Chapter 4 – Natural Resources

Introduction

It is the abundance and quality of natural resources that draw people to live and recreate in Presque Isle Township. That same abundance of woodlands, wetlands, water, and wildlife drew pioneers here over 100 years ago and Native Americans here thousands of years ago. An important role of local land use planning is to provide for community development while protecting the critical and vital web of ecological resources within a community. Since resources extend far beyond the Township borders, we also have a responsibility to communities outside the Township.

Environmental Vision

The Township's Environmental Vision is to preserve and maintain the ecological, visual, forest, wetland, and scenic resources of the Township, preserve the environment, and maintain and enhance the overall quality of life for Township residents.

Why protect nature in our community?

1. Natural areas enhance the quality of life for residents and help define community identity by connecting residents to the natural landscape.
2. Healthy, functioning natural areas provide recreational opportunities including hiking, fishing, biking, bird watching, paddle sports, and nature study.
3. Natural landscapes soften the hard edge of built-up areas with the greenery of leaves, the many colors of flowers and fruits, the smell of blossoms, and the sounds of birds.
4. Parks and open spaces may enhance the economic value of the area. Open lands cost less in services than other uses and may add to the value of properties nearby.
5. Natural landscapes have many environmental benefits - they control erosion, help retain stormwater, help clean the air of pollutants, protect surface water quality, mitigate climate change by absorbing carbon dioxide and other greenhouse gases, and help shelter and cool our homes. All of these services are provided absolutely free.
6. Future generations will enjoy the legacy of today's efforts to protect our natural heritage.
7. Spiritual Values – "A sense of place, a sense of well-being, a quiet place to look inward, feeling at one with the earth," there are many ways people express the spiritual values associated with spending time in natural areas.

Collaboration

There are great benefits to communities working together. Watersheds, streams, ecological corridors, and wildlife have a complete disregard for political boundaries. The interconnected web of life, the "green infrastructure" was established long before the land area was divided into political units. Without question, the actions of one community can have a direct impact on the resources in an adjacent community. Therefore, it is imperative that adjacent communities coordinate land use planning and development activities. Working together to protect critical area-wide resources and to improve and re-establish degraded ecological corridors is a win-win scenario for all communities.

Climate

The climate is a factor that contributes to Presque Isle Township's appeal as a place to live and recreate. The Township's climatic conditions are best described as long cold winters and moderately warm summers. The year-round climate is heavily influenced by Lake Huron. Lake Huron acts like a large hot water bottle in the fall, warming the nearby land area and prolonging the growing season. In the spring and early summer, Lake Huron has the opposite effect of cooling the adjacent land area. Further inland, the lake moderating effect diminishes. Local topography can influence temperatures and associated frost conditions. For example, low areas and depressions will often experience earlier frosts than surrounding uplands. Within Presque Isle County, weather recording station locations have changed periodically. **Table 4-1** contains weather statistics recorded at the weather reporting station in Onaway as this is the nearest station to Presque Isle Township that has uninterrupted data for the last 30 years. As mentioned above, the weather conditions do vary across the Township, depending upon topography and proximity to Lake Huron.

The frost-free season is typically June 1st to September 12th which provides for an average 107-day growing season. The mean annual temperature for Presque Isle Township is 44.5°F. In the winter the average temperature is 20.1° F with the average minimum daily temperature of 6.7°F throughout February. The lowest temperature on record is - 35°F. In the summer, the average daily temperature is 69°F throughout July. The highest recorded summer temperature is 106°F in 1936. The average annual precipitation, including snowfall, is 31.05 inches, 18.61 inches of the precipitation occurs as rainfall during the growing season of April through September. The average annual snowfall is 77.34 inches.

Table 4-1: 30-Year Average Annual Weather Statistics, Presque Isle County

January average minimum temperature	12.7°F
January average maximum temperature	27.4°F
July average minimum temperature	56.3°F
July average maximum temperature	81.9°F
Average daily temperature for the year	44.51°F
Average annual precipitation	31.05 inches
Average annual snowfall	77.34 inches

Source: Midwestern Regional Climate Center, Onaway, Michigan Station

Geology

The geology of Presque Isle Township, as well as the entire northern Lower Peninsula, can be described in terms of the surface geology (glacial landforms created thousands of years ago) and bedrock geology (sedimentary bedrock laid down over 300 million years ago). The hills, valleys, wetlands, forests, lakes, and rivers all attribute their presence and location in the township to the surficial and bedrock geology. This section will describe the quaternary geology (glacial and postglacial landforms) and the underlying bedrock geology.

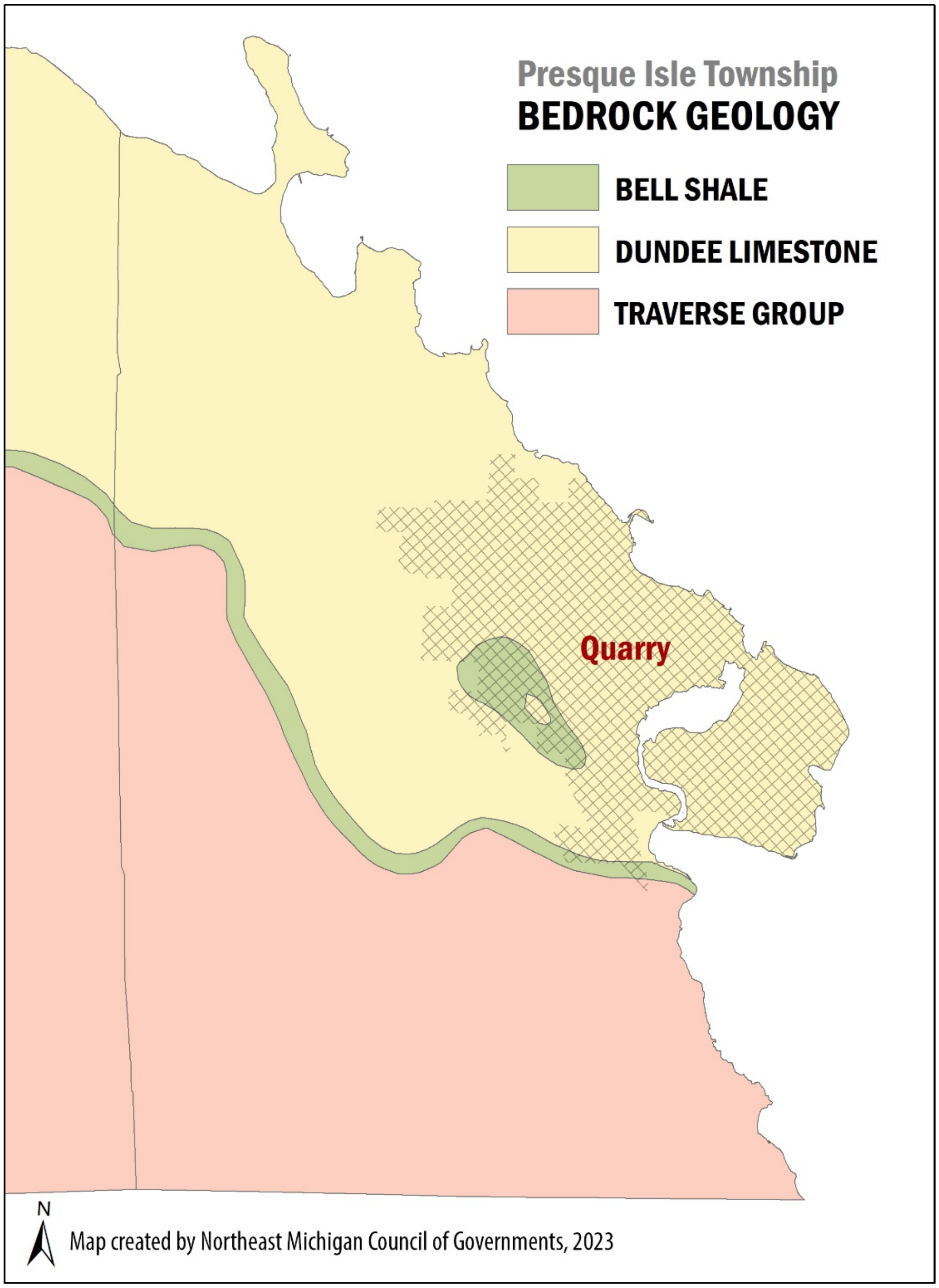
Bedrock Geology

The foundation of the Lower Peninsula, beneath the mantel of glacial deposits, consists of sedimentary bedrock formed in ancient seas between 200 and 500 million years ago. The upper layers of bedrock within the Township consist of layers of sedimentary bedrock that were created during the Middle Devonian Period of the Paleozoic Era. The bedrock was formed in ancient seas which covered the area some 345 to 405 million years ago. Shallow marine seas deposited layers of silt, clay, sediments, marine animals, plants, coral, and other calcareous materials. These deposits formed shale, limestone, and dolomite bedrock. The youngest bedrock formation, Traverse Group, is found in the southern portions of Presque Isle Township. Limestone is the primary bedrock and shale is considered secondary bedrock in this formation. Bell Shale (black shale and limestone), and Dundee Limestone (limestone and dolomite) are the other underlying bedrock formations in the Township. Limestone and dolomite, extracted from Carmeuse Calcite Operations (near Rogers City) and LaFarge/Holcim Operations (in Presque Isle Township), are fine-grained, finely crystalline, very pure, and high-quality. The quarrying of limestone is an important economic activity within Presque Isle Township. The location of quarry-able stone near the ground surface and adjacent to Lake Huron has made limestone from northeast Michigan relatively economical to market. Figure 4-1 identifies the bedrock formations in the township as well as the quarry location.

Another important feature of the regional bedrock is the occurrence of sinkholes and underground streams. As groundwater flows through cracks and fissures in the bedrock, the limestone gradually dissolves, and the openings are widened. Over a long period of time, underground caverns form, and the ceilings become thinner. The ceiling collapses when it becomes too thin to support the weight above, thus forming a sinkhole. "Karst" is the scientific term used to describe a type of topography that is formed in dissolved limestone, dolomite, or gypsum and is characterized by sinkholes, caves, and underground drainage. Karst is also a term used to describe a very distinct terrain as well as the process by which it formed. Figure 4-2 illustrates karst features.

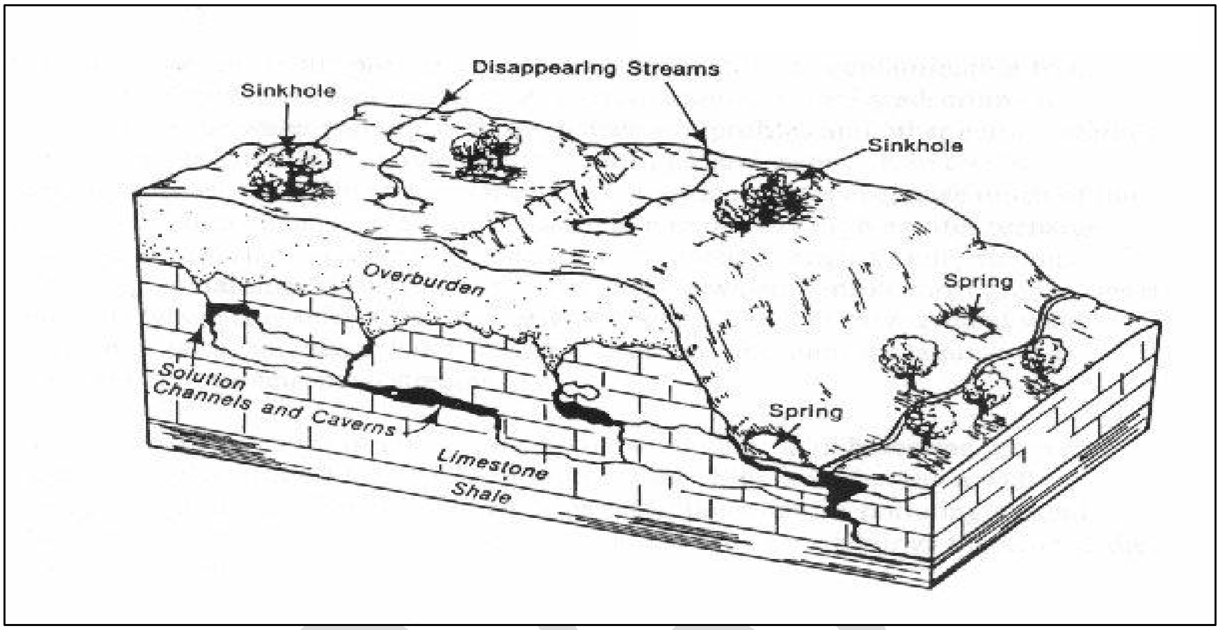
Karst features are present in several northern Michigan counties but are most prevalent and have the greatest number of exposed features in Presque Isle and Alpena Counties. With bedrock at or near the surface in the township, karst features such as swallow holes, earth cracks, porous stone aquifers, sinkholes, and bedrock lakes can be found. Figure 4-3 shows the grouping of sinkholes in the Rockport State Park property in Presque Isle Township. In addition to providing an interesting geographic feature, sinkholes also can host unusual plant communities. The relatively moist terrain with bedrock at or near the surface and the partially subterranean shaded location provide an environment, which sustains vegetation not found in the surrounding surface areas.

Figure 4-1: Bedrock Geology



Sinkhole areas are often especially vulnerable to pollution. Over the years sinkholes have been used as dump areas. The accumulation of refuse is especially dangerous, because of the direct connection to the groundwater, which usually exists in a sinkhole. Local action to protect and preserve sinkholes is recommended both on account of their scenic value and as a groundwater quality protection measure.

Figure 4-2 Karst Topography



Glacial Geology

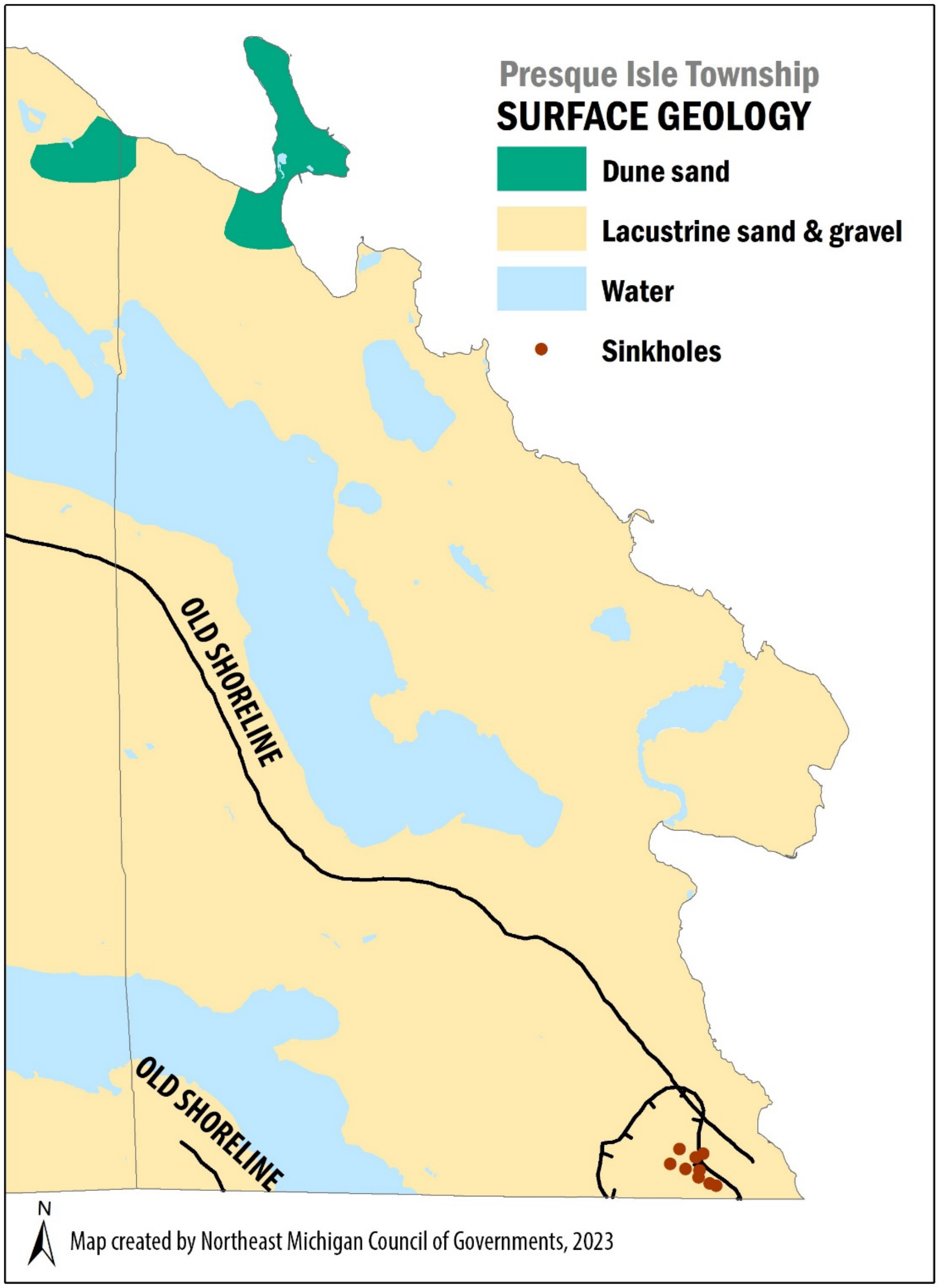
Starting some 2 million years ago during the Pleistocene epoch, continental glaciers formed in the Hudson Bay area. Four times over this two million-year period, the massive sheets of ice built up and inched their way south across North America covering what is today Michigan. The massive ice sheets, more than one mile thick, advanced in a southerly direction and bulldozed their way across the landscape. The glacier pushed material in front of it, incorporated rocks, and soil into the debris-laden ice; and ground and broke apart the sedimentary bedrock of the Michigan Basin.

Each advance and retreat of the continental glaciers took tens of thousands of years. This reoccurring process shaped and reshaped the land; first obliterating and then creating hills, valleys, rivers and lakes, swamps, and marshes. The last glacial period called the Wisconsin era, created the landscape we know today. The glacier left behind boulders, rocks, cobble, sand, gravel, silt, clay, and loam. In some areas, the material was deposited in unsorted masses called till plains, ground moraines, and end moraines. Water flowing from melting glaciers also sorted materials, creating outwash channels, sand deltas, kames, and eskers. Fine materials, captured in fast-moving glacial melt water, settled to the bottom of expansive glacial lakes creating lacustrine clay and silt plains. According to W. A. Burgess and D. F. Eschman, Presque Isle Township is located in the Devils Lake Karst Topography, a landform characterized by fractured limestone bedrock, overlain with a relatively thin mantle of lacustrine sand and gravel.

As the continental glaciers melted, huge blocks of ice became separated from the retreating ice front. The ice blocks became embedded in the glacial debris deposited by the retreating glacier. The embedded ice blocks eventually melted and left depressions (kettle holes) which are today's inland lakes and associated wetlands. Most of the natural lakes in Presque Isle County were formed in this manner. However, water bodies in Presque Isle Township, including Grand Lake and Long Lake, have origins different than the typical kettle lake. Fault lines in the sedimentary bedrock were weak points. Acting like large bulldozers, the glaciers exploited these weak points, broke apart the level sedimentary bedrock, and scoured out the long linear lake basins we know today. **Figure 4-4** shows a graphic rendition of the fault lines and how they influenced the configurations of both Long Lake and Grand Lake. The jagged coastline with the many bays and points along with numerous shoals in near-shore areas reflect the influence of bedrock and determined work of the glaciers.

As the melting glaciers retreated north, deep basins carved out of the bedrock were filled with water. These emerging lake basins were the beginnings of our Great Lakes.

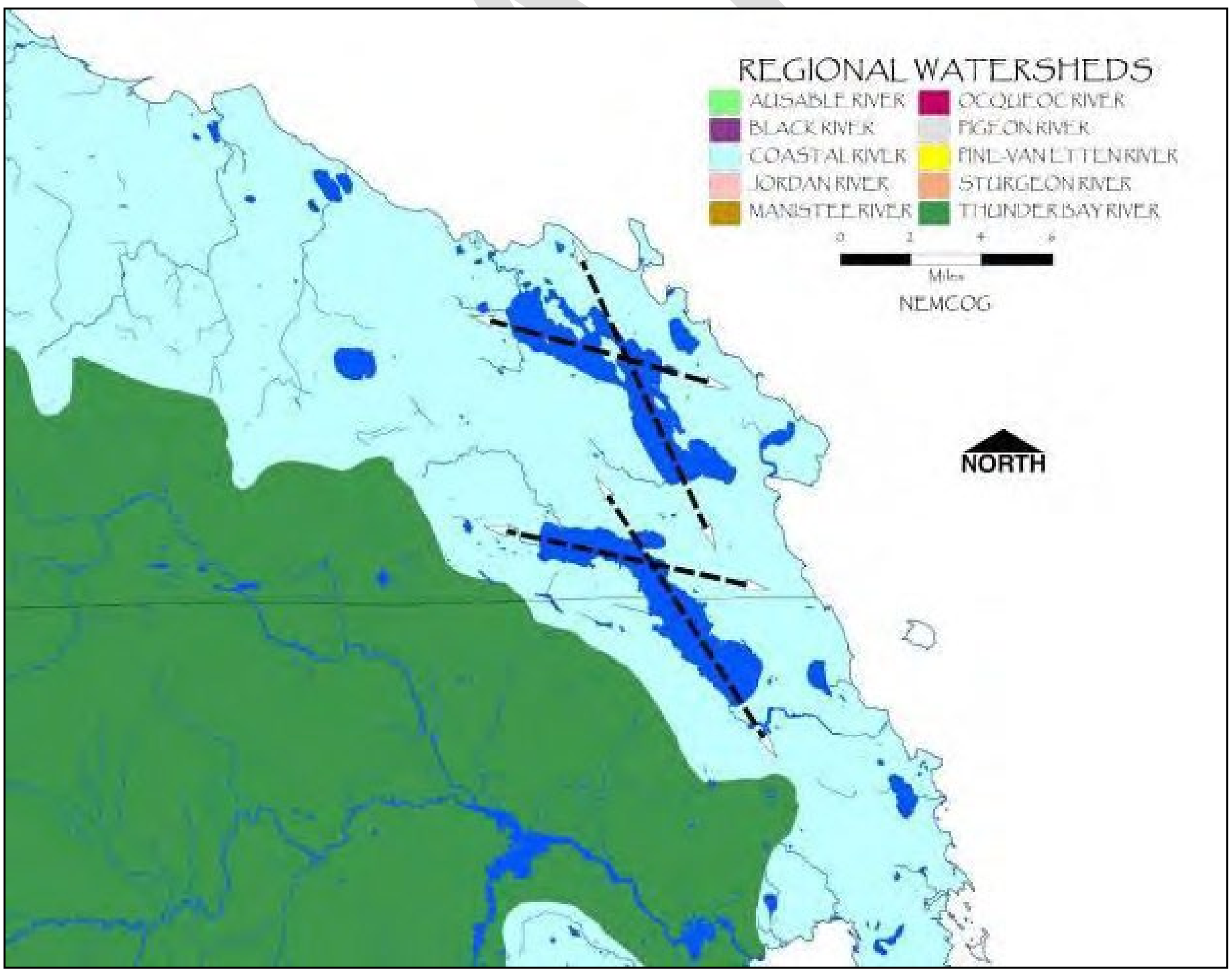
Figure 4-3 Quaternary Geology & Sinkhole Area



Geologists have identified and named the different pro and post-glacial great lake stages in the Huron basin. In some stages, the water levels were much higher and covered the Township, while during other stages the level was much lower, and Presque Isle Point would not have been waterfront property. The first pro-glacial lake to have influenced Presque Isle Township was Lake Warren, which formed at the front of the melting Huron glacial lobe around 12,000 years before present. Waters of Lake Warren flooded the Township, as did subsequent lake stages named Algonquin, Nipissing, and Algoma. Landforms and soils adjacent to Lake Huron were heavily influenced by these high lake-level stages.

A two to eleven-mile-wide lake plain formed from lacustrine sand and gravel deposits that runs along the entire coastal area of Presque Isle County. This relatively level glacial landform was created by the receding postglacial Great Lakes. Some areas are sandy plains covered by pine and aspen forests while other areas consist of poorly drained swamps covered with cedar forests. Grand Lake and Long Lake are located in these lacustrine deposits. In the eastern part of the Presque Isle County the mantle of glacial deposits is very thin, and as a result, the limestone bedrock is close to the surface and outcrops are frequent.

Figure 4-4: Regional Watersheds



Topography

The topography of Presque Isle Township is relatively flat, in part as a consequence of glaciation and inundation by glacial Lake Huron. The approximate mean lake level of Lake Huron is 580 feet above sea level. Slightly inland, the shoreline forming the eastern boundary of the Township is approximately 600 feet above sea level. Grand Lake's approximate mean lake level is set at 594 feet. Grand Lake is relatively shallow with a maximum water depth of 25 feet. Land to the south end of Grand Lake is 600 to 620 feet above sea level and is not highly developed. The east side of the lake shows considerable development even though the elevation is nearly the same as on the south end. However, hydric soils do not appear as often on the east side as on the south end. The west side of the lake reflects the most concentrated development, where elevations range as high as 650 feet above sea level.

Lake Esau on the northeast part of the Township shows an approximate mean lake level of 597 feet with the surrounding land at about 600 feet above sea level. The approximate mean lake level of Long Lake is 649 feet above sea level. The highest elevations (670 to 710 feet above sea level) in the Township are located in the extreme southern portion of the Township between Long Lake and the Rockport sinkholes. Because U.S. Geological Survey maps are not routinely updated, the topography of areas within the quarry is not current due to the continued disturbance.

Soils

When planning for types and intensity of future land uses, soil types, and slopes are two important factors that determine the carrying capacity of the land. Soils most suitable for development purposes are well-drained and are not subject to a high water table. Adequate drainage is important to minimizing stormwater impacts and the efficient operation of septic drain fields. Adequate depth to the water table is necessary to prevent groundwater contamination from septic systems or other non-point source runoff. The construction of roads, buildings, and septic systems on steeply sloped areas or areas with organic and hydric soils requires special design considerations. In addition, costs for developing these sensitive areas are greater than in less constrained parts of the Township. If developed improperly, the impacts to natural resources can be far-reaching.

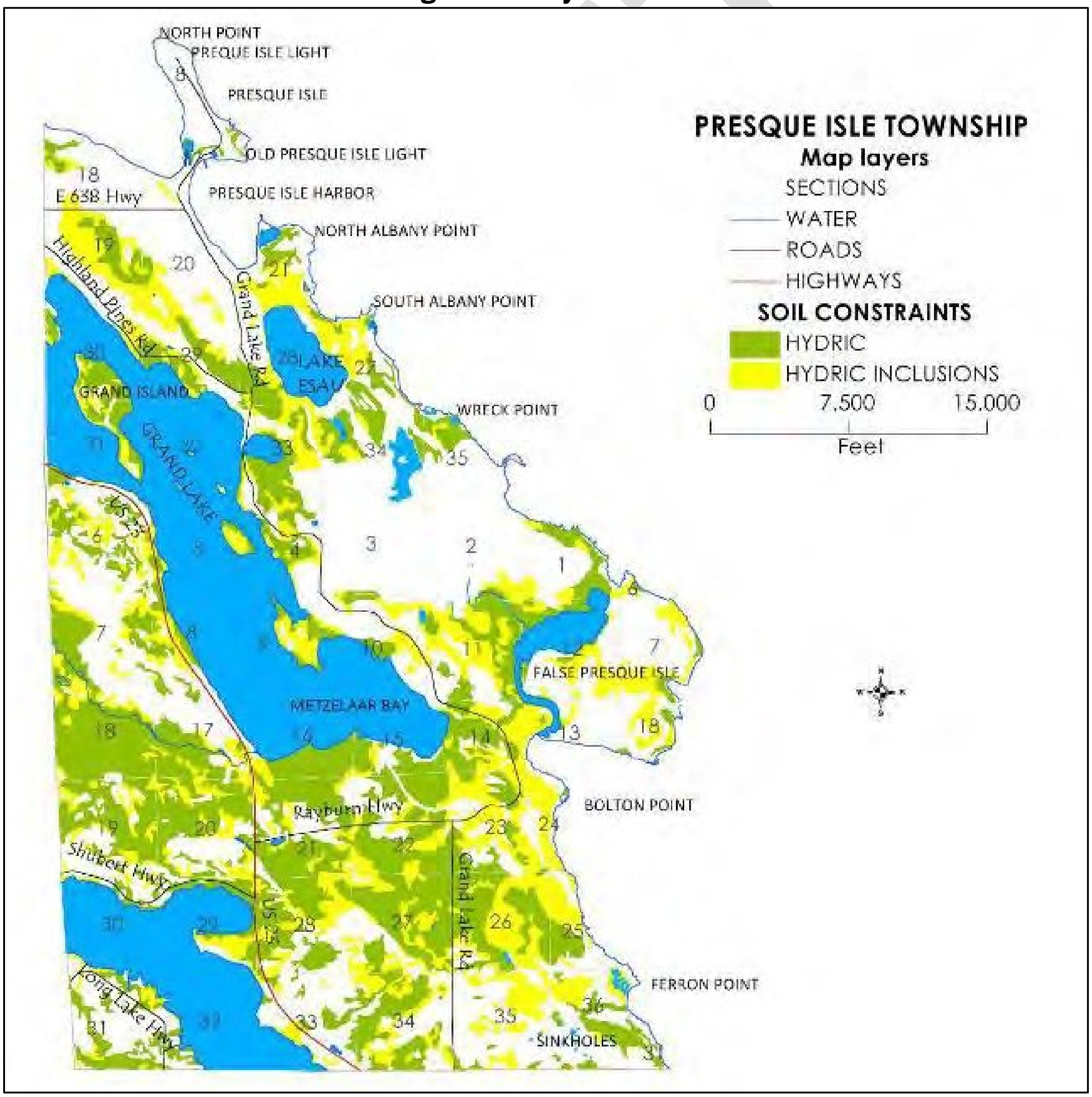
The Natural Resource Conservation Service completed a detailed soil survey of Presque Isle County in 1988. Using information contained within the published soil survey book, a series of maps is presented that depict hydric soils, slopes 10 percent and greater, and areas where the bedrock is close to the surface. Because the soil survey was completed in 1988, the digital files did not reflect the extent of existing quarrying activities. In fact, the soil survey showed little to no mining on False Presque Isle. The soil maps were updated using recent aerial photographs and mining maps to reflect the current boundaries of quarrying operations.

While soil constraints discussed in this section can be used as general guides for the planning process, soil constraints should not be used for the development of specific sites. Detailed on-site investigations should be conducted prior to development.

Hydric Soils

Figure 4-5 is a thematic map that classifies hydric soils and soils with hydric inclusions. Lower density and less intensive development should be directed to these areas with severe building constraints. Hydric soils are saturated, flooded, or ponded during part of the growing season and are classified as poorly drained and very poorly drained. Hydric soils have poor potential for building site development and sanitary facilities. Wetness and frequent ponding are severe problems that are difficult and costly to overcome. Sites with high water tables may be classified as wetlands, and a wetlands permit would be required to develop these areas. The hydric soils are generally located adjacent to streams and creeks. This connectivity of riparian wetlands and surface water features can be seen throughout the landscape.

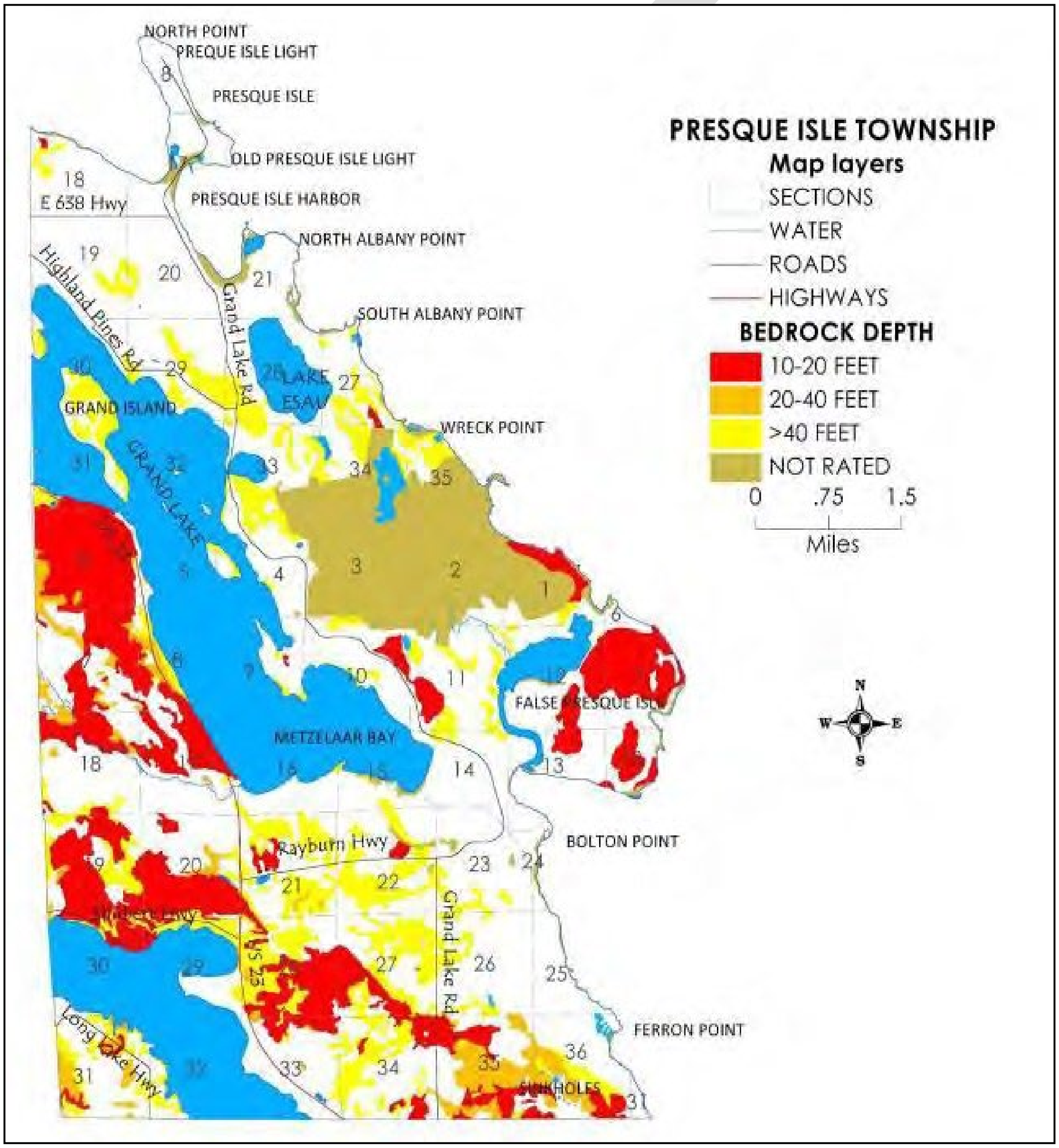
Figure 4-5: Hydric Soils



Depth to Bedrock

The soil survey of Presque Isle County identifies soils where the karst bedrock is near the surface. Areas with these shallow soils have severe constraints to development. Of particular concern is that bedrock aquifers are highly susceptible to surface contamination from septic systems. Effluent from drain fields is treated as it percolates down through the soil. If there is a lack of separation from the drain field to the bedrock, the effluent is not treated properly by the soil, and it will contaminate the bedrock aquifers with pathogens. Figure 4-6 shows areas with shallow soils over limestone bedrock.

Figure 4-6: Depth to Bedrock



Groundwater

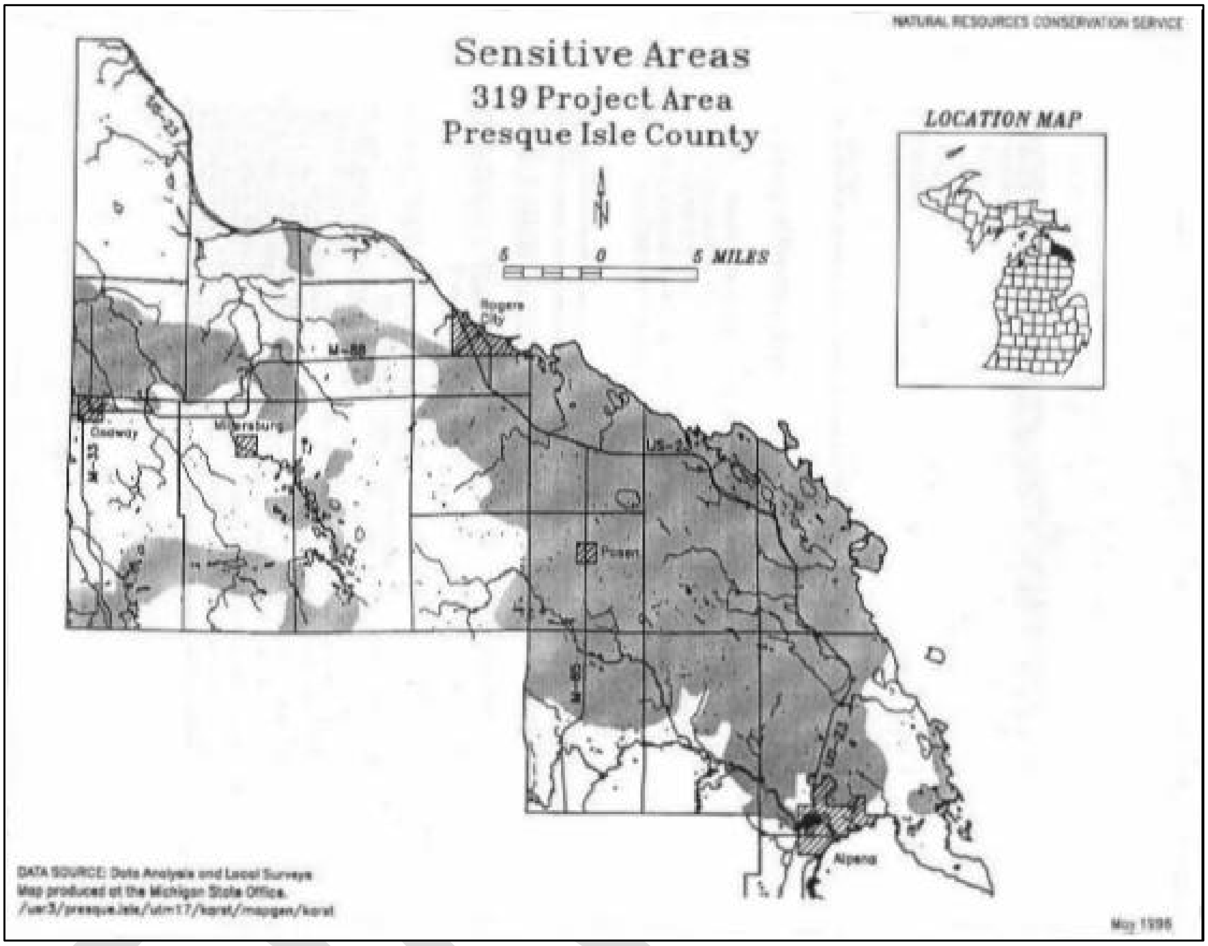
All of the drinking water in Presque Isle Township is derived from groundwater in subsurface aquifers. *Groundwater* is water beneath the earth's surface, which fills openings *(pore spaces)* in sand or gravel or in fractures of sand, gravel, or rock. It begins as rain or snow and passes through the soil and bedrock. An *Aquifer* is an underground layer of rock, sand, or gravel containing enough groundwater to supply a well.

Groundwater is generally available in adequate quantities throughout Presque Isle Township. Water wells are developed in past glacial deposit areas and the underlying bedrock. Since the bedrock is close to the surface in many areas, most water wells are developed in the limestone bedrock. Overall, Presque Isle Township has good water quality. In general, the groundwater is quite hard, containing high concentrations of calcium and magnesium. Concentrations range from an average of 250-700 mg/l. According to the State of Michigan, samples of nitrate concentrations in the range of less than 5 mg/l have been recorded throughout the Township. In localized areas, the nitrate levels may be much higher and are attributed to septic systems and fertilizers. The State has no recorded occurrence of Volatile Organic Compounds (VOCs) in the Township. VOCs are generally associated with an industrial solvent release, landfill leachate, chemical transportation spill, fuel spill and leak, illegal waste disposal, etc.

Given the karst geology and sandy soils that are prevalent throughout the Township, groundwater is a resource at risk. The Presque Isle Natural Resources Conservation District, in cooperation with a number of agencies, has developed the Northeast Michigan Karst Aquifer Protection Plan (1996). The primary objective of the plan is to protect the area's drinking water by correcting the sources of pollution. A secondary objective is to increase awareness of the connection between different land use pollutants and drinking water in karst areas.

The plan covers Presque Isle County and parts of Alpena County. **Figure 4-7** shows karst-sensitive areas within the study area. According to the plan, "Much of the project area is characterized by karst. Karst is defined as a type of topography that is formed over limestone, dolomite, or gypsum by dissolving or solution. It is characterized by sinkholes, caves, and underground drainage through fractures in bedrock. Karst waters are just as susceptible to contamination as surface water because much of the water moves through open channel ways, resulting in extremely high aquifer recharge rates. Consequently, the shallow aquifers of the project area are extremely vulnerable to contamination from surface and subsurface sources."

Figure 4-7 Karst Sensitive Areas



Surface Water

There are two major watersheds (Grand Lake and Long Lake) and numerous small coastal Lake Huron watersheds with include Lake Esau and Bell River) in the Township, all of which are part of the Lake Huron drainage basin, see **Figure 4-8**. Of course, Lake Huron is the largest surface water resource for Presque Isle Township. Lake Huron is the second largest of the five Great Lakes in surface area (23,000 square miles). However, due to its many islands and inlets, it has the greatest length of shoreline at 3,827 miles, over 1,000 miles more than Lake Superior, which is the largest in surface area. The Great Lakes are the largest system of fresh surface water on Earth, containing roughly 18 percent of the world's fresh water. Water quality, lake levels, and fisheries continue to be in flux as numerous stressors impact the lake. Two primary factors influencing Lake Huron are climate change and invasive species.

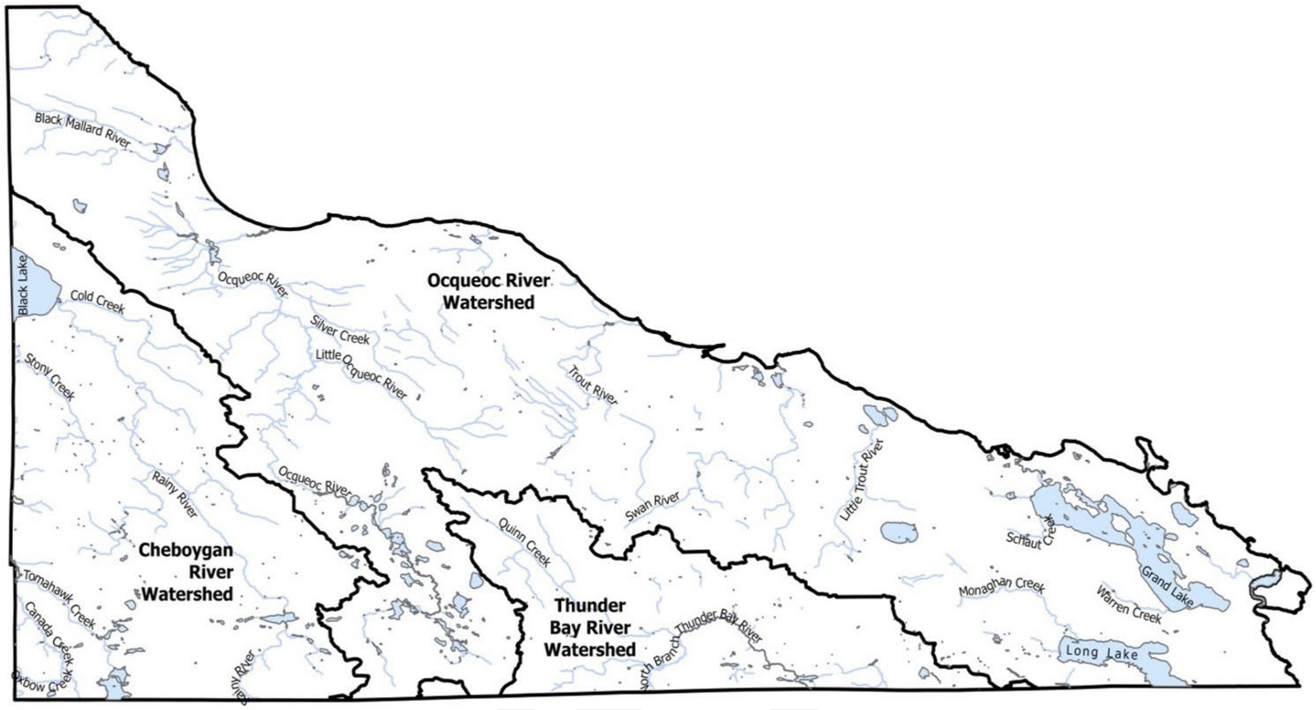
Lake Huron and its rugged coastline are clearly a major part of the community's sense of place.

The Township's history is closely tied to Lake Huron, from early Great Lakes shipping and passenger transportation to lighthouses, commercial fishing, shipwrecks, and tourism. Today, recreational boating, paddle sports, sport fishing, and diving on near shipwrecks are activities pursued by residents and visitors. Given that shipping routes take Great Lakes freighters close to Presque Isle, views of the large ships are still a common sight. Also, since the quarry's only feasible means of shipping its large amount of product is by freighters, the area's economy still depends on the "Blue Highway" for transportation. As for the importance of the coastline, nearly 62 percent (26 miles) of the Township's boundary is Lake Huron. Bell River and Bell Bay would add another 6 miles to the coastline. Unlike inland townships, Presque Isle can describe its boundary by geographic features such as False Presque Isle Harbor, Bell Bay, North Bay, North Point, South Albany Point, and Shipwreck Point.

Approximately two-thirds of Grand Lake's eight-mile length is located within Presque Isle Township, with the northwest one-third located in Presque Isle County's Krakow Township. The Grand Lake Watershed covers 24,879 acres. Grand Lake is 5,874 acres in size and has a maximum depth of 25 feet and boasts 19 islands. The established legal lake level is 594 feet above sea level. Warren Creek flows into the west side of Grand Lake's southeast end. Schalk's and Schout Creeks flow into the west side of its northwest end. Lotus Pond is located on the east side of Grand Lake and is within the Grand Lake Watershed.

NEMCOG, with funding support from Michigan's Coastal Management Program, developed the Grand Lake and Coastal Watershed Plan. During the fall of 2005, a shoreline greenbelt survey was conducted. Field visits and aerial photo interpretation techniques were used to conduct the survey. The Grand Lake survey was conducted by boat. Small lakes, creeks, and developed areas of the Lake Huron shoreline were viewed from accessible locations. Aerial photo interpretation methods were employed to refine field surveys and inventory inaccessible locations. Shorelines were classified into four categories: undeveloped, developed good condition, developed fair condition, and developed poor condition.

Figure 4-8: Watersheds



A summary of the Grand Lake shoreline is provided in **Table 4-2** below. Nearly, 40 percent of Grand Lake's shoreline is undeveloped. With the exception of the islands, much of the undeveloped lakefront property is low and likely wetlands. Approximately, 50 percent of waterfront properties were found to be lacking in adequate greenbelts. Thirty-one percent of the shoreline was classified as having poor greenbelt conditions. Lakeshore properties are dominated by manicured, green lawns which do not provide proper water quality buffers or needed wildlife habitat. Education programs should focus on these properties to restore wildlife habitat and water quality buffers.

Results of the watershed plan's water quality inventories show that there is relatively little erosion occurring in the watershed. However, a severe lack of greenbelts in the developed areas of the lake allows significant amounts of pollutants such as phosphorus and nitrogen to enter the lake. Below is a brief summary of the findings.

- At road/stream crossings, damaged, ineffective, or perched culverts, embankment erosion, and culvert outlet erosion were some of the factors impacting the watershed's streams.

- Many of the access sites to Grand Lake are not paved and heavy foot, boat and trailer traffic is taking its toll on the shoreline.

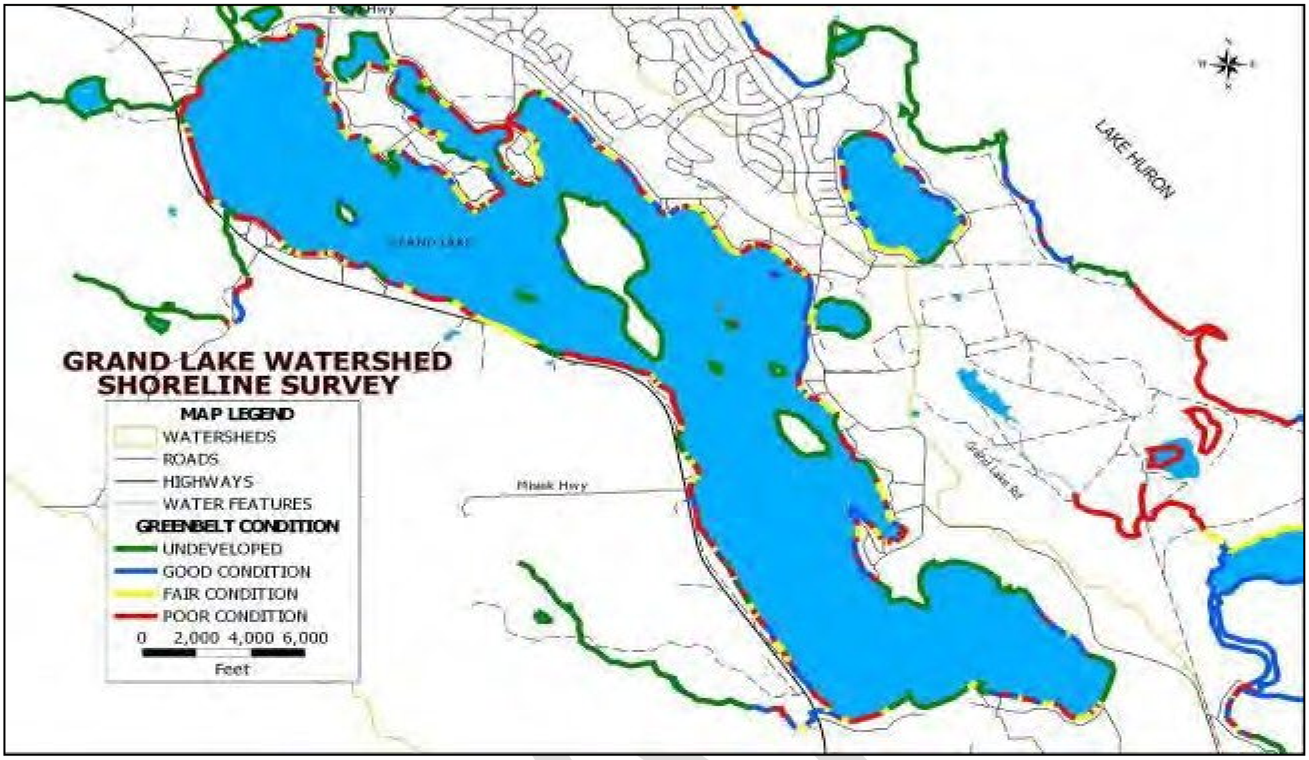
- Sediments and nutrients are the pollutants of greatest concern in the watershed. To maintain the high level of water quality expected by the watershed community, best management practices will need to be implemented at sites of concern. Educating the public about the importance and benefits of greenbelts and shoreline buffers should be considered a priority component of the watershed plan.

Table 4-2: Grand Lake Shoreline Survey

Description		All Shoreline		Shoreline w/o Islands	
Undeveloped	Natural vegetation intact.	79,340 ft	39%	45,150 ft	28%
Developed Good Condition	Trees, shrubs and herbaceous plants covering much of shoreline; lawn not to water's edge.	28,619 ft	14%	25,462 ft	16%
Developed Fair Condition	Trees, shrubs and herbaceous plants present but mowed lawn covering less than 60 percent, no hardened shoreline.	32,602 ft	16%	32,408 ft	20%
Developed Poor Condition	Trees and shrubs limited, mowed lawn covers much of the lake yard; hardened shore of rocks, concrete or metal retainer walls may be present.	61,705 ft	31%	60,709 ft	37%

Source: NEMCOG, Grand Lake and Coastal Watershed Management Plan, 2007

Figure 4-9: Grand Lake Watershed Shoreline Survey



The southern half of Long Lake is located in Alpena County's Alpena Township, while the northern half is in Presque Isle County, Presque Isle, and Krakow Townships. Information regarding Long Lake is referenced from a water quality study prepared in 2001 by Dr. Wallace E. Fusilier of Water Quality Investigators. Long Lake has a surface area of 5,652 acres and has a shoreline length of nearly 29 miles. The maximum depth is 25 feet with a mean depth of 12.5 feet. Long Lake is 7.8 miles in length at its longest dimension, and the elevation of the lake is 649 feet above sea level. The size of the Long Lake drainage area, including the lake, is approximately 52 square miles. Water samples were collected during the spring and summer of 2001 at five different sampling stations. Tests performed included total phosphorus, total nitrate nitrogen, total alkalinity, pH, conductivity, chlorophyll, Secchi disk depth, temperature and dissolved oxygen. Analysis of the factors tested was presented in graphic form showing the total Lake Water Quality Index (LWQI). On a scale of 0-100, Long Lake's LWQI scores ranged between 94 and 98, depending on the time of year and location where the test samples were collected. According to Dr. Fusilier's study, these scores indicate Long Lake has excellent water quality. *These are fairly old numbers, but this is the only source we have as of now (unless the township has a more recent source?)*

Lake Esau is located on the eastern side of the Township between Lake Huron and Grand Lake. It is about 275 acres in size and has a maximum depth of about 25 feet. The established lake level is 597 feet above sea level. A water quality survey conducted in 1979 by NEMCOG classified Lake Esau as oligothophic, or having low level of nutrient enrichment. Just below Lake Esau is the smaller 55-acre Lotus Pond. Bell River is connected to Lake Huron's False Presque Isle Harbor, making up the western boundary of the land mass known as False Presque Isle on the east side of the Township. The Lake Esau watershed covers 646 acres. This watershed has been greatly reduced in size by the quarry operation, and both water quality and water quantity are major concerns for the watershed community. *Again, this is referencing old information.*

Fish and Wildlife Resources

The predominance of forests, wetlands and surface water makes Presque Isle Township home to many species of fish and wildlife. The Lake Huron fisheries have undergone significant shifts over the last century. Construction of the Wellington Canal in 1919 both opened the Great Lakes to ocean-going vessels and opened the door to aquatic non-native and invasive species. First, the sea lamprey decimated native species such as lake trout, lake whitefish, chub, and lake herring, which were already under stress from overfishing and pollution. The loss of these predators allowed alewives, another invasive species, to explode in population and further upset the lake's ecosystem by negatively impacting other native species. The introduction of salmon into the Great Lakes brought the alewives population under control and reestablished an important sport and commercial fisheries. The numerous salmon tournaments and charter fishing businesses on Lake Huron were a testament to these high-quality fisheries.

However, as new stressors have been introduced into Lake Huron, the food web has once again been altered. Continued introduction of aquatic invasive species, such as zebra mussels, quagga mussels, and round goby, from ship ballast water, caused the collapse of plankton, alewives, perch, brown trout, and salmon populations during the last decade. The lake's most productive zones have shifted from historic offshore to nearshore areas. This shift combined with critical habitat protection, habitat restoration, and efforts to rehabilitate native species has resulted in increased populations of perch, whitefish, lake trout smallmouth bass, and walleye. In the short term, commercial and sport fishing shows promise, but what the future may bring is still uncertain. Continued introduction of aquatic invasive species from ship ballasts or worse introduction of Asian carp through connected waterways will continue to have negative impacts on the fisheries.

The Fisheries Management Division of the Michigan Department of Natural Resources (MDNR) periodically conducts fish collections in order to determine the species population numbers and the size and health of fish in inland waters. Grand and Long Lakes have historically been managed under the MDNR's Large Lakes Program from 2000 until 2010 and then shifted to fall under the Northern Lake Huron Management Unit. The most recent survey report for Grand Lake was completed in 2019. Long Lake survey report was completed in 2004-2005 as part of the Large Lakes Program and most recently did receive a status report update.

Grand Lake

Grand Lake has a relatively long survey history that describes the fish community since 1950. The goal of the current 2019 fisheries survey of Grand Lake was to best mimic sampling conditions from past surveys (1995 and 2004) which would allow favorable comparisons of both species' size and structure to the past several decades. The collected data met the goal and survey numbers fell between 1995 and 2005 survey numbers.

Grand Lake has a predator population having moderate diversity and is dominated by Walleye and Smallmouth Bass, and to a much lesser degree, Northern Pike. A total of 955 Walleye were collected and ranged from 8-24 inches with an average of 14.2 inches. This coincides with the surveys presented statewide and in the past several decades (1995 and 2005). The fisheries report indicates a slow-growing consistent naturally reproducing Walleye population. A total of 331 Smallmouth Bass were captured ranging from 7-20 inches with an average of 15.7 inches. Grand Lake continues to demonstrate that Smallmouth Bass grow well in the structural habitat living between 10 and 15 years. The Smallmouth Bass population have done well in following the invasion of invasive species such as Round Goby and Zebra Mussels. However more needs to be known about the competition effects between invasive species such as goby and small game fish and predatory fish. Native to Gran Lake and in low abundance the Northern Pike has been supported by in-lake spawning on chara and pondweed flats. As well Schalks Creek Pike Marsh, connected to Grand Lake, is used to supplement the natural production of pike in the lake by enhancing natural production. Allowing naturally running northern pike to get up to Schalks Creek to the manmade (flooded) spawning marsh.

The current 2019 fish community of Grand Lake has a panfish community that is low in diversity dominated by Yellow Perch and Rock Bass. However, very little is known about the change in the size of Perch since large amounts of data have not been collected during past surveys. Pumpkinseed and Bluegill also inhabit Grand Lake, but in much lower numbers. Pumpkinseed are more abundant than Bluegill and both do better with aquatic vegetation Present. Additionally, other species are native to Grand Lake such as Suckers, Gar, Bowfin, and Bullheads. Grand Lake tends to be dominated by anglers seeking Yellow Perch, Walleye, and Smallmouth Bass.

Long Lake

Fish community surveys and observations are noted for Long Lake dating back to the 1920s. Field investigations in 1925 and 1926 found a fish community similar to what is found in Long Lake today. Bluegills were noted as rare, while some sunfish (pumpkinseeds) were present. Rock bass, northern pike, walleyes, and yellow perch were common. Interestingly, reports of lake whitefish spearing were noted. Overall, the fish community of Long Lake has displayed consistent species composition over the last eighty years. The MDNR fisheries spring 2004 survey, caught more large, mature fish of several species than would normally be caught in surveys that have historically been conducted later in spring or summer. This includes spring spawners such as walleyes, northern pike, white sucker, and smallmouth bass. Additionally, because of the mesh-size bias, smaller fish were not represented in our sample in proportion to their true abundance in the lake.

The size structure of walleyes in the spring survey (86% legal size) was above the average of legal-size walleyes (69%) in spring surveys for 14 populations surveyed under the Large Lakes Program. Based on past surveys and the current survey, walleyes in Long Lake rarely attain lengths much greater than 25 inches. The size structure of northern pike in the spring survey (35% legal size) was near the average (28%) of legal-size northern pike in spring surveys for thirteen populations surveyed under the Large Lakes Program. While we did not collect a large number of northern pike, the number of large (≥36 inch) fish was notable, and northern pike in Long Lake have the potential to reach trophy size. The size structure of smallmouth bass in our spring survey (66% legal size) was similar to the average percentage (65%) of legal-size smallmouth bass in spring surveys for twelve populations surveyed under the Large Lakes Program. Currently, smallmouth bass in Long Lake are likely to attain lengths of 18 inches and have the potential to reach 20 inches.

Angler Survey: Summary.–The fishery of Long Lake is dominated by yellow perch and smallmouth bass, which comprised 93% of the total annual harvest. The open-water period accounted for 74% of the annual yellow perch harvest, and harvest was highest in September/October. Smallmouth bass were harvested primarily during the open-water period and provided consistent catch rates throughout the year. Walleye and northern pike contributed to the fishery of Long Lake, but to a much lesser extent than yellow perch and smallmouth bass. Walleyes were harvested throughout the year, but most readily from July through October. The catch rate for walleye was highest in September/October and overall it was low. Overall, the fishery of Long Lake is not very diverse, especially in the winter when yellow perch, walleye, and northern pike were the only species harvested. A few other species provide angling opportunities throughout the year, though not to any large degree.

Walleyes are the second most abundant large predator in Long Lake. However, the walleye fishery in 2004-2005 was below average with respect to other large lakes in Michigan. Northern pike had the lowest abundance of the three predator species targeted in this survey. The population in Long Lake has an average density of legal-size northern pike, but a low density of adult northern pike. Contrary to the walleye and northern pike fisheries, the smallmouth bass fishery in Long Lake is exceptional.

Stocking does not appear to be necessary to maintain any of the fish populations or fishery in Long Lake even though both the walleye and northern pike populations are currently at low densities. It would appear that the predator population could tolerate augmentation given the relatively high abundance of prey such as yellow perch and white suckers; however, the only predator species with distinctly above-average growth is the northern pike. Thus, augmenting the northern pike population would be the most biologically sound option, though the social acceptance of this action would need to be assessed. If walleye stocking were considered as a management option, it should be kept at a level that will prevent potential harmful effects from density-dependent interactions such as increased competition for food or cannibalism.

Michigan Department of Natural Resources is generally responsible for stocking and monitoring fish resources in Lake Huron and surrounding waters. In some cases, they allow local groups or individuals to oversee fish management projects. Long Lake Stocking of walleye since 2004 is at a total of 1,644,088. Most of the fish were planted by the state when 1,550,000 walleye fry were planted in May of 2006. The Long Lake Association has sponsored a number of fall plantings from 2006-2015 with each planting averaging approximately 3,000 fingerlings.

Deer, rabbit, grouse, and woodcock are abundant in the Township. Bear, coyote, bobcat, elk, and turkey have small to moderate populations that are growing. October and November bring hunters to the Township for small game hunting, bear and bow season (deer), peaking sharply in mid-November with the opening day of deer (rifle) season. Wildlife is a resource that brings in hunters and tourists.

Unfortunately, large deer populations, combined with indiscriminate feeding practices, were contributing factors to the spread of Bovine Tuberculosis (TB) in Presque Isle County and across northern Michigan. TB is a serious disease caused by bacteria attacking the respiratory system. There are three main types of TB - human, avian, and bovine. Human TB is rarely transmitted to non-humans, and avian TB is typically restricted to birds. Bovine TB - also known as 'cattle TB' is the most infectious of the three and is capable of infecting most mammals.

Although the State of Michigan attained Bovine TB accredited-free state status in 1979, it is now thought that during earlier periods of high TB reactor rates, there was a spillover of Bovine TB from infected cows into Michigan's white-tailed deer population, a result of shared pastures. In 1994, a TB-infected deer was killed by a hunter in Alpena County. The 2021 test season tested 11,745 deer within the state with 5,091 tests coming from the Northeast 11 Counties. The 11 Northeast Counties had 16 deer test positive or be suspected of having the disease in 2021. For the 2021 testing season, Presque Isle County had no deer test positive for TB. Although primarily found in hoofed animals, and not considered a health risk to humans, humans can and have contracted Bovine TB. The disease has been found in coyotes, raccoons, black bears, bobcats, red foxes, and opossums.

The effort to eradicate the disease has led to an aggressive TB testing campaign and the creation of a surveillance zone and Deer Management Unit (DMU) 452. Hunters in the surveillance area are asked to submit deer heads for testing. In DMU 452 testing is mandatory. Presque Isle County (DMU 487) is in the infected area but is not a part of DMU 452. Efforts to eradicate the disease have led to changes in deer feeding rules, deer harvest increases, an extension of the number of hunting days, and the banning of new deer or elk farms. As the eradication effort continues, more changes in hunting and feeding rules can be expected.

The diverse assortment of upland hardwoods and pines, lowland hardwood forests, conifer swamps, coastal marshes, fens, cobble beaches, swamps, bogs, streams and lakes provide endless opportunities for viewing birds, waterfowl, reptiles, and even insects. Thompson's Harbor State Park and Rockport State Park are popular birding sites. Coastal fens and marshes are great areas for amateur entomologists, especially those looking for dragonflies. Migrating songbirds follow the coastline in the spring and rely on a unique food source to sustain their energy for the long flight further northward. Conifer forests along the shoreline, warmed by the spring sun, produce massive hatches of midges (a small flying insect), which the song birds feast upon. The richness in biodiversity of the coastal regions is demonstrated in the following section on rare species.

Invasive Species

Invasive species have been a growing problem in coastal areas of northeast Michigan. Insects, mammals, plants, and plant diseases inadvertently brought into the Great Lakes region are causing damage to terrestrial and water ecosystems. It is clearly important for communities to gain an understanding of invasive species and when possible partner with groups to address impacts, particularly on publicly owned lands. The emerald ash borer has become established in the region and western united states causing significant impacts on the lowland forest types in the Township with large numbers of black ash, a prominent species, being eliminated.

The Department of Environment, Great Lakes, and Energy (EGLE) has identified a list of invasive species that are not native and also have the potential to harm human health, nature, agriculture, or silvicultural resources (Table 4-3). Species may be listed as prohibited or restricted and it is unlawful to possess, sell or offer that species for sale as a live organism. All *underlined* species are part of EGLE invasive species watch list meaning they have been confirmed in the wild or have a limited known distribution.

Table 4-3 Invasive Species List

Species Type	Species Common Name
Birds	Eurasian Collared Dove, Mute Swan
Crustaceans	Chinese Mitten Crab, Fishhook Waterflea, Killer Shrimp, ***Marbled Crayfish***, ***Red Swamp Crayfish***, Rusty Crayfish, Spiny Waterflea, Yabby
Diseases	Beech Bark Disease, ***Beech Leaf Disease***, Boxwood Blight, Oak Wilt, ***Thousand Cankers Disease***.
Fish	Bitterling, ***Bighead Carp***, ***Black Carp***, ***Grass Carp***, ***Silver Carp***, Eurasian Ruffe, Ide, Japanese/Oriental Weatherfish, ***Northern Snakehead***, Round Goby, Rudd, Sea Lamprey, Stone Moroko, Tench, Tubenose Goby, Wels Catfish, Zander
Insects	**Asian Longhorned Beetle**, ***Balsam Woolly Adelgid***, Box Tree Moth, Brown Marmorated Stink Bug, Emerald Ash Borer, ***Hemlock Wooly Adelgid***, Japanese Beetle, Spongy Moth, ***Spotted Lanternfly***.
Mammals	***Nutria***, Russian Boar
Mollusks	Asian Clam, Brown Garden Snail, Carthusian Snail, Giant African Snail, Girdled Snail, Golden Mussel, Heath Snail, ***New Zealand Mudsnail***, Quagga Mussel, Wrinkled Dune Snail, Zebra Mussel.
Aquatic Plants	African Oxygen Weed, ***Brazilian Elodea***, Carolina Fanwort, Curly-Leaf Pondweed, Cylindro, Didymo (Rock Snot), Eurasian Watermilfoil, ***European Frog-bit***, ***European Water Clover***, Flower Rush, Giant Salvinia, **Hydrilla**, ***Parrot Feather***, Pharagmites (Common Reed), Purple Loosestrife, Starry Stonewort, ***Water Chestnut***, ***Water Hyacinth***, ***Water Lettuce,*** ***Water Soldier***, ***Yellow Floating Heart***
Grasses	***Asiatic Sande Sedge***, ***Japanese Stiltgrass***, Phragmites (Common Reed)
Herbs	Butterbur, Garlic Mustard, Giant Hogweed, **Himalayan Balsam**, ***Japanese Chaff Flower***, Purple Loosestrife, Spotted Knapweed, Wild Parsnip
Shrubs	Autumn Olive, Common Buckthorn, Giant Knotweed, Glossy Buckthorn, Japanese Barberry, Japanese Knotweed, Multiflora Rose

Trees	Black Locust, Tree of Heaven
Vines	Black Swallow-wort, **Chinese Yam**, ***Kudzu***, ***Mile-A-Minute Weed***, Oriental Bittersweet, Pale Swallow-wort

Source: Michigan Department of Environment, Great Lakes & Energy

Threatened and Endangered Species

Presque Isle Township is also home to a number of plants and animals that are threatened, endangered or of special concern as identified in Michigan Natural Features Inventory (MNFI) database. **Table 4-4** is a listing of Endangered (E) or Threatened (T) plant and animal species and plant communities in Presque Isle County. Endangered and Threatened species are afforded protection under the Endangered Species Act of the State of Michigan (Public Act 203 of 1974 as amended). This list also includes plant and animal species of Special Concern (SC). While not afforded legal protection under the act, many of these species are of concern because of declining populations in the State. If these species continue to decline, they would be recommended for Threatened or Endangered status. Protection of Special Concern species before they reach dangerously low population levels would prevent the need to list them in the future by maintaining adequate numbers of self-sustaining populations.

A testament to the rich biodiversity of the area, many of the listings in the county table can be found in the Presque Isle Township. The dwarf lake iris *(Iris lacustris)* is the state's designated wildflower. Globally rare, yet locally prolific, the plant thrives in areas with shallow soils over limestone bedrock, especially if the forest cover has been disturbed. In April, carpets of the small delicate iris flowers are a wonder to behold. The rare plants and animals, combined with special plant communities offer unique experiences exploring the natural environment and are components of the community's identity.

Table 4-4 Presque Isle County Threatened and Endangered Species

Scientific Name	Common Name	Federal Status	State Status
Accipiter gentilis	Northern goshawk		T
Acipenser fulvescens	Lake sturgeon		T
Adlumia fungosa	Climbing fumitory		T
Alasmidonta marginata	Elktoe		SC
Alasmidonta viridis	Slippershell		T
Appalachia arcana	Secretive locust		SC
Appalachina sayanus	Spike-lip crater		SC
Arnoglossum plantagineum	Prairie indian-plantain		SC
Astragalus neglectus	Cooper's milk vetch		SC
Bombus borealis	Northern amber bumble bee		SC

Bombus terricola	Yellow banded bumble bee		SC
Brychius hungerfordi	Hungerford's crawling water beetle	LE	E
Buteo lineatus	Red-shouldered hawk		SC
Calypso bulbosa	Calypso or fairy-slipper		T
Cambarus robustus	Big water crayfish		SC
Carex richardsonii	Richardson's sedge		SC
Carex scirpoidea	Bulrush sedge		T
Cirsium hillii	Hill's thistle		SC
Cirsium pitcheri	Pitcher's thistle	LT	T
Coregonus artedi	Lake herring or Cisco		T
Coregonus reighardi	Shortnose cisco		X
Cottus ricei	Spoonhead sculpin		SC
Cypripedium arietinum	Ram's head lady's-slipper		SC
Drosera anglica	English sundew		SC
Eleocharis engelmannii	Engelmann's spike rush		SC
Elliptio complanata	Eastern elliptio		SC
Emydoidea blandingii	Blanding's turtle		SC
Erynnis martialis	Mottled duskywing		SC
Gavia immer	Common loon		T
Glaucomys sabrinus	Northern flying squirrel		SC
Glyptemys insculpta	Wood turtle		T
Graphephorum melicoides	Purple false oats		SC
Haliaeetus leucocephalus	Bald eagle		SC
Hiodon tergisus	Mooneye		E
Iris lacustris	Dwarf lake iris	LT	T
Juncus militaris	Bayonet rush		T
Lanius ludovicianus migrans	Migrant loggerhead shrike		E
Lasmigona compressa	Creek heelsplitter		SC
Lasmigona costata	Flutedshell		SC
Myotis septentrionalis	Northern long-eared bat	LT	T
Notropis anogenus	Pugnose shiner		E
Pandion haliaetus	Osprey		SC
Physella magnalacustris	Great Lakes physa		SC
Pinguicula vulgaris	Butterwort		SC

Potamogeton hillii	Hill's pondweed		T
Pterospora andromedea	Pine-drops		T
Pyrgus centaureae wyandot	Grizzled skipper		T
Rorippa aquatica	Lake cress		SC
Sagittunio nasutus	Eastern pondmussel		E
Sander canadensis	Sauger		E
Setophaga discolor	Prairie warbler		SC
Setophaga kirtlandii	Kirtland's warbler		E
Sistrurus catenatus	Eastern massasauga	LT	T
Solidago houghtonii	Houghton's goldenrod	LT	T
Somatochlora hineana	Hine's emerald dragonfly	LE	E
Sterna hirundo	Common tern		T
Tanacetum bipinnatum ssp. huronense	Lake Huron tansy		SC
Trimerotropis huroniana	Lake Huron locust		T

Source: Michigan State University Extension, Michigan Natural Feature Inventory

Woodlands & Wetlands

By far the most common forest type is aspen/birch. The next most prevalent forest types are lowland hardwoods (black ash, slippery elm, balsam poplar, aspen, and red maple) and lowland conifers (cedar, tamarack, and spruce). Other forest types include pine (red, jack, and white), oak (red and white), and northern hardwoods (sugar maple, red maple, American beech, and basswood).

In addition to the scenic characteristics of woodlands, forested areas provide habitat for wildlife, protect the soil from erosion, and act as a buffer from noise on heavily traveled highways. **Figure 4-10** depicts the forest types according to the update of the MIRIS Land Cover/Use Data. It is important to note, this update was completed with very limited field checking but relied instead on ancillary data such as USDA soils and the national wetlands inventory to map the forest types.

Forested lands are the predominant land cover in the Township and account for over 13,000 acres. Upland forests cover 6,641 acres in the Township. Of the forested lands, aspen-birch forests comprise nearly 2/3 of the upland forested lands, (4,056 acres). The aspen-birch type is quite variable in species composition and depending upon forest age and soils, other tree species such as white pine, balsam fir, northern white cedar, red maple, and sugar maple are mixed with the forest type. Northern hardwoods include species such as sugar maple, red maple, American beech, basswood, and yellow birch. Bigtooth aspen, quaking aspen, white birch, white pine, balsam fir, and red maple are the primary tree species found in the aspen-birch type. White and red pine trees are found in the pine forest category.

Lowland forests occupy slightly over 6,704 acres of the Township. Lowland forests grow on soils with a seasonally high water table and are often classified as wetlands (**Figure 4-11**). Lowland forests include lowland hardwoods like elm, black ash, red maple, balsam poplar, and quaking aspen, which are estimated to cover around 3,882 acres. Lowland conifers, such as northern white cedar, black spruce, balsam fir, white spruce, and eastern tamarack are estimated to cover around 2,822 acres. It is common to find both hardwoods and conifers growing in mixed forests.

Figure 4-10: Forests

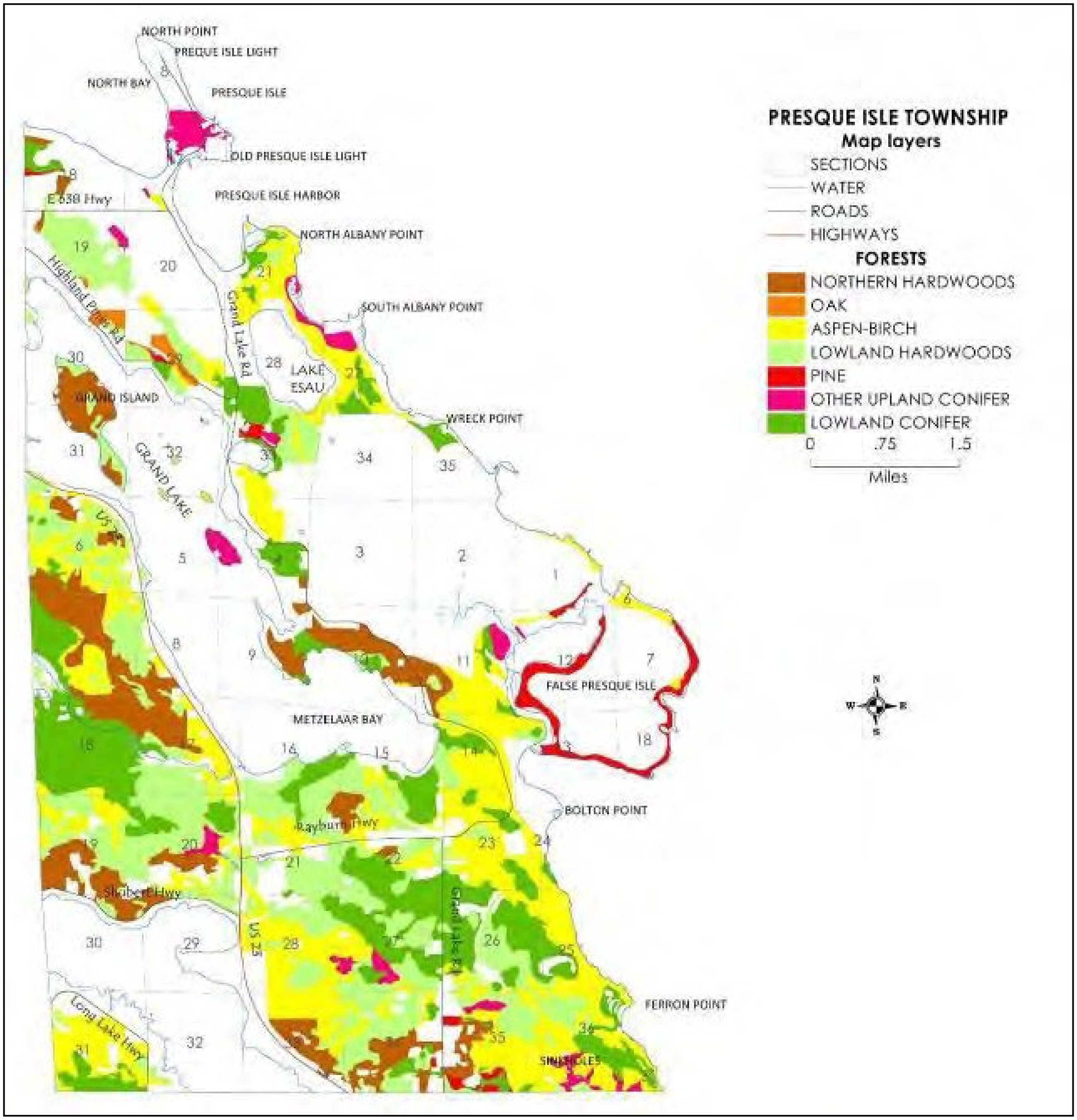
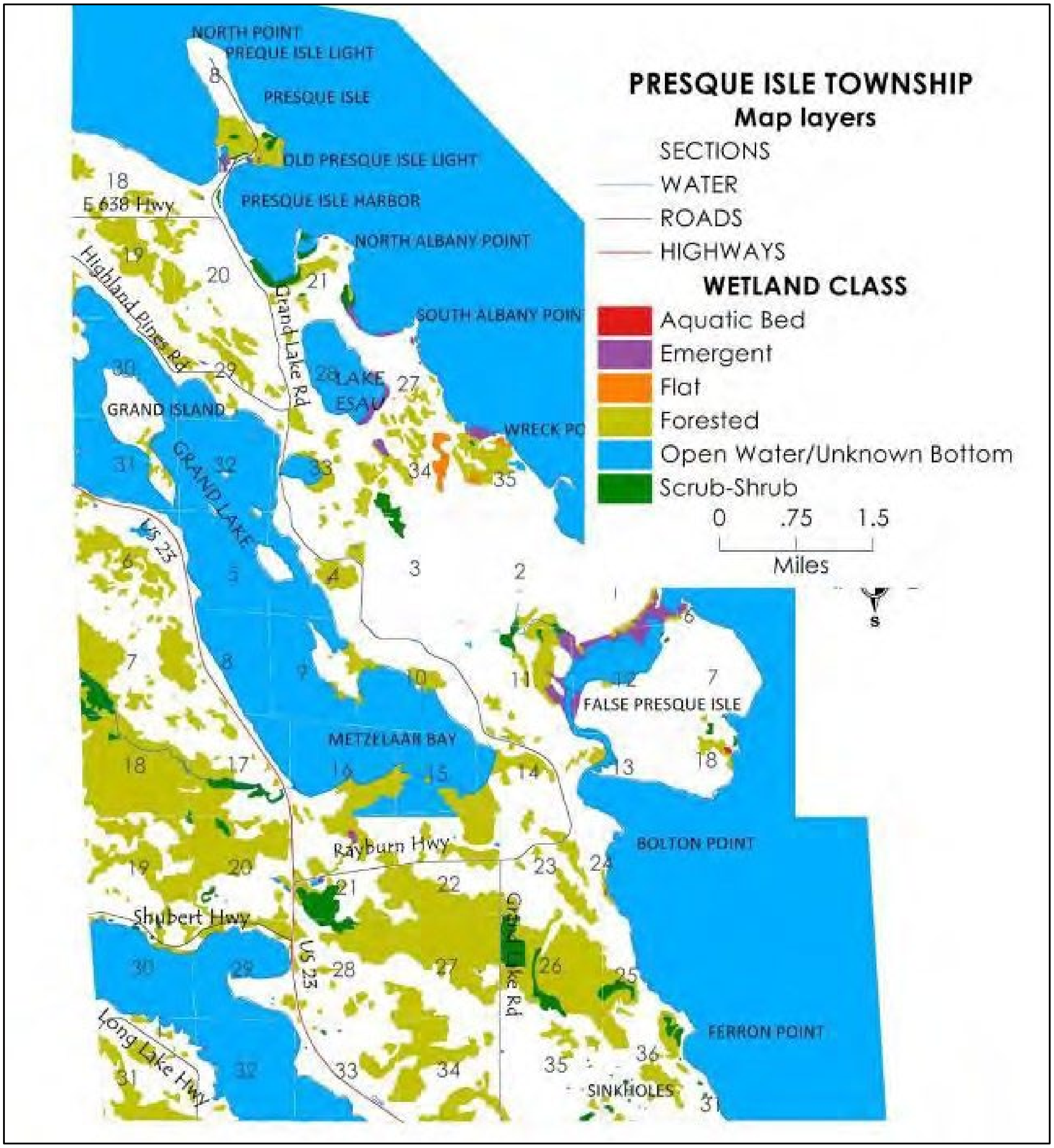


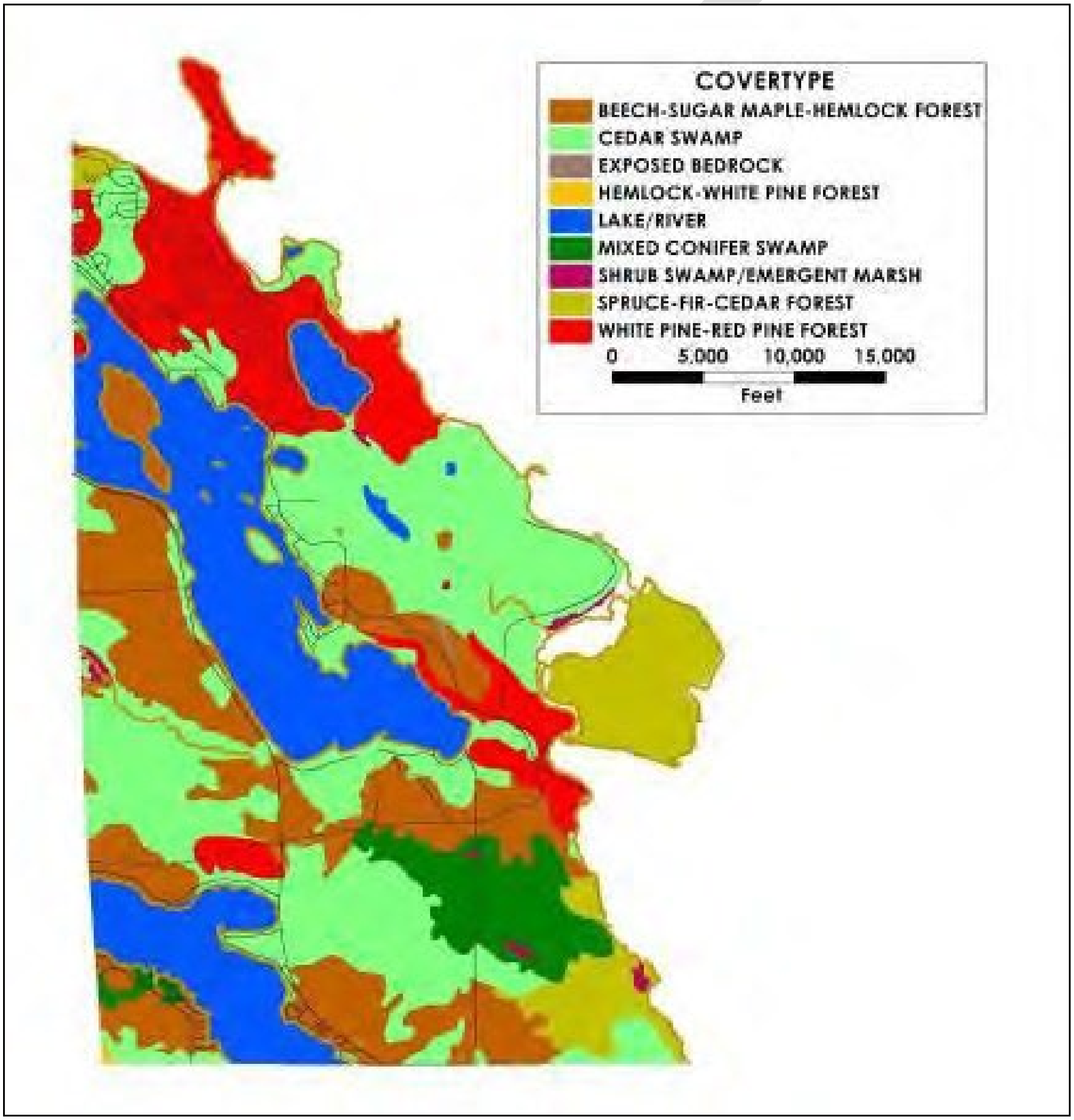
Figure 4-11: Wetland Class



Pre-Settlement Vegetation

The Michigan Department of Natural Resources has compiled pre-settlement vegetation maps of counties in Michigan. The maps were generated from information contained in the first government land survey notes in the 1800's along with information such as current vegetation, landforms, and soils. A review of the pre-settlement vegetation map **Figure 4-12** of Presque Isle Township shows white pine-red pine forests were concentrated in the sandy well-drained areas in the Presque Isle Harbor Association and adjacent to False Presque Isle Harbor. Lowland forest types of mixed conifer swamps and cedar swamps covered extensive areas. Beech-sugar maple-hemlock forests were growing on well-drained sites in the central and southern parts of the Township. Logging and subsequent wildfires around the turn of the last century converted some forests to other species. For example, white pine-red pine forests converted to forests dominated by aspen, birch, and oak. Without another major disturbance, aspen-birch forests are slowly converting back to pine, oak, or maple forests.

Figure 4-12: Pre-Settlement Vegetation



Lake Levels

In a natural setting, where watersheds and outlets have not been altered by human activities, lake levels fluctuate from spring to fall and from year to year. Lake levels are tied to precipitation and evaporation rates. Human activities such as constructing dams, deepening outlet channels, increasing of impervious surfaces, or even reducing watershed sizes by quarrying and redirecting water courses will impact lake levels. Legal lake levels have been established for Grand Lake, Long Lake, and Lake Esau.

The U.S. Army Corps of Engineers has maintained lake-level records for Lake Huron since 1900. **Figure 4-13** shows Lake Huron-Lake Michigan Lake average lake levels from 1918 to 2021. During periods of high water levels, shoreline erosion is problematic, particularly where development and armoring are close to the lakeshore and on bluffs. Coastal wetlands change in size and species composition as Lake Huron water levels rise and fall.

During periods of low water levels, wetland herbaceous vegetation expands out into the exposed bottomlands. Woody plants such as northern white cedar and balsam poplar march outward from the forest's edge onto now dryer sites. As the lake level rises, the newly established vegetation is inundated and the plant communities are pushed back inland. The flooded vegetation creates critical habitat for fish and wildlife, in addition to protecting shore areas from erosion. The ebb and flow of lake levels create a constant see-saw of early succession plant communities along the zones.

Figure 4-13 Water Levels in Lake Michigan-Huron 1918-2021

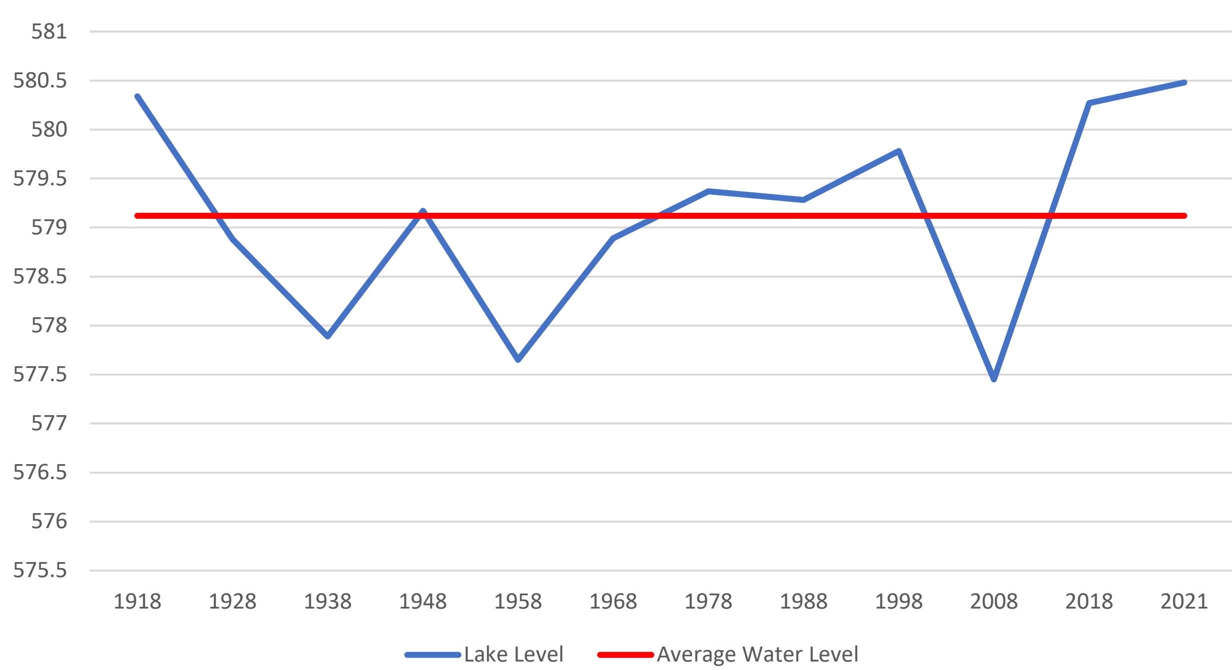
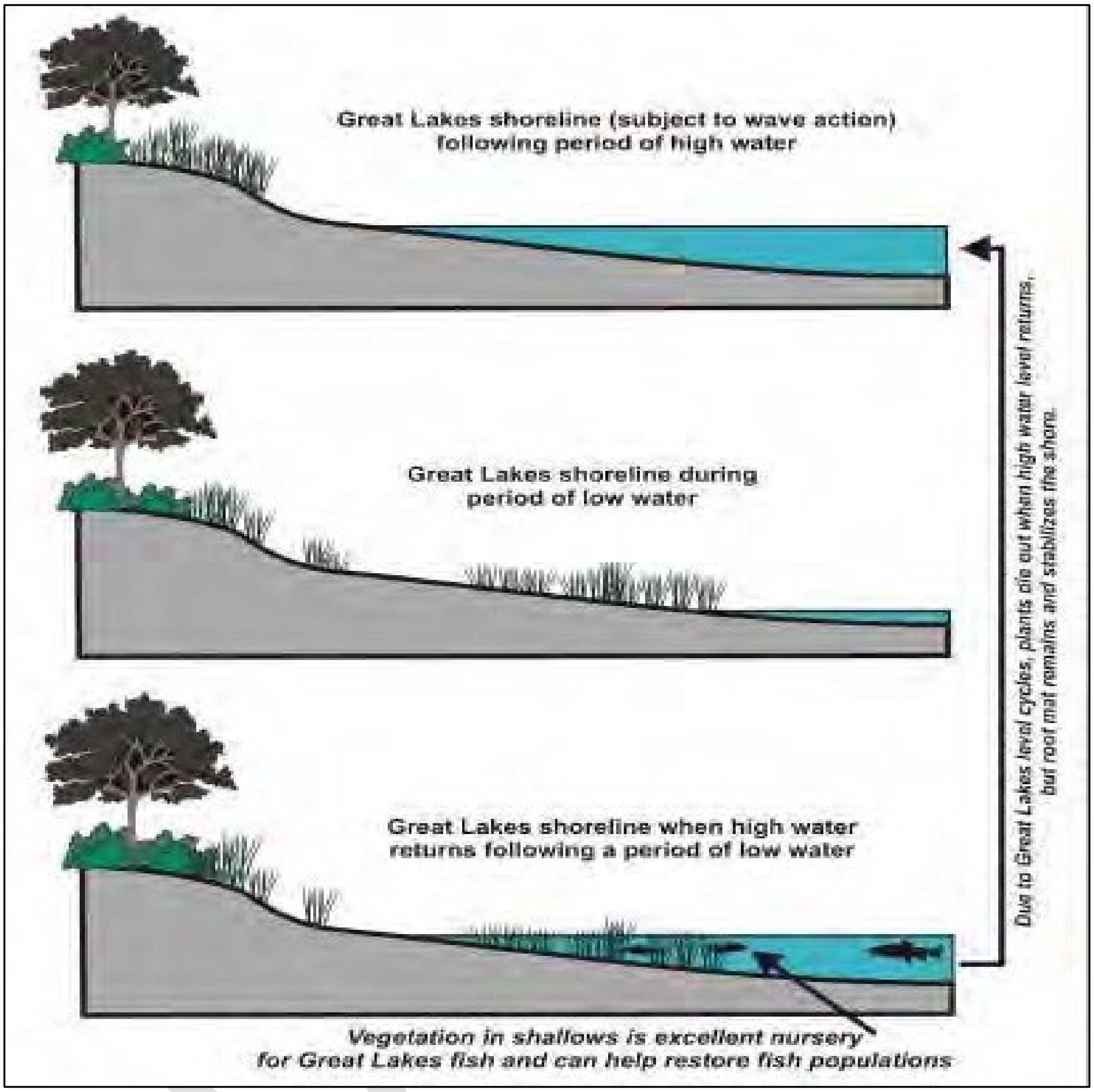


Figure 4-13: Shoreline Fluctuations



Over the years there has been significant community concern over whether Lake Esau and Lotus Pond, water levels have been impacted by quarrying activities within the watersheds. The 2014 Master Plan recommended that the Township seek funding and conduct a hydro geological study to assess long term lake level issues (page 30), however funding for the project was never obtained. The water levels for both are now maintained by pumping water from the Stoneport quarry. The amount of water pumped annually varies depending on the amount of natural precipitation.**Table 4-5** provides a history of pumping activities into the lakes. Lake Esau pumping began in July of 1985 at just over 98 million gallons per year; the 2002 total was nearly 400 million gallons pumped. Lotus Pond pumping began in August of 1992 at 73 million gallons, because the lake was nearly dry at that time. For the year 2002, 55 million gallons were pumped into Lotus Pond. The issue facing Presque Isle Township is what will happen to Lake Esau and Lotus Pond water levels when quarrying operations (and pumping operations) cease as limestone resources are exhausted. *We will need updated numbers on the pumping volume.*

There have been concerns about falling lake levels in Lake Esau since the late 1970's. As lake levels continued to fall, concerned residents petitioned the Presque Isle County Board to establish a legal lake level. In 1984, circuit court action established the legal lake level for Lake Esau as 597 feet above sea level. The following year, Presque Isle County and Presque Isle Corporation entered into an agreement that resulted in the quarry began pumping water from its de-watering process into Lake Esau. The agreement does not attribute causes for the falling lake level and allows the quarry to stop pumping with proper advanced notice. Annual pumping data for Lake Esau and Lotus Pond are displayed in a graph from "A Study of Grand lake, Lake Esau and Lotus Pond." Pumping volumes have ranged from 100 million gallons per year to as high as 480 million gallons per year in 1991 and 2005 in order to keep the lakes at historic levels. **Figure 4.x** shows pumping volumes for Lake Esau, Lotus Pond and the Presque Isle Harbor Water Company. *Once we get updated numbers, we can update the figure (not included for now)*

Lake Esau, fed by subterranean, bedrock springs and surface run-off, has is no inlet or outlet. Hydro geologists who have studied Lake Esau cannot agree on whether the quarry operation has had an impact on lake levels by removing part of the watershed or whether quarrying has altered local aquifer systems. This uncertainty on such an important issue highlights the fact that the Township should redouble its efforts to obtain the funding for a comprehensive hydro geological survey. Another concern that the mine operation has altered local aquifer systems cannot be determined without an extensive and very expensive hydro-geological study. Empirical observations, such as water wells going dry, wetlands between the quarry and Grand Lake "drying-up" and underwater springs along the eastern shore of Grand Lake no longer noticeable, would indicate some relationship between the quarry depth/dewatering process and alteration of pre-mining groundwater aquifer systems. The quarry foot print has continued to expand towards the lakes, and is within 1,060 feet of Lake Esau, 425 feet of Lotus Pond and 1,500 of Grand Lake. **Figure 4-14** depicts elevations of lake levels and lake bottoms in comparison to the mean Lake Huron level. As can be seen mining operations have quarried to a depth of 160 below the mean level of Lake Huron. This depth is over 150 feet below the bottoms of inland lakes. The elevation of the bottom of Lotus Pond is approximately eight above the mean Lake Huron elevation and the historic surface elevation is 18 feet above Lake Huron. The legal lake level of Lake Esau is 21 feet above Lake Huron, while the deepest part of the lake is nearly nine feet below the mean Lake Huron level.

The concern for local residents is what will happen to Lake Esau and Lotus pond, when the quarry stops pumping water into the lakes? Since the lake levels are artificially maintained, the obvious answer would be the levels would fall to undetermined levels. Additionally, when the quarry discontinues operation at some time in the future, and the dewatering process stops, the quarry will fill with water. The elevation of the water level in the abandoned quarry is up for debate. If seepage occurs from Lake Huron, or if the quarry was opened to Lake Huron, the quarry water level would reach equilibrium with Lake Huron. However, if there is a hydrological connection between the lakes and the quarry, and given the elevations of Lake Esau and Lotus Pond, relative to Lake Huron, equilibrium would result in water levels of the inland lakes being much lower than historic levels.

Figure 4-14: Elevation Comparisons

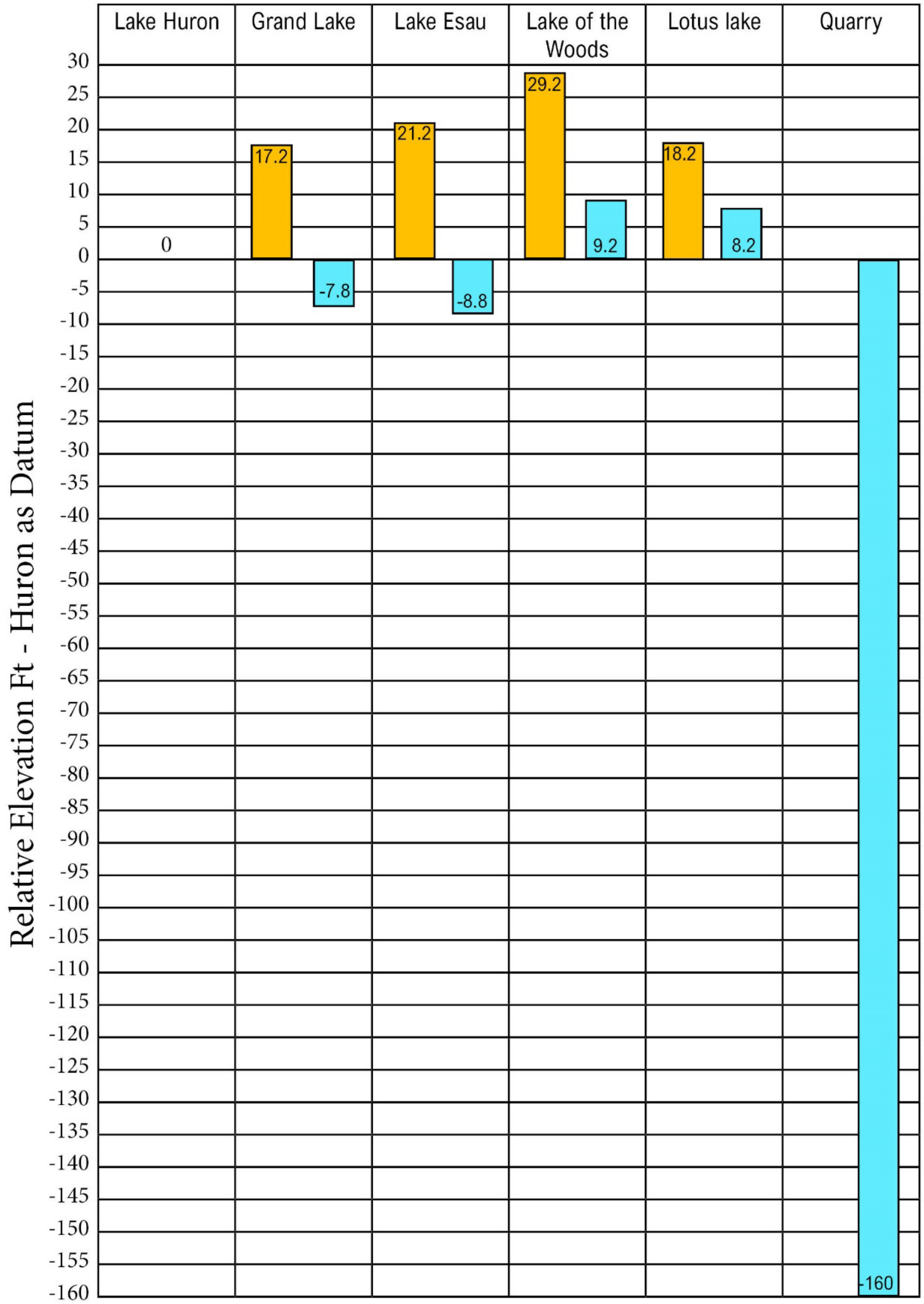


Table 4-5 Summary of Quarry Pumping into Lake Esau and Lotus Pond

Year	Lake Esau Gallons Pumped	Lotus Pond Gallons Pumped
1985	Pumping began 7/4/85 98,400,000	
1986	186,000,000	
1987	188,400,000	
1988	199,900,000	
1989	175,600,000	
1990	185,700,000	
1991	477,000,000	
1992	211,800,000	Pumping began 8/1/92 73,300,000
1993	290,600,000	214,600,000
1994	224,200,000	156,400,000
1995	255,100,000	28,300,000
1996	277,900,000	25,900,000
1997	151,600,000	19,400,000
1998	254,900,000	33,370,000
1999	249,000,000	21,600,000
2000	298,400,000	60,200,000
2001	315,100,000	38,600,000
2002	398,800,000	55,060,000
2003	430,500,000	23,500,000
Total	4,868,900,000	676,930,000
Average	**256,257,895**	**62,519,167**

Sites of Environmental Contamination

The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended regulates facilities of environmental contamination in Michigan. The Remediation and Redevelopment Division of EGLE works toward managing and revitalizing sites of environmental contamination to protect the environment. The division administers two programs: Environmental Remediation (release of hazardous substances from facilities) and Leaking Underground Storage Tanks (release of hazardous substances from underground storage tanks).

The facility inventory database has information for Sites of Environmental Contamination (Part 201) and Leaking Underground Storage Tanks (Part 213). In Presque Isle Township, the facility inventory database reports the following:

- 1 site listed as Sites of Environmental Contamination (Part 201)
- 1 site listed as Leaking Underground Storage Tanks (Part 213)

Surface Water and Air Discharge Permits

Table 4-6 shows National Pollutant Discharge Elimination System (NPDES) permits issued in Presque Isle Township. Anyone discharging, or proposing to discharge, waste, or wastewater into the surface waters of the State is required to obtain a NPDES permit. The NPDES program is intended to control direct discharge into the surface waters of the State by imposing effluent limits and other conditions necessary to meet State and federal requirements. The NPDES program regulates pollutants discharged directly into waterways from wastewater sources. Table 4-7 shows the active Air Discharge Permits in Presque Isle Township.

Table 4-6 Presque Isle Township NPDES Permits

Site Name	Permit Number	Permit Type	Issue Date	Expiration Date	Site Address
Lafarge-Presque Isle	MI0003468	Industrial/Commercial	10/21/2014	10/1/2017	11351 East Grand Lake Road

Source: Michigan Department of Environment Great Lakes and Energy

Table 4-7 Active Air Discharge Permits Presque Isle Township

Permit Number	Date Approved	Company	Location
M1891	1/27/2021	LeFarge Presque Isle Quarry	11351 East Grand Lake Road

Source: Michigan Department of Environment Great Lakes and Energy

The following program does not appear to be on-going, so we recommend deleting this.

Lake Huron Bi-National Partnership Action Plan 2008-2010

The purpose of the Lake Huron Bi-National Partnership is to advance the bi-national protection and restoration of the Lake Huron ecosystem. The United States Environmental Protection Agency, Environment Canada, Michigan's Departments of Environmental Quality and Natural Resources, and Ontario's Ministries of Environment and Natural Resources formed the core of the Partnership by providing leadership and coordination. The Nature Conservancy facilitated the planning process. The multi-year effort included stakeholder workshops in Michigan and Ontario. Agencies, universities, conservation organizations, Tribes/First Nations, non-government organizations, regional agencies, local units of government and the public participated.

The Lake Huron Partnership agreed upon three bi-national issues to focus on: 1) Contaminants in fish and wildlife, 2) Biodiversity and ecosystem change, and 3) Fish and wildlife habitat. This 2008-2010 Action Plan provides updated information on environmental trends, identifies priority issues, and promotes management activities to be pursued over the next two-year cycle. Consistent with an adaptive management approach, the Action Plan tracks progress on issues identified in the previous cycle, including contaminants in fish, changes in food web structure and protection of critical habitat. The Action Plan was expanded to address emerging issues, such as lake water levels; beach fouling and contamination; observed increases in nearshore algae; and diseases such as botulism and viral hemorrhaghic septicemia (VHS).

A primary focus area in the Action Plan, Aquatic and Coastal Habitats, relates most closely to Presque Isle Township and community planning. The Lake Huron Bi-national Partnership has identified degradation and loss of historical habitat in tributaries, near shore, and coastal wetland habitats as major stressors to the Lake Huron ecosystem. Although many of the ecosystems have been fragmented and others nearly eliminated, the Lake Huron basin exhibits a high level of diversity in its natural environments. The basin's coastal marshes, islands and rocky shorelines, sand dunes, alvars, tributaries, savannahs and prairies contain features that are either unique to, or are best represented within the Lake Huron watershed. The health of the lake and its biological diversity is directly related to the health of each of these habitat components. The plan provides a detailed analysis of coastal wetlands, alvars, coastal dunes, Lake Huron islands, Lake Huron reefs, and tributaries; all of which can be found in or near the Township. Map 17 and Map 18 are two maps from the Action Plan that show the uniqueness and biological richness of the coastal areas of northeast Michigan. Cobble beaches so common in Presque Isle Township are very rare on a lake wide basis.

Map 17: Lake Huron Biodiversity Strategy – Cobble Beach Rarity

Map 18: Lake Huron Biodiversity Strategy – Ecosystem Significance

The following programs are old. I will delete these but we could use some of the goals and objectives from the Green Infrastructure Plan in this plan.

Presque Isle County Water Quality and Natural Resource Protection Master Plan and Zoning Ordinance

Microsoft Word - Presque Isle County Final Report (northeastmichiganwatersheds.org)

Presque Isle County Green Infrastructure

Presque Isle County Green Infrastructure Plan 2007 - Discover Northeast Michigan