

H3 - 27 to 34 inches: silty clay loam

H4 - 34 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: C/D

Ecological site: F096XA008MI - Snowy Acidic Sandy Depression

Hydric soil rating: No

Minor Components

Au gres

Percent of map unit: 4 percent

Landform: Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Nester

Percent of map unit: 3 percent
Landform: Till plains, Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Kalkaska

Percent of map unit: 3 percent
Landform: Outwash plains, Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

TmB—Tonkey-Munuscong-Iosco sandy loams, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6dlj
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Tonkey and similar soils: 35 percent
Munuscong and similar soils: 30 percent
Iosco and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tonkey

Setting

Landform: Depressions on depressions on lake plains, Depressions on glacial drainageways, Outwash plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 20 inches: fine sandy loam
H3 - 20 to 60 inches: stratified sand to sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F096XA005MI - Snowy Wet Loamy Depression
Hydric soil rating: Yes

Description of Munuscong

Setting

Landform: Depressions on outwash plains, Depressions on lake plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 40 inches of loamy material over clayey lacustrine deposits

Typical profile

H1 - 0 to 10 inches: sandy loam
H2 - 10 to 24 inches: fine sandy loam
H3 - 24 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F096XA005MI - Snowy Wet Loamy Depression
Hydric soil rating: Yes

Description of losco

Setting

Landform: Outwash plains, Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 20 to 40 inches of sandy glaciofluvial deposits over loamy till or glacialacustrine deposits

Typical profile

H1 - 0 to 8 inches: loamy sand

H2 - 8 to 27 inches: sand

H3 - 27 to 34 inches: silty clay loam

H4 - 34 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: C/D

Ecological site: F096XA008MI - Snowy Acidic Sandy Depression

Hydric soil rating: No

Minor Components

Au gres

Percent of map unit: 4 percent

Landform: Lake plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Nester

Percent of map unit: 4 percent

Landform: Till plains, Moraines

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Kalkaska

Percent of map unit: 4 percent

Landform: Outwash plains, Lake plains

Custom Soil Resource Report

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Hettinger

Percent of map unit: 3 percent

Landform: Depressions on lake plains

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: Yes

WID—Wind eroded land, steep

Map Unit Setting

National map unit symbol: 6dln

Elevation: 600 to 1,000 feet

Mean annual precipitation: 28 to 36 inches

Mean annual air temperature: 39 to 50 degrees F

Frost-free period: 100 to 180 days

Farmland classification: Not prime farmland

Map Unit Composition

Wind eroded land: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wind Eroded Land

Typical profile

H1 - 0 to 60 inches: sand

Interpretive groups

Land capability classification (irrigated): None specified

Ecological site: F096XA007MI - Snowy Sandy Drift

Hydric soil rating: Unranked

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1925 Breton Road SE, Suite 100; Grand Rapids, MI 49506

Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF

DATE: 4/23/2026

LOCATION: Traverse City, Michigan

PROJECT NO. 20260066

ESTIMATOR: DIU

WORK: WTP Pump Improvements

CHECKED BY: RVW

ENR CCI#: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	AMOUNT
1	Pump Rehabilitation (two high service/two low service)	4	EA	\$130,000	\$520,000
2	Install VFDs on pumps with installation	4	EA	\$80,000	\$320,000
	Construction Subtotal				\$840,000
	Contingencies	30	%		\$252,000
	Engineering, Legal, and Administrative	20	%		\$168,000
	TOTAL PROJECT COST				\$1,260,000



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Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF

LOCATION: Traverse City, Michigan

WORK: WTP Electrical Improvements

DATE: 4/23/2026

PROJECT NO. 20260066

ESTIMATOR: DIU

CHECKED BY: RVW

ENR CCI#: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	AMOUNT
1	Replace Basement Switchgear	1	LS	\$125,000	\$125,000
2	Replace High Service Pump Station Switchgear	1	LS	\$375,000	\$375,000
3	Replace Low Service Pump Station Switchgear	1	LS	\$375,000	\$375,000
4	Equipment Installation	20	%	\$1,110,000	\$222,000
5	Misc Metal	1	%	\$1,110,000	\$12,000
6	Misc Mechanical	1	%	\$1,110,000	\$12,000
7	Misc Painting	1	%	\$1,110,000	\$12,000
8	Electrical and SCADA Allowance	35	%	\$1,110,000	\$392,000
	Construction Subtotal				\$1,525,000
	Contingencies	30	%		\$458,000
	Engineering, Legal, and Administrative	20	%		\$305,000
	TOTAL PROJECT COST				\$2,290,000



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Telephone: (616) 454-4286

PROJECT:	Traverse City DWSRF
LOCATION:	Traverse City, Michigan
WORK:	WTP and Wayne Hill Overflow Improvements

DATE:	4/23/2026
PROJECT NO.	20260066
ESTIMATOR:	DIU
CHECKED BY:	RVW
ENR CCI#:	14176

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	WTP Reservoir 30" PVC Drain	50	LF	\$500	\$25,000
2	Wayne Hill Reservoir 16" PVC Drain	300	LF	\$350	\$105,000
3	WTP Reservoir 30" DIP Exposed Fittings and Concrete	1	LS	\$75,000	\$75,000
4	Wayne Hill Reservoir 16" DIP Exposed Fittings and Concrete	1	LS	\$50,000	\$50,000
5	30" Flap Gate/Duckbill	1	EA	\$25,000	\$25,000
6	16" Flap Gate/Duckbill	1	EA	\$20,000	\$20,000
7	Discharge Plate/Headwall	2	LS	\$15,000	\$30,000
8					
9	Construction Subtotal				\$330,000
10	Contingencies	30	%		\$99,000
11	Engineering, Legal, and Administrative	20	%		\$66,000
	TOTAL PROJECT COST				\$500,000



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Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF
LOCATION: Traverse City, Michigan
WORK: WTP Sodium Hypochlorite Improvements

DATE: 4/23/2026
PROJECT NO.: 20260066
ESTIMATOR: DIU
CHECKED BY: RVW
ENR CCI#: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	Demo Existing Wall	1	LS	\$13,225	\$13,225
2	New 15' x 15' FRP Panel Wall	225	SF	\$225	\$50,625
3	Wall Header and Jams	1	LS	\$28,500	\$28,500
4	8100 Gallon Polyethylene Tank	2	EA	\$30,000	\$60,000
5	Level Transducers	2	EA	\$2,645	\$5,290
6	Transfer Pumps	2	EA	\$13,225	\$26,450
7	Chemical Resistant Coating	1200	SF	\$33	\$39,675
8	Concrete Surface Repairs	200	SF	\$66	\$13,225
9	4" Fill Piping	50	LF	\$53	\$2,645
10	4" Ball Valves	2	EA	\$1,323	\$2,645
11	4" Camlock Fittings	2	EA	\$661	\$1,323
12	Equipment Installation	40	%	\$205,225	\$82,090
13	Misc Metal	1	%	\$205,225	\$2,052
14	Misc Mechanical	1	%	\$205,225	\$2,052
15	Misc Painting	1	%	\$205,225	\$2,052
16	Electrical and SCADA Allowance	30	%	\$4,600	\$1,380
	Construction Subtotal				\$334,000
	Contingencies	30	%		\$101,000
	Engineering, Legal, and Administrative	20	%		\$67,000
	TOTAL PROJECT COST				\$510,000



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1925 Breton Road SE, Suite 100; Grand Rapids, MI 49506

Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF
LOCATION: Traverse City, Michigan
WORK: WTP Service Elevator

DATE: 4/23/2026
PROJECT NO.: 20260066
ESTIMATOR: DIU
CHECKED BY: RVW
ENR CCI#: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	Car and Hydraulics (10,000 lb rating)	1	LS	\$300,000	\$300,000
	Construction Subtotal				\$300,000
	Contingencies	30	%		\$90,000
	Engineering, Legal, and Administrative	20	%		\$60,000
	TOTAL PROJECT COST				\$450,000



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1925 Breton Road SE, Suite 100; Grand Rapids, MI 49506

Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF

LOCATION: Traverse City, Michigan

WORK: WTP Generator Replacements

DATE: 4/23/2026

PROJECT NO. 20260066

ESTIMATOR: DIU

CHECKED BY: RVW

ENR CCI#: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	750 kW WTP Generator	1	LS	\$350,000	\$350,000
2	Generator Switchgear for New Generator and ATS	1	LS	\$25,000	\$25,000
3	Concrete Pad and Sitework	1	LS	\$20,000	\$20,000
4	Equipment Installation	1	LS	\$10,000	\$10,000
5	350 kW Low Service PS Generator, ATS, and Pad	1	LS	\$180,000	\$180,000
6	Misc Metal	1	%	\$405,000	\$4,050
7	Misc Mechanical	1	%	\$405,000	\$4,050
8	Misc Painting	1	%	\$405,000	\$4,050
9	Electrical and SCADA Allowance	20	%	\$405,000	\$81,000
	Construction Subtotal				\$679,000
	Contingencies	30	%		\$204,000
	Engineering, Legal, and Administrative	20	%		\$136,000
	TOTAL PROJECT COST				\$1,020,000



1925 Breton Road SE, Suite 100; Grand Rapids, MI 49506

PROJECT: **Traverse City DWSRF**

LOCATION: **Traverse City, Michigan**

WORK: **WTP High Service Valve Replacements**

DATE: **4/23/2026**

PROJECT NO. **20260066**

ESTIMATOR: **DIU**

CHECKED BY: **RVW**

ENR CCI#: **14176**

ORIGINAL (2021)

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	14-inch Plug Valve (100% Port)	3	EA	\$15,000	\$45,000
2	12-inch Plug Valve (100% Port)	1	EA	\$14,000	\$14,000
3	Electro-Pneumatic Actuators	4	EA	\$27,600	\$110,400
4	14-inch Butterfly Valve	3	EA	\$13,800	\$41,400
5	12-inch Butterfly Valve	1	EA	\$11,500	\$11,500
6	Equipment Installation	25	%	\$228,850	\$57,213
7	Misc Metal	1	%	\$228,850	\$2,289
8	Misc Mechanical	1	%	\$228,850	\$2,289
9	Misc Painting	1	%	\$228,850	\$2,289
10	Electrical and SCADA Allowance	15	%	\$110,400	\$16,560
	Construction Subtotal				\$303,000
	Contingencies	30	%		\$91,000
	Engineering, Legal, and Administrative	20	%		\$61,000
	TOTAL PROJECT COST				\$455,000



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Telephone: (616) 454-4286

PROJECT:	Traverse City DWSRF
LOCATION:	Traverse City, Michigan
WORK:	WTP Low Service Pump Station Raw Water Main Replacement

DATE:	4/23/2026
PROJECT NO.	20260066
ESTIMATOR:	DIU
CHECKED BY:	RVW
ENR CCI#:	14176

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	30" DIP Buried	1,000	LF	\$500	\$500,000
2	30" DIP Gate Valves	3	EA	\$65,000	\$195,000
3	Connection to Existing 30"	1	LS	\$5,000	\$5,000
4	Pavement Replacement	1,000	LF	\$125	\$125,000
5	Traffic Control	1	LS	\$25,000	\$25,000
6					
7	Construction Subtotal				\$850,000
8	Contingencies	30	%		\$255,000
9	Engineering, Legal, and Administrative	20	%		\$170,000
	TOTAL PROJECT COST				\$1,275,000



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Telephone: (616) 454-4286

PROJECT: **Traverse City DWSRF**

LOCATION: **Traverse City, Michigan**

WORK: **South Union Street Bridge Water Main**
MDOT Project

DATE: **4/23/2026**

PROJECT NO. **20260066**

ESTIMATOR: **DIU**

CHECKED BY: **RVW**

CURRENT ENR: **14176**

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	New 12-inch Water Main (RJ, CL 52, DIP, with Hangers)	750	LF	\$500	\$375,000
2	Hydrants (1 every 350 ft)	3	EA	\$6,000	\$18,000
3	12-inch Gate Valve and Box (1 every 500 ft)	2	EA	\$24,000	\$48,000
4	Connection to Existing Main	2	EA	\$12,000	\$24,000
	Construction Subtotal				\$465,000
	Contingencies	30	%		\$140,000
	Engineering, Legal, and Administrative	20	%		\$93,000
	TOTAL PROJECT COST				\$700,000



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Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF
LOCATION: Traverse City, Michigan
WORK: 2027 Galvanized Service Line Replacements (City Wide)

DATE: 4/23/2026
PROJECT NO. 20260066
ESTIMATOR: DIU
CHECKED BY: RVW
CURRENT ENR: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	Replacement of lead service lines	50	LEAD	\$10,000	\$500,000
	Construction Subtotal				\$500,000
	Contingencies	0	%		\$0
	Engineering, Legal, and Administrative	6	%		\$30,000
	TOTAL PROJECT COST				\$530,000



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Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF

LOCATION: Traverse City, Michigan

WORK: 24-inch from Lake/Cass to Lake/Union

DATE: 4/23/2026

PROJECT NO. 20260066

ESTIMATOR: DIU

CHECKED BY: RVW

ENR CCI#: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	New 24 inch Water Main (RJ, CL 52, DIP, 5' Cover)	664	LF	\$450	\$298,800
2	Hydrants (1 every 350 ft)	3	EA	\$6,000	\$18,000
3	24-inch Gate Valve and Box (1 every 500 ft)	2	EA	\$24,000	\$48,000
4	Water Service Connection	2	EA	\$6,000	\$12,000
5	Connection to Existing Main	5	EA	\$12,000	\$60,000
6	Pavement Replacement	664	LF	\$180	\$119,520
7	Traffic Control	1	LS	\$12,000	\$12,000
	Construction Subtotal				\$569,000
	Contingencies	30	%		\$171,000
	Engineering, Legal, and Administrative	20	%		\$114,000
	TOTAL PROJECT COST				\$860,000



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Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF

LOCATION: Traverse City, Michigan

WORK: 24-inch from Lake/Union to Lake/Wadsworth

DATE: 4/23/2026

PROJECT NO. 20260066

ESTIMATOR: DIU

CHECKED BY: RVW

ENR CCI#: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	New 24-inch Water Main (RJ, CL 52, DIP, 5' Cover)	1190	LF	\$450	\$535,500
2	Hydrants (1 every 350 ft)	5	EA	\$6,000	\$30,000
3	24-inch Gate Valve and Box (1 every 500 ft)	3	EA	\$24,000	\$72,000
4	Water Service Connection	8	EA	\$6,000	\$48,000
5	Connection to Existing Main	5	EA	\$12,000	\$60,000
6	Pavement Replacement	1190	LF	\$180	\$214,200
7	Traffic Control	1	LS	\$12,000	\$12,000
	Construction Subtotal				\$972,000
	Contingencies	30	%		\$292,000
	Engineering, Legal, and Administrative	20	%		\$195,000
	TOTAL PROJECT COST				\$1,460,000



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1925 Breton Road SE, Suite 100; Grand Rapids, MI 49506

Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF

LOCATION: Traverse City, Michigan

WORK: 24-inch from Webster/Rose to 8th/Railroad

DATE: 4/23/2026

PROJECT NO. 20260066

ESTIMATOR: DIU

CHECKED BY: RVW

ENR CCI#: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	New 24-inch Water Main (RJ, CL 52, DIP, 5' Cover)	1720	LF	\$450	\$774,000
2	Hydrants (1 every 350 ft)	6	EA	\$6,000	\$36,000
3	24-inch Gate Valve and Box (1 every 500 ft)	5	EA	\$24,000	\$120,000
4	Water Service Connection	40	EA	\$6,000	\$240,000
5	Connection to Existing Main	12	EA	\$12,000	\$144,000
6	Pavement Replacement	1720	LF	\$180	\$309,600
7	Traffic Control	1	LS	\$12,000	\$12,000
	Construction Subtotal				\$1,636,000
	Contingencies	30	%		\$491,000
	Engineering, Legal, and Administrative	20	%		\$328,000
	TOTAL PROJECT COST				\$2,460,000



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1925 Breton Road SE, Suite 100; Grand Rapids, MI 49506

Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF
LOCATION: Traverse City, Michigan
WORK: 24-inch from Garfield/Washington to Webster/Rose

DATE: 4/23/2026
PROJECT NO. 20260066
ESTIMATOR: DIU
CHECKED BY: RVW
CURRENT ENR: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	New 24-inch Water Main (RJ, CL 52, DIP, 5' Cover)	2610	LF	\$450	\$1,174,500
2	Hydrants (1 every 350 ft)	8	EA	\$6,000	\$48,000
3	24-inch Gate Valve and Box (1 every 500 ft)	7	EA	\$24,000	\$168,000
4	Water Service Connection	100	EA	\$7,000	\$700,000
5	Connection to Existing Main	5	EA	\$12,000	\$60,000
6	Pavement Replacement	2610	LF	\$180	\$469,800
7	Traffic Control	1	LS	\$12,000	\$12,000
	Construction Subtotal				\$2,633,000
	Contingencies	30	%		\$790,000
	Engineering, Legal, and Administrative	20	%		\$527,000
	TOTAL PROJECT COST				\$3,950,000



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1925 Breton Road SE, Suite 100; Grand Rapids, MI 49506

Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF
LOCATION: Traverse City, Michigan
WORK: 24-inch from 7th/Division to 7th/Spruce

DATE: 4/23/2026
PROJECT NO. 20260066
ESTIMATOR: DIU
CHECKED BY: RVW
CURRENT ENR: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	New 24-inch Water Main (RJ, CL 52, DIP, 5' Cover)	900	LF	\$450	\$405,000
2	Hydrants (1 every 350 ft)	3	EA	\$6,000	\$18,000
3	24-inch Gate Valve and Box (1 every 500 ft)	7	EA	\$24,000	\$168,000
4	Water Service Connection	22	EA	\$5,000	\$110,000
5	Connection to Existing Main	1	EA	\$10,000	\$10,000
6	Pavement Replacement (assume split with street project)	900	LF	\$200	\$180,000
7	Traffic Control	2	LS	\$10,000	\$20,000
	Construction Subtotal				\$911,000
	Contingencies	10	%		\$92,000
	Engineering, Legal, and Administrative	15	%		\$137,000
	TOTAL PROJECT COST				\$1,140,000



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Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF
LOCATION: Traverse City, Michigan
WORK: 24-inch on 7th/Division to 7th/Wadsworth

DATE: 4/23/2026
PROJECT NO. 20260066
ESTIMATOR: DIU
CHECKED BY: RVW
CURRENT ENR: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	New 24-inch Water Main (RJ, CL 52, DIP, 5' Cover)	1600	LF	\$450	\$720,000
2	Hydrants	0	EA	\$6,000	\$0
3	24-inch Gate Valve and Box (1 every 500 ft)	3	EA	\$24,000	\$76,800
4	Water Service Connection	0	EA	\$5,000	\$0
5	Connection to Existing Main	5	EA	\$10,000	\$50,000
6	Pavement Replacement (assume split with street project)	1600	LF	\$200	\$320,000
7	Traffic Control	1	LS	\$10,000	\$10,000
	Construction Subtotal				\$1,177,000
	Contingencies	10	%		\$118,000
	Engineering, Legal, and Administrative	15	%		\$177,000
	TOTAL PROJECT COST				\$1,480,000



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1925 Breton Road SE, Suite 100; Grand Rapids, MI 49506

Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF
LOCATION: Traverse City, Michigan
WORK: 16-inch on Spruce from 7th to Wayne

DATE: 4/23/2026
PROJECT NO. 20260066
ESTIMATOR: DIU
CHECKED BY: RVW
CURRENT ENR: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	New 16-inch Water Main (RJ, CL 52, DIP, 5' Cover)	3000	LF	\$350	\$1,050,000
2	Hydrants	0	EA	\$6,000	\$0
3	16-inch Gate Valve and Box (1 every 500 ft)	6	EA	\$15,000	\$90,000
4	Water Service Connection	10	EA	\$5,000	\$50,000
5	Connection to Existing Main	2	EA	\$10,000	\$20,000
6	Pavement Replacement (assume split with street project)	3000	LF	\$200	\$600,000
7	Traffic Control	1	LS	\$10,000	\$10,000
	Construction Subtotal				\$1,820,000
	Contingencies	10	%		\$182,000
	Engineering, Legal, and Administrative	15	%		\$273,000
	TOTAL PROJECT COST				\$2,280,000



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1925 Breton Road SE, Suite 100; Grand Rapids, MI 49506

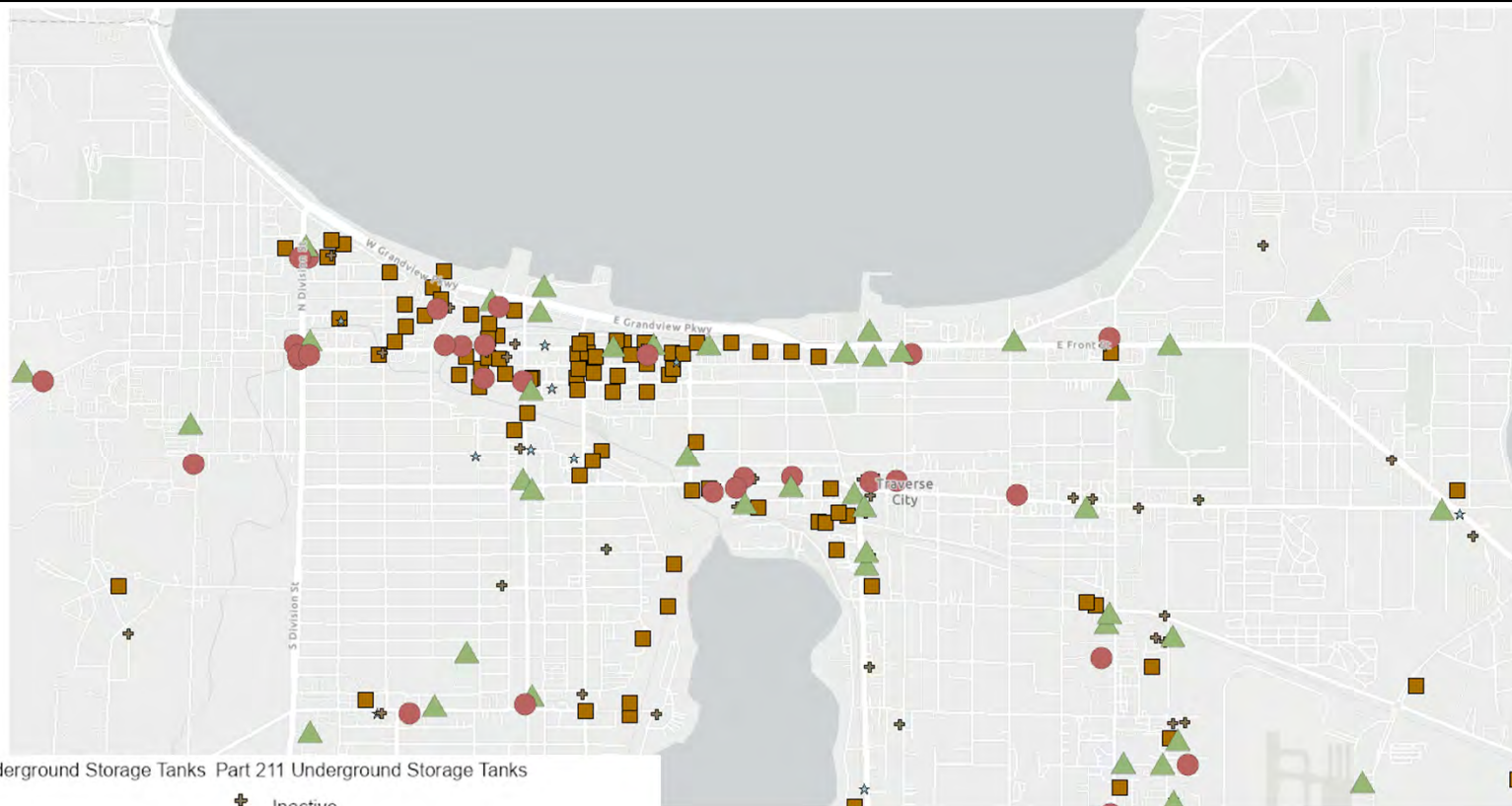
Telephone: (616) 454-4286

PROJECT: Traverse City DWSRF
LOCATION: Traverse City, Michigan
WORK: 16-inch on East Front from Franklin to Park Street

DATE: 4/23/2026
PROJECT NO. 20260066
ESTIMATOR: DIU
CHECKED BY: RVW
ENR CCI#: 14176

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	New 16-inch Water Main (RJ,CL 52, DIP, 5' Cover)	1800	LF	\$350	\$630,000
2	Hydrants	7	EA	\$6,000	\$42,000
3	16-inch Gate Valve and Box (1 every 500 ft)	5	EA	\$15,000	\$69,000
4	Water Service Connection	42	EA	\$5,000	\$210,000
5	Connection to Existing Main	5	EA	\$10,000	\$50,000
6	Pavement Replacement (with street replacement project)	1800	LF	\$50	\$90,000
7	Traffic Control	1	LS	\$10,000	\$10,000
	Construction Subtotal				\$1,101,000
	Contingencies	10	%		\$111,000
	Engineering, Legal, and Administrative	15	%		\$166,000
	TOTAL PROJECT COST				\$1,380,000

APPENDIX E: EGLE SITE CONTAMINATION ONLINE MAPPER TOOL



- Part 213 Leaking Underground Storage Tanks Part 211 Underground Storage Tanks
- ▲ Closed
 - Open
 - ✚ Inactive
 - ☆ Active
 - Part 201 Environmental Contamination Sites



Traverse City Drinking Water Improvements

EGLE RRD Listed Facilities Map

Date
4/13/2026

Figure No.
3.3

**City of Traverse City
Public Hearing Notice Regarding
the Application to the Michigan Department of Environment,
Great Lakes, and Energy (EGLE) for funding assistance
through the Drinking Water State Revolving Fund**



The City of Traverse City will hold a public hearing on the application to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for funding assistance through the Drinking Water State Revolving Fund, better known as the State Revolving Fund (SRF) Program for the proposed Drinking Water System Improvements project. The public hearing is being held for the purpose of receiving comments from interested persons.

The hearing will be held at 7:00 p.m. on Monday, May 18, 2026 during the City Commission Regular Meeting. The proposed Drinking Water System Improvements project descriptions and details are organized into a comprehensive 20-year Project Plan. If the SRF application is successful, the City will have the ability to employ the program to fund the proposed project with low interest loans and grants. The project construction will include improvements within the Water Treatment Plant including low service and high service pump improvements, new electrical switch gears and variable frequency drives for improved electrical efficiency, reservoir piping installation, hypochlorite storage tank and building, freight elevator, standby generators, pump station control valves, and new raw water main. In addition, EGLE lead and copper rule required service line replacements, and replacement of aging and undersized water mains throughout the distribution system. Work will occur at the existing water treatment plant site, located at 2010 Eastern Avenue as well as other locations throughout the City within the distribution system.

Impacts of the proposed project may include:

Noise: Noise due to construction activities such as construction equipment, machinery, generators, compressors, etc. will be kept to a minimum, as practicable. The work hours will be maintained in accordance with local ordinances.

Traffic Disturbance: Traffic control devices and temporary lane closures will be necessary during construction in the collection system. This may impact vehicular and pedestrian traffic flow patterns. Construction activities will be coordinated by location to mitigate any cumulative impacts.

The total cost of the improvements is estimated to be \$24.0 million. The repayment of the SRF loan, if approved, will be apportioned to City water customers at a monthly rate of approximately \$9.33 per residential service. The estimated user costs to finance the proposed project have been determined, assuming SRF financing with a 3.0% interest rate (current SRF interest rate) and a 20-year debt retirement. The apportionment costs are based on an annual average over a 20-year period to provide an estimate of the average charge per residential service.

Copies of the Drinking Water System Draft Project Plan detailing the proposed project is available for review beginning on Friday, May 7, 2026 at:

- City of Traverse City - City Hall, 400 Boardman Avenue, Traverse City, Michigan, 49684 and at the City's website www.traversecitymi.gov.

Written comments received before the hearing record is closed on May 18, 2026 will receive responses in the Final Project Plan. Written questions should be sent to:

Sarah Lutz, City Clerk, City Hall, 400 Boardman Avenue, Traverse City, Michigan, 49684
Or tcclerk@traversecitymi.gov

IF YOU ARE PLANNING TO ATTEND THE PUBLIC MEETING AND YOU HAVE A DISABILITY REQUIRING ANY SPECIAL ASSISTANCE, PLEASE NOTIFY THE ADA COORDINATOR AT 992-4440 OR TDD #922-4412 AS SOON AS POSSIBLE.

The City of Traverse City does not discriminate on the basis of disability in the admission or access to, or treatment or employment in, its programs or activities. Penny Hill, Assistant City Manager has been designated to coordinate compliance with the non-discrimination requirements contained within Section 35.107 of the Department of Justice regulations. Information concerning the provisions of the Americans with Disabilities Act, and the rights provided thereunder, are available from the ADA Coordinator.

Published on May 7, 2026 in the Traverse City Record-Eagle

Sarah Lutz, MiPMC, City Clerk

City of Traverse City

Office of the City Clerk

GOVERNMENTAL CENTER
400 Boardman Avenue
Traverse City, MI 49684
(231) 922-4480
tcclerk@traversecitymi.gov



**TRAVERSE CITY
CITY COMMISSION RESOLUTION**

**ADOPTION OF A FINAL PROJECT PLAN FOR DRINKING WATER
IMPROVEMENTS AND DESIGNATION OF AN AUTHORIZED PROJECT
REPRESENTATIVE**

WHEREAS, the City of Traverse City recognizes the need to make improvements to its existing water treatment and distribution system; and

WHEREAS, the City of Traverse City authorized Hubbell, Roth and Clark to prepare a Project Plan, which recommends the construction of Drinking Water Improvements; and

WHEREAS, said Project Plan was presented at Public Hearing May 18, 2026 and all public comments have been considered and addressed;

WHEREAS, adoption of the Project Plan and approval of the loan program does not obligate the City to accept any funding that may be approved through the application process, if approved by the State, it allows the City to be a candidate for SRF loan consideration; and

NOW THEREFORE BE IT RESOLVED, that the City of Traverse City formally approves and adopts said Project Plan and Program Application for the Michigan Department of Environment, Great Lakes and Energy State Revolving Fund Loan.

BE IT FURTHER RESOLVED, that the City Manager, a position currently held by Martin Colburn, is designated as the authorized representative for all activities associated with the project referenced above, including the submittal of said Project Plan as the first step in applying to the State of Michigan for a Drinking Water State Revolving Fund (DWSRF) Loan to assist in the implementation of the selected alternative.

I, Benjamin Marentette, City Clerk of the City of Traverse City, do hereby certify that the above is a true and correct copy of a resolution adopted at the meeting of the City Commission of the City of Traverse City on May 18, 2026, at which a quorum was present and voted.

Sarah Lutz, Clerk
City of Traverse City, Michigan



MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
Finance Division

**Drinking Water State Revolving Fund (DWSRF)
Project Planning Document Submittal Form**

General Information

Project Name: Traverse City DWSRF Water Improvements

Project Description: Improvements to the City of Traverse City drinking water distribution system and water treatment plant

Legal Name of Applicant: City of Traverse City
(Name of the applicant municipality bonding for the project. Ex. A county bonding on behalf of a village or township)

Applicant Address: 400 Boardman Avenue, PO Box 592

City: Traverse City Zip Code: 49686 County: Grand Traverse

Applicant's Federal Employer Identification Number (EIN): 386027348

Project's Impacted Political Districts:

U.S. Congressional: 1st State Senate: 35, 37 State House: 101, 104

Population served by Water Supply: 32,649 Water Supply Serial Number (WSSN): 06640

Estimated Total Project Cost: 24,000,000 Target Construction Start Date: March 1, 2027

Applicant Authorized Representative Name: Benjamin Marentette

Title: City Manger Phone: 231-922-4440 Email: bmarentette@traversecitymi.gov

Authorized Representative Address. If same as applicant address above, check here ☒

Address: _____ City: _____ Zip Code: _____

Signature of Authorized Representative

Date

Submittal Questions

Joint Resolution of Project Planning Document Adoption/Authorized Representative Designation.

☒ Attached

A completed [DWSRF Project Scoring Form](#) and [Overburdened Determination Form](#) must be submitted to EGLE using the linked forms.

☐ Submitted

Submission

A final project planning document must be prepared and adopted in accordance with EGLE's [DWSRF Project Planning Document Preparation Guidance](#). The final project planning document must be submitted by the annual deadline as indicated on EGLE's [DWSRF website](#) for a proposed project to be considered for placement on Michigan's DWSRF Project Priority List for the upcoming fiscal year.

Please email your final project planning document, this form, and attachments to your EGLE [Water Infrastructure Funding and Financing Section Project Manager](#). The email file size limit is 25MB. Larger files must be submitted to your project manager to download through file sharing.

People with disabilities may request this material in an alternate format by emailing EGLE-Accessibility@Michigan.gov or calling 800-662-9278.

EGLE does not discriminate on the basis of race, sex, religion, age, national origin, color, marital status, disability, political beliefs, height, weight, genetic information, or sexual orientation in the administration of any of its programs or activities, and prohibits intimidation and retaliation, as required by applicable laws and regulations.

This form and its contents are subject to the Freedom of Information Act and may be released to the public.