2.3 Water

This section includes site-specific and regional descriptions of the hydrology, water use, and water quality conditions to serve as a baseline for assessing the impacts of construction or operation of Fermi 3. The site-specific and regional surface-water and groundwater information establishes the baseline hydrologic conditions against which to assess potential construction or operation impacts and the adequacy of related monitoring programs. The potential construction and operational impacts to water resources are presented in Chapter 4 and Chapter 5, respectively. Monitoring programs are presented in Chapter 6.

The following subsections are included herein:

- Subsection 2.3.1 describes the basis hydrology in the site vicinity. This section includes discussion of both the surface-water bodies and groundwater aquifers that could affect the plant water supply and effluent disposal or that could be affected by plant construction or operation of the proposed project.
- Subsection 2.3.2 describes the surface-water and groundwater uses that could affect or be affected by the construction or operation of the proposed project.
- Subsection 2.3.3 describes the water quality characteristics of surface-water bodies and groundwater aquifers that could affect plant water use and effluent disposal or be affected by the construction and operation of the proposed project.

Section 2.3 describes site and hydrologic elevations in various elevation datums. NAVD 88 (North America Vertical Datum) is the reference datum for use at the Fermi 3 site. The following chart provides the elevational relationship of other referenced datums against NAVD 88.

Reference Datum		English Units (feet)	Metric Units (meters)
NAVD 88	(current msl[1])	100	100
IGLD[2] 55		99.15	99.74
IGLD 85		99.74	99.92
NGVD[3] 29	(old msl)	99.51	99.85
Plant Datum		101.22	100.37

1. Mean Sea Level elevation
2. International Great Lakes Datum
3. National Geodetic Vertical Datum

2.3.1 Hydrology

This subsection describes the surface-water bodies and the groundwater aquifers that supply water into the western basin of Lake Erie that is located in the vicinity of the Fermi site. The Fermi site-specific and regional data on the physical and hydrologic characteristics of these water bodies are discussed in the subsections below. This subsection contains data that providesa baseline of how these water bodies could affect, or be affected by the construction or operation of Fermi 3.

The existing and proposed site-specific and regional hydrosphere is summarized to provide a full evaluation of impacts on surface-water bodies and groundwater aquifers within the approximately 299,000 square mile area of the Great Lakes Drainage Basin (Reference 2.3-1). Within this basin, the Fermi site is 1260 acres. The site-specific area for the construction and operation of Fermi 3 is approximately 325 acres. Fermi 3 will be located within the same vicinity as Fermi 2, but further inland from the shoreline of Lake Erie. The topography of the site is flat to gently rolling plain and is located in the Swan Creek Watershed, which has an elliptical-shaped basin trending northwest-southeast and contributes a small water flow to the relatively large water capacity of Lake Erie.

The east side of the Fermi site is the shoreline of Lake Erie. The shoreline is on the outer part of the lake's western basin, which is the most important water body near the Fermi site. This subsection provides historical data and future projections concerning the hydrological characteristics of this particular region of Lake Erie. The hydrosphere of this region and the historical water levels of the area's major water bodies make it unnecessary to address seasonal drought conditions.

There are no significant impoundments, reservoirs, estuaries, or oceans located in this region that need to be considered when analyzing the water impacts on the construction and operations of Fermi 3. The site currently contains a man-made water basin that specifically supports the function of the circulating water system for Fermi 2. Fermi 3 will not rely on this water basin. Furthermore, construction and operation of Fermi 3 will not impact this water basin. The site contains two Quarry Lakes that were established following rock quarry operations in support of Fermi 2 site development activities. Fermi 3 will not rely on the Quarry Lakes.

2.3.1.1 **Surface-Water Resources**

This subsection describes the site-specific and regional surface-water resources at the Fermi site and in the site vicinity.

The Great Lakes Drainage Basin encompasses the Fermi site, and is shown on Figure 2.3-1. The figure also includes the five Great Lakes: Lake Erie, Lake Huron, Lake Michigan, Lake Ontario, and Lake Superior (Reference 2.3-17). As shown on Figure 2.3-1, the Fermi site is located on the western shoreline of Lake Erie.

The overall water system is shown on Figure 2.3-2 (Reference 2.3-2). Figure 2.3-2 shows a description of the hydrological cycle for the entire Great Lakes water system noting the approximate values pertaining to runoff, precipitation, evaporation, and flow capacity for each of the Great Lakes. The water contributions and water losses shown for Lake Erie demonstrate that it is a significant component of the water system.

Lake Erie is part of the larger network of the five Great Lakes. The outflows from two of the five Great Lakes (Lake Superior and Lake Ontario) are regulated by control structures. These outflows vary in accordance with their respective regulation plans. The outflows from Lakes Michigan-Huron and Erie are not regulated, but rather, are controlled exclusively by the hydraulic characteristics of their outlet rivers (Reference 2.3-3). The watershed of the Great Lakes includes part or all of eight states (Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania and New York) and the Canadian province of Ontario. Currently, more than 33 million people inhabit the drainage basin surrounding the Great lakes; more than one-tenth of the population of the United States and one-quarter of the population of Canada (Reference 2.3-4).

Fermi 3 is located on the western basin of Lake Erie. Thus, Lake Erie is the primary surface-water body to be considered for potential impact to Fermi 3. Lake Erie is also the primary surface-water body with potential for being impacted by the construction and operation of Fermi 3. Certain onsite water bodies and wetlands areas may also be subject to construction and operational impacts. Due to the proximity to the site, Swan Creek is also considered. The local site characteristics of the western basin of Lake Erie and its tributaries are described in Subsection 2.3.1.1.3.1.

The topography of the site and vicinity is described in Section 2.1. Natural features of note in the Fermi site vicinity include Lake Erie as the prominent feature immediately east of the Fermi site. The area also includes Stony Point, a distinctively shaped landform projecting into Lake Erie just south of the Fermi site, and several other bodies of water. These nearby bodies of water include Swan Creek north of the Fermi site, Stony Creek, about 3 miles southwest, River Raisin, about 6 miles southwest, and the Huron River about 5.75 miles north.

Lake Erie is the primary water source for Fermi 3. Lake Erie is a very large surface-water body compared to the site water needs. Thus, the construction and operation of Fermi 3 will require minimal, if any, hydrographic modifications within the region. Information concerning the potential construction and operational impacts is discussed in Chapter 4 and Chapter 5. Based on site configuration, stormwater runoff will flow toward the lagoons located to the north and south of Fermi 3 before entering Lake Erie.

2.3.1.1.1 **Lake Erie Drainage Basin**

The Lake Erie Drainage Basin is a sub-basin of the Great Lakes Drainage Basin shown on Figure 2.3-3. The U.S. Army Corps of Engineers (USACE) and other major regulatory agencies monitor and study a variety of issues given that Lake Erie supports more than 11 million people and 11 major ports.

As shown on Figure 2.3-3 and Figure 2.3-8 (Reference 2.3-6 and Reference 2.3-11) Lake Erie is identified mainly by three separate drainage basins:

- The western Lake Erie basin is a very shallow basin with an average depth of 24 feet. The western basin is partially restricted from the rest of Lake Erie by a chain of barrier beaches and islands.

- The central Lake Erie basin is uniform in depth with an average depth of 60 feet and maximum depth of 82 feet.
- The eastern Lake Erie basin is a small, relatively deep basin. The average depth in the eastern basin is 82 feet with a maximum depth of 210 feet.

As shown in Figure 2.3-4 Lake Erie can be sub-divided into smaller areas for use in runoff modeling. For each defined area, Figure 2.3-4 also provides the sub-divided areas in square meters.

Approximately 80 percent of Lake Erie's total inflow is from the Detroit River, 11 percent from precipitation, with the remaining nine percent from tributaries flowing through watersheds in Michigan, Ohio, Pennsylvania, New York and Ontario. Thirty-nine percent of the entire Lake Erie Basin is drained by the Thames River and Grand River in Ontario and the Maumee River in Ohio and Indiana. The outlets are Welland Canal and the Niagara River (Reference 2.3-1 and Reference 2.3-8). This information is also consistent with the values shown on Figure 2.3-2.

Collectively, the drainage basin for Lake Erie within the United States and Canada is approximately 23,400 square miles which expands across portions of the state of Michigan, Indiana, Ohio, Pennsylvania, New York and Ontario and is second only to the Lake Michigan Basin, which is more than twice as large (Reference 2.3-7).

As shown on Figure 2.3-5, the Lake Erie Drainage Basin consists of 12 main tributaries: Ashtabula River, Black River, Buffalo River, Clinton River, Cuyahoga River, Detroit River, Maumee River, Presque Isle Bay, River Raisin, Rouge River, St. Clair River, and the Wheatley Harbour. The 12 main tributaries are all listed as Areas of Concern (AOC); where an AOC is defined as a waterway where beneficial uses of the water resources have been impaired by human activities (Reference 2.3-10). The Detroit River and River Raisin are the two tributaries most relevant to the Fermi site. The Detroit River is located to the north of the site and the River Raisin is located to the south of the Fermi site. These two tributaries are discussed in Subsection 2.3.1.1.3.1.

2.3.1.1.2 **Lake Erie Characteristics**

Lake Erie is the shallowest, warmest, most southern and most biologically productive of all the Great Lakes. The actual length of Lake Erie is approximately 241 miles, breadth of 57 miles and its shoreline length is approximately 871 miles. The average depth of Lake Erie is 62 feet and its maximum depth is 210 feet. The water surface area is approximately 9910 square miles (Reference 2.3-4). The volume of Lake Erie is 116 cubic miles. Historically, the Lake Erie water level has ranged between 563.64 and 576.22 feet with respect to International Great Lakes Datum (IGLD) 85. The low water datum of Lake Erie at the Fermi site is established at an elevation of 569.2 feet with respect to IGLD 85.

Lake retention time (also called the residence time of lake water, the water age, or flushing time) is a calculated quantity expressing the mean time that water (or some dissolved substance) spends in a particular lake. At its simplest form, the retention time is the result of dividing the lake volume by the flow in or out of the lake. It roughly expresses the amount of time taken for a substance introduced into a lake to flow out of it again. The retention time is especially important where pollutants are concerned. The retention time of Lake Erie is 2.6 years, which is the shortest of all the Great Lakes (Reference 2.3-11).

The average flow rate of Lake Erie according to data recorded by USACE is 201,750 cubic feet per second. (Reference 2.3-12) The lake is slow and meandering and velocity varies due to wind currents and seasonal climate variations. The actual velocity of water that flows via Detroit River across the Fermi site to the Toledo intake has been estimated to be approximately 0.3 feet per second in the winter months and as high as 0.5 feet per second during summer months (Reference 2.3-13). The runoff, precipitation and evaporation factors have been considered in estimating the average flow rate.

The climate of the region exhibits an extreme difference seasonally from warm temperatures in the spring and summer months to freezing temperatures during the winter months. The distinction between the extreme contrasts in climate variations regionally is illustrated on Figure 2.3-6. Figure 2.3-6 provides the following information for the Great Lakes region:

- Winter Temperatures and Ice Conditions
- Frost Free Period and Dominant Air Masses
- Summer Temperatures
- Precipitation and Snowbelt Areas

This information provides a picture of the overall seasonal and weather related effects in the Great Lakes Basin (Reference 2.3-33).

Table 2.3-2 provides precipitation information for the five Great lakes. The table provides average precipitation levels for the years 1900 to 1999 as compared to recent data. In addition, Table 2.3-2 shows the average outflow from Lake Erie as compared to recent data. The data in this table indicates that there is correlation between the lake outflow and the amount of precipitation. The historical water surface temperatures as well as the annual average air temperatures for all the Great Lakes is shown on Table 2.3-3 and Figure 2.3-7 respectively. Table 2.3-3 provides Lake Erie surface-water monthly temperatures for 1948 through 2004. Figure 2.3-7 provides annual average air temperatures over all the Great Lakes. As shown on Figure 2.3-7, the air temperature over Lake Erie, historically, is greater than all of the other Great Lakes.

The historical annual precipitation, on a monthly basis, for Lake Erie within the lake and overland within the drainage basin is shown in Table 2.3-4 for the time period 1900 through 2006. In addition, the information in Table 2.3-4 provides the mean, the maximum and the minimum values. The historical amounts of the water evaporated for Lake Erie on a monthly and annual basis are shown in Table 2.3-5.

The yearly lake levels of Lake Erie and also the average, minimum and maximum water level values for all lakes in the Great Lakes Basin are shown on Table 2.3-6 and Table 2.3-7. Table 2.3-6 shows the data for Lake Erie, specifically. Table 2.3-7 shows the lake level data for all the Great Lakes for comparison purposes.

Table 2.3-8 shows the historical average Lake Erie water levels for the time period of 1918 through 2006 based on averages interpolated between two National Oceanic & Atmospheric Administration (NOAA) gauges, Toledo (9063085) and Fairport (9063053), and two Department of Fisheries and Oceans of Canada (DFO) gauges, Port Stanley (45132) and Port Colborne (45142) (Reference 2.3-12). The data in Table 2.3-8 does not include the gauge located at the Fermi site in this average (Reference 2.3-15 and Reference 2.3-16). This NOAA gauge is discussed in Subsection 2.3.1.1.3.

The intake structure and discharge for Fermi 3 will utilize the western basin of Lake Erie. The bathymetry of Lake Erie and Lake Saint Clair is shown on Figure 2.3-8 (Reference 2.3-11). Figure 2.3-8 shows that the western basin is much shallower than the other basins. Subsection 2.3.1.1.3 provides more detailed discussion of the Lake Erie western basin, including historical hydrological data, water characteristics, and local water bodies specifically in close proximity to the Fermi site.

2.3.1.1.3 **Lake Erie Western Basin**

The western basin of Lake Erie has many tributaries north and south of the Fermi site. The main tributaries of the western basin that are in close proximity to the Fermi site and could possibly impact or be impacted by Fermi 3 are the River Raisin, Swan Creek, and Stony Creek. The Detroit River is a farther distance from the site than these three tributaries, but further discussion on the river is provided due to its size, proximity and relative contribution to Lake Erie.

These tributaries have been evaluated in the discussion below due to the amount of water and sediment inflow distributed to the western basin and proximity to Fermi 3. As previously discussed, the majority of water inflow to Lake Erie is from the Detroit River. Regarding tributaries in close proximity to the site (Swan Creek, Stony Creek, and the River Raisin), the majority of water inflow comes from the River Raisin. Thus, the majority of water inflow and sediment transfer regarding tributaries closest to the site is primarily from the Detroit River and the River Raisin. Swan Creek and Stony Creek are located north and south of the site respectively. Swan Creek is located approximately 1.3 miles north of the site and Stony Creek approximately 3 miles southwest. These are much smaller tributaries with lower contributions to incoming water flow and sediment.

The entire Fermi site is located in the Swan Creek Watershed. The Swan Creek drainage basin will impact the site during certain storm events. The water body distributes minor flow, but under certain flood conditions this water body may have an impact locally on the site.

The Fermi site has a station gauge (ID 9063090) within the vicinity of the Fermi 2 intake structure, monitored by the NOAA to monitor the water level at the Fermi site. The historical water levels of this gauge are shown in Table 2.3-9 and Table 2.3-11 for the period of 1996 through 2007 (Reference 2.3-19). For each month in this time period, the maximum and minimum recorded water levels are shown in Table 2.3-9 including the data and time of occurrence. For this same time period, Table 2.3-11 shows the ten highest and lowest recorded water levels, including date and time of occurrence.

The Fermi 3 intake structure will be constructed in close proximity to the Fermi 2 intake structure between the two groins that extend into Lake Erie. The details of the spacing between the intake structures are discussed in Subsection 2.3.1.1.3.3. The outfall for Fermi 3 will be via an underwater pipe discharging into the lake well offshore to maximize mixing and preclude possible recirculation to the Fermi 3 intake. Offshore discharge is also selected to avoid potential impacts to the South Lagoon during seiche events, such as warm discharge water flowing back into the lagoon area at the outlet. Section 5.3 discusses the thermal plume analysis and Section 3.4 discusses design of the discharge system.

The gradient and currents of Lake Erie are minimal and reasonably slow for all three regions of the lake. The historical water levels for the Gibraltar station gauge (ID 9044020) located near the outlet end of the Detroit River and the Niagara Intake station gauge (ID 9063012) located near the entrance of the Niagara River are shown on Figure 2.3-9. Given their relative locations, these two gauges provide a picture of the velocity gradient for Lake Erie (Reference 2.3-20).

The velocity of the water in Lake Erie is typically less than 0.3 knots (0.5 feet per second). There are currently three stations of measurement: Port Stanley (45132), Port Colborne (45142), and West Erie (45005). The wind and water currents are shown on Figure 2.3-10 and Figure 2.3-11. These figures represent the typical flow pattern that is monitored by the NOAA instruments at various monitoring stations within the confines of Lake Erie (Reference 2.3-9). As shown on Figure 2.3-10, the wind current pattern is typically from west to east, with the largest velocity in the open waters of the central basin (Reference 2.3-21).

In addition, a complete dataset of ambient temperature and velocity was obtained from NOAA's Great Lakes Coastal Forecasting System (GLCFS) model, an automated model-based prediction system utilized to provide improved guidance of water levels, water currents, and water velocities in the Great Lakes. Twenty-six months of model-estimated data were used in compiling statistics for characterization of the ambient Lake Erie conditions for every month of the year. These data provide information for a 2 km x 2 km model grid cell at the location of the outfall. This data is summarized in Table 2.3-10. The data in Table 2.3-10 is comparable to the surface-water temperature data in Table 2.3-3, accounting for the shallow western basin. It is noted that the shallower western basin is the first of the three basins of Lake Erie to form ice and the first to lose ice (Reference 2.3-9).

The water level at the Fermi site has been estimated locally by the USACE in the event of potential storms. The information of the possible storm induced increase of Lake Erie water level at the Fermi site is shown on Table 2.3-12 (Reference 2.3-22). The characteristics of the tributaries near the Fermi site for potential storm conditions are described in the subsection below.

The existing shoreline at the Fermi site is sufficient to provide protection from water level increases during significant storms since the top of the bank is nine feet above normal water level of the western basin of Lake Erie. The analysis of potential storms is discussed in more detail in FSAR Subsection 2.4.2.

Figure 2.3-15 shows the open coast flood level reaches for Lake Erie. From Figure 2.3-15, the Fermi site is in Reach Z. Figure 2.3-16 shows the Federal Emergency Management Agency (FEMA) flood map for the Fermi site. As shown, the location for Fermi 3 is located in Zone X, which represents areas outside the 500-year flood zone. The flood levels are shown in the IGLD 1985 datum in Table 2.3-1; thus, accounting for the differences between the FEMA map elevations in Figure 2.3-16 elevations are recorded in NAVD 1988 datum. As shown in Table 2.3-1, the 10-year flood level is 576.3 feet, the 50-year flood level is 577.4 feet, the 100-year flood level is 577.9 feet and the 500-year flood level is 578.8 feet. All of these flood levels are less than the site grade elevation. Therefore, based on design and configuration, the site is adequately protected from flooding (Reference 2.3-5).

2.3.1.1.3.1 **Western Basin Tributaries**

The following discussion provides information on each of the tributaries that supply water to Lake Erie. In addition to the tributaries that are in close proximity to the site (Swan Creek, Stony Creek and the River Raisin), the Detroit River is also included in the discussion due to its relatively significant contribution of water and sediment to Lake Erie.

Detroit River

The Detroit River is about 32 miles long from its head at the Windmill Point Light to its mouth at the Detroit River Light in Lake Erie. The decrease in water level from Lake St. Clair to Lake Erie is approximately three feet. The river is characterized by two distinct reaches. The specific details and features of the Detroit River are shown on Figure 2.3-12 (Reference 2.3-23).

The Detroit River outlet mouth is approximately 16.5 miles northeast of the Fermi site. The Detroit River is the largest and most important tributary for the western basin of Lake Erie as it provides approximately 80 percent of Lake Erie's water inflow (Reference 2.3-8).

The water quality of the western basin for the most part is similar to the Detroit River. The water quality attributes of Lake Erie are further discussed in Subsection 2.3.3. The Detroit River has four monitoring stations which have been established by NOAA. The stations are located in Windmill Point, MI; Fort Wayne, MI; Wyandot, MI; and Gibraltar, MI. They are listed from north to south of the river with Gibraltar station being the closest to the Fermi site.

The historical Detroit River water levels (Gibraltar gauge station) that are closest to the site are shown on Figure 2.3-9 (Reference 2.3-20). Given the hydrosphere of the region, the hydrological function of the Detroit River relative to the western basin of Lake Erie, and the distance of its outlet from the Fermi site; flooding of the Detroit River will have no impact on the Fermi site.

The average velocity of water flow of the Detroit River has been estimated to be approximately 0.3 feet per second in the winter months and as high as 0.5 feet per second during summer months (Reference 2.3-13). The annual average flow-rate for the Detroit River during 2006 was 4999 cubic meters per second (m^3/s) or 176,538 cfs. The historical flow rates are shown on Table 2.3-13 (Reference 2.3-25). The amounts of suspended and dissolved solids that come from the Detroit River and the other tributaries of the Lake Erie western basin are shown on Table 2.3-14. As expected, based on the contribution of water to Lake Erie, the amount of suspended and dissolved solids contributed by the Detroit River is significantly greater than that contributed by the other tributaries. The one exception that stands out is the Maumee River which, for its relative flow contribution, contributes a high degree of suspended and dissolved solids.

There are potential impacts within the hydrosphere due to seasonal weather; primarily during the winter months with ice forming in the river. The potential and historical ice events within the region affecting the Fermi site are discussed in the FSAR Subsection 2.4.2 and FSAR Subsection 2.4.7.

Other Tributaries in Regional Vicinity

The tributaries discussed below are in the closest proximity to the Fermi site. These tributaries are significant to the site primarily because of location and water quality. The water quality impacts of these water bodies are discussed in Subsection 2.3.3. Due to their smaller relative sizes, these tributaries have minor impact to the overall characteristics of the western basin of Lake Erie.

The characteristics of Swan Creek and Stony Creek were retrieved from Michigan Department of Environmental Quality (MDEQ) and FEMA Flood Maps. The River Raisin data was also retrieved from the MDEQ from a USGS monitoring Gauge No. 04176500. The gauge datum is 616.75 feet above sea level (NAVD 88).

Swan Creek Watershed

The Swan Creek Watershed is an elliptical-shaped basin trending northwest-southeast. It rises to the west from Lake Erie and reaches its maximum elevation of 700 feet at the southeastern corner of the city of Ypsilanti, approximately 25 miles inland. The mouth elevation of Swan Creek is determined by the local level of Lake Erie, which fluctuates and is located approximately 1.3 miles north of the Fermi site as shown on Figure 2.1-3 in Section 2.1. The average mouth elevation is 571.32 feet, which implies an average total vertical fall of 128.68 feet. This vertical fall over 25 miles equals an average slope of approximately 5.15 feet per mile. The Swan Creek Watershed is shown on Figure 2.3-13.

The entire Swan Creek Watershed is situated within a flat to gently rolling plain. Basin surface soils are primarily lacustrine clay, with some lacustrine sand ridges at the head of the watershed. The infiltration capacity of the basin soils is low. Surface drainage is poor and drainage ditch improvements are common in the upper part of the basin. The area has developed a slightly meandering dendritic drainage pattern, which has generally poor flow characteristics due to typical cover of deciduous trees and brush undergrowth. Currently, Swan Creek is an ungauged water body; and therefore the historical information concerning the creek's flow rate has been estimated by the MDEQ. The MDEQ used the drainage-area ratio method to generate monthly flows. The drainage-area ratio method is based on the assumption that the stream flow for a site of interest can be estimated by multiplying the ratio of the drainage area for the site of interest and the drainage area for nearby stream flow gauging station (Reference 2.3-27). The monthly flow rates for Swan Creek were generated from the measurements taken from the Plum Brook gauge 04163500, which is a 23.8 square mile watershed near Utica, MI. Table 2.3-16 shows the monthly flow rates for Swan Creek generated by the drainage-area ratio method (Reference 2.3-28). As shown in Table 2.3-16, the monthly flow rates are typically at a maximum in the spring and a minimum in late summer.

Low water flow rates for Swan Creek are shown in Table 2.3-15. The data in Table 2.3-15 shows the 50 percent and 95 percent exceedance values and the mean. As discussed in Table 2.3-15, the lowest 95 percent and 50 percent exceedance, the Harmonic Mean, and 90-day once in 10-year flow are estimated to be 0 cfs, 2.8 cfs, 4.6 cfs and 0.9 cfs, respectively. (Reference 2.3-71)

Since Swan Creek receives stormwater and other effluents via the overflow canal located north of the site, an impact occurs on sedimentation and other water quality characteristics in the vicinity of the site within the western basin of Lake Erie. The degree to which it impacts the water quality in the western basin of Lake Erie is discussed in Subsection 2.3.3.

Swan Creek at Mouth, Section 16, T6S, R10E, Frenchtown Township, Monroe County, has a drainage area of approximately 100 square miles. The 10 percent, 2 percent, 1 percent, 0.5 percent, and 0.2 percent peak flow rates are estimated to be 2500 cfs, 3700 cfs, 4100 cfs, 4600 cfs, and 5000 cfs, respectively (Reference 2.3-29). The impacts to the Fermi site from flooding in the Swan Creek Watershed are discussed in FSAR Subsection 2.4.2 and FSAR Subsection 2.4.3.

<u>Stony Creek</u>

The Stony Creek Watershed is located in Washtenaw County and Monroe County in Southeastern Michigan. As shown in Figure 2.1-2, Stony Creek empties into the western basin of Lake Erie approximately 2.5 miles southwest of the Fermi site. The watershed for Stony Creek is shown on Figure 2.3-13 (Reference 2.3-75). There is no anticipated interface between Stony Creek and the construction and operation of Fermi 3. However, Stony Creek does impact the sediment and other water quality characteristics within the western basin of Lake Erie in the vicinity of the Fermi site. The degree to which it impacts the water quality in the western basin of Lake Erie is discussed in Subsection 2.3.3.

Stony Creek at Mouth, Section 25, T6S, R09E, Frenchtown Township, Monroe County, has a drainage area of approximately 124 square miles. The 10 percent, 2 percent, 1 percent, 0.5 percent, and 0.2 percent chance peak flows are estimated to be 1800 cfs; 2900 cfs; 3600 cfs; 4100 cfs; and 4900 cfs, respectively (Reference 2.3-30). The monthly flow rates for Stony Creek are shown on Table 2.3-17. The drainage-area ratio method was used to estimate flows at the gauge 04175340 which represents 69.4 square miles located near the outlet end of Stony Creek. As shown in Table 2.3-17, the monthly flow rates are typically at a maximum in the spring and a minimum in late summer. Because of the location, flooding of Stony Creek does not have the potential to impact the Fermi site.

Low water flow rates for Stony Creek are shown on Table 2.3-15. The data in Table 2.3-15 shows the 50 percent and 95 percent exceedance values and the mean. As discussed in Table 2.3-15, the lowest 95 percent and 50 percent exceedance, the Harmonic Mean, and 90-day once in 10-year flow are estimated to be 6.4 cfs, 16 cfs, 30 cfs and 11 cfs, respectively (Reference 2.3-72).

River Raisin

The River Raisin, located in the extreme southeastern portion of Michigan's Lower Peninsula, flows in a generally southeast direction and discharges into the western basin of Lake Erie at Monroe Harbor, approximately 5.5 miles southwest of the Fermi 3 site (Figure 2.1-1). The river is approximately 115 miles long with a drainage encompassing approximately 1070 square miles of Southeast Michigan.

The River Raisin basin includes portions of five Michigan counties (Hillsdale, Jackson, Lenawee, Monroe and Washtenaw counties) and a small portion of northern Ohio. It is a water body within the Lake Erie western basin that has been under the Remedial Action Plan (RAP) since 1987. The primary purposes of the RAP are to improve water quality, provide a safe environment for diverse biological communities, and reduce persistent toxic substances in the river.

The River Raisin is one of the AOC tributaries of Lake Erie. This specific AOC has been defined as the lower (2.6 miles) portion of the River Raisin, downstream from the low head dam at Winchester Bridge in the city of Monroe, extending 0.5 miles out into Lake Erie following the Federal Navigation Channel and along the near-shore zone of Lake Erie, both north and south, for one mile. The main AOC is located at the outlet end of River Raisin.

There is no anticipated interface between the River Raisin and the construction and operation of Fermi 3. However, the River Raisin does impact the sediment and other water quality characteristics within the western basin of Lake Erie in the vicinity of the Fermi site. The degree to which it impacts the water quality in the western basin of Lake Erie is discussed in Subsection 2.3.3.

The River Raisin gauge is located at its mouth, entering Lake Erie. The River Raisin, Section 11, T7S, R09E, City of Monroe, Monroe County, has a drainage area of 1070 square miles. The 10 percent, 2 percent, 1 percent, 0.5 percent, and 0.2 percent chance peak flows are estimated to be 10,000 cfs; 15,000 cfs; 17,000 cfs; 19,000 cfs; and 23,000 cfs, respectively (Reference 2.3-70). The monthly flow rates for River Raisin are shown on Table 2.3-18. The drainage-area ratio method was to estimate flows at the gauge 04176500, which represents 1033.9 square miles located near the outlet end of the river. As shown in Table 2.3-18, the monthly flow rates are typically at a maximum in the spring and a minimum in late summer. Because of the location, flooding of the River Raisin does not have the potential to impact the Fermi site.

Low water flow rates for the Raisin River are shown in Table 2.3-15. The data in Table 2.3-15 shows the 50 percent and 95 percent exceedance values and the mean. As discussed in Table 2.3-15, the lowest 95 percent and 50 percent exceedance, the Harmonic Mean, and 90-day once in 10-year flow are estimated to be 51 cfs, 140 cfs, 250 cfs and 75 cfs, respectively. (Reference 2.3-73)

2.3.1.1.3.2 **Lake Erie Western Basin Erosion Characteristics and Sediment Transport**

The majority of the erosion and deposit of sediment materials regarding the tributaries closest to Fermi 3 in the western basin of Lake Erie comes from the Detroit River followed by the River Raisin south of the Fermi site. The mouth of the Maumee River is located approximately 25 miles south of the site and drains more than 4.2 million acres in Ohio, Indiana, and Michigan. More than 70 percent of the acreage is cultivated cropland. Due to the large size of the watershed and its high percentage of intensively cultivated cropland, the Maumee River discharges more tons of suspended sediment per year than any other tributary to the Great Lakes. Table 2.3-14 provides a more detailed breakdown of the suspended and dissolved solids contributed to western basin of Lake Erie by the major tributaries.

The Fermi site is partially protected by a shoreline barrier against the high water levels of Lake Erie. The rock shore barrier is located in front of Fermi 2 along the shore between Plant Coordinate System Grid N6800 and N7800. The rock shore barrier crest elevation is 583 feet nominal plant datum. The dimensions and materials that make up this barrier are shown on Figure 2.3-14. The barrier is significant and, historically, functioned in keeping the shoreline bordering Fermi 2 from eroding inland. In addition to the protection afforded by the shoreline barrier, Fermi 3 is located further inland than Fermi 2 (see Figure 2.1-4). Accordingly, a detailed analysis of local erosion characteristics and sediment transport is not necessary.

2.3.1.1.3.3 **Plant Intake/Discharge Interface with Lake Erie**

The intake structure for Fermi 3 will be located in the vicinity of the intake structure for Fermi 2. More specifically, the intake structure will be located between the two groins that protrude into Lake Erie. The existing local impoundment that is currently used to receive dredging material for the Fermi 2 intake structure will be used during the construction of the intake structure for Fermi 3.

The details of the Fermi 3 intake structure are included in Section 3.4 and Section 5.3. Dredging is periodically performed in the area between the two groins to ensure that the Fermi 2 access to Lake Erie is maintained. The current dredge cycle for the Fermi 2 intake canal is 4-years. The most recent major dredging was performed in 2004. In addition to major dredging of the canal, annual cleaning of the Fermi 2 General Service Water pump house is performed.

The local dredge basin is an approximate 11 acre pond supported by embankment areas used to retain dredge spoils from returning to the western basin of Lake Erie waterways. The dredge basin is located south of the Fermi 1 site along the shore of Lake Erie. The dredge basin includes a weir that allows water to return back to Lake Erie while retaining the sediment. The dredge basin has a unique outfall number with associated limitations in the Fermi 2 National Pollutant Discharge Elimination (NPDES) permit.

The Fermi 2 discharge is located along the shoreline of Lake Erie, north of Fermi 2, due east of the cooling towers. The circulating water system blowdown discharge pipe for Fermi 3 will be located southeast of the plant in Lake Erie. The discharge from the pipe structure will directly lead to the western basin of Lake Erie. The details of the discharge are included in Section 3.4 and Section 5.3.

2.3.1.1.3.4 **Conclusions on Plant Interface With Lake Erie**

As described above, the primary source of water for use by Fermi 3 is the western basin of Lake Erie. The western basin is also the primary offsite water body that could be impacted during the construction and operations of Fermi 3. The intake structure and discharge line are primary points of impacts which are described above.

The intake structure of Fermi 3 will allow the unit to function at full capacity at the historical low water level of the western basin. The construction of the shoreline barrier that runs along the eastern boundary of the Fermi site was initially designed to handle the most historical high water level of the western basin of Lake Erie that would potentially take place given the worst case scenario. Design bases flooding scenarios are addressed in FSAR Subsection 2.4.2, FSAR Subsection 2.4.3, and FSAR Subsection 2.4.5.

The information provided in Subsection 2.3.1 provides a sufficient baseline from which to judge the construction and operational impacts on the hydrology of Lake Erie. These impacts are discussed in Section 4.2 and Section 5.2. There are no known future hydrologic activities that will affect data accuracy.

2.3.1.1.4 **Wetlands and Onsite Water Bodies**

Detroit Edison performed a wetland investigation for the Fermi property in May and June, 2008. This investigation included a wetland delineation, and a functions and values assessment. The Fermi property has delineated 505 acres of wetlands and 48 acres of open water (not including open water areas in Lake Erie). The primary wetland type on the Fermi property is palustrine emergent marsh (PEM) comprising 322 acres followed by forested wetland (PFO, 167 acres) and scrub-shrub wetland (PSS, 16 acres).

For the functions and values assessment, the majority of the delineated wetland units are considered one large wetland system, hydraulically connected by direct, contiguous water ways or culverts under roads. Lagoons located to the north and the south of the proposed Fermi 3 site are hydraulically connected to Lake Erie through direct contiguous water ways. On the western side of the site are two canals and a stagnant waterbody. The canal northwest of the proposed Fermi 3 location (directly west of Fermi 2) flows to the North Lagoon. This canal is known as the overflow canal, and serves as an outfall for Fermi 2. The drainage canal is located directly to the west of the proposed Fermi 3 site, and flows to the South Lagoon. The stagnant waterbody is between the north and south canals. The wetlands to the west of the proposed Fermi 3 site are hydraulically connected to the north and south canals through culverts. The culverts provide a drainage flow path for the wetlands to the two canals and ultimately to Lake Erie. Through the North and South Lagoons, the two canals and the culverts, the wetlands are hydraulically connected to Lake Erie both to the north and to the south. Table 2.3-6 demonstrates that there is little monthly variation in lake level. The wetlands are hydrologically connected with Lake Erie and water levels typically fluctuate annually in unison with the larger waterbody, though at slightly different rates depending on resistance to flow for an individual waterbody. Seasonal water depths may vary depending on the long-term weather conditions. For example, during the spring thaw wetland water levels tend to be higher while extended dry periods such as autumn typically yield lower water levels. The annual variation in water elevation is relatively small and is largely dependent on Lake Erie water levels.

The principal functions and values of the wetland system on the Fermi property are floodflow alteration, sediment/toxicant retention, nutrient removal and habitat for fish and wildlife. A more detailed summary of the investigation report is provided Subsection 2.4.1.2.3**.**

2.3.1.2 **Groundwater**

This subsection describes the regional, and onsite hydrogeologic conditions present at Fermi 3. For the purposes of this subsection, regional refers to the area of Monroe County, Michigan, and five counties adjacent to Monroe County, and onsite refers to the physical boundaries of the Fermi site. Regional and local groundwater resources that may be affected by the construction and operation of Fermi 3 are discussed. The regional and site-specific data on the physical and hydrologic characteristics of these groundwater resources are summarized in order to provide basic data for an evaluation of impacts on the aquifers of the area.

2.3.1.2.1 **Description and Onsite Use**

This subsection describes the following:

- Regional and onsite groundwater aquifers and associated geologic formations
- Regional and onsite groundwater sources (areas of recharge) and sinks (areas of discharge)
- Regional and onsite use of groundwater

The Fermi site covers an area of approximately 1260 acres and is located on the glacial plain on the western shoreline of Lake Erie in Monroe County, Michigan. The site is approximately 30 miles southwest of Detroit, Michigan, and 24 miles northeast of Toledo, Ohio. The existing Fermi 2 plant buildings date from the 1970’s. They are located south of the two cooling towers and the circulating water basin, used for cooling water supply. Fermi 3 will lie immediately southwest of Fermi 2 and east of the overflow canal (Figure 2.3-17).

Historically, the site vicinity was characterized by surface wetlands. These wetlands were drained through the installation of drainage tiles in the 1800s to accommodate the development of local agriculture. There still exist many drainage ditches and tile systems in the area (Reference 2.3-76). The Fermi site has virtually no relief, since the site lies entirely on imported fill material placed and graded after excavating significant volumes of native material, which was wetland in nature (Reference 2.3-77). Swan Creek flows into an estuary on the northern edge of the site, which ultimately feeds into Lake Erie. The undeveloped area between the Fermi plant and Fisher Street to the west exhibits seasonally variable surface water and wetland vegetation.

Regional and local surface water features are described in Subsection 2.3.1.1, and a detailed description of regional and local geology is presented in FSAR Subsection 2.5.1.

2.3.1.2.1.1 **Regional Aquifers, Formations, Sources, and Sinks**

The site is located in Monroe County Michigan, and lies in the Eastern Lake Section of the Central Lowlands Physiographic Province (Reference 2.3-78). Physiographic provinces are described in detail in FSAR Subsection 2.5.1.1.1. Land surface in this area is characterized by relatively flat topography with some rolling hills. The geologic materials underlying the Central Lowlands Physiographic Province consist of Quaternary sediments of glacial and lake origin atop a sequence of Paleozoic carbonate units (FSAR Subsection 2.5.1.1.3).

Regionally, the Surficial Aquifer System is the uppermost and most widespread aquifer in the area (Reference 2.3-79). This aquifer system consists primarily of glacial sediments deposited during multiple glaciations in the Paleo-Pleistocene epochs. In areas where significant quantities of sand and gravel have been deposited, the aquifer may provide water supply for local wells. Glacial deposits thicken northwest of the site. In areas of northern mainland Michigan near Lake Michigan, glacially-derived sand and gravel deposits may be up to 1000 ft thick. In the site vicinity, however, these deposits are mapped as being less than 50 ft thick, which is confirmed by data collected during the Fermi 3 hydrogeology and geotechnical subsurface investigation, and are comprised almost entirely of clay and other fine-grained sediments (FSAR Subsection 2.5.1.2.3). The native glacial materials at the site are not, for the purposes of this document, considered to be an aquifer, since they consist almost entirely of clay and silt, and wells completed in these materials have not generally demonstrated the ability to produce water in economically beneficial quantities. However, regionally these sediments are hydrologically significant due to the water they transmit over large areas to the underlying bedrock formations.

The unconsolidated deposits that make up the shallow zone vary in thickness in Monroe County from approximately 140 ft thick in the northwestern part of Monroe County to zero thickness at some streams. The typical thickness in Monroe County is no more than 50 ft (Reference 2.3-79). The unconsolidated deposits are made up primarily of glacial till and lacustrine deposits (FSAR Subsection 2.5.1.2.3).

The primary source of recharge for the Surficial Aquifer System is from direct precipitation onto the aquifer surface where it is exposed. During times of elevated water surface elevations in Lake Erie, the shallow aquifer along the coast may be directly recharged from surface water features. Regional sinks, or areas of discharge, from the Surficial Aquifer System include discharge to wells, and discharge to streams, lakes, and other surface water features.

The glacial deposits are underlain by a series of Silurian-Devonian bedrock formations consisting primarily of limestone and dolomite, with some small sandstone layers locally (Figure 2.3-18). These formations reach thicknesses of thousands of feet and contain groundwater that ranges from fresh to brackish. Significant amounts of groundwater are withdrawn from the bedrock aquifer for industrial, municipal, and irrigation purposes (Reference 2.3-79). As part of the U.S. Geological Survey's (USGS) Regional Aquifer System Analysis (RASA) program (Reference 2.3-80), the bedrock aquifer, which is composed of Silurian-Devonian aged carbonates, was subdivided into five permeable zones, vertically adjacent and bounded on the top and bottom of this sequence by non-aquifer shales. The units are from bottom to top (oldest to youngest):

- Salina Group
- Bass Islands Group
- Sylvania Sandstone
- Detroit River Dolomite
- Dundee Formation

The hydraulic properties of these strata differ. However, there are no significant continuous confining units between them, leading to their consideration regionally as a single undifferentiated bedrock aquifer, in which groundwater occurs under artesian conditions beneath the surficial aquifer. Figure 2.3-19 presents a conceptual cross section of the aquifers trending NW-SE beneath Monroe County (Reference 2.3-76).

Regionally, the Antrim and Coldwater shales overlie the Dundee Formation and generally are not considered to be aquifers, and prevent significant recharge from overlying glacial deposits where present. Thus, where present, these shale units act as a confining unit above the Silurian-Devonian aquifer. The Coldwater Shale was used as the lateral hydraulic boundary in the Michigan Basin RASA. (Reference 2.3-81)

Regionally, the Ordovician or lower Silurian shales comprise the lower boundary to the bedrock aquifer system. The base of the Michigan Basin bedrock aquifer considered here is assumed to be the Salina Group Unit C Shale. The boundary to groundwater flow west of the regional study area is saline water. The density difference between saline and fresh water retards freshwater flow and creates a boundary to regional movement. Lake Erie constitutes a hydraulic boundary to the east. Under pre-development conditions, the lake represented a discharge area for groundwater flow from the bedrock aquifer. In recent decades, however, bedrock water levels in Monroe County have declined to the point that in places they are tens of feet below lake level in the county, thereby inducing flow from beneath the lake to local discharge areas. It is assumed that water levels in the bedrock aquifer approach lake level at some point eastward beneath Lake Erie (Reference 2.3-82).

The primary source of recharge for the bedrock aquifer is areally extensive downward vertical groundwater flow from the overlying glacial sediments to the bedrock formations, where confining shales are not present. Regional sinks, or areas of discharge, include flow to wells and downward flow from upper bedrock units to those underlying.

2.3.1.2.1.1 **Sole Source Aquifers**

A Sole Source Aquifer (SSA), as defined by U.S. Environmental Protection Agency (EPA), is an aquifer which is the sole or principal source that supplies at least fifty percent of the drinking water consumed by the area overlying the aquifer. The SSA program was created by the United States Congress in the Safe Drinking Water Act. The Act allows for the protection of these resources.

The Fermi site is located in EPA Region 5, which covers Minnesota, Wisconsin, Illinois, Michigan, Indiana, and Ohio. The EPA has designated seven aquifers in the Region as a SSA (Reference 2.3-83), with one additional aquifer pending designation (Reference 2.3-84). None of these SSAs are located in the state of Michigan. The closest SSA is the Bass Islands aquifer on Catawba Island in eastern Ottawa County, Ohio, about 35 miles southeast across Lake Erie.

A map of SSAs in EPA Region 5 is presented on Figure 2.3-20. A summary of SSAs is presented as Table 2.3-19.

2.3.1.2.1.2 **Site Aquifers, Formations, Sources, and Sinks**

The zone of shallow overburden characterized by unconsolidated deposits at Fermi 3 average 28 ft in thickness (FSAR Subsection 2.5.1.2.3), which is consistent with conditions in much of Monroe County (Reference 2.3-79). The local bedrock formation subcropping beneath the overburden is the Bass Islands Group. As previously stated this unit is part of the bedrock aquifer that exists throughout Monroe County. The Salina Group underlies the Bass Islands aquifer at the site. Geologic cross sections based on the Fermi 3 subsurface investigation data are presented in FSAR Subsection 2.5.1 and on FSAR Figure 2.5.1-237 through FSAR Figure 2.5.1-240.

The uppermost hydrogeologic unit present at the site is the shallow overburden. This layer is collectively comprised of rock fill imported for plant construction (0-16 ft), lacustrine deposits consisting of peaty silt and clay (0-9 ft), and two distinct units of glacial till composed primarily of clay (6-19 ft) (FSAR Subsection 2.5.1.2.3.2). The Fermi site in its undeveloped state was underlain by approximately 30 ft of glacial till and lacustrine deposits. Approximately 0-20 ft of this native material was excavated and removed from some areas during Fermi 2 construction, and replaced with fill material more suitable to geotechnical requirements during construction of Fermi 1 and 2. The fill for Fermi 2 was primarily rock removed from the onsite quarry west of Lagoona Boulevard; the quarry has filled with groundwater since the cessation of operations, and is now identified as Fermi 2 Quarry Lakes (Figure 2.3-17). Some clay material was used as fill at Fermi 1. The overburden is not considered an aquifer for the purpose of this document, because, with the exception of the quarried rock fill, the earth materials are characterized by low hydraulic conductivity such that water cannot be extracted from a well in significant quantities. As part of the Fermi 3 subsurface investigation, 17 monitoring wells and piezometers were installed into this layer. Hydraulic parameters and groundwater movement within and from this layer are discussed later in this subsection.

As with the Regional Surficial Aquifer System, the primary source of recharge for the groundwater within the overburden on site is direct precipitation onto the land surface. The portion of precipitation that does not run off, evaporate, or get consumed by plant transpiration ultimately percolates downward through the unsaturated zone to replenish the water table. During times of elevated water surface elevations in Lake Erie, the shallow zone may be directly recharged from surface water features. Additionally, groundwater inflow from the west flows onto the site, as discussed in the water level section in Subsection 2.3.1.2.2.3. Local sinks in the shallow zone include discharge to surface water features, and to the atmosphere via evapotranspiration losses.

The Bass Islands aquifer lies beneath the overburden at the site. As previously described, this is a bedrock dolomite aquifer in which the primary flow is in the fracture system present in the formation. For the purposes of this discussion, the entire thickness of the Bass Islands Group is considered to be an aquifer. Eleven monitoring wells and/or piezometers were installed into the Bass Islands aquifer as part of the hydrogeologic field program. The primary recharge source for the Bass Islands aquifer at the Fermi site under pre-development conditions is downward vertical flow from the overlying shallow zone and lateral inflow from the west. Surface water features may recharge the Bass Islands aquifer locally as discussed in Subsection 2.3.1.2.2.3.2.2 and Subsection 2.3.1.2.2.3.2.4.

The Salina Group underlies the Bass Islands Group at the site. The Salina Group is also a bedrock aquifer with observed joints and fracture systems with multiple orientations, vuggy zones, and paleokarst features, all of which contribute to the hydraulic conductivity. One piezometer (P-398 D) is screened in the Salina Group Unit F. Another piezometer (P-399 D) that targeted the Bass Islands Group penetrated the upper few feet of the Salina Group.

2.3.1.2.1.3 **Onsite Use**

The plant potable water supply is furnished by Frenchtown Township, Michigan, which uses a water intake in Lake Erie for its source water. The Station Water source for Fermi 3 operations is a new intake structure on Lake Erie.

No permanent dewatering systems are required for Fermi 3. Fermi 3 does not use groundwater for any plant operating requirements or permanent needs.

2.3.1.2.2 **Sources**

This subsection describes:

- Current and projected groundwater use in the region
- Regional and local groundwater levels and movement
- Hydrogeologic properties of subsurface materials
- Potential for reversibility of groundwater flow
- Effects of groundwater use on gradients beneath the site

2.3.1.2.2.1 **Present Groundwater Use**

Although Lake Erie is the largest regional water supply source, and many communities in the region are supplied by various water supply entities tapping this source, some water user groups in the area rely on groundwater for their supply.

The largest withdrawals of groundwater in Monroe County are at quarries (Reference 2.3-76 and Reference 2.3-85). There are seven quarries in Monroe County that are presently active on at least a seasonal basis. In addition, there are two active quarries in Wayne County. These quarries are shown on Figure 2.3-21.

Some local households are domestically self-sufficient for water. Groundwater is the largest source of water for self-sufficient households according to the year 2000 USGS Water Use estimates (Reference 2.3-85).

Groundwater is used to a lesser extent for public water supply systems as classified by the Michigan Department of Environmental Quality (MDEQ). This information is reported to the EPA which displays the information through the Safe Drinking Water Information System (SDWIS). SDWIS shows that only three community water systems in Monroe County use groundwater as their primary water source (Reference 2.3-86).

- The closest community water system that uses groundwater is the Flat Rock Village Mobile Home Park. The Flat Rock Village Mobile Home Park is located approximately 6.5 miles to the northwest of the site and serves 830 people.
- The next closest is the Bennett Mobile Home Park located approximately 23 miles to the southwest of the site and serves 70 people, and
- The farthest is the Bedford Meadows Apartments also known as Stoney Trail Apartments that serves 140 people and is located approximately 25 miles to the southwest of the site.

Monroe County also has 15 non-community, non-transient water systems (a public water system that regularly supplies water to at least 25 of the same people at least six months per year, but not year-round), along with 102 transient, non-community water systems (a public water system that provides water in a place such as a gas station or campground where people do not remain for long periods of time) (Reference 2.3-87) that use groundwater. Wayne County, Michigan, whose southern boundary is located about six miles north-northeast of the site, has no community water systems using groundwater and only one non-transient, non-community water system using groundwater which is located 35 miles north-northwest of the site at Maybury Child Care.

Washtenaw County, Michigan, whose boundary is located approximately 16 miles northwest of the site, has 21 community water systems that use groundwater, however, only one is located within 25 miles of the site: the City of Milan. The city has four water wells that are located between 80 and 100 ft deep. (Reference 2.3-88)

Groundwater is used for irrigation of crops at many locations throughout Monroe and Washtenaw Counties.

Figure 2.3-22 through Figure 2.3-24 display the wells in the state databases that lie within two miles, five miles, and 25 miles of the Fermi site. Because there is no groundwater use at Fermi 3, it is considered that the 25-mile radius circle lies well beyond any potential influence from plant operations. Information regarding wells within 25 miles of the Fermi site is presented by county in FSAR Appendix 2.4AA (Reference 2.3-89 and Reference 2.3-90).

2.3.1.2.2.2 **Projected Future Groundwater Use**

Year 2000 water use data documented in USGS Circular 1268 (Reference 2.3-85) is supplemented with the State of Michigan water use data for Thermoelectric Power Generation for the year 2000

(Reference 2.3-91), and data presented in USGS Investigations Report 03-4312 (Reference 2.3-76) for a combined estimate of year 2000 water use by water user group. Water user groups include Public Supply, Self-Supplied Domestic, Industrial (including quarries), Irrigation, and Thermoelectric Power Generation.

Using population projection data and the year 2000 water use data, estimates were developed of future water use by user group through the year 2060. A direct linear relationship was assumed between population and water usage for water user groups Public Supply, Self-Supplied Domestic Users, and Industrial Users. The projected water use was increased or decreased by the percentage change in population for both Monroe and Wayne counties. For the user groups Irrigation, Livestock, and Thermoelectric Power Generation, no direct linear relation with population was assumed. Projected use estimates for these categories were maintained at the level of usage reported in the year 2000.

Projected water use by user group for Monroe County and Wayne County, Michigan, is presented in Table 2.3-20 and Table 2.3-21, respectively.

2.3.1.2.2.3 **Groundwater Levels and Movement**

This subsection presents regional and local data describing the movement of groundwater at and near Fermi 3. Data was gathered from public sources and collected onsite during the Fermi 3 subsurface investigation in 2007. The details of the subsurface investigations are described in FSAR Subsection 2.5.4.2.2.1.

2.3.1.2.2.3.1 **Regional Groundwater Levels and Movement**

Prior to the development of agriculture in the state and the associated draining of wetland areas, groundwater elevations along the Lake Erie shoreline in both the surficial aquifer system and the bedrock aquifer were above the lake level, and artesian flow conditions in wells was common (Reference 2.3-76). As part of a regional modeling report, the USGS presents simulated regional groundwater flow in the bedrock aquifer under pre-development conditions (Figure 2.3-25). This figure displays the understanding that under pre-development conditions, regional flow in the bedrock aquifer in the Michigan-Ohio region was generally from the southwest to the northeast, with Lake Erie being an area of regional discharge. These results correspond with regional patterns and pre-development conditions described by Nicholas et al (Reference 2.3-92).

Groundwater conditions in Monroe County were evaluated using data from a series of USGS monitoring wells installed in the county in the early 1990's. There are a total of 40 wells that have some records for the depth to groundwater. As part of the investigation for IR 94-4161 (Reference 2.3-92) the USGS drilled 33 observation wells into the bedrock aquifers and one into the unconsolidated glacial deposits. The USGS also has two long-term observation wells located approximately two miles southeast of Petersburg, Michigan (about 23 miles to the west southwest of the site). Ash Township installed four observation wells in early 2006.

Potentiometric surface maps for the bedrock aquifer in Monroe County for the years 1993 and the initial period beginning in 2008 are presented on Figure 2.3-26 and Figure 2.3-27. Most of the wells used in these maps are completed in the Bass Islands Group, although some wells in the northwest portion of Monroe County are completed in younger strata of the Silurian-Devonian bedrock aquifer. These figures reinforce the observation of the southwest to northeast flow direction evident in the regional water levels. Groundwater flow enters beneath Monroe County from the southwest, and the primary flow direction is to the northeast. The 1993 water level map displays a cone of depression along the northeastern county line associated with quarrying operations located there. The 2008 potentiometric surface map displays a significant new groundwater depression centered just southwest of the City of Monroe, Michigan. This is apparently associated with a new quarrying operation that was not active in 1993. The contour maps demonstrate that dewatering of quarries can significantly impact the bedrock groundwater flow.

2.3.1.2.2.3.2 **Site Groundwater Levels and Movement**

As part of the Fermi 3 subsurface investigation, 28 groundwater piezometers and monitoring wells were installed and developed at the site. Using the information on the soil and bedrock stratigraphy, monitoring wells were installed in the overburden, and the Bass Islands and Salina Groups. Water levels in these wells were measured on a monthly basis from June 2007 to May 2008. In addition to wells installed for the Fermi 3 program, water levels in some existing Fermi site wells installed as part of other projects were also measured and recorded. The water level elevation data presented in this subsection is referenced to North American Vertical Datum 1988 (NAVD 88). Table 2.3-22 presents construction details of wells considered in this analysis. The elevation of water recorded in each well is presented in Table 2.3-24.

Five surface water gauging stations (GS-1 through GS-5) were also installed as part of the Fermi 3 subsurface investigation. The surface water gauges installed as part of Fermi 3 were not readable from November 2007 to March 2008 due to ice buildup at the stations. Gauges GS-1 through GS-3, and GS-5, were re-established in April 2008. GS-4 was not re-established since it’s data was redundant to other wells. Surface water gauge elevation data is presented on Table 2.3-23. Surface water elevations at GS-1 through GS-4 were used to help develop groundwater contours in the shallow zone. It should be noted, however, that the surface water elevation data are considered somewhat less precise than measured groundwater elevations due to the effects of wind and tides on water at the gauges. For this reason, if small discrepancies between surface water and groundwater elevations were observed, they may not be reflected in the contours if the data was judged to be anomalous with respect to the rest of the data. This circumstance was most prevalent at Gauge GS-3, located in the shallow water of the lagoon south of Fermi Drive, which is in direct hydraulic connection with Lake Erie. Gauge GS-5 is not used for contouring because the quarry in which it is located is hydraulically connected to both the Bass Islands aquifer and the overburden. Surface water elevations from the National Oceanic and Atmospheric Administration (NOAA) Fermi Gauge Station were used. The circulating water basin located to the north of the Fermi 2 Protected Area had a surface water gauge at which data was collected only from June through August 2007. However, this data was not used in developing contours because Fermi 2 construction drawings indicate that the pond is encircled by a clay dike keyed into the underlying glacial till, thereby minimizing the hydraulic connection between the pond and the surrounding rock fill. The surface water features in the undeveloped wetland area west of the overflow canal were used to help shape contours.

2.3.1.2.2.3.2.1 **Overburden**

The following issues were considered in the interpretation of onsite water level data from wells screened in the overburden.

Seventeen monitor wells/piezometers were installed into the overburden at the site to document hydrogeologic conditions. Additionally, five wells previously installed as part of other projects were included in the overburden data collection (EFT-1 S, EFT-1I, EFT-2 S, MW-5d, and GW-02).

Several man-made features at the site affect groundwater levels in the overburden. The site contains a series of clay-filled construction dikes that were built as part of the construction effort for Fermi 2 (Figure 2.3-17). A former muck disposal site is located in the southwest area of the site. Monitoring wells MW-383 S and MW-384 S are located in this area, and were installed into material that was dredged from the site and/or Lake Erie during and after the construction of Fermi 2. The area of Fermi 1 occupied by EFT-1 S and EFT-2 S consists of clay fill, and these wells are screened in this material. These issues were considered during the development of overburden water table contours.

Five of the 16 wells installed to date as part of the Fermi 1 License termination were considered for use with this COL Application. These five wells are split into two well groups by location, which are EFT-1 and EFT-2. The EFT-1 well group consists of three wells, a shallow, intermediate, and deep. The EFT-2 well group consists of two wells, a shallow and a deep well. The shallow wells monitor the clay fill installed during construction of Fermi 1, the intermediate well monitors the native glacial till, and the deep wells monitor the upper part of the Bass Islands Group.

Water levels collected in June and July 2007 for monitoring well MW-388 S were not used because the recorded water levels at or below well screen at this location.

Water level data were collected at monthly intervals for 12 months from June 2007 to May 2008. Only quarterly maps are presented as part of this discussion, displaying conditions that varied seasonally and with the construction activities on site. The remainder of the monthly water level maps are presented in FSAR Appendix 2.4BB.

June 2007: The overburden water table map contoured from data collected on June 29, 2007 is presented on Figure 2.3-28.

Two distinct patterns of groundwater flow are evident in this map; one in the active plant area, and one in the undeveloped area west of the plant. The active plant area is defined for the purpose of this document as the area bounded by the overflow canal, Fermi Drive, and Lake Erie. The undeveloped area is defined as the area between the overflow canal and Fisher Street.

The water table surface in the active plant area is characterized by radial flow outward from a local maximum near the center of the plant area (well MW-5d in Fermi 2) toward the construction dikes previously discussed, and ultimately to the surface water features of Lake Erie, the overflow canal, and the lagoons north and south of the active plant area. It is assumed that the construction dikes control the location of the contours due to the low permeability of clay as compared to the adjacent rock fill. There are local minima in the water table surface apparent at P-397 S and MW-386 S. These may reflect variations in the overburden and/or bedrock.

Wells MW-387 S, P-385 S, and MW-386 S have groundwater elevations lower than the surface water elevations at all five of the surface water gauge stations considered. This indicates that there may be local flow from the surface water features onto the Fermi 3 site during this monitoring event. Local perched groundwater in the southern part of the active area near wells MW-383 S and MW-384 S, and near wells EFT-1 S and EFT-2 S, is likely associated with clay fill placed there during previous construction.

The undeveloped area west of the overflow canal displays contours that indicate flow approximately northwestward from the overflow canal to the offsite area beyond Fisher Street. There are local minima in the water table surface apparent at P-382 S and P-389 S, with water table elevations lower than the nearby surface water elevations in the overflow canal. These features may reflect variations in underlying bedrock topography or hydraulic conductivity.

At P-382 S, there is a sandy silt layer logged at the bottom of the boring that may provide a preferential path for drainage from the overburden to the underlying bedrock, possibly causing this local water table depression.

<u>September 2007</u>: The overburden water table map generated from data collected on September 28-29, 2007 is presented on Figure 2.3-29.

For the active plant area, the groundwater flow patterns are similar to those observed in the June monitoring event. In the Fermi 2 area, groundwater appears to flow radially outward from a local maximum near MW-5d toward the construction dikes and encircling surface water features. Local perched groundwater is apparent near Fermi 1 and in the former muck disposal area in the southwest part of the active area. The water level in the area of Fermi 3 is now higher than the surrounding surface water, indicating groundwater flow discharging to the surface water bodies.

The contours in the undeveloped area west of the plant, by contrast, display a marked change in flow pattern from the June event. Although there is still a small component of flow directed offsite to the northwest, as defined by the low elevation at MW-388 S, the primary flow direction of this area has reversed from the June event. The primary flow direction is now eastward toward the overflow canal. The cause of this change may reflect seasonally variable hydrologic conditions associated with the wetlands present on the surface. Piezometers P-382 S and P-389 S again display groundwater elevations lower than the nearby surface water elevations, defining local minima in the water table.

<u>December 2007</u>: The overburden water table map generated from data collected on December 30, 2007 is presented on Figure 2.3-30.

For the active plant area, the groundwater flow patterns in December are similar to those observed in the June and September monitoring events. In the Fermi 2 area, groundwater still appears to flow radially outward from a local maximum near MW-5d toward the construction dikes and encircling surface water features. Local perched groundwater is apparent near Fermi 1 and in the former muck disposal area in the southwest part of the active area. Groundwater elevations at Fermi 3 are marginally higher than the surface water elevation recorded at the NOAA gauge.

The contours in the undeveloped area west of the plant have changed slightly from the flow pattern displayed in the September event. There is now an unambiguous gradient from the corners of the site toward the surface water features. From MW-381 S, the primary direction of flow is east/northeast toward the wetland surface water feature north of Fermi Drive and the overflow canal. From MW-393 S, flow is southeast toward the same features, indicative of the surface water features being discharge areas for the overburden groundwater flow at the time of data collection. There is no longer any component of flow evident from the contours that indicate offsite flow to the west, as there was in the June and September monitoring events. Piezometer P-389 S displays an elevation that is a local minimum, lower than the nearby surface water elevations. P-382 S is no longer a minimum as it was in September and June.

March 2008: The shallow zone water table map generated from data collected on March 29, 2008 is presented on Figure 2.3-31.

For the active plant area, the groundwater flow patterns in March are similar to those observed in the previous monitoring events. In the Fermi 2 area, groundwater still appears to flow radially outward from a local maximum near MW-5d toward the construction dikes and encircling surface water features. Local perched groundwater is apparent near Fermi 1 and in the former muck disposal area in the southwest part of the active area. The area near MW-386 S is a local minimum in the water table surface.

The contours in the undeveloped area west of the plant are similar to those displayed in the December event. There is a clear gradient from the corners of the site converging toward the surface water features. From MW-381 S, the primary direction of flow is east/northeast toward the wetland surface water feature north of Fermi Drive and the overflow canal. From MW-393 S, flow is southeast toward the same features, indicative of the surface water features being discharge areas for the shallow zone groundwater flow at the time of data collection. Piezometer P-389 S still displays an elevation that is a local minimum, lower than the nearby surface water elevations.

2.3.1.2.2.3.2.2 **Bass Islands Aquifer**

The following issues were considered in the interpretation of onsite water level data from wells screened in the Bass Islands aquifer.

Water levels from four wells were omitted from the analysis due to issues regarding their construction details. It was observed that filter packs in wells MW-387 D and GW-01 extended slightly up into the overlying glacial till. Due to this circumstance, it was judged that the water levels measured in these wells were not effectively isolated from the hydraulic influence of groundwater conditions in the overburden, and these data were not contoured. Similarly, wells EFT-1 D and EFT-2 D have approximately one foot of bentonite seal between the top of the well screen and the bottom of the glacial till. For the purpose of water level map development, this seal was not considered adequate between the till and bedrock well screen as compared to other wells included in this data analysis. The comparatively elevated water levels in EFT-1 D and EFT-2 D compared to those nearby suggest that the short bentonite well seal may not effectively isolate the water levels expressed in these bedrock wells from the influence of the groundwater in the overburden, which has a higher head than the groundwater in the bedrock aquifer.

Apart from well construction issues, the heterogeneous conditions of a fracture flow system, coupled with the variety of well screened intervals, introduce a measure of ambiguity into the interpretation of the water level data. Monitoring wells and piezometers screened in the Bass Islands aquifer were installed under both the hydrogeology and the geotechnical subsurface investigations. Under the hydrogeology investigation, screen interval selections were based on the location of the most fractured and permeable zones identified at each boring location during the packer testing program. Under the geotechnical investigation, boring depths and screen interval selections were based on anticipated excavation depths during plant construction. This results in well completions at varying depths within the Bass Islands aquifer. Some monitoring wells and piezometers are screened near the top of the aquifer, some midway, and others near the bottom. Figure 2.3-43 displays the effective intervals of each well completed in the Bass Islands aquifer. The Bass Islands aquifer is a distinct hydrogeologic unit; however, the varied zones monitored within the Bass Islands aquifer, coupled with the irregular nature of the fracture system introduce considerable local complexity to the data, including evidence of downward vertical flow (discussed in Subsection 2.3.1.2.2.3.2.4). However, the contours were developed in adherence to the data collected, and reflect the overall trends of groundwater flow within the Bass Islands aquifer.

One piezometer, P-399 D, straddles the Bass Islands Group-Salina Group contact. Inspection of the downhole natural gamma log for this boring indicates that the bottom five feet of the screen penetrates the extreme upper portion of the Salina Group Unit F. This could potentially have the effect of lowering water level measurements in this piezometer due to downward flow from the Bass Islands Group into the Salina Group (discussed in detail in Subsection 2.3.1.2.2.3.2.4). Because this is an important southern control point, and because the effect of the screen placement on water levels is ambiguous, data from this well were used in the development of potentiometric surface contours.

All bedrock wells have water levels that reflect artesian conditions except for MW-381 D. Water levels measured in MW-381 D are consistently below the top of the Bass Islands Group.

Data from surface water Gauge GS-5 was not used to develop contours. This gauge is located in a lake formed by a quarry that penetrates into the bedrock; therefore, the lake level is hydraulically associated with both the bedrock aquifer and the overburden. It is assumed that the Bass Islands aquifer is effectively hydraulically separated from other surface water features.

June 2007: The Bass Islands aquifer potentiometric surface map generated from data collected on June 29, 2007 is presented on Figure 2.3-32.

The contours developed for June through August 2007 indicate a significantly different flow pattern than the contours developed for the ensuing months. This is likely due to effects from the geotechnical field program, which was being carried out simultaneously with the water level data collection for the summer month monitoring events. Several geotechnical borings in the Fermi 3 area were open during this time period, providing a hydraulic connection between the Bass Islands Group and the underlying Salina Group. Because the vertical gradient between these two units is downward, this provided a temporary local sink for groundwater flow in the Bass Islands aquifer.

The flow pattern indicates that the groundwater appears to be flowing onto the active site area from the north, and converging towards the area of the geotechnical investigation at Fermi 3. The closed contours at Fermi 3 indicate that groundwater is converging on the area from all directions. Groundwater entering this sink in the Bass Islands aquifer is likely being conveyed downward into the Salina Group through the open geotechnical borings.

More distant from the Fermi 3 area, beneath the undeveloped area west of the overflow canal, flow direction is south by southwest. In the area south of Fermi Drive, the flow direction is approximately northward. The southern and northern flow regimes converge along an axis parallel with the location of Fermi Drive, moving toward a local minimum defined at MW-381 D. This flow direction is counter to the regional flow direction, which is approximately toward Lake Erie, but may be impacted by offsite quarry dewatering activities, as previously discussed.

September 2007: The Bass Islands aquifer potentiometric surface map generated from water level data collected on September 28-29, 2007 is presented on Figure 2.3-33.

All the geotechnical borings that had provided vertical hydraulic connection had been abandoned and backfilled at least seven days prior to this monitoring event. This appears to have had a marked effect on the groundwater flow patterns. There are no longer any closed contours or a groundwater sink evident in the potentiometric surface at Fermi 3. The gradient across the Fermi 3 site is comparatively steep, but flow continues to the southwest and west, and appears to flow offsite to the west.

September 2007 is the first month in which water level data was collected from piezometer EB/TSC-C2. Water levels in this piezometer are over four feet higher than those recorded in nearby piezometers P-385 D and CB-C5. The groundwater contour interpretation presented in Figure 2.3-33 displays an elongated lobe of slightly elevated water levels (groundwater mound) over the western half of Fermi 2. The screened interval for piezometer EB/TSC-C2 is considerably shallower than those of P-385 D and CB-C5, creating some complexity in the contour analysis due to the downward gradient in the bedrock (see Subsection 2.3.1.2.2.3.2.4). However, even with the complexities, the contours indicate that the primary flow direction beneath the site is still to the south. The presence of the mound associated with EB/TSC-C2 has the effect of creating a local area of flow beneath Fermi 2 that is directed eastward towards Lake Erie. There is a very small eastward component of flow near MW-391 D in the June potentiometric surface map (Figure 2.3-32), but the inclusion of the elevation data for EB/TSC-C2 accentuates the eastward flow direction in this area.

Flow from the south converges with flow from the north to flow offsite to the west/northwest in the vicinity of MW-381 D.

December 2007: The Bass Islands aquifer potentiometric surface map generated from water level data collected on December 30, 2007 is presented on Figure 2.3-34.

The flow patterns displayed in the potentiometric surface are similar to those observed during the September monitoring event. Flow enters the site from the north and south, and converges to leave the site to the west in the vicinity of MW-381 D. There remains a mound in the potentiometric surface associated with EB/TSC-2, and local flow to the east beneath Fermi 2 is toward Lake Erie. However, the gradient of the flow entering the site from the south appears to be somewhat flatter than was evident in the September map.

March 2008: The Bass Islands aquifer potentiometric surface map generated from water level data collected on March 29, 2008 is presented on Figure 2.3-35.

The flow patterns are similar to those displayed in September and December 2007. Flow enters from the north and south, and exits to the west/northwest in the vicinity of MW-381 D. Mounding is still evident at EB/TSC-2. Locally, flow leaves eastward toward Lake Erie near MW-391 D. The flow gradient of groundwater entering the site from the south continues to flatten.

2.3.1.2.2.3.2.3 **Salina Group – Unit F Aquifer**

One piezometer intended to be screened in the Bass Islands aquifer is completed within the Salina Group (P-398 D). Since only one well is screened in this unit, contours can not be generated for this aquifer. However, water levels at this well were lower than the surrounding water levels from wells screened in the Bass Islands aquifer.

2.3.1.2.2.3.2.4 **Vertical Flow**

The USGS indicated that regionally, the vertical gradient of groundwater flow was downward from the surficial aquifer system to the Silurian-Devonian bedrock aquifer (Reference 2.3-76). Local site data confirm this conceptual understanding. Beneath the site, the vertical component of groundwater flow is predominantly downward from the overburden to the Bass Islands aquifer. This is generally evidenced by the paired hydrographs displayed on Figure 2.3-36.

These hydrographs display monthly water level time series for well pairs in which one well is completed in the overburden, and the immediately adjacent well is completed in the bedrock aquifer. The well pairs in the southern half of the site (MW-381, MW-383, MW-384, MW-386, P-385) display strong downward gradients from the overburden to the bedrock aquifer, with head differences of over 15 ft in some cases (MW-381).

To the north at site MW-395 located along the overflow canal, there is only a very slight difference in head between the two zones, indicating that they are nearly in equilibrium with one another. This is an indication that the Bass Islands aquifer may be receiving more recharge in this area than further south at Fermi 3. Well pairs MW-388/GW-04 and MW-393 S/D, located along the western site boundary in the undeveloped portion of the site, display hydrograph lines that cross, indicating that the direction of vertical flow, though predominantly downward, may reverse locally with seasonal conditions.

The effect of the open geotechnical boreholes during the summer months is also reflected on the hydrographs of the wells located at Fermi 3. Hydrographs for MW-387 D and P-385 D, located within the geotechnical subsurface investigation area, display lower water levels for the months of June through August that recover significantly in September after the geotechnical borings were properly abandoned and the hydraulic connection between the Bass Islands Group and the Salina Group was removed. This is additional evidence of a downward vertical gradient.

As previously discussed, the Fermi 3 water level patterns for the Bass Islands aquifer for June, July, and August 2007 reflect the presence of a groundwater sink in the area of the geotechnical borings (July and August maps are included in FSAR Appendix 2.4BB). These borings were left open into the Salina Group during this time, and the presence of the closed contour in these maps indicates that water flowed from the Bass Islands Group downward into the Salina Group via the open boreholes, indicating a downward vertical gradient.

Evidence that flow is downward from the Bass Islands aquifer to the Salina Group is also reflected in water levels collected at P-398 D. Although this is the only well completed in the Salina Group, the groundwater elevations here are consistently and significantly lower than those recorded in the nearest Bass Islands wells (MW-391 D and MW-395 D), providing further evidence of a downward gradient between the units.

Downward vertical flow is also evident in the bedrock based on water level data from monitoring wells and piezometers screened in different zones within the Bass Islands aquifer in the immediate area of Fermi 3. The water levels were higher in shallow wells and lower in deeper wells. As noted previously in Subsection 2.3.1.2.2.3.2.2, water level elevations in piezometer EB/TSC-C2 (where the effective interval monitored is centered at approximately elevation 543 ft NAVD 88) were over four feet higher than elevations in nearby piezometers CB-C5 and P-385 D (where the effective interval monitored is centered at approximately elevation 505 ft NAVD 88), providing evidence of downward gradient within the Bass Islands aquifer. For reference, Figure 2.3-43 displays monitored intervals for the monitoring wells and piezometers. The figure also provides the locations of the monitored interval relative to the Bass Islands Group and Salina Group Unit F.

In addition, heat pulse data was collected during geophysical logging of geotechnical borings RB-C8 and TB-C5, and hydrogeologic borings MW-384 D, P-385 D, P-398 D, and P-399 D. Heat pulse data in P-384 D and P-385 D indicate downward flow within the Bass Islands aquifer. Data from the other borings where heat pulse readings were recorded indicate downward flow from the Bass Islands aquifer into the Salina Group.

2.3.1.2.2.3.2.5 **Temporal Groundwater Trends**

Reeves documented the water level declines in Monroe County from 1991-2001. The USGS well database was queried for well data that provides up to date water level data in Monroe County. Water level maps for 1991 and 2008 are described in Subsection 2.3.1.2.2.3.1. This subsection presents temporal groundwater trends in Monroe County.

Figure 2.3-37 (Reference 2.3-93) displays hydrographs for selected Monroe County monitoring wells for the years 1991 through 2008. Several different temporal trends are evident across the county from these hydrographs.

Well G-28, located in the area of regional inflow in the southwest corner of the county, displays no long-term decline evident in the water level hydrograph. This well displays large seasonal fluctuations in water level (up to 40 ft in some years), but displays no long-term declines since 1991.

Well G-33, located in the southeast corner of the county in an area of groundwater discharge to Lake Erie, also shows stable water levels over the period, indicating no water level declines with time. Seasonal fluctuations in this well are small by comparison, only about four feet.

Wells G-8 and G-12 hydrographs display a declining trend from 1991 to 2003, then rebounding water levels from 2003 until 2008. This pattern appears to be evidence of the operation of nearby quarrying for the first part of the hydrograph, reflected by the declining water levels associated with dewatering. The rising water levels in the second half of these hydrographs reflect rising water levels resulting from the closing of the quarry and cessation of dewatering. London Quarry ceased operations in 2003.

Well G-4, located in the northeast part of the county within the influence of the several quarries, displays a declining trend with no water level recovery evident to date. Operations at quarries in this area continue to the present day.

Well G-17, located just southwest of the City of Monroe, displays the largest water level decline through this time period, with levels dropping nearly 90 ft between 1994 and 2002. This well is within the influence of the Dennison Quarry (formerly known as the Hanson Quarry), which is currently operating.

Wells G-14, G-15, and G-16, located west of the Fermi site, all show moderate declines of about 10 to 15 ft since 1991, with no recovery apparent to date. These wells are located approximately midway between the cones of depression associated with the quarries to the north and the Dennison Quarry to the south. The moderate declines in this area may be a combined result from both operations.

2.3.1.2.2.4 **Hydrogeologic Properties of Subsurface Materials**

This subsection presents data on the hydrogeologic properties of the overburden and the bedrock aquifer subsurface materials beneath the site.

2.3.1.2.2.4.1 **Overburden**

Hydraulic conductivity in the overburden is highly variable. In order to estimate hydraulic conductivities in the overburden, seventeen slug tests (Reference 2.3-94) were performed on thirteen shallow wells or piezometers as part of the site hydrogeologic investigation. Slug tests were performed in the field in June 2007 using electronic transducers to record water levels.

Assumptions for slug test analysis of unconfined strata were as follows:

- Aquifer thickness is equivalent to saturated thickness in the unconfined zone
- Saturated thickness is equivalent to well depth minus depth to water
- Screen length from field well completion diagrams and tables were used
- No “skin effects” due to drilling mud cake on the borehole wall were present
- Well filter pack porosity was assumed to be 0.3
- Horizontal to vertical anisotropy ratio was assumed to be 1

Eleven tests yielded slug test data typical of a damped response to initial displacement, and were analyzed using traditional methods. Slug test data was analyzed using the software Aqtesolv© Version 3.0 and Version 4.5 (Reference 2.3-95), using the assumptions described previously. Analyses on wells with damped response to initial displacement were performed using two methods for which the fundamental assumptions are valid: the Hvorslev method for unconfined aquifers and the Bouwer-Rice method for unconfined aquifers. The average of these two values was calculated and reported as a representative hydraulic conductivity in the immediate vicinity of the monitoring well/piezometer.

Six of the slug tests were performed on monitoring wells/piezometers screened in the rock fill. Inspection of data for these wells (P-385 S, MW-387 S, MW-390 S, MW-391 S, P-392 S, and P-396 S) indicate that initial displacement was small (on the order of one to several inches) and response nearly instantaneous (one to three seconds). The oscillatory pattern of these data indicate conditions of high hydraulic conductivity, wherein inertial forces of water movement and well bore storage effects may be greater than the forces governing flow in porous media. The Butler solution method for unconfined aquifers of high hydraulic conductivity was used to analyze these data (Reference 2.3-95).

Calculated hydraulic conductivity values for the overburden ranged from 0.015 to 20 ft/day in the glacial materials, and 251 to 1776 ft/day in the rock fill. Table 2.3-25 provides hydraulic conductivity estimates for the wells screened in the overburden. Figure 2.3-38 displays the locations of overburden hydraulic conductivity results on the site map. Slug test data are included in FSAR Appendix 2.4CC.

2.3.1.2.2.4.2 **Bass Islands Aquifer**

Estimates of hydraulic conductivity (or the associated parameter transmissivity, which is hydraulic conductivity multiplied by aquifer thickness) within the Bass Islands Group may vary widely with location. In Monroe County, USGS monitoring wells G-29 and G-30 are located in the southern part of the county just over a mile from each other. Their reported transmissivities are 3400 ft^2/day and 10 ft^2/day, respectively, a difference of over two orders of magnitude (Reference 2.3-76).

Reeves used an estimate of 5.0 ft/day as representative of the Bass Islands Group hydraulic conductivity in the USGS regional groundwater model (Reference 2.3-76).

A pump test performed south of the site near Stony Point in 1959 yielded hydraulic conductivity estimates of 10.6 ft/day and 36.1 ft/day for two different zones in the bedrock aquifer. One of these zones may have been at least partially in the Salina Group. Estimates for the storage coefficient of the aquifer from these aquifer tests ranged from 4.1 x 10^{-5} to 2.5 x 10^{-4}. These storativity values are typical of confined aquifer conditions. (Reference 2.3-96)

To estimate the hydraulic conductivity in the local bedrock aquifer beneath the site, packer tests were performed in boreholes advanced into the Bass Islands Group. Tests were performed at multiple depths in each borehole in zones which were identified from boring logs or geophysical logs as being fractured. Transducers were placed in the target test zone, and also in the zones directly above and below the packers to record piezometric heads and determine if there were any packer leaks or hydraulic connection with zones outside the target zone. Injected water into the test zone of the aquifer was also recorded with time. Packer test analyses are performed using the equation reported in Royle (Reference 2.3-97):

$$T = \frac{Q \ln\left(\frac{R}{r_b}\right)}{2\pi P_i}$$ [Eq. 1]

where:

T = Transmissivity (ft^2/day)
Q = Injection flow rate (ft^3/day)
R = Radius of influence (ft)
r_b = Radius of borehole (ft)
P_i = Net pressure injection (ft)

and

K = T/b [Eq. 2]

where:

K = Hydraulic conductivity (ft/day)
T = Transmissivity (ft^2/day)
b = Length of interval tested

Hydraulic conductivity in the Bass Islands Group is highly variable. In general, hydraulic conductivity decreases with depth in this unit. Some packer test data indicated hydraulic connection with zones above or below the zone being tested, thereby violating the assumptions of the analysis. However, these data are included in the presentation of results for the purpose of completeness. If these data are not considered, the average hydraulic conductivity calculated for the Bass Islands zone is 3.28 ft/day. If these data are considered, the average is 6.93 ft/day.

A summary table of hydraulic conductivity estimates calculated from packer test analysis results for the boreholes advanced into the Bass Islands Group is presented on Figure 2.3-39 and in Table 2.3-26. Packer test data is included in FSAR Appendix 2.4DD.

2.3.1.2.2.5 **Potential Reversibility of Groundwater Flow**

On a regional level, the potential exists for reversal of groundwater flow due to the large impact of quarry dewatering on the water levels in Monroe County and surrounding counties. Presently, multiple quarries are operating that significantly impact water levels in the county. Water levels have declined nearly 90 ft southwest of the site, and nearly 40 ft to the north of the site. These regional cones of depression may be affecting the current local flow direction, at the site. In other words, the present flow pattern is reversed from the pre-development flow pattern. If the quarries were to stop operating, water levels in the county could potentially recover to the point that the flow direction beneath the site might revert to the natural pre-development patterns.

As stated previously, Fermi 3 operations do not rely on groundwater and therefore have no impact on reversibility.

On a local scale, however, construction of Fermi 3 includes excavation into the Bass Islands Group to build foundations. This activity will require temporary dewatering of the excavation site to levels approximately 45-50 ft below the present groundwater elevation. This will alter groundwater flow locally near the site. A groundwater model is utilized to estimate the offsite area in the Bass Islands aquifer to experience drawdown resulting from excavation dewatering activities during construction of Fermi 3.

2.3.1.2.2.5.1 **Groundwater Modeling for Excavation Dewatering**

A published 2003 USGS MODFLOW (Reference 2.3-98 and Reference 2.3-99) regional model was used for this analysis. The original regional model was a steady-state model, and this application is also steady-state. The proprietary software package Groundwater Modeling System Version 6.0 (Reference 2.3-100) was used for pre- and post-processing.

The active area of the model includes all of Monroe County and parts of six other counties in Michigan and Ohio (Figure 2.3-25). The purpose of the original regional USGS MODFLOW groundwater model is to simulate regional water level declines associated with the increased dewatering activities by the quarrying industry in Monroe County. The purpose of this model application is to evaluate offsite effects of excavation dewatering, including drawdown and flow changes.

The original regional model grid was re-discretized vertically and laterally to provide a finer grid in the excavation area. The original grid is 297 rows x 194 columns x 10 layers. The refined grid consists of 349 rows x 235 columns x 11 layers (Figure 2.3-40). All physical and hydrogeologic parameters are retained from the regional model. Quarry dewatering in the original regional model was represented using MODFLOW's drain package. This conceptual approach was maintained for the excavation dewatering analysis. The target groundwater elevations during dewatering, represented by the assigned MODFLOW drain elevation, are five feet lower than the excavation bottom elevation. The overlying glacial material will be stripped away.

Two simulations were performed as follows representing two possible approaches to the excavation system combining excavation support and seepage control:

- A reinforced diaphragm concrete wall surrounding the excavation with the interior bedrock below the excavation grouted.
- A grout curtain or freeze wall surrounding the excavation with the interior bedrock below the excavation grouted.

The effects of a pressure grouting program are represented by reducing the hydraulic conductivity of the rock below the excavation from the native value of 1.54 to 0.29 m/day, based on reported results from the Fermi 2 grouting program (Reference 2.3-101). Diaphragm concrete wall cells are assigned a hydraulic conductivity of 1.0 x 10^{-7} cm/sec (8.64 x 10^{-5} m/day), a value representative of a hydraulic barrier wall.

Figure 2.3-41 and Figure 2.3-42 display the 1-ft drawdown contour for each of the two simulations described, along with the location of registered wells in the Michigan state database. On Figure 2.3-41, which represents the diaphragm concrete wall simulation, the 1-ft drawdown contour is entirely within the site. On Figure 2.3-42, which represents the grout curtain or freeze wall, the 1-ft drawdown contour is approximately 8500 ft from due west of the reactor. These results reflect the fact that the second simulation represents less restrictive barrier conditions (grout curtain or freeze wall) than the first simulation (with perimeter diaphragm concrete wall).

Drawdown of this magnitude in the bedrock aquifer should not impact water levels in the onsite wetlands. The wetlands are hydraulically connected to Lake Erie via culverts, so the lake level will control wetland water levels at the site.

2.3.1.2.2.6 **Potential Recharge Areas Within Influence of Plant**

As discussed during presentation of the site water level data in Subsection 2.3.1.2.2.3.2.2, it appears that the Bass Islands aquifer may be receiving recharge from the overlying overflow canal through the glacial till. However, there is no onsite use of Bass Islands aquifer groundwater, so there is no significant consequence should this local recharge feature be temporarily affected.

2.3.1.2.3 **Subsurface Pathways**

This subsection presents an evaluation of subsurface pathways for a release at Fermi 3 to the groundwater. The subsection focuses on advective groundwater flow.

2.3.1.2.3.1 **Potential Contaminant Pathways**

As discussed in Subsection 2.3.1.2.1.1, the geology beneath the site consists of native glacial deposits and imported fill, overlying Bass Islands Group dolomite. This subsection discusses possible subsurface pathways in groundwater through the overburden and bedrock.

If a release was to enter the groundwater within the overburden, the water supply receptor for this scenario is considered to be Lake Erie or other contiguous surface water features such as the overflow canal. The distance from the center of the Reactor Building to the overflow canal is the shortest pathway to a potential receptor. The gradient in the vicinity of Fermi 3 is very low, and as a result may actually display changes in direction during different months. A westward gradient toward the overflow canal is observed during several months, so this pathway is possible. The distance is about 820 ft.

If a release was to enter the Bass Islands aquifer, potential pathways are considered for the following two conditions:

- The documented present day condition, in which the groundwater flow direction in the Bass Islands aquifer is westward offsite.
- A possible future condition in which the flow direction has returned to flow toward Lake Erie.

The documented groundwater flow direction beneath the Reactor Building is consistently south by southwest, with the flow direction changing to west by northwest as the groundwater flows offsite (Figure 2.3-34). The nearest exposure point offsite along this flow path is household well 58000002901, listed in the state database as a bedrock well with a depth of 74 ft and use type of household. The well is located immediately west of the corner of Fermi Drive and Toll Road (Figure 2.3-22). The distance from the Reactor Building to this well is approximately 4756 ft along the flowpath. (Reference 2.3-89)

As discussed in Subsection 2.3.1.2.2.5, the possibility exists for a return to flow toward Lake Erie in the Bass Islands aquifer should all quarry dewatering in the county come to a halt. In this case the most direct pathway toward a potential receptor (Lake Erie) is approximately 1476 ft to the east. This assumes that Lake Erie and the Bass Islands aquifer are in hydraulic communication at the shoreline, which is a conservative assumption.

2.3.1.2.3.2 **Advective Transport**

Advective transport assumes that any release to the groundwater travels at the same velocity as groundwater flow. The groundwater flow velocity (or seepage velocity) is calculated from the following equation (Reference 2.3-102):

$$V = Ki/ n_e \qquad \text{[Eq. 3]}$$

where:

V = Average linear velocity (ft/day)
K = Hydraulic Conductivity (ft/day)
i = Hydraulic gradient (ft/ft)
n_e = Effective porosity (dimensionless)

The travel time from the source to the receptor is calculated by:

$$T = D/V \qquad \text{[Eq. 4]}$$

where:

T = Travel time (days)
D = Distance from source to receptor (ft)
V = Average linear groundwater velocity (ft/day)

Groundwater velocity is locally dependent on hydraulic conductivity, hydraulic gradient, and porosity. Hydraulic conductivity is estimated from slug test and packer test data collected during the Fermi subsurface investigation, and is discussed in Subsection 2.3.1.2.2.4.1 and Subsection 2.3.1.2.2.4.2. Hydraulic gradient is estimated from Fermi 3 potentiometric surface maps (November water level maps were selected as being representative of site conditions). No porosity field data was collected , so literature values were used. Seepage velocity calculations were performed using the high and low range estimates of porosity (10-25 percent for glacial till, 25 percent for rock fill, 1-20 percent for limestone/dolomite) to bracket the range of possible results (Reference 2.3-102 and Reference 2.3-103).

For a direct release to the rock fill overburden at Fermi 3, the following conditions are assumed. Hydraulic conductivity is 1170 ft/day based on the P-385 S slug test. The gradient is 0.0007, based on the November water table map (FSAR Appendix 2.4BB), and porosity is 25 percent for the rock fill. This results in a calculated flow velocity of 3.27 ft/day. Applying this velocity to the pathway distance of 820 ft to the overflow canal, the travel time is calculated to be 0.69 years (250 days). This assumes instantaneous delivery to the water table (i.e., no time to travel through the vadose zone from the surface).

For a direct release to the Bass Islands aquifer under present day potentiometric surface conditions, the following conditions are assumed:

- The average gradient along the flowpath from Fermi 3 to the point that it leaves the site to the west is 0.002
- Porosity is assumed to be one percent, the most conservative estimate

The highest hydraulic conductivity estimate for a packer test that did not indicate vertical leakage to adjacent zones was 17.57 ft/day (MW-395 D at 37 ft: it should be noted that this boring is near the cooling towers, not along the flowpath). The lowest hydraulic conductivity for a valid packer test is 0.11 ft/day (MW-383 D at 67 ft). Based on the maximum hydraulic conductivity estimate, the calculated velocity is 3.5 ft/day. Based on the minimum hydraulic conductivity estimate, the calculated velocity is 0.02 ft/day. Based on a pathway distance of 4756 ft, the two velocity estimates yield travel time estimates along this pathway to the offsite well west of the site ranging from 3.7 years to 652 years.

To evaluate the pre-development groundwater flow gradient, Figure 2.3-25 was reviewed and an eastward gradient of 0.001 was estimated near the Fermi plant. For a direct release to the Bass Islands formation under pre-development conditions with this gradient and the range of hydraulic conductivities discussed in the previous paragraph, calculated groundwater velocities range from 0.01 to 1.76 ft/day. Based on this range of velocities, the estimated travel time for the 1476-ft pathway east to Lake Erie ranges from 2.3 years to 368 years.

2.3.1.2.4 **Groundwater Monitoring**

A limited groundwater level monitoring program at Fermi 2 is currently performed as part of the Radiological Environmental Monitoring Program (REMP). Fermi 2 has four groundwater wells included in its REMP which are monitored monthly for water levels and sampled quarterly for the radionuclides and sensitivities specified in the Offsite Dose Calculation Manual (ODCM) (Reference 2.3-104).

In addition, 16 groundwater monitoring wells have been installed around Fermi 1 in support of decommissioning activities. These are also sampled on a quarterly basis with samples assayed for tritium and gamma emitters for the sensitivities specified in the Fermi 2 ODCM.

Some of the existing Fermi 3 piezometers will be abandoned prior to construction activities due to anticipated earth work and heavy construction requirements. It is not anticipated that this will affect any future groundwater monitoring program. However, prior to the commencement of construction activities, the monitoring well network will be evaluated to determine if any significant data gaps are created by the abandonment of existing wells.

As part of the detailed design for Fermi 3, the present groundwater monitoring programs will be evaluated with respect to the addition of Fermi 3 to determine if any modification of the existing programs is required to adequately monitor plant effects on the groundwater. As mentioned previously, several wells exist onsite from previous projects and investigations. It may be possible to integrate some of these wells into future monitoring activities. Any revised integrated monitoring plan will adhere to the guidance outlined in “Integrated Ground-Water Monitoring Strategy for NRC-Licensed Facilities and Sites: Logic, Strategic Approach and Discussion” (Reference 2.3-105). Possible components of monitoring plans to be evaluated may include the following for both the overburden and the Bass Islands aquifer.

- Construction Groundwater Monitoring:
  - During construction dewatering, piezometers are monitored as needed to evaluate drawdown of overburden and bedrock groundwater levels associated with dewatering. Detroit Edison will use Fermi 3 wells or piezometers, as appropriate. Monitoring is performed at frequent intervals when construction dewatering begins, in order to document water level declines. Monitoring frequency is reduced after dewatering levels have stabilized.

  - Post construction dewatering: Monitor shallow and bedrock piezometers and monitoring wells monthly to establish groundwater flow patterns with Fermi 3 in-place. Use dewatering piezometers and Fermi 3 monitoring wells and piezometers, as appropriate.

- Pre-operational Groundwater Monitoring:

  - Two monitoring well nests, one upgradient and one downgradient of Fermi 3, are established. The monitoring well nest locations are based on the post dewatering flow patterns. If existing wells are insufficient, new wells may be installed.

  - One set of groundwater samples is collected from each of the Fermi 3 upgradient and downgradient locations. The water samples are analyzed for radionuclides and sensitivities specified in the ODCM. These results are used to characterize background water quality.

  - Measure groundwater levels monthly. Use dewatering piezometers and Fermi 3 piezometers, as appropriate.

- Operational Groundwater Monitoring:

  - Measure groundwater levels quarterly. Use new upgradient and downgradient monitoring locations, dewatering piezometers, and Fermi 3 hydrogeology monitoring locations, as appropriate.

  - Groundwater samples are collected quarterly for radionuclide monitoring (REMP). Samples are collected from upgradient and downgradient wells of Fermi 3, and existing REMP wells included in the current Fermi 2 monitoring program. The water samples are analyzed for radionuclides and sensitivities specified in the ODCM.

- Operational Groundwater Accident Monitoring:

  - This is triggered in the event of an accidental liquid release from Fermi 3, and includes monthly groundwater sampling of the upgradient well and selected wells located downgradient from the point of release. Wells are selected based on flow directions documented in the most recent water level maps available for the site. The water samples are analyzed for radionuclides and sensitivities specified in the ODCM.

Safeguards will be implemented to minimize the possibility of adverse impacts to groundwater due to construction and operation of Fermi 3. Such safeguards would include typical Best Management Practices (BMPs) for storage, handling, and conveyance of hazardous materials, such as appropriate containment areas around storage tanks, emergency cleanup procedures in the event of surface contaminant spills, secure hazardous materials storage areas, etc.

2.3.2 **Water Use**

This subsection describes surface-water and groundwater uses that provide the baseline for assessing the impacts of construction and operation of Fermi 3. Subsection 2.3.2.1 addresses surface-water use. Subsection 2.3.2.2 addresses groundwater use.

This subsection identifies consumptive and non-consumptive water uses, and quantifies water consumptions, withdrawals, and returns. The projected water use for Fermi 3 as well as local and federal specifications and permits concerning water use within the Fermi site area are described.

2.3.2.1 Surface-Water Use

2.3.2.1.1 Surface-Water

The Fermi site is located within the Swan Creek watershed, which is the smallest drainage basin within the region; it is bordered by the Huron River basin from the north and the River Raisin basin from the south. The mouth of Swan Creek is located approximately 1.3 miles north of the Fermi site. The location of Fermi 3 relative to the closest watersheds is shown on Figure 2.3-13. The regional view of Lake Erie and its major tributaries are shown on Figure 2.3-5. The tributaries in the vicinity of the Fermi site (Swan Creek, Stony Creek, and the River Raisin) are described in more detail in Subsection 2.3.1. Figure 2.1-2 shows the 7.5-mile vicinity with the water bodies and land features identified. Consistent with the discussion in Subsection 2.3.1, only Lake Erie and Swan Creek water users are potentially impacted by the construction and operation of Fermi 3.

The Fermi 3 water use is described in Section 3.3. Lake Erie is the principal source of water to the operation of the station. The most important Lake Erie parameter with respect to water use is lake water level. Fermi 3 has been designed to operate at full capacity assuming the lowest historical water level at the plant basin intake. A discussion of historical lake levels is provided in Subsection 2.3.1. The vast size of the lake and its flow characteristics render the ability to obtain necessary cooling water flow insensitive to non-Fermi consumptive water use affects, potential flow diversions, or water rights issues. These topics are discussed further in Subsection 2.3.2.1.2, Subsection 2.3.2.1.3, and Subsection 2.3.2.1.4.

2.3.2.1.2 Consumptive Surface-Water Use

There are two categories of surface-water use, withdrawal (non-consumptive) and consumption:

- “Withdrawal” refers to water drawn from the surface or groundwater sources that eventually returned to the area from where it came.
- “Consumption” refers to water that is withdrawn but not returned to the region.

The Great Lakes Basin has nine main sectors of water consumption: Public Water Supply, Self-Supply Domestic, Self-Supply Irrigation, Self-Supply Livestock, Self-Supply Industrial, Self-Supply Thermoelectric (Fossil Fuel), Self-Supply Thermoelectric (Nuclear), Hydroelectric, Self-Supply Other. The most recent data collected concerning these sectors has been by the Great Lakes Commission (Reference 2.3-35).

The nine sectors are defined in Table 2.3-28. Table 2.3-29 displays a representation of the sectors for states that border the Great Lakes (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, and Wisconsin), as well as two provinces of Canada (Quebec and Ontario). The consumptive use coefficients are actually the percentages listed categorically on the table for each sector. The percentage represents the amounts of water actually consumed from the withdrawals.

The actual withdrawals and consumption of Great Lakes water have decreased by 48 percent in the past two decades. The decrease is largely a result of technological innovations, many of which improve the quality of water discharged back to the basin. However, the public data on withdrawals overstates certain consumptive uses. For example, hydroelectric utilities routinely are cited as among the largest users of Great Lakes water. In fact, all but one percent of billions of gallons of water utilized to drive turbine generators are returned to the basin. Considering hydroelectric use, the volume of Great Lakes withdrawals decreases from 845 billion gallons per day to 45 billion gallons per day, a 95 percent difference (Reference 2.3-34).

The yearly consumptions and water withdrawal totals for Lake Erie is shown in Table 2.3-30 through Table 2.3-33. These tables contain information retrieved from the Great Lakes Commission Great Lake Basin reports from 1998 through 2004. Table 2.3-30 provides the data for 2004, formatted to display the yearly withdrawals and consumptions in accordance with each of the nine sectors defined in Table 2.3-28. Table 2.3-30 also identifies definitions regarding the nomenclature used in the charts by the Great Lakes Commission. The same nomenclature is used in Table 2.3-31 through Table 2.3-33. Table 2.3-31 provides similar data for the years 2002 and 2003 withdrawals and consumption for Lake Erie (Reference 2.3-41 and Reference 2.3-42). Table 2.3-32 provides the same data for 2000 and 2001 (Reference 2.3-43 and Reference 2.3-44). Table 2.3-33 provides the same data for 1998 and 1999 (Reference 2.3-45 and Reference 2.3-46).

The main sectors of water consumption regarding the region of influence from the construction and operation of Fermi 3 obtained from the MDEQ are the following: Thermoelectric Power Generation, Public Water Supply, Agricultural Irrigation, Self-Supply Industrial, and Golf Course Irrigation. Water use information (total water use) for these sectors for Monroe County for the years 2000 through 2006 is summarized in Table 2.3-34.

Table 2.3-35 and Table 2.3-36 further identify the significant water users with the sectors identified in Table 2.3-34 for 2005 through 2006. Table 2.3-35 presents the total water usage by each of these users (Reference 2.3-35). For these same users, Table 2.3-37 identifies the capacity for each. Table 2.3-35 and Table 2.3-36 consist of the specific facilities within Monroe County that use a significant amount of water from the western basin of Lake Erie. The quantities for the most significant Industrial, Irrigation, and Thermoelectric facilities are listed. Table 2.3-35 through Table 2.3-37 show that the current water use for Fermi 2 is relatively small, representing approximately 3 percent of the overall water used by the three power generation facilities located nearby (Reference 2.3-38).

Figure 2.3-44 illustrates the total withdrawals by sector for the State of Michigan. The capacity for the withdrawals of the three thermoelectric power generation facilities located in the vicinity of Fermi 3 is shown in Table 2.3-37. Accordingly, the local influence of water withdrawals from the western basin of Lake Erie for thermoelectric power generation is less than 25 percent of the withdrawal quantities for the State of Michigan.

Agricultural industries within the vicinity of Fermi 3 are taken into consideration, although they may have little or no impact in terms of water use. Industries, business parks and recreation, along with agricultural elements that are located approximately within a 32-mile radius, are of slight or no concern due to relatively smaller surface-water usage. Table 2.3-39 identifies the water intake pipelines for Frenchtown Township and Monroe water systems of Monroe County, which serve as a combined raw water pumping plant. The distances and direction shown on Table 2.3-39 represents the approximate distance between the beginning Frenchtown Township and Monroe water intake pipelines that extends out into the western basin of Lake Erie and the end of discharge pipeline of Fermi 3. The average daily water consumption values for the year 2006 listed for each system are minimal with respect to the water source of the western basin of Lake Erie.

As shown on Figure 2.3-13, Fermi 3 is encompassed by the Swan Creek Watershed which is approximately 106 square miles. Swan Creek is the main outlet for the area within this watershed. The Swan Creek outlet is approximately 1.4 miles NE of Fermi 3 as shown on Figure 2.3-13. The mean monthly flow rates for Swan Creek are shown in Table 2.3-15. Fermi 3 is located at the relative location where Swan Creek flows into Lake Erie.

2.3.2.1.3 **Non-Consumptive Surface-Water Use**

In the Great Lakes Basin, non-consumptive withdrawals comprise 95 percent of water use, consumption five percent. The vast majority of withdrawals, 90 percent, are from lakes, while five percent is withdrawn from streams and five percent from groundwater sources. The graphic on Figure 2.3-45 illustrates the water withdrawals of each of the Great Lakes states and provinces.

The same five factors identified in Table 2.3-34 can also be associated with non-consumptive surface-water use:

- Thermoelectric Power Generation
- Public Water Supply
- Agricultural Irrigation
- Self-Supplied Industrial
- Golf Course Irrigation

The degree of impact for each sector is shown on Figure 2.3-46 which displays the total withdrawal rates for each sector for the fiscal year of 2004. The volumes of water per day for the Thermoelectric Power Generation sector combines water withdrawal due to thermoelectric power generation from all fuel types (Reference 2.3-35).

Comparing the amount of withdrawals taken within the vicinity of Fermi 3 provided in Table 2.3-34 with water supplies to Lake Erie represented in Table 2.3-27 shows that the water usage by thermoelectric power generation is relatively small. The net total supply for Lake Erie based in 2005 averages approximately 46,661 billion gallons per year and the most conservative amount of withdrawals estimated per year for Monroe County totals approximately 670 billion gallons per year, which is approximately 1.4 percent of the total of Lake Erie net total supply. Additionally, when considering the water withdrawal of the entire region on Lake Erie from the 2004 Basin Report shown in Table 2.3-30, the impact is less than 50 percent of the Net Total Supply. The specific amount of withdrawals that will be made by Fermi 3 are discussed in Section 3.3 (Reference 2.3-34).

Along the shoreline of Lake Erie in Monroe County, there are numerous communities with beaches and boating facilities. Recreational activities include swimming, water skiing, motor boating, and sport fishing. The following are the principal communities with recreational water use facilities within a 6-mile radius of Fermi 3.

- Pointe Aux Peaux (1 mile S)
- Stony Point (1 mile SSW)
- Estral Beach (2 miles NE)
- Woodland Beach (3 miles WSW)
- Detroit Beach (4 miles WSW)

Subsection 2.2.1.2.5 also provides information on recreational water use.

2.3.2.1.4 **Statutory and Legal Restrictions on Surface-Water Use**

The State of Michigan Water Law, that became effective on February 28, 2006, amended Parts 327 and 328 of the Natural Resources and Environmental Protection Act and Safe Drinking Water Act which require annual reports on withdrawals by water users with a capacity to withdraw more than 100,000 gallons of water per day over any 30-day period, even if the actual withdrawals are less. Fermi 3 will be an additional facility in this category. Table 2.3-38 displays the type, number of facilities, and amounts of daily withdrawals (Reference 2.3-34).

Part 327 prohibits a new or increased large quantity withdrawal from causing an “adverse resource impact.” An adverse resource impact is defined as impairing the lake or stream’s ability to support its characteristic fish population. The MDNR can determine the characteristic fish population of a stream by comparing the amount of groundwater contributing to stream flow to the size of the stream’s watershed. Taking too much water from a stream will change the flow depth, velocity, and temperature of the stream; and hence the types of fish expected to be found there. Until February 28, 2008, Part 327 prohibited an adverse resource impact only to trout streams. After that date, it prohibits an adverse resource impact to all streams and lakes. Additionally, under Part 327, a new or increased withdrawal from one of the Great Lakes of greater than five million gallons per day would require additional reviews (Reference 2.3-34).

A permit will not be granted if the withdrawal would cause an adverse resource impact. If the withdrawal is from a Great Lake, all water withdrawn, less consumptive use must be returned to the lake’s watershed. The withdrawal must comply with other laws, including regional and international agreements concerning use of Great Lakes water. The proposed use must be reasonable under traditional Michigan Water Law. And, the applicant must consider voluntarily adopting water-use conservation measures. A person proposing a withdrawal that does not need a permit may request the MDEQ to determine whether the withdrawal would cause an adverse resource impact

(Reference 2.3-34). The other permits and requirements that will be needed in order to construct and operate Fermi 3 are listed in Section 1.2.

2.3.2.2 Groundwater

Subsection 2.3.1.2 and FSAR Subsection 2.4.12 discuss groundwater use that is within the hydrological influence of Fermi 3. Based on detailed information gathered and developed, local groundwater use in the vicinity of the Fermi site is primarily limited to individual residences. Subsection 2.3.1.2 provides details of groundwater wells within a 25-mile radius of Fermi 3.

2.3.2.3 Projected Future Water Use

Projected water use was estimated based on year 2000 water use data documented in USGS Circular 1268 supplemented with the State of Michigan Water Use data for Thermoelectric Power Generation for the year 2000, and data presented in USGS Investigations Report 03-4312 to estimate year 2000 water use by water user group. Water user groups identified in this document include Public Supply, Self-Supplied Domestic, Industrial (including quarries), Irrigation, and Thermoelectric.

Based on population projection data (Subsection 2.5.1) and the 2000 water use data, estimates were developed of future water use by user group through the year 2060. A direct linear relationship was assumed between population and water usage for water user groups Public Supply, Self-Supplied Domestic Users, and Industrial Users. The projected water use was increased or decreased by the percentage change in population for both Monroe and Wayne counties. For the user group categories of Irrigation, Livestock, and Thermoelectric Power Generation, no direct linear relation with population was assumed. Projected use estimates for these categories were maintained at the level of usage reported in the year 2000.

Projected water use by user group for Monroe County and Wayne County, Michigan, is presented in Table 2.3-40 and Table 2.3-41, respectively.

2.3.3 Water Quality

This section describes the site-specific surface-water and groundwater characteristics that could be affected by Fermi 3 construction and operation or that could affect water use and effluent disposal within the vicinity of the Fermi site. The Fermi site is located on the western shore of Lake Erie within the Swan Creek drainage basin. Water quality data was obtained through the Environmental Protection Agency (EPA) Great Lakes Environmental Database (GLENDA) and STORET (short for STOrage and RETrieval) database, MDEQ databases, USGS National Water Information System (NWIS) database, Fermi site surface-water and groundwater sampling, and other available sources.

The data acquired provides the basis to characterize the water bodies in terms of water quality impacts and suitability for aquatic organisms and to serve as a baseline for assessing impacts of Fermi 3 construction and operations. Effluent discharges during Fermi 2 operations are monitored and regulated within the NPDES permitting program and NRC license. Fermi 2 is currently permitted under NPDES Permit No. MI0037028 (Reference 2.3-59). This permit authorizes the discharge of wastewater from the following outfalls (see Figure 2.3-47):

- Outfall 001, Lake Erie - Monitoring Point 001A, cooling tower blowdown, processed radwaste wastewater, chemical metal cleaning wastes, non-chemical metal cleaning wastes, and residual heat removal system service water excess to Lake Erie. Monitored parameters include flow, temperature (intake and discharge), total residual chlorine, dechlorination reagent, BetzDearborn Spectrus CT-1300 (a zebra mussel control additive), total mercury (intake, discharge, net discharge), pH, total suspended solids, oil and grease, total copper, and total iron. Monitoring Point 001B, residual heat removal service water decanted to circulating pond, only after CT1300 verified below 50 ppb in the residual heat removal reservoir. Monitoring Point 001D, internal radwaste decant outfall used only once after the Fermi 2 turbine accident. Under normal conditions, Fermi 2 is a zero liquid radwaste discharge plant.
- Outfall 009, Swan Creek via an overflow canal - low volume wastes, chemical metal cleaning wastes and non-chemical metal cleaning wastes, and stormwater runoff to Swan Creek via an overflow canal. Monitored parameters include flow, total suspended solids, oil and grease, total copper, total iron, total boron, total residual chlorine, dechlorination reagent, and pH.
- Outfall 011, Swan Creek via an overflow canal - oily waste treatment water, service water screen backwash, and stormwater runoff to Swan Creek via an overflow canal. Monitored parameters include flow, total mercury, total selenium, pH, total suspended solids, and oil and grease.
- Outfall 013, Lake Erie - settled water from a basin storing material dredged from Lake Erie. Monitored parameters include flow, total suspended solids (intake, discharge, net discharge), and pH.

Stormwater Outfalls 002, 004, 005, 007, and 012 are shown in Figure 2.3-47. Stormwater Outfall 002 discharges for the Fermi 2 Protected Area. Stormwater Outfall 012 discharges into south lagoon, and Stormwater Outfalls 004, 005, 007 discharge to Quarry Lakes.

Lake Erie, Swan Creek, and certain onsite water bodies are the water bodies most likely to be directly affected by Fermi 3 construction and operation or that most likely could affect water use and effluent disposal. Most of the water quality data available in the vicinity of the Fermi site are related to Lake Erie and the river basins north and south of the Fermi site. Water quality data for Lake Erie are available through the EPA's Great Lakes National Program Office, which conducts monitoring programs that collect water, aquatic life, sediments, and air data in order to assess the health of the Great Lakes ecosystem. These data were obtained through the EPA's GLENDA website. Intake data collected in October 2003 for the 2004 NPDES Permit Renewal is included in Table 2.3-68. The River Raisin, Huron River, and Rouge River USGS monitoring stations contained the largest amount of continuous water quality data available from the 1960s to the present. These rivers drain into the western basin of Lake Erie and impact the water quality in the western basin, where the Fermi site is located. However, Fermi does not impact the water quality in the River Raisin, Huron

River, and Rouge River. Water quality studies were also conducted by the MDEQ and MDNR at various locations in the Swan Creek Watershed. Figure 2.3-48 shows the locations of the water bodies discussed in this section. **[START COM 2.3-001]** Detroit Edison will perform confirmatory updated baseline surface water sampling that meets the characteristics described in ESRP 2.3.3. A revision to the Environmental Report will be provided to the NRC within one year after docketing of the COL Application that reflects the survey results. **[END COM 2.3-001]**

The portion of the Lake Erie watershed within the United States includes sections of Michigan, Indiana, Ohio, Pennsylvania, and New York, and is referred to as the Lake Erie-Lake Saint Clair Drainage, a subbasin of the Great Lakes Drainage Basin. On a regional scale, the Fermi site lies within the Lake Erie-Lake Saint Clair Drainage in Monroe County, Michigan. Land use and human activities greatly influence water quality in this watershed. The most important parameters in terms of evaluating water quality in the Lake Erie-Lake Saint Clair Drainages are nutrient enrichment, pesticide contamination, sedimentation, and chemical contaminants such as organochlorine compounds, mercury, and polychlorinated biphenyls (PCBs). These chemical contaminants are important as they are bioaccumulated in aquatic biota. Stormwater runoff from urban and agricultural areas contributes to elevated herbicide and nutrient concentrations. (Reference 2.3-66) The most probable water pollutant expected during construction would be sediment or dust entering Lake Erie, the surrounding streams, and certain onsite water bodies. It is unlikely that groundwater quality would be affected by sediment or dust since they would tend to filter out rapidly in unconsolidated sediments. Also, since when in bedrock the groundwater would be artesian, it would be unlikely to be impacted by sediments. A summary of Water Quality impairments is included in Table 2.3-67. **[START COM 2.3-002]** Detroit Edison will perform confirmatory updated baseline groundwater water sampling that meets the characteristics described in ESRP 2.3.3. A revision to the Environmental Report will be provided to the NRC within one year after docketing of the COL Application that reflects the survey results. **[END COM 2.3-002]**

2.3.3.1 **Surface-Water Quality**

The Fermi site is located within the Swan Creek drainage basin, which is a relatively small basin, and is bordered on the north by the Huron River basin and on the south by the Stony Creek and River Raisin drainage basins. Subsection 2.3.1 describes the surface-water bodies and groundwater aquifers in greater detail.

Water quality data are presented below by watershed. The water bodies in this section were chosen based upon the amount of data available, the proximity to the site, and inclusion in the Fermi 2 Environmental Report. Water quality data available at the Fermi Site and in the immediate vicinity that was available is included as well as representative regional water quality data. USGS/STORET stations in the River Raisin and Huron River contain the largest amount of continuous data available in the area. The stations chosen present a continuous record of water quality over the past 30-40 years.

<u>Lake Erie</u>

Lake Erie is the smallest of the Great Lakes in volume and is the shallowest of the five lakes. Therefore, it warms rapidly in the spring and summer, and frequently freezes over in winter.

Subsection 5.3.2.1 provides a thermal description and discusses physical impacts associated with Fermi 3. Lake Erie has the shortest retention time of the Great Lakes, calculated at 2.6 years. The Fermi site is located on the shores of Lake Erie's western basin, which comprises about one-fifth of the lake area. The western basin is very shallow with an average depth of 24 feet and a maximum depth of 62 feet. (Reference 2.3-50)

Approximately one-third of the total population of the Great Lakes basin resides within the Lake Erie basin, making it the most populous of the Great Lakes basins. As a result of the large population, it receives a proportionally greater amount of effluent from sewage treatment plants than the other Great Lakes. Lake Erie is also the Great Lake subjected to the most sediment loading, primarily from intensive agricultural development. The Detroit River delivers sediment to Lake Erie from the actively eroding shorelines of southeastern Lake Huron and Lake St. Clair. Long stretches of active erosion on the Lake Erie shoreline (outside of the vicinity of the Fermi site) also add to the sediment load. Because of this sediment loading, the western basin is generally the most turbid area of the lake. (Reference 2.3-53)

In the Great Lakes Water Quality Agreement of 1978 as amended by protocol in 1987, the United States and Canada, in Annex 2 of the protocol, (Reference 2.3-52) committed to cooperate with state and local governments to ensure that RAPs are developed and implemented for designated AOCs in the Great Lakes Basin. AOCs are severely impaired geographic areas. The AOCs are defined within Annex 2 of the agreement as "geographic areas that fail to meet the general or specific objectives of the agreement where such failure has caused or is likely to cause impairment of beneficial use of the area's ability to support aquatic life." Forty-three AOCs have been identified under the agreement. RAPs are being developed for each of these AOCs to address impairments to beneficial uses. There are fourteen AOCs in Michigan. (Reference 2.3-36) The three closest AOCs to Fermi are the Detroit River, Rouge River, and River Raisin. Annex 2 also requires that Lake Management Plans (LaMPs) be prepared and that each LaMP assess impairment to 14 beneficial water resource uses as the first step in identifying restoration and protection actions for each of the Great Lakes.

The following beneficial use impairments (BUI) have been reported in the Lake Erie LaMP (Reference 2.3-53):

- Restrictions on fish and wildlife consumption
- Degraded fish and wildlife populations
- Fish tumors or other deformities and animal deformities or reproduction problems
- Degradation of benthos
- Restrictions on dredging activities
- Eutrophication or undesirable algae
- Recreational water quality impairments
- Degradation of aesthetics

- Degradation of phytoplankton and zooplankton populations
- Loss of fish and wildlife habitat

Lake Erie is protected for agricultural uses, navigation, industrial water supply, public water supply, cold-water fish, other indigenous aquatic life and wildlife, partial body contact recreation, and total body contact recreation (May through October). (Reference 2.3-60)

Lake Erie (Monroe and Wayne Counties) is included on the MDEQ 2006 Section 303(d) list for PCBs and TCDD (dioxins). The Total Maximum Daily Load (TMDL) scheduled completion year is 2012. Lake Erie Luna Pier Beach (Monroe County) is on the Section 303(d) list for pathogens with the TMDL due in 2007. (Reference 2.3-63)

The water quality trend in Lake Erie has improved greatly in the last two decades as a result of reduction in the discharges of pollutants including nutrients, persistent organics, metals, and oils. Aquatic plant and algal growth in Michigan waters is often phosphorus limited, and reductions in phosphorus loading to Lake Erie have contributed to improved water quality. The western basin of Lake Erie is currently classified as mesotrophic (moderate nutrient level).

The 2004 Lake Erie LaMP reported a number of ongoing and emerging water quality issues. Eutrophication and total phosphorus concentrations in the lake have been decreasing. However, nutrient concentrations in the spring have been increasing. Blue-green algal blooms occur in certain places and times in the lake. Specific areas in the lake have problems with turbidity, excess Cladophora buildup on the shoreline, and anoxic conditions on the lake bottom. Mercury and PCB contamination continue to cause impairment, primarily in relation to fish and wildlife consumption advisories.

Non-native invasive species such as the zebra and quagga mussels have become established in the lake and altered the lake ecosystem. With the establishment of zebra and quagga mussels beginning in the early 1990s, zoobenthic composition, abundance, and distribution have become dramatically altered. These non-native mussels may be abundant enough in the lake to regulate phytoplankton production, and they are becoming increasingly important in the diet of both sport fish and invading species (round gobies). They are also affecting the distribution of other benthic organisms, such as aquatic insects, crayfish, and other shallow-water and deepwater crustaceans.

Non-native mussels have changed the habitat in the lake; their physical presence is altering the nature of hard and soft substrates. Water clarity has increased as a result of zebra and quagga mussels filtering activity. Populations of zebra and quagga mussels are steady or declining. The development of thick mats of algae along shorelines reduces the habitat available for these mussels. Overall mussel densities seem to be lower now, possibly because there are so many round gobies now in the lake. Populations are expected to decline over time as a result of collaborative and co-operative efforts among government agencies, academic institutions, industry, and the public to remove and control the non-native invasive species in the lake. (Reference 2.3-53)

The western basin of Lake Erie receives inputs from the Detroit River, Huron River, River Raisin, Rouge River, as well as smaller drainages including Swan Creek and Stony Creek. Eighty percent of the total input of water to Lake Erie comes through the Detroit River. The Detroit River is a natural channel that links Lake St. Clair and Lake Erie. Total phosphorous concentrations in the Detroit River have undergone an order-of-magnitude decrease since the late 1960s. Water quality data collected from 1992 to 2003 show seasonal fluctuations for phosphorus and nitrogen and a slight increasing trend for orthophosphate. Water quality data collected and analyzed for metals from 1998 to 2003 indicate a decreasing trend for lead and zinc, an increasing trend in mercury concentrations with some seasonal fluctuations, and no trends for cadmium, chromium, copper, or nickel. The Detroit River is on the MQED Section 303(d) list for 2006. The river is listed for water quality standard exceedances for PCBs and TCDDs (dioxin) (TMDL completion year 2012) and mercury (TMDL completion year 2011). It is also listed for pathogens (combined sewer overflows) (TMDL completion year 2011) and fish consumption advisories for PCBs, TCDD (dioxins), and mercury in fish tissue (TMDL completion year 2012). (Reference 2.3-63)

Water quality data collected through the EPA's Great Lakes National Program Office were obtained through the EPA's GLENDA database. Data were available from sampling stations in Lake Erie for 1996 through 2004. Data from five sampling stations in the western basin are summarized and provided in Table 2.3-42. The five sampling station locations are shown in Figure 2.3-49. Data were collected in April and August each year (with the exception of 1999 when sampling was conducted in March and August); therefore, the data are representative of the spring and summer seasons. (Reference 2.3-69)

Fermi 2 monitors intake water from Lake Erie monthly for mercury in accordance with NPDES Permit No. MI0037028. A summary of recent (August 2006 to September 2007) mercury concentrations monitored monthly at the intake is provided in Figure 2.3-50 (average = 4.72 ng/l, minimum = 0.78 ng/l, maximum = 13.00 ng/l).

Two surface-water samples were collected in the vicinity of the Fermi site on August 1, 2007. One sample was collected from the canal that discharges to Swan Creek and one sample was collected from Lake Erie near the plant gauging station. These data are provided in Table 2.3-43. The sampling locations are identified in Figure 2.3-57.

Swan Creek

As noted earlier, Swan Creek receives discharges from the Fermi 2 plant. Swan Creek is protected for agricultural uses, navigation, industrial water supply, public water supply at the point of water intake, warm-water fish, other indigenous aquatic life and wildlife, partial body contact recreation, and total body contact recreation (May through October). (Reference 2.3-60)

Swan Creek (in Monroe County from Sigler Road downstream to the confluence with Lake Erie) is listed by MDEQ as having an impaired use, but the impairment is not caused by a pollutant. The impairment listed for this reach is habitat modification – channelization (i.e., a stream that has been channelized and therefore has insufficient habitat to support an acceptable biological community). (Reference 2.3-63)

Biological surveys carried out by the MDNR document the water quality at three locations along Swan Creek approximately six miles upstream of Lake Erie in June 1993. The analytical results are provided in Table 2.3-44 and Table 2.3-45. A habitat evaluation characterized the Sigler Road station as fair (moderately impaired), the Bell Road station as poor (severely impaired), and the Maxwell Road station as good (slightly impaired). The 1993 survey also included Plum Creek and Sandy Creek. All three creeks are tributaries to Lake Erie. Samples collected from Swan Creek showed the highest levels of ammonia, kjeldahl nitrogen, and total phosphorus of the three creeks. Nutrient inputs were attributed to both agricultural and urban runoff. (Reference 2.3-65)

Water quality data collected by the USGS were obtained through the NWIS database. Data from sampling events conducted at two sampling stations in Swan Creek in 1990 and 1991 are summarized and provided in Table 2.3-46. The data for each parameter are presented as an average. The data were collected during the months of July, August, and September. Figure 2.3-51 shows the locations of the two stations. (Reference 2.3-31)

Stony Creek

Biological surveys carried out by the MDEQ in September and December 1995 and July 1997 document the water quality at several locations along Stony Creek. The analytical results are provided in Table 2.3-47 through Table 2.3-49. (Reference 2.3-55 and Reference 2.3-56)

The 1995 survey was conducted to assess the impact of the effluent discharged by London Aggregates, which discharges to a tributary of Stony Creek approximately 16 miles upstream of the discharge point into Lake Erie south of the Fermi site. The survey indicated that the effluent from London Aggregates impacts the water quality of Amos Palmer Drain and Stony Creek. The September 1995 sample indicated elevated levels of total dissolved solids, hardness, conductivity, ammonia, total calcium, and total magnesium for at least 2.5 miles downstream in Stony Creek. The total dissolved solids concentrations downstream exceeded the levels allowed from controllable sources of Michigan’s Water Quality Standards. The December sample also indicated downstream impacts to total dissolved solids and conductivity in Stony Creek. Dissolved oxygen and hydrogen sulfide concentrations at the outfall location were at unacceptably toxic levels; however, sulfide was not detected downstream in Stony Creek. (Reference 2.3-55)

The 1997 survey also was conducted to evaluate the impact of the effluent discharged by London Aggregates to Amos Palmer Drain and Stony Creek. The water chemistry results indicated total dissolved solid concentrations in excess of the Michigan Water Quality Standard of 500 mg/l (average) and 750 mg/l (maximum) as far downstream as Exeter Road in Stony Creek. The hydrogen sulfide concentration in Amos Palmer Drain also exceeded the Michigan Water Quality Standard. Conductivity, sulfate, and calcium at the downstream sampling stations were elevated above the upstream background level concentrations. (Reference 2.3-56)

Water quality data collected by the USGS were obtained through the NWIS database. Data from two sampling stations in Stony Creek are summarized and are provided in Table 2.3-46. The Stony Creek at Oakville sampling station had sampling data collected from 1971-1973 and in 1990 and 1991. The Stony Creek near Woodland Beach sampling station had data collected in 1990 and

1991. Due to the small number of samples, the data for Stony Creek are presented as an average. Data from these stations were collected between the months of May and September each year. Figure 2.3-51 shows the locations of the stations.

River Raisin

The River Raisin is located in the southeastern part of Michigan's Lower Peninsula and flows in a generally southeast direction and discharges into the western basin of Lake Erie at Monroe Harbor. The River Raisin is protected for agricultural uses, navigation, industrial water supply, public water supply at the point of water intake, warm-water fish, other indigenous aquatic life and wildlife, partial body contact recreation, and total body contact recreation (May through October). (Reference 2.3-62)

The River Raisin is on the MQED Section 303(d) list for 2006. The watershed is listed for exceedances of the water quality standard for PCBs (TMDL completion year 2010). The area in the vicinity of Monroe is listed for mercury (TMDL completion year 2011) and for a fish consumption advisory for PCBs (TMDL completion year 2010). The River Raisin South Branch, from the confluence with Lake Erie upstream to the vicinity of the Adrian Wastewater Treatment Plant (WWTP), is listed for pathogens, combined sewer overflows, and water quality exceedances for total dissolved solids, chlorides, turbidity, and siltations (TMDL completion year 2008). The River Raisin South Branch, from the confluence with Lake Erie upstream to Carlton Road in the vicinity of Adrian, is listed for a fish consumption advisory for PCBs (TMDL completion year 2010). (Reference 2.3-63)

The River Raisin has a designated AOC that has been defined as the lower (2.6 miles) portion of the river, downstream from the low head dam at Winchester Bridge in the city of Monroe, extending one-half mile out into Lake Erie following the Federal Navigation Channel and along the nearshore zone of Lake Erie, both north and south, for one mile. (Reference 2.3-48)

The 1987 River Raisin RAP identified the primary pollutant of concern as PCB-contaminated sediments. (Reference 2.3-64) The 2002 plan update reported that sedimentation sampling and analysis by Harding ESE determined that PCB contamination is still a concern within the AOC. The 2002 update states that the primary impaired use in the AOC is fish consumption, due to high levels of PCB's found in fish samples. Studies were conducted on caged fish in 1988 and 1998. PCB contamination levels decreased in the time between the studies; however, they still exceeded the trigger levels for fish consumption. (Reference 2.3-48)

The following beneficial use impairments (BUIs) were identified for the River Raisin AOC as of 1987:

- Restrictions on fish and wildlife consumption
- Degradation of fish and wildlife populations
- Degradation of benthos
- Eutrophication or undesirable algae

- Degradation of aesthetics
- Loss of fish or wildlife habitat
- Loss of flora

In addition to the above BUIs, three additional BUIs were identified for the River Raisin AOC as of 2002:

- Bird or animal deformities or reproductive problems
- Restrictions on dredging activities
- Beach closings or restrictions on body contact

Historical discharges from industrial facilities and municipal waste disposal sites of oil and grease, heavy metals, and PCBs are the primary cause of these impairments. (Reference 2.3-48)

Water quality data collected through the USGS for the River Raisin were obtained through the NWIS database and are provided in Table 2.3-50. (Reference 2.3-31) Data from 1970 and 1971 recorded at two sampling stations (4175700 - River Raisin near Tecumseh and 4176000 - River Raisin near Adrian) that were presented in the 1967 Fermi Unit 3 Construction Permit Environmental Report (Reference 2.3-49) are summarized and provided alongside data from sampling station 4176500 - River Raisin near Monroe, which recorded data from 1967 through 1995. Data was collected throughout the year and are representative of all seasons. Figure 2.3-52 shows the locations of the stations.

Additional data from the EPA STORET Database, STORET Station Number 580046, are provided in Table 2.3-51. (Reference 2.3-37) The data was collected in the years 1995 through 2006 by the MDEQ. Data were collected throughout the year near the mouth of the River Raisin in Monroe, Michigan. This set of data was chosen because it is recent. Figure 2.3-52 shows the location of the station.

<u>Rouge River</u>

The Rouge River is on the Michigan Section 303(d) list for 2006. The designated uses for the Rouge River are navigation, industrial water supply, warm-water fish, general aesthetic, partial body contact recreation, and total body contact recreation (May through October). (Reference 2.3-54) The segment from the W. Jefferson Avenue Bridge upstream 0.5 miles and downstream 0.05 miles is listed for exceedances of the water quality standard for mercury (TMDL completion year 2011). The Main, Upper, Middle, and Lower Branches are listed for a fish consumption advisory for PCBs (TMDL completion year 2008). The Main, Upper, Middle, Lower, Bell, and Franklin Branches and Evans Ditch are listed for pathogens and for water quality exceedances for dissolved oxygen. Fish and macroinvertebrate communities are rated poor (TMDL completion years 2007 and 2011). The entire Rouge River Watershed is listed for water quality exceedances for PCBs (TMDL completion year 2008).

The Rouge River's designated AOC is the entire watershed. The watershed drains 466 square miles of urban/suburban land in southeastern Michigan and discharges into the Detroit River.

Water quality in the Rouge River is influenced by combined sewer overflows, sanitary sewer overflows, non-point source and point source discharges, contaminated sediments, and high flow variability. These stressors have resulted in poor biotic communities, impoundment eutrophication, channel morphology perturbation, and public health advisories for fish consumptions. (Reference 2.3-63)

In 1994, MDEQ determined that 13 uses were impaired throughout most of the watershed. These BUIs included:

- Restrictions on swimming and other water-related activities
- Loss of fish and wildlife habitat
- Degradation of fish communities
- Degradation of benthos
- Degradation of wildlife populations
- Eutrophication or growth of undesirable algae
- Degradation of aesthetics
- Restrictions on fish consumption
- Bird or animal deformities or reproduction problems
- Restrictions on dredging activities
- Fish tumors or other deformities
- Tainting of fish and wildlife flavor
- Restrictions to navigation

The Rouge River RAP was revised in 2004 by the Rouge River Advisory Council (RRAC). In the opinion of the RRAC, the following six use impairments identified for the Rouge River AOC could be delisted in the near future (Reference 2.3-68):

- Restrictions on fish consumption
- Bird or animal deformities or reproduction problems
- Restrictions on dredging activities
- Fish tumors or other deformities
- Tainting of fish and wildlife flavor
- Restrictions to navigation

Water quality data collected by the USGS were obtained through the NWIS database. Data were collected at various times of the year at sampling stations in the Rouge River between 1966 and 2006. (Reference 2.3-31) This set of data was chosen because it contains recent and historical data and is representative of all seasons. Data from two sampling stations (4166100 - Rouge River at Southfield and 4166000 - Rouge River at Birmingham) are summarized and provided in Table 2.3-52. Figure 2.3-53 shows the locations of these stations.

Huron River

The Huron River is on the MQED Section 303(d) list for 2006. The designated uses for the Huron River are agricultural uses, navigation, industrial water supply, public water supply at the point of water intake, warm-water fish, other indigenous aquatic life and wildlife, partial body contact recreation, and total body contact recreation (May through October). (Reference 2.3-54) The reach from Dawson Road upstream two miles in Oakland County is listed for water quality exceedances for dissolved oxygen (TMDL completion year 2013). The Huron River Watershed from the confluence with Lake Erie upstream to include all tributaries is listed for water quality exceedances for PCBs (TMDL completion year 2010). (Reference 2.3-63)

Water quality data collected by the USGS were obtained through the NWIS database. Stations used in the 1967 Fermi Unit 3 Construction Permit Environmental Report (Reference 2.3-49) were chosen along with stations with the most recent or most continuous data available. Data were collected throughout the year at sampling stations in the Huron River between 1966 and 2003. (Reference 2.3-31) Data from six sampling stations are summarized and provided in Table 2.3-53. Figure 2.3-54 shows the locations of these stations.

Additional data from the EPA STORET Database, STORET Station Number 580364, are provided in Table 2.3-54. (Reference 2.3-37) The data was collected in the years 1998 through 2005. Data was collected throughout the year in the Huron River. Figure 2.3-54 shows the location of the station. The data from this station were collected relatively recently and are in proximity to the Fermi site.

2.3.3.2 **Groundwater Quality**

This section describes the regional and local groundwater resources that could be affected by the construction and operation of Fermi 3. Groundwater use at Fermi is discussed in Subsection 2.3.2. North and west of the Fermi site, the unconsolidated Pleistocene and recent sediments comprise the principal aquifers. The uppermost bedrock stratum at the site consists of upper Silurian dolomite of the Bass Island Group. In the Fermi site vicinity, groundwater occurs in the fractured upper zones of the Bass Island dolomite. Surface deposits consist predominantly of lacustrine clay in the site vicinity, and grade to fine lacustrine sand to the west. In the immediate site location, organic soils were removed and replaced by crushed rock fill during Fermi 2 construction.

Groundwater provides approximately 23 percent of the Michigan public water supply, and more than 2.7 million people supply their own water from private wells in the state. Groundwater is a significant source of water for industry and agriculture as well. The pumpage of fresh groundwater in Michigan in 2000 was estimated to be about 730 million gallons per day of the 27 billion gallons per day of natural recharge to Michigan’s groundwater systems. Although statewide groundwater is abundant, the availability of groundwater locally is highly variable. Thermoelectric Power Generation is the fourth largest groundwater use sector, following public water supply, agricultural irrigation, and industrial (in that order). Nearly all groundwater in Michigan naturally discharges to surface-water. In southeastern Michigan, regional groundwater movement is eastward toward Lake Erie, except where altered by local features such as the quarry dewatering near the Fermi facility. (Reference 2.3-51)

Aquifers important from the standpoint of furnishing large quantities of groundwater for municipal water supply systems are shown in Figure 2.3-55. Groundwater in the Bass Island dolomite has a highly variable chemical pattern. (Reference 2.3-49)

Regional Groundwater Quality

One USGS well location, approximately 20 miles from the Fermi site was sampled in 1979 and 1984. The well was completed in the Silurian-Devonian aquifers (Detroit River Group) at a depth of 72 feet. Water levels collected in the same well between 1978 and 2006 ranged between 32.3 feet below land-surface datum to 53.6 feet below land-surface datum. The results of these sampling events are provided in Table 2.3-55. For the parameters that have National Primary or Secondary Drinking Water Standards, the reported levels in this well were all below the current standards (Maximum Contaminant Level or Maximum Contaminant Level Goal). (Reference 2.3-37)

Nine USGS wells within 10 miles of the Fermi site were sampled one time by USGS in 1991 to 1992. The results of these sampling events are provided in Table 2.3-56. These wells were analyzed for carbon dioxide, nitrogen compounds, pH, phosphorous, turbidity, silica, metals, potassium, and sodium. For the parameters that have National Primary or Secondary Drinking Water Standards, the reported levels in these wells were all below the current standards (Maximum Contaminant Level or Maximum Contaminant Level Goal). These wells were also analyzed for tritium, deuterium/protium ratio, oxygen-18/oxygen-16 ratio, carbon-14 percent modern, and sulfur-34/sulfur-32 ratio. (Reference 2.3-31)

Tritium is a radioactive type of hydrogen that is produced during the operation of nuclear power plants. Water containing tritium and other radioactive substances is normally released from nuclear plants under controlled, monitored conditions that the NRC mandates to protect public health and safety. The NRC recently identified several nuclear power plants where unplanned, unmonitored tritium releases to the environment had occurred. Fermi was not one of these plants. (Reference 2.3-47) In a September 2006 report, the NRC task force did not identify any instances where the health of the public was impacted by these identified releases (Reference 2.3-24). As part of a voluntary Nuclear Energy Institute initiative, Fermi 2 undertook an investigation to verify there were no unmonitored radioactive releases. To date, no unmonitored radioactive releases have been identified at the Fermi 2 site.

As part of the radiological environmental monitoring program (REMP) at Fermi 2, Groundwater is collected on a quarterly basis from four wells surrounding Fermi 2. The groundwater is analyzed for gamma emitting radionuclides and tritium. Quarterly groundwater sampling for radioactivity is taken from one up-gradient and three down-gradient sampling locations. (Reference 2.3-67)

Groundwater samples from private wells were collected by the Michigan Department of Agriculture in 1990 and 1991. Results in Michigan townships near the Fermi site (within approximately 20 miles) are provided in Table 2.3-57. These samples were analyzed for the following parameters:

specific conductance, total chloride, total fluoride, total hardness, total sodium, total iron and total nitrate nitrogen. Of these parameters, chloride, fluoride, iron and nitrate nitrogen are on the National Primary or Secondary Drinking Water Standards in 40 CFR 141. The reported levels of these parameters in the wells (see Table 2.3-57) meet the current standards (Maximum Contaminant Level or Maximum Contaminant Level Goal). However, the current standards may differ from the standards that were in effect at the time the samples were collected. (Reference 2.3-37) A summary of groundwater sampling locations is provided in Figure 2.3-56.

MDEQ provided county-specific data covering the time period from 1983 to 2007 for arsenic, nitrates, and volatile organic compounds (VOCs). Average arsenic levels in well water samples within about five miles of the Fermi site are provided in Table 2.3-58. Source data ranged from 0.0004 to 0.018 mg/l. Nitrate levels in well water samples within about five miles of the Fermi site, provided in Table 2.3-59, ranged from 0.1 to 9.1 mg/l. VOC levels in well water samples within about five miles of the Fermi site are provided in Table 2.3-60. Detected VOCs included bromoform, chloroform, chlorodibromomethane, dichlorobromomethane, total trihalomethanes, toluene, dichlorodifluoromethane, and meth tert-butyl ether. Some of these samples may have been collected after disinfection, since bromine and chlorine substituted organics can form as part of the disinfection process. There were no temporal trends evident in the MDEQ data. (Reference 2.3-57)

Plant Groundwater Data

Chemical analyses from samples collected in the Fermi site vicinity by the Detroit Edison Company in 1969 and 1970 are shown in Table 2.3-61 and Table 2.3-62. Those samples indicated that the water contained high concentrations of calcium sulfate, commonly had a hydrogen sulfide odor, was very hard, and had high iron concentrations. Sulfate levels in four of the samples were above the current standards. At that time, although undesirable for domestic purposes, groundwater was used in many homes that were not served by a public water system. (Reference 2.3-49)

Data from onsite monitoring wells sampled in August 2007 are provided in Table 2.3-63 through Table 2.3-66. Shallow well MW-383s (DQH0538-02) is located east of the in-plant ditch, near the south end of the developed site. In the sample from this well, levels for alkalinity, total dissolved solids, some metals, ammonia, and nitrate were elevated above the average for August 2007 samples, indicating a possible influence from the ditch. Iron and sulfate levels were above National Secondary Drinking Water Standards in most samples. The well locations are shown in Figure 2.3-57.

Data provided by MDEQ included samples collected at the Fermi site. This Fermi site data is included in Table 2.3-60 through Table 2.3-66. The arsenic level for a sample collected in 1988 was <0.005 mg/l. Nitrate levels in 24 samples between 1983 and 1995 averaged 0.3 mg/l. A 1993 sample indicated no detectable VOCs, while at the site tap, chlorodibromomethane, chloroform, dichlorobromomethane, and total trihalomethanes were detected. These chemicals are typical disinfection by-products. (Reference 2.3-57)

2.3.3.3 **Wastewater Treatment System**

Water treatment and non-radioactive waste systems are discussed in Section 3.3 and Section 3.6, respectively. These systems compare favorably with the standard practices described in AWWA 1990. The Fermi 3 wastewater treatment system collects sewage and wastewater generated from the portions of the plant outside radiological control areas and uses mechanical, chemical, and biological treatment processes. Cooling water effluent will be discharged via a new pipeline to Lake Erie. The treated process effluent will be discharged through, permitted outfalls to Lake Erie in accordance with the NPDES permit. The sanitary effluent will be gathered and discharged to the Frenchtown Township Sewage Treatment Facility.

The Fermi 3 wastewater treatment operations are similar to the existing Fermi 2 wastewater treatment operations and uses processes that are commonly used in wastewater treatment plants throughout the U.S. The sanitary waste effluent will be discharged to a municipal waste treatment facility. Effluent must meet the limits outlined in the Industrial/Non-domestic User Discharge permit with the Frenchtown Township Sewage Treatment Facility. Permanent components of the Fermi 3 sanitary wastewater treatment system include waste basin, wet well, septic tank, settling tank, wet well pumps, sewage discharge pumps and associated valves, piping, and controls. Chemical treatments applied to the waste are those within the Frenchtown Township Sewage Treatment Facility, in keeping with the municipal sewage treatment standards. The wastewater treatment piping, tanks, venting, and valving arrangements are separated from other plant chemical or radiological processes and treatments by appropriate isolation devices.

The treated process effluent will meet the applicable NPDES permit requirements, health standards, regulations, and total maximum daily loads (TMDLs) set by the MDEQ and the EPA. The measures and controls used to limit water quality impacts associated with the construction and operation of Fermi 3 are addressed in Section 4.6 and Section 5.10. Subsection 3.3.2 describes the treatment of plant wastewater.

2.3.3.4 **Other Pollutant Sources**

Both non-point and point sources contribute to pollution in Lake Erie and its tributaries, including Swan Creek. Forestry, agriculture, sewage disposal and combined sewer overflows have caused high inputs of nutrients and sediments to the lake. In recent years, these inputs and their effects on the lake have been reduced through remedial actions. However, excessive phosphorus remains a localized problem. Along with nutrients, sediment loading remains a problem in numerous tributaries particularly in the western half of the lake. The offshore waters of the western basin still show residual effects of eutrophication. (Reference 2.3-53)

NPDES permitted point sources with relatively high permitted discharge volumes in the vicinity of the Fermi site are described below.

Swan Creek

A domestic wastewater treatment plant located in Newport, Michigan discharges treated municipal wastewater to Swan Creek upstream of the Fermi site. The Berlin Township Wastewater Treatment Plant (WWTP) is authorized to discharge sanitary wastewater under NPDES Permit No.

MI0020826. The permit contains effluent limitations for five-day carbonaceous biochemical oxygen demand and total suspended solids based on federal secondary treatment standards. It contains effluent limitations for ammonia nitrogen, total phosphorus, fecal coliform bacteria, total residual chlorine, total mercury, pH, and dissolved oxygen that are based on water quality standards. (Reference 2.3-58)

Lake Erie

The Detroit Edison Company Monroe Power Plant is located on Lake Erie, south of the Fermi site. The plant is authorized to discharge to Lake Erie and the River Raisin under NPDES Permit No. MI0001848 (Reference 2.3-61). According to the NPDES Permit No. MI0001848 Fact Sheet, once through non-contact cooling water is discharged to Lake Erie via the power plant discharge canal. Potentially oil-contaminated water is treated in oil-water separators prior to discharge. The plant has facilities for treatment of chemical metal cleaning wastes but has not discharged such wastes in several years. Process wastewater is treated in settling basins prior to discharge to Lake Erie. Effluent limitations for total residual chlorine, heat addition, total copper, and pH are based on water quality standards. Effluent limitations for total suspended solids, oil and grease, total copper (internal waste stream), and total iron (internal waste stream) are based on federal effluent guidelines. Monitoring for temperature is based on water quality concerns. Thermal monitoring is discussed in Section 6.1.

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Table 2.3-1 Open Coast Flood Levels at Various Return Periods

	10-Year (feet)		50-Year (feet)		100-Year (feet)		500-Year (feet)	
REACH	IGLD 1955/1985		IGLD 1955/1985		IGLD 1955/1985		IGLD 1955/1985	
A	578.4	579	579.8	580.4	580.3	580.9	581.4	582.0
B	577.8	578.4	579.2	579.8	579.6	580.2	580.7	581.3
C	577.3	577.9	578.6	579.2	578.9	579.5	580.0	580.6
D	576.8	577.4	578.1	578.7	578.3	578.9	579.4	580.0
E	576.3	576.9	577.6	578.2	577.8	578.4	578.9	579.5
F	575.9	576.5	577.1	577.7	577.3	577.9	578.4	579.0
G	575.5	576.1	576.6	577.2	576.9	577.5	577.9	578.5
H	575.2	575.8	576.2	576.8	576.5	577.1	577.4	578.0
J	574.9	575.5	575.8	576.4	576.2	576.8	577.0	577.6
K	574.6	575.2	575.5	576.1	575.9	576.5	576.7	577.3
L	574.4	575	575.2	575.8	575.6	576.2	576.4	577.0
M	574.2	574.8	575.0	575.6	575.4	576.0	576.1	576.7
N	574.1	574.7	574.8	575.4	575.2	575.8	575.9	576.5
P	573.9	574.5	574.7	575.3	575.1	575.7	575.7	576.3
Q	573.8	574.4	574.6	575.2	575.0	575.6	575.6	576.2
R	573.9	574.5	574.7	575.3	575.1	575.7	575.8	576.4
S	574.1	574.7	574.9	575.5	575.3	575.9	576.1	576.7
T	574.3	574.9	575.1	575.7	575.5	576.1	576.4	577.0
U	574.5	575.1	575.1	575.7	575.8	576.4	576.7	577.3
V	574.7	575.3	575.7	576.3	576.1	576.7	577.1	577.7
W	574.9	575.5	576.0	576.6	576.4	577.0	577.5	578.1
X	575.1	575.7	576.2	576.8	576.7	577.3	577.7	578.3
Y	575.4	576	576.5	577.1	577.0	577.6	577.9	578.5
Z (Fermi)	575.7	576.3	576.8	577.4	577.3	577.9	578.2	578.8
AA	576.6	577.2	577.8	578.4	578.2	578.8	579.2	579.8

Source: Reference 2.3-5

Table 2.3-2 Great Lake Basin Hydrology November 2007

PRECIPITATION (inches)

	November				12-Month Comparison			
BASIN	**2007**	**Average (1900-1999)**	**Diff.**	**% of Average**	**Last 12 months**	**Average (1900-1999)**	**Diff.**	**% of Average**
Superior	0.93	2.51	-1.58	37	31.32	30.52	0.80	103
Michigan-Huron	2.12	2.76	-0.64	77	29.76	32.18	-2.42	92
Erie	3.02	2.83	0.19	107	35.15	35.04	0.11	100
Ontario	4.21	3.14	1.07	134	29.54	35.35	-5.81	84
Great Lakes	2.17	2.74	-0.57	79	30.44	32.42	-1.98	94

	November Water Supplies[2] (cfs)		November Outflow[3] (cfs)	
LAKE	**2007[1]**	**Average[5] (1900-1999)**	**2007[1]**	**Average[4] (1900-1999)**
Superior	-16,000	18,000	55,000	80,000
Michigan-Huron	-114,000	39,000	159,000	190,000
Erie	4000	-5000	180,000	199,000
Ontario	0	20,000	225,000	238,000

Notes:
Values (excluding averages) are based on preliminary computations. cfs denotes cubic feet per second.
1. Estimated
2. Negative water supply denotes evaporation from lake exceeded runoff from local basin.
3. Does not include diversions.
4. Niagara and St Lawrence rivers average outflows are based on period of record 1900-1989 and 1900-2005, respectively
5. Lakes Erie and Ontario average water supplies based on 1900-1989

Source: Reference 2.3-12

Table 2.3-3 Lake Erie Modeled Water Surface Temperatures (Celsius) (Sheet 1 of 3)

Note: model limits the temperature to 0° or above

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1948	0.00	0.00	0.00	1.56	8.95	16.91	22.16	23.06	22.57	16.54	11.85	6.12
1949	1.73	0.50	0.75	4.50	12.09	18.51	24.53	24.90	20.83	17.77	11.69	4.90
1950	2.03	0.82	0.00	1.77	8.97	17.44	21.49	22.77	21.65	18.29	12.55	3.89
1951	0.13	0.00	0.11	2.76	11.23	18.66	22.42	23.24	21.47	17.84	10.18	3.81
1952	0.56	0.00	0.40	3.88	11.43	18.54	24.05	23.91	22.44	16.46	10.44	5.90
1953	2.02	1.07	1.55	4.84	11.63	18.58	23.36	24.08	22.33	18.16	12.93	6.97
1954	0.86	0.06	0.78	3.88	10.79	18.02	22.46	23.09	21.65	18.62	12.16	5.83
1955	1.64	0.00	0.33	4.35	12.75	18.82	24.61	25.68	22.67	18.64	11.26	3.41
1956	0.06	0.00	0.09	2.72	9.27	16.93	21.39	22.65	20.76	16.92	12.66	6.14
1957	0.69	0.00	0.46	3.60	10.84	17.65	21.81	22.72	21.38	16.64	10.35	4.81
1958	0.26	0.00	0.00	2.32	10.23	16.49	21.80	23.51	21.32	17.20	12.34	3.27
1959	0.05	0.00	0.00	1.24	9.08	18.30	23.45	25.31	23.94	19.47	12.07	6.43
1960	2.24	0.51	0.00	1.60	8.86	16.93	21.20	23.17	22.50	17.94	11.14	3.56
1961	0.00	0.00	0.00	1.76	8.73	15.78	21.10	23.48	23.57	18.06	12.20	5.36
1962	0.07	0.00	0.00	0.99	9.29	17.95	21.63	22.45	21.31	17.64	10.95	4.07
1963	0.00	0.00	0.00	0.79	7.73	16.56	21.46	22.03	19.89	17.36	12.20	4.39
1964	0.00	0.00	0.00	2.11	10.85	17.03	22.76	21.91	20.90	15.49	11.61	4.66
1965	0.95	0.00	0.00	1.08	8.90	16.69	21.06	22.07	21.25	16.53	10.84	5.66
1966	1.26	0.00	0.00	2.38	9.14	17.52	23.20	22.98	21.49	15.74	10.42	5.25
1967	0.60	0.00	0.00	1.78	7.96	17.09	21.27	22.39	20.43	16.37	9.92	4.50
1968	0.02	0.00	0.00	1.25	8.48	16.19	21.10	23.51	21.61	18.02	11.44	4.31

Table 2.3-3 Lake Erie Modeled Water Surface Temperatures (Celsius) (Sheet 2 of 3)

Note: model limits the temperature to 0° or above

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1969	0.00	0.00	0.00	0.89	8.18	15.77	21.52	23.57	21.73	16.83	10.33	3.13
1970	0.00	0.00	0.00	0.14	5.91	15.90	20.26	22.85	21.11	17.16	11.72	4.79
1971	0.08	0.00	0.00	0.38	6.20	16.08	20.99	21.66	21.99	18.94	13.17	6.75
1972	1.43	0.00	0.00	0.81	7.96	15.69	20.59	21.86	21.18	16.27	10.68	4.54
1973	0.44	0.01	0.53	3.86	10.10	18.07	22.47	24.07	22.65	18.73	11.99	6.42
1974	0.59	0.08	0.34	3.17	10.22	16.93	21.77	23.29	20.85	15.50	11.52	5.00
1975	1.20	0.09	0.17	1.93	10.02	18.30	23.37	24.30	21.06	17.10	13.11	6.21
1976	0.38	0.00	0.44	4.67	10.65	18.27	21.99	23.09	20.95	16.13	8.32	1.30
1977	0.00	0.00	0.00	0.74	8.36	16.80	22.49	22.80	22.13	16.76	12.31	4.12
1978	0.01	0.00	0.00	0.27	6.13	16.46	21.48	23.49	22.37	17.05	11.94	4.98
1979	0.11	0.00	0.00	0.92	8.01	16.07	20.80	22.34	21.41	16.91	11.19	5.42
1980	0.85	0.00	0.00	1.14	8.59	16.00	21.87	24.20	22.69	16.66	9.55	3.53
1981	0.00	0.00	0.00	1.59	8.78	17.14	22.34	23.01	21.56	15.67	11.10	5.02
1982	0.39	0.00	0.00	0.43	7.52	16.08	22.15	22.64	20.43	17.61	12.07	7.46
1983	2.49	0.66	2.22	4.59	10.75	18.24	23.60	25.12	23.29	18.10	12.07	4.81
1984	0.00	0.00	0.00	0.63	6.84	16.21	21.10	23.55	20.66	17.96	12.41	6.20
1985	1.33	0.00	0.00	2.92	11.53	16.96	21.81	23.24	22.21	17.68	12.83	5.08
1986	0.00	0.00	0.00	2.19	10.45	17.82	22.50	23.43	21.02	18.19	12.15	5.88
1987	1.91	0.00	0.99	5.03	12.99	20.23	24.26	24.75	22.33	16.75	11.32	6.38
1988	0.38	0.00	0.00	2.50	10.55	17.58	22.95	25.50	21.62	16.77	10.49	5.01
1989	1.05	0.22	0.08	2.71	9.55	17.61	23.04	23.35	21.98	16.61	11.22	2.85

Table 2.3-3 Lake Erie Modeled Water Surface Temperatures (Celsius) (Sheet 3 of 3)

Note: model limits the temperature to 0° or above

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	0.00	0.02	0.83	4.12	11.35	17.42	21.99	23.82	22.45	17.77	12.08	6.82
1991	1.62	0.07	1.43	5.51	13.50	21.09	24.44	24.40	23.14	17.80	11.63	6.12
1992	1.79	0.21	1.15	3.98	11.95	17.57	21.50	22.28	21.59	16.61	10.95	5.70
1993	1.67	0.08	0.00	2.20	10.28	17.28	23.57	24.34	22.17	16.29	10.57	5.82
1994	0.12	0.00	0.00	1.12	8.47	17.61	22.80	22.98	21.43	17.97	13.65	7.99
1995	2.84	0.11	0.85	4.19	11.55	19.42	23.80	26.59	22.63	18.44	10.95	3.39
1996	0.01	0.00	0.00	0.81	7.23	17.06	22.06	24.15	22.80	18.11	11.78	6.18
1997	1.19	0.00	0.75	4.51	10.81	18.27	23.17	22.98	21.53	18.42	11.50	6.32
1998	2.76	2.30	2.86	7.80	15.26	19.75	24.42	25.19	23.58	19.25	12.93	8.66
1999	0.58	0.36	1.00	5.54	13.57	19.89	24.62	24.40	22.64	17.65	12.41	7.64
2000	1.73	0.00	0.83	4.27	11.23	17.07	21.11	21.76	20.21	16.00	11.22	2.92
2001	0.00	0.00	0.00	1.18	9.24	16.63	21.19	22.75	20.21	15.53	11.13	8.30
2002	2.94	2.24	2.36	5.23	10.05	16.24	21.60	23.12	22.31	17.88	10.87	4.11
2003	0.45	0.00	0.00	0.80	7.28	15.43	20.90	23.24	21.13	16.09	12.17	6.59
2004	1.39	0.00	0.02	2.95	10.60	17.75	21.96	22.55	22.25	17.73	13.17	7.42
Average	0.82	0.17	0.37	2.58	9.80	17.43	22.29	23.43	21.78	17.31	11.57	5.30
Maximum	2.94	2.30	2.86	7.80	15.26	21.09	24.62	26.59	23.94	19.47	13.65	8.66
Minimum	0.00	0.00	0.00	0.14	5.91	15.43	20.26	21.66	19.89	15.49	8.32	1.30

Average Maximum (1948-2004) = 14.10 Average Minimum (1948-2004) = 9.03

Source: Reference 2.3-7

Table 2.3-4 Lake Erie Overlake Precipitation (millimeters) (Sheet 1 of 6)

1900-1929 = NOS Lake Survey 1930-1947 = Norton 1948-end = Croley

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1900	55.1	108.5	65.8	43.2	47.8	69.6	125.7	73.7	49.3	55.4	100.3	22.9	817.3
1901	49.3	43.7	66.0	69.1	75.9	61.5	77.7	79.5	65.8	31.8	58.2	100.1	778.6
1902	39.9	28.2	57.7	41.1	94.0	151.9	156.0	34.0	124.0	59.9	43.9	69.6	900.2
1903	51.1	83.6	62.7	100.8	49.3	104.9	138.9	117.9	47.8	61.5	41.4	58.7	918.6
1904	105.9	71.6	101.1	67.8	80.8	37.8	91.7	78.0	71.6	55.4	7.1	55.1	823.9
1905	63.8	46.2	34.0	60.5	100.6	91.7	68.1	80.3	52.3	69.6	70.1	46.2	783.4
1906	40.6	26.2	71.1	45.7	51.1	65.0	88.9	88.9	61.5	132.1	57.7	82.0	810.8
1907	116.1	19.3	75.9	55.4	80.5	92.5	77.5	34.0	119.1	95.0	47.2	94.0	906.5
1908	62.2	102.9	71.4	74.7	84.6	53.3	70.6	89.9	15.2	32.0	34.0	51.8	742.6
1909	68.8	103.1	68.1	81.0	106.7	78.7	83.8	73.4	56.9	51.6	92.7	74.4	939.2
1910	105.7	89.4	11.7	94.0	87.1	42.2	88.9	45.2	67.8	109.7	67.8	64.8	874.3
1911	78.7	64.3	48.5	69.3	47.2	71.6	57.9	117.9	95.0	106.2	89.4	72.6	918.6
1912	69.9	52.3	64.0	88.4	73.7	60.5	92.5	114.6	99.1	85.9	53.3	56.6	910.8
1913	135.4	46.7	170.4	72.6	86.1	61.0	83.3	90.4	44.5	98.0	81.5	25.7	995.6
1914	82.0	44.7	68.3	94.0	118.6	57.9	39.6	138.9	51.1	56.9	50.3	74.2	876.5
1915	76.7	61.5	29.5	22.4	82.3	74.7	156.0	138.2	86.4	51.6	61.5	77.2	918.0
1916	99.6	54.9	78.7	67.3	122.4	95.3	27.9	58.2	64.5	72.6	51.6	71.4	864.4
1917	67.3	38.9	78.5	57.9	109.7	133.6	73.2	72.1	55.1	162.3	23.6	41.7	913.9
1918	63.2	56.1	75.2	57.4	76.2	69.3	45.7	55.4	116.8	61.2	52.8	74.4	803.7
1919	28.4	36.6	80.3	137.7	114.6	57.2	41.7	93.7	53.6	100.8	48.8	31.5	824.9
1920	46.7	30.2	43.4	105.2	30.0	118.1	80.8	77.2	44.2	72.6	79.2	69.9	797.5

Table 2.3-4 Lake Erie Overlake Precipitation (millimeters) (Sheet 2 of 6)

1900-1929 = NOS Lake Survey 1930-1947 = Norton 1948-end = Croley

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1921	33.0	47.5	110.7	96.5	58.2	63.5	69.9	89.7	84.6	66.5	94.0	50.3	864.4
1922	38.6	37.1	101.3	66.5	63.8	66.0	74.2	78.5	63.0	41.9	40.9	62.7	734.5
1923	66.0	36.1	67.6	59.4	73.7	63.5	65.0	45.7	77.2	47.8	59.7	114.6	776.3
1924	84.1	48.3	51.3	71.1	68.6	115.8	67.6	56.1	135.4	10.7	23.6	87.4	820.0
1925	34.8	62.0	72.4	34.3	37.3	53.8	102.4	53.1	105.9	83.1	87.1	37.8	764.0
1926	54.6	71.9	55.6	96.5	30.7	80.5	42.9	146.8	178.3	126.5	74.4	49.8	1008.5
1927	44.2	54.9	60.5	55.1	95.5	54.9	103.1	41.1	54.6	51.6	166.1	90.4	872.0
1928	44.2	49.8	52.3	53.3	45.2	131.8	99.1	63.8	44.2	75.2	70.1	44.2	773.2
1929	107.2	36.8	71.6	148.3	96.0	65.0	74.7	25.4	56.9	87.9	87.4	99.8	957.0
1930	119.6	54.1	68.1	56.6	46.7	69.9	27.7	23.9	66.5	50.0	40.6	29.7	653.4
1931	52.2	42.1	52.1	79.5	56.4	85.8	89.9	62.2	88.9	60.0	70.3	58.8	798.2
1932	113.9	34.2	45.0	48.8	111.7	35.1	98.0	54.7	79.5	84.7	71.9	86.4	863.9
1933	40.5	44.7	77.9	68.7	74.4	35.3	35.9	65.3	65.5	49.7	66.4	50.6	674.9
1934	48.1	19.7	73.8	73.6	14.1	48.0	45.9	78.8	104.6	38.6	61.3	55.7	662.2
1935	61.7	66.4	53.5	41.9	69.9	71.7	67.7	89.9	58.2	45.2	64.4	51.8	742.3
1936	43.7	61.9	71.4	60.5	33.8	58.6	50.4	50.6	89.5	74.9	54.8	51.2	701.3
1937	174.6	46.7	59.7	151.8	60.9	163.1	90.0	70.8	43.0	93.5	42.5	76.3	1072.9
1938	32.8	113.3	91.0	53.6	85.6	81.5	90.1	59.1	121.1	33.8	73.5	47.1	882.5
1939	61.4	100.2	73.5	92.1	35.6	89.4	75.3	42.6	63.7	68.0	25.7	36.5	764.0
1940	35.6	55.2	65.1	78.1	113.8	102.2	47.3	131.4	67.7	51.6	84.5	98.5	931.0
1941	46.0	25.4	32.1	39.2	54.6	66.4	66.5	80.9	35.7	98.5	56.0	47.7	649.0

Table 2.3-4 Lake Erie Overlake Precipitation (millimeters) (Sheet 3 of 6)

1900-1929 = NOS Lake Survey 1930-1947 = Norton 1948-end = Croley

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1942	43.8	76.0	80.0	63.4	131.7	74.8	100.2	78.1	103.5	93.5	90.2	83.8	1019.0
1943	47.8	44.5	64.9	100.3	144.9	68.0	110.3	64.9	61.7	76.2	47.4	27.5	858.4
1944	30.4	60.2	77.9	105.5	82.0	78.0	38.1	74.8	79.1	44.3	60.5	64.6	795.4
1945	49.0	56.9	105.6	81.7	105.1	122.6	69.4	73.6	163.7	126.3	62.3	52.0	1068.2
1946	29.0	54.6	65.6	23.7	137.9	109.6	62.9	53.9	35.6	86.6	61.2	68.8	789.4
1947	99.8	24.6	61.7	140.2	134.1	105.5	87.4	87.7	81.3	29.2	72.6	55.0	979.1
1948	45.6	65.1	114.6	81.5	105.4	116.4	62.5	65.6	44.5	81.1	94.9	57.0	934.5
1949	80.8	61.7	68.3	59.3	80.3	47.4	86.1	82.6	83.7	39.6	75.8	83.6	849.3
1950	149.1	108.8	92.6	96.1	42.3	69.9	100.7	72.3	90.7	68.3	143.5	63.7	1098.1
1951	70.6	80.8	107.5	79.3	67.3	93.4	62.1	44.0	67.1	63.1	109.6	99.1	943.7
1952	93.4	51.3	67.3	73.1	89.2	38.2	53.1	87.8	80.2	24.0	61.7	69.4	788.4
1953	76.9	28.3	75.9	66.5	111.3	59.3	61.3	65.1	62.9	17.2	63.6	66.7	754.9
1954	68.5	80.8	126.3	129.2	30.7	61.8	48.0	67.8	52.0	216.3	58.6	62.2	1002.1
1955	54.9	63.8	86.1	86.3	50.6	49.1	49.7	106.2	54.7	138.2	80.3	38.1	857.9
1956	44.9	73.7	95.1	97.6	128.6	65.1	91.4	165.7	57.0	24.7	60.7	65.6	970.0
1957	74.0	53.8	36.6	127.4	82.8	133.6	90.5	60.0	113.2	64.7	68.8	85.5	990.8
1958	48.4	30.3	19.5	75.2	52.7	110.3	108.0	100.3	105.2	52.2	97.8	29.4	829.2
1959	115.2	74.9	73.6	99.4	79.8	42.8	77.9	53.2	69.4	132.0	81.9	81.6	981.8
1960	76.3	63.0	38.6	70.6	92.9	92.9	63.8	65.7	43.6	40.2	49.8	27.0	724.3
1961	17.6	80.2	70.3	165.0	55.6	91.3	90.1	108.7	69.4	41.6	68.7	54.7	913.1
1962	70.9	56.5	32.1	38.3	39.9	80.5	72.0	81.8	98.5	71.3	68.5	70.2	780.4

Table 2.3-4 Lake Erie Overlake Precipitation (millimeters) (Sheet 4 of 6)

1900-1929 = NOS Lake Survey 1930-1947 = Norton 1948-end = Croley

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1963	29.3	22.7	72.0	73.7	55.0	42.6	63.4	68.2	36.8	18.6	78.9	49.4	610.6
1964	51.5	30.8	106.1	112.4	67.7	53.5	68.8	146.7	38.4	35.0	35.2	80.9	826.9
1965	109.7	75.4	75.5	50.6	61.1	64.0	62.2	95.6	67.4	90.3	70.9	70.7	893.3
1966	40.8	48.4	66.5	86.9	48.7	77.0	72.2	85.7	71.6	36.1	131.5	110.8	876.2
1967	35.4	40.2	40.9	86.4	81.7	93.6	69.7	72.7	73.7	80.7	89.9	91.2	856.1
1968	87.8	25.1	49.4	58.0	104.0	91.9	76.5	86.2	70.2	65.8	106.8	98.3	920.0
1969	77.8	14.0	39.8	119.9	140.0	107.3	139.6	30.7	67.1	61.1	96.5	64.6	958.2
1970	42.4	37.0	53.2	74.6	74.4	82.3	108.3	38.2	116.2	89.7	96.2	62.9	875.3
1971	36.3	79.8	41.8	35.0	59.3	66.4	64.7	64.0	67.5	51.0	66.8	103.2	735.7
1972	47.2	51.0	90.7	87.7	85.8	116.3	70.2	86.9	125.0	63.6	110.0	89.4	1023.8
1973	41.6	43.6	119.2	69.9	94.9	122.2	73.8	55.8	45.0	93.7	85.7	89.2	934.5
1974	70.9	59.5	101.4	86.3	109.2	103.6	49.9	57.9	68.7	37.0	122.4	79.0	945.8
1975	79.1	73.2	74.6	39.0	57.1	105.5	58.8	196.9	89.5	43.4	65.4	107.6	990.0
1976	78.9	88.0	118.9	59.7	78.0	88.8	105.6	62.8	113.6	73.1	34.1	41.5	942.9
1977	46.8	42.3	98.1	117.5	43.1	86.9	118.8	151.8	184.0	52.5	99.9	114.1	1155.7
1978	100.8	13.4	61.2	76.6	82.2	72.1	38.6	73.2	95.8	99.0	50.2	76.7	839.7
1979	83.0	37.5	67.4	111.0	95.5	69.2	60.3	102.3	94.7	89.4	115.2	100.6	1025.9
1980	30.9	28.2	96.9	85.3	60.2	106.1	139.1	121.8	105.0	90.4	42.0	56.2	962.1
1981	24.7	90.0	29.8	121.2	59.6	128.7	102.8	89.4	146.3	91.1	48.9	70.0	1002.5
1982	84.6	41.1	85.5	48.1	75.1	112.8	59.0	66.1	102.0	47.5	163.7	98.2	983.6
1983	30.8	27.6	64.2	99.1	110.2	84.2	121.8	90.5	82.0	97.1	121.8	110.7	1039.8

Table 2.3-4 Lake Erie Overlake Precipitation (millimeters) (Sheet 5 of 6)

1900-1929 = NOS Lake Survey 1930-1947 = Norton 1948-end = Croley

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1984	38.6	73.2	68.7	72.6	130.4	90.1	62.5	90.9	103.3	40.2	79.5	97.0	946.8
1985	57.5	85.9	125.9	40.4	75.1	73.2	91.5	99.8	59.5	98.4	218.9	63.3	1089.3
1986	40.1	72.9	55.4	77.6	102.3	149.7	81.8	84.6	139.6	114.0	66.8	91.3	1076.1
1987	53.0	13.1	72.1	57.3	45.3	115.3	84.2	173.9	87.5	90.7	67.9	81.2	941.5
1988	37.0	60.2	44.7	59.7	41.9	20.9	86.7	79.6	67.4	123.5	95.2	61.9	778.6
1989	45.2	30.8	69.9	63.8	152.5	114.4	67.5	56.2	87.7	76.2	82.4	52.5	899.2
1990	49.7	113.7	38.0	77.2	122.2	67.7	84.7	123.7	149.4	97.1	68.6	161.0	1152.8
1991	47.0	35.0	75.5	103.6	73.8	30.6	55.7	83.3	52.2	104.1	73.7	55.8	790.2
1992	54.9	50.5	61.5	94.4	47.3	56.0	174.0	128.0	146.3	73.3	140.3	71.3	1097.7
1993	96.0	44.9	73.1	80.4	41.1	112.5	54.2	47.6	114.3	81.2	89.7	56.5	891.6
1994	75.8	35.9	65.3	105.0	46.8	124.3	62.9	121.4	63.2	48.8	75.5	67.0	891.8
1995	105.4	31.6	43.2	86.2	90.8	52.4	83.3	79.6	35.9	133.1	105.9	41.5	888.8
1996	73.5	44.2	52.8	136.1	86.9	129.4	103.3	32.2	226.4	96.7	80.3	84.9	1146.6
1997	58.9	84.2	100.9	49.7	128.1	113.5	59.4	92.6	83.7	53.9	64.5	63.0	952.4
1998	100.4	48.6	88.6	114.3	44.9	61.1	86.5	86.4	39.6	43.4	41.8	47.8	803.2
1999	107.7	45.1	46.8	99.0	53.6	60.3	68.9	68.6	80.8	70.6	83.7	69.6	854.6
2000	48.9	42.3	46.2	106.6	114.1	139.1	114.5	110.8	88.7	69.8	71.9	80.4	1033.4
2001	36.1	51.2	45.0	66.0	89.4	66.5	29.8	76.6	92.8	126.3	68.4	78.4	826.5
2002	66.6	59.3	78.1	112.7	121.3	49.7	69.7	29.0	92.5	60.5	87.4	73.3	900.1
2003	43.6	56.4	59.0	68.8	131.4	71.6	113.1	75.1	147.1	76.6	89.4	78.0	1009.9
2004	66.5	20.7	95.9	73.7	163.5	73.5	118.7	73.8	67.9	73.1	83.3	98.7	1009.2

Table 2.3-4 Lake Erie Overlake Precipitation (millimeters) (Sheet 6 of 6)

1900-1929 = NOS Lake Survey 1930-1947 = Norton 1948-end = Croley

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2005	119.1	59.0	34.1	108.1	40.9	54.8	100.3	85.2	98.3	56.0	96.6	59.0	911.3
2006	66.5	58.7	60.1	67.3	101.7	89.2	192.8	81.0	132.4	140.5	60.6	101.2	1151.9
Mean	64.9	54.1	69.6	79.5	80.2	81.8	80.4	80.8	82.8	73.3	75.0	69.6	892.1
Max.	174.6	113.7	170.4	165.0	163.5	163.1	192.8	196.9	226.4	216.3	218.9	161.0	1155.7
Min.	17.6	13.1	11.7	22.4	14.1	20.9	27.7	23.9	15.2	10.7	7.1	22.9	610.6

Source: Reference 2.3-7

Table 2.3-5 Lake Erie Monthly Evaporation (mm over lake) from GLERL Lake Evaporation Model (Sheet 1 of 3)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Ann.
1948	43.98	8.72	8.37	0.52	16.02	27.58	76.82	110.94	164.75	195.90	130.38	111.75	895.73
1949	40.86	28.54	31.51	14.39	43.41	24.14	90.81	151.95	215.59	144.30	165.37	83.44	1034.31
1950	40.08	39.55	27.27	13.81	4.75	43.48	70.79	107.71	152.98	132.40	190.52	95.36	918.70
1951	30.15	10.88	15.48	4.24	14.98	33.64	77.85	125.68	177.99	162.46	167.45	83.41	904.21
1952	32.35	21.60	18.61	5.26	25.71	32.72	97.72	118.89	173.76	237.55	112.50	77.22	953.89
1953	35.79	33.03	21.36	22.12	16.48	31.30	93.59	116.87	191.56	153.65	150.18	122.13	988.06
1954	48.43	13.29	31.18	6.65	30.09	33.90	83.01	131.52	144.83	168.25	141.58	99.06	931.79
1955	54.57	12.54	22.81	1.13	26.81	49.79	77.91	142.40	178.74	197.61	179.64	85.36	1029.31
1956	30.11	17.97	21.53	10.02	20.87	31.19	70.51	105.32	172.89	141.44	173.25	71.84	866.94
1957	52.47	12.55	14.83	11.12	31.05	32.50	82.60	139.96	159.76	194.22	145.27	78.79	955.12
1958	49.64	26.94	9.10	5.00	27.92	49.35	54.22	123.38	145.67	186.40	154.68	100.42	932.72
1959	25.15	10.27	13.79	0.14	3.00	39.73	69.33	90.57	173.80	203.20	161.14	69.16	859.28
1960	45.46	41.21	29.35	0.69	5.03	35.49	83.76	101.05	142.46	211.10	137.87	122.74	956.21
1961	19.31	4.83	10.80	6.19	28.15	38.39	50.45	109.15	162.29	197.39	159.00	115.97	901.92
1962	33.88	10.99	9.19	3.89	3.65	32.63	98.01	104.13	181.00	165.29	120.46	112.47	875.59
1963	18.04	10.12	7.51	1.44	12.43	32.77	77.12	137.17	156.81	130.32	154.34	120.32	858.39
1964	28.41	18.87	16.31	3.43	21.97	34.78	86.11	137.70	165.25	175.67	122.51	86.61	897.62
1965	48.53	14.87	17.60	3.16	8.55	41.25	88.56	115.86	117.48	202.20	133.27	71.60	862.93
1966	58.39	9.02	13.50	4.66	29.20	22.26	100.59	112.72	184.94	182.22	106.77	95.62	919.89
1967	41.34	33.44	10.39	4.38	22.79	24.71	69.58	125.90	163.44	159.34	149.21	71.02	875.54
1968	28.20	14.98	9.81	2.49	13.23	30.55	71.35	112.75	123.10	194.90	142.08	114.12	857.56
1969	27.10	15.00	18.93	-0.03	10.58	29.69	53.39	110.27	162.78	193.18	128.42	94.69	844.00

Table 2.3-5 Lake Erie Monthly Evaporation (mm over lake) from GLERL Lake Evaporation Model (Sheet 2 of 3)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Ann.
1970	21.92	13.12	12.54	1.78	0.96	35.85	50.12	119.79	138.16	158.25	164.37	100.09	816.95
1971	38.56	10.13	19.61	8.48	8.99	14.87	92.78	107.82	112.06	129.80	192.54	89.12	824.76
1972	68.57	18.59	14.10	8.11	3.77	43.43	52.87	97.17	138.88	189.69	120.96	72.91	829.05
1973	48.22	27.83	5.54	12.61	20.12	27.01	79.26	103.30	179.09	162.81	154.80	110.28	930.87
1974	33.02	34.48	23.07	7.14	21.25	40.15	80.17	103.37	174.51	163.00	124.05	80.89	885.10
1975	44.47	29.91	27.06	20.48	0.64	25.03	94.63	113.03	181.47	158.48	124.03	109.59	928.82
1976	47.09	6.92	11.99	17.37	28.43	29.22	82.36	127.41	171.48	203.01	137.15	70.54	932.97
1977	11.37	9.02	7.46	2.00	4.53	40.17	73.88	108.38	129.66	196.27	142.13	102.39	827.26
1978	28.02	5.44	7.79	1.61	-2.15	25.21	71.83	89.90	150.57	190.70	135.02	104.35	808.29
1979	33.61	7.42	7.76	3.94	11.83	38.32	54.77	106.75	144.10	186.14	124.38	95.84	814.86
1980	55.43	18.69	10.65	1.13	5.57	42.99	55.50	86.45	169.15	223.46	130.60	85.41	885.03
1981	18.14	7.75	14.55	2.07	12.97	30.81	79.34	100.24	169.80	176.32	124.04	94.79	830.82
1982	41.54	10.58	10.00	12.03	-1.76	30.45	59.02	130.74	116.29	164.25	134.82	86.53	794.49
1983	62.76	27.47	27.56	21.98	34.61	33.72	80.69	113.28	186.81	193.15	137.57	122.73	1042.33
1984	13.90	9.08	16.49	0.29	8.23	24.16	74.16	103.86	144.36	116.56	177.62	85.78	774.49
1985	63.12	9.28	10.71	5.80	18.95	57.55	77.89	111.69	144.41	174.70	135.05	133.07	942.22
1986	28.00	11.31	8.65	2.98	5.43	45.41	60.82	149.74	107.08	182.44	149.76	87.35	838.97
1987	50.33	23.92	19.44	12.68	17.67	52.63	77.27	167.84	136.66	216.70	124.66	91.11	990.91
1988	52.19	24.74	13.97	6.24	13.27	63.92	55.61	140.48	152.66	227.62	107.42	97.53	955.65
1989	32.84	35.98	15.44	8.29	9.05	26.11	69.37	115.84	166.41	168.62	165.02	90.46	903.43
1990	12.12	21.46	20.21	11.00	28.69	32.72	72.89	102.39	173.16	182.97	128.24	101.25	887.10
1991	59.05	22.27	17.69	7.38	13.15	60.68	113.37	117.62	206.25	159.99	150.26	95.50	1023.21

Table 2.3-5 Lake Erie Monthly Evaporation (mm over lake) from GLERL Lake Evaporation Model (Sheet 3 of 3)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Ann.
1992	45.76	20.80	29.69	8.99	30.33	53.30	67.86	120.50	150.06	184.59	116.75	97.83	926.46
1993	45.73	36.55	17.28	1.81	16.92	25.18	76.55	101.92	201.68	189.28	124.24	96.29	933.43
1994	34.12	10.58	9.74	0.69	10.48	26.71	64.86	115.08	149.91	163.59	152.67	82.75	821.18
1995	64.95	33.49	10.68	15.62	15.06	27.31	75.80	125.07	200.14	191.37	166.51	92.33	1018.33
1996	28.40	7.64	16.26	2.13	7.48	9.66	88.18	96.48	161.55	170.81	152.19	75.54	816.32
1997	51.67	11.32	16.62	17.66	35.23	19.17	95.33	118.28	145.69	178.65	134.96	80.07	904.65
1998	34.87	17.75	32.86	22.41	21.61	56.27	120.42	120.45	164.19	204.36	148.80	107.93	1051.92
1999	57.00	24.10	29.95	14.05	32.16	52.14	82.50	165.74	168.38	197.16	127.71	107.46	1058.35
2000	45.82	17.42	20.02	33.93	49.81	64.96	90.68	94.02	121.31	88.70	94.40	67.46	788.53
2001	17.56	18.81	19.13	19.86	52.32	57.30	102.32	98.05	109.33	109.35	54.94	54.55	713.52
2002	25.73	27.84	29.23	26.60	48.89	58.10	99.62	101.54	101.15	110.15	81.58	46.51	756.94
2003	48.14	12.62	6.28	2.37	10.01	31.41	79.01	115.41	192.22	191.37	133.10	105.08	927.02
2004	63.95	13.14	9.02	6.29	10.23	59.42	80.10	118.35	149.89	190.19	151.66	129.87	982.11
2005	48.50	15.86	18.31	13.05	29.40	31.89	101.15	143.62	171.88	216.35	181.41	100.77	1072.19
Mean	39.81	18.32	16.67	8.37	18.12	36.98	78.57	116.96	158.49	176.55	140.19	93.71	902.73
Max.	68.57	41.21	32.86	33.93	52.32	64.96	120.42	167.84	215.59	237.55	192.54	133.07	1072.19
Min.	11.37	4.83	5.54	-0.03	-2.15	9.66	50.12	86.45	101.15	88.70	54.94	46.51	713.52

Source: Reference 2.3-7

Table 2.3-6 Great Lakes Water Level Table for Lake Erie (Sheet 1 of 2)

Lake Erie: 1918-2006
(Meters, IGLD 1985)

Minimum and Maximum Water Level

Year	January meters feet	February meters feet	March meters feet	April meters feet	May meters feet	June meters feet	July meters feet	August meters feet	September meters feet	October meters feet	November meters feet	December meters feet
2000	173.84	173.76	173.84	173.96	174.08	174.19	174.27	174.23	174.10	174.01	173.89	173.84
	570.34	570.08	570.34	570.73	571.13	571.49	571.75	571.62	571.19	570.90	570.51	570.34
2001	173.77	173.85	173.95	174.03	174.05	174.10	174.04	173.95	173.84	173.82	173.81	173.88
	570.11	570.37	570.70	570.96	571.03	571.19	571.00	570.70	570.34	570.28	570.24	570.47
2002	173.86	173.98	174.03	174.21	174.31	174.34	174.25	174.16	174.05	173.96	173.85	173.82
	570.41	570.80	570.96	571.56	571.88	571.98	571.69	571.39	571.03	570.73	570.37	570.28
2003	173.82	173.74	173.79	173.97	174.09	174.18	174.19	174.18	174.05	173.93	173.87	173.90
	570.28	570.01	570.18	570.77	571.16	571.46	571.49	571.46	571.03	570.64	570.44	570.54
2004	173.95	173.86	173.96	174.12	174.23	174.37	174.35	174.30	174.26	174.08	174.02	174.02
	570.70	570.41	570.73	571.26	571.62	572.08	572.01	571.85	571.72	571.13	570.93	570.93
2005	174.24	174.27	174.30	174.39	174.41	174.33	174.23	174.15	174.08	174.01	173.89	173.86
	571.65	571.75	571.85	572.15	572.21	571.95	571.62	571.36	571.13	570.90	570.51	570.41
2006	173.98	174.08	174.12	174.17	174.21	174.26	174.29	174.24	174.15	174.10	174.11	174.17
	570.80	571.13	571.26	571.42	571.56	571.72	571.82	571.65	571.36	571.19	571.23	571.42
Record High	174.86	174.78	174.88	174.98	174.97	175.04	175.03	174.94	174.83	174.94	174.85	174.90
	573.69	573.43	573.75	574.08	574.05	574.28	574.25	573.95	573.59	573.95	573.65	573.82
Record Low	173.21	173.18	173.20	173.38	173.44	173.45	173.45	173.43	173.38	173.30	173.20	173.19
	568.27	568.18	568.24	568.83	569.03	569.06	569.06	569.00	568.83	568.57	568.24	568.21

Table 2.3-6 Great Lakes Water Level Table for Lake Erie (Sheet 2 of 2)

Lake Erie: 1918-2006
(Meters, IGLD 1985)

Minimum and Maximum Water Level

Year	January meters feet	February meters feet	March meters feet	April meters feet	May meters feet	June meters feet	July meters feet	August meters feet	September meters feet	October meters feet	November meters feet	December meters feet
*Average	173.99	173.98	174.07	174.22	174.30	174.33	174.32	174.25	174.16	174.06	173.99	173.99
	570.83	570.80	571.10	571.59	571.85	571.95	571.92	571.69	571.39	571.06	570.83	570.83

* The average is estimated from 1918-2006
Source: Reference 2.3-14

Table 2.3-7 Great Lakes Water Levels (Sheet 1 of 3)

Long Term Average Min-Max Water Levels - Period of Record 1918-2006
All levels in this table are referenced in the International Great Lakes Datum of 1985 (IGLD 85)
English Units (feet)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lake Superior												
Mean	601.5	601.3	601.2	601.3	601.6	601.9	602.1	602.2	602.2	602.1	602.0	601.7
Max	602.7 1986	602.5 1986	602.4 1986	602.6 1986	602.8 1986	602.9 1986	603.1 1950	603.2 1952	603.2 1985	603.4 1985	603.3 1985	603.1 1985
Min	599.8 1926	599.6 1926	599.5 1926	599.5 1926	599.6 1926	599.9 1926	600.3 1926	600.5 1926	600.8 1926	600.7 1925	600.4 1925	600.1 1925
Lakes Michigan-Huron												
Mean	578.5	578.4	578.5	578.8	579.1	579.3	579.4	579.3	579.2	578.9	578.7	578.6
Max	581.3 1987	581.1 1986	581.1 1986	581.5 1986	581.6 1986	581.8 1986	582.0 1986	582.0 1986	582.0 1986	582.3 1986	582.0 1986	581.6 1986
Min	576.1 1965	576.1 1964	576.0 1964	576.1 1964	576.6 1964	576.6 1964	576.7 1964	576.7 1964	576.6 1964	576.4 1964	576.3 1964	576.2 1964
Lake St. Clair												
Mean	573.6	573.5	573.8	574.3	574.5	574.7	574.8	574.6	574.4	574.1	573.9	573.9
Max	576.8 1986	576.8 1986	576.8 1986	576.8 1986	576.9 1986	577.2 1986	577.2 1986	577.1 1986	576.9 1986	577.3 1986	576.8 1986	576.8 1986
Min	570.5 1936	570.5 1926	571.0 1934	571.9 1926	572.2 1934	572.3 1934	572.5 1934	572.2 1934	572.0 1934	571.8 1934	571.5 1934	571.7 1964
Lake Erie												
Mean	570.8	570.8	571.1	571.6	571.9	571.9	571.9	571.7	571.4	571.1	570.8	570.8
Max	573.7 1987	573.4 1987	573.8 1986	574.1 1985	574.0 1986	574.3 1986	574.2 1986	574.0 1986	573.6 1986	574.0 1986	573.7 1986	573.8 1986
Min	568.3 1935	568.2 1936	568.2 1934	568.8 1934	569.0 1934	569.1 1934	569.1 1934	569.0 1934	568.8 1934	568.6 1934	568.2 1934	568.2 1934

Table 2.3-7 Great Lakes Water Levels (Sheet 2 of 3)

Lake Ontario												
Mean	244.6	244.7	245.0	245.7	246.1	246.2	246.0	245.7	245.2	244.8	244.6	244.5
Max	246.6 1946	246.9 1952	247.3 1952	248.2 1973	248.5 1973	248.6 1952	248.2 1947	248.0 1947	247.4 1947	246.8 1945	246.7 1945	246.7 1945
Min	242.2 1935	242.1 1936	242.6 1935	242.9 1935	243.1 1935	243.4 1935	243.2 1934	242.8 1934	242.5 1934	242.2 1934	242.0 1934	241.9 1934
Metric Units (meters)												
Lake Superior												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Mean	183.34	183.28	183.25	183.27	183.37	183.46	183.52	183.55	183.55	183.52	183.48	183.41
Max	183.70 1986	183.63 1986	183.61 1986	183.68 1986	183.74 1986	183.76 1986	183.82 1950	183.86 1952	183.86 1985	183.91 1985	183.89 1985	183.81 1985
Min	182.83 1926	182.76 1926	182.74 1926	182.72 1926	182.76 1926	182.85 1926	182.96 1926	183.02 1926	183.12 1926	183.10 1925	183.01 1925	182.92 1925
Lakes Michigan-Huron												
Mean	176.32	176.31	176.32	176.41	176.50	176.57	176.60	176.58	176.53	176.46	176.40	176.36
Max	177.18 1987	177.11 1986	177.12 1986	177.23 1986	177.28 1986	177.33 1986	177.39 1986	177.39 1986	177.38 1986	177.50 1986	177.38 1986	177.26 1986
Min	175.60 1965	175.59 1964	175.58 1964	175.61 1964	175.74 1964	175.76 1964	175.78 1964	175.77 1964	175.76 1964	175.70 1964	175.65 1964	175.62 1964
Lake St. Clair												
Mean	174.84	174.79	174.90	175.04	175.12	175.17	175.19	175.15	175.09	175.00	174.91	174.91
Max	175.80 1986	175.80 1986	175.80 1986	175.82 1986	175.83 1986	175.92 1986	175.93 1986	175.90 1986	175.84 1986	175.96 1986	175.82 1986	175.80 1986
Min	173.88 1936	173.89 1926	174.05 1934	174.32 1926	174.42 1934	174.45 1934	174.50 1934	174.41 1934	174.34 1934	174.27 1934	174.18 1934	174.24 1964

Table 2.3-7 Great Lakes Water Levels (Sheet 3 of 3)

Lake Erie												
Mean	173.99	173.98	174.07	174.22	174.30	174.33	174.32	174.25	174.16	174.06	173.99	173.99
Max	174.86 1987	174.78 1987	174.88 1986	174.98 1985	174.97 1986	175.04 1986	175.03 1986	174.94 1986	174.83 1986	174.94 1986	174.85 1986	174.90 1986
Min	173.21 1935	173.18 1936	173.20 1934	173.38 1934	173.44 1934	173.45 1934	173.45 1934	173.43 1934	173.38 1934	173.30 1934	173.20 1934	173.19 1934
Lake Ontario												
Mean	74.56	74.59	74.67	74.88	75.01	75.04	74.99	74.88	74.74	74.61	74.54	74.53
Max	75.16 1946	75.27 1952	75.37 1952	75.65 1973	75.73 1973	75.76 1952	75.66 1947	75.58 1947	75.41 1947	75.22 1945	75.18 1945	75.20 1945
Min	73.81 1935	73.78 1936	73.94 1935	74.03 1935	74.11 1935	74.19 1935	74.14 1934	74.00 1934	73.91 1934	73.82 1934	73.75 1934	73.74 1934

Source: Reference 2.3-14

Table 2.3-8 Lake Erie Mean Lake Levels (IGLD 1985)

		December	January	February	March	April	May	June	July	August	September	October	November
***2007	Ft.	-	571.88	571.62	571.75	571.95	572.08	571.75	571.39	571.33	571.16	570.70	570.24
	M.	-	174.31	174.23	174.27	174.33	174.37	174.27	174.16	174.14	174.09	173.95	173.81
*2006	Ft.	571.42	570.80	571.10	571.29	571.42	571.52	571.72	571.82	571.65	571.39	571.19	571.26
	M.	174.17	173.98	174.07	174.13	174.17	174.20	174.26	174.29	174.24	174.16	174.10	174.12
2005	Ft.	570.37	-	-	-	-	-	-	-	-	-	-	-
	M.	173.85	-	-	-	-	-	-	-	-	-	-	-
	Ft.	573.82	573.69	573.43	573.75	574.08	574.05	574.28	574.25	573.95	573.59	573.95	573.65
**Max.	M.	174.90	174.86	174.78	174.88	174.98	174.97	175.04	175.03	174.94	174.83	174.94	174.85
	Yr.	1986	1987	1987	1986	1985	1986	1986	1986	1986	1986	1986	1986
	Ft.	568.21	568.27	568.18	568.24	568.83	569.03	569.06	569.06	569.00	568.83	568.57	568.24
**Min.	M.	173.19	173.21	173.18	173.20	173.38	173.44	173.45	173.45	173.43	173.38	173.30	173.20
	Yr.	1934	1935	1936	1934	1934	1934	1934	1934	1934	1934	1934	1934
**Avg.	Ft.	570.83	570.83	570.80	571.10	571.59	571.85	571.95	571.92	571.69	571.39	571.06	570.83
	M.	173.99	173.99	173.98	174.07	174.22	174.30	174.33	174.32	174.25	174.16	174.06	173.99

* Provisional (for 2005-2006)
** Average, Maximum and Minimum for period 1918-2006
*** Provisional (for 2006-2007)

Source: Reference 2.3-15 and Reference 2.3-16

Table 2.3-9 Historical Max and Min Water Levels for Fermi 3 (Sheet 1 of 5)

Fermi Power Plant, MI
Station ID: 9063090

Station	Year	Mo	Max	Max Date	Time	Min	Min Date	Time
9063090	1996	9	573.55	19960926	19:00	570.55	19960914	19:00
9063090	1996	10	573.71	19961030	00:00	568.35	19961030	12:00
9063090	1996	11	573.02	19961115	22:00	570.92	19961101	12:00
9063090	1996	12	573.83	19961231	15:00	569.42	19961224	16:00
9063090	1997	1	574.65	19970109	09:00	569.07	19970110	18:00
9063090	1997	2	575.32	19970228	01:00	570.04	19970227	16:00
9063090	1997	3	575.33	19970313	21:00	570.76	19970315	06:00
9063090	1997	4	574.93	19970412	07:00	570.28	19970407	02:00
9063090	1997	5	574.76	19970501	22:00	570.42	19970501	10:00
9063090	1997	6	575.21	19970607	19:00	573.48	19970626	04:00
9063090	1997	7	574.78	19970722	10:00	572.75	19970704	07:00
9063090	1997	8	574.31	19970812	20:00	572.36	19970822	09:00
9063090	1997	9	574.14	19970925	22:00	571.17	19970930	09:00
9063090	1997	10	574.16	19971026	17:00	570.83	19971021	21:00
9063090	1997	11	573.80	19971122	02:00	570.64	19971117	06:00
9063090	1997	12	573.91	19971210	15:00	570.04	19971206	07:00
9063090	1998	1	574.52	19980114	23:00	570.40	19980110	14:00
9063090	1998	2	575.46	19980217	21:00	571.98	19980212	13:00
9063090	1998	3	575.35	19980321	02:00	570.18	19980314	11:00
9063090	1998	4	576.22	19980409	14:00	572.35	19980402	11:00
9063090	1998	5	574.74	19980507	18:00	572.82	19980531	09:00
9063090	1998	6	574.45	19980605	04:00	571.96	19980626	06:00
9063090	1998	7	574.05	19980705	03:00	571.22	19980722	03:00
9063090	1998	8	573.52	19980819	03:00	571.49	19980825	12:00
9063090	1998	9	573.24	19980901	02:00	571.51	19980927	12:00
9063090	1998	10	573.21	19981005	21:00	570.40	19981013	19:00
9063090	1998	11	572.35	19981103	09:00	566.36	19981111	09:00
9063090	1998	12	571.88	19981223	00:00	568.28	19981222	13:00
9063090	1999	1	573.47	19990102	20:00	567.37	19990103	16:00

Table 2.3-9 Historical Max and Min Water Levels for Fermi 3 (Sheet 2 of 5)

Fermi Power Plant, MI
Station ID: 9063090

Station	Year	Mo	Max	Max Date	Time	Min	Min Date	Time
9063090	1999	2	572.22	19990223	22:00	569.27	19990212	08:00
9063090	1999	3	573.63	19990309	13:00	569.69	19990304	10:00
9063090	1999	4	574.19	19990409	14:00	570.03	19990406	19:00
9063090	1999	5	573.08	19990513	11:00	569.84	19990525	12:00
9063090	1999	6	572.40	19990603	23:00	570.85	19990602	23:00
9063090	1999	7	572.50	19990729	02:00	570.33	19990729	07:00
9063090	1999	8	572.32	19990806	21:00	570.34	19990808	08:00
9063090	1999	9	571.87	19990925	18:00	569.50	19990929	23:00
9063090	1999	10	572.30	19991004	00:00	568.69	19991026	05:00
9063090	1999	11	572.00	19991111	04:00	568.04	19991103	01:00
9063090	1999	12	572.99	19991214	04:00	567.38	19991226	05:00
9063090	2000	1	571.93	20000103	21:00	567.87	20000111	15:00
9063090	2000	2	570.86	20000218	16:00	568.12	20000205	20:00
9063090	2000	3	571.86	20000318	20:00	568.95	20000301	19:00
9063090	2000	4	572.38	20000417	13:00	568.88	20000406	13:00
9063090	2000	5	573.32	20000519	11:00	569.63	20000510	14:00
9063090	2000	6	572.91	20000605	10:00	570.64	20000602	18:00
9063090	2000	7	572.39	20000718	09:00	570.98	20000721	18:00
9063090	2000	8	572.40	20000817	00:00	570.58	20000816	16:00
9063090	2000	9	572.63	20000905	07:00	568.68	20000921	07:00
9063090	2000	10	572.26	20001005	12:00	569.90	20001010	22:00
9063090	2000	11	571.58	20001106	20:00	567.08	20001120	23:00
9063090	2000	12	571.80	20001212	15:00	565.73	20001217	17:00
9063090	2001	1	570.58	20010108	08:00	568.31	20010109	23:00
9063090	2001	2	571.94	20010224	20:00	567.46	20010225	22:00
9063090	2001	3	572.59	20010316	12:00	569.28	20010314	05:00
9063090	2001	4	571.87	20010407	12:00	569.58	20010412	19:00
9063090	2001	5	571.80	20010506	21:00	569.84	20010527	21:00
9063090	2001	6	571.82	20010601	04:00	570.13	20010603	05:00

Table 2.3-9 Historical Max and Min Water Levels for Fermi 3 (Sheet 3 of 5)

Fermi Power Plant, MI
Station ID: 9063090

Station	Year	Mo	Max	Max Date	Time	Min	Min Date	Time
9063090	2001	7	572.31	20010726	15:00	570.38	20010726	06:00
9063090	2001	8	571.46	20010811	02:00	569.21	20010817	17:00
9063090	2001	9	571.54	20010914	03:00	568.11	20010926	10:00
9063090	2001	10	572.50	20011016	09:00	565.60	20011026	00:00
9063090	2001	11	571.51	20011129	03:00	568.72	20011108	00:00
9063090	2001	12	571.80	20011214	16:00	568.43	20011220	06:00
9063090	2002	1	572.38	20020131	12:00	568.63	20020115	09:00
9063090	2002	2	572.27	20020202	00:00	566.49	20020201	16:00
9063090	2002	3	572.51	20020317	10:00	564.66	20020310	02:00
9063090	2002	4	573.07	20020427	20:00	570.16	20020425	05:00
9063090	2002	5	573.15	20020512	06:00	570.18	20020510	10:00
9063090	2002	6	572.85	20020603	20:00	570.60	20020616	08:00
9063090	2002	7	572.96	20020710	11:00	570.85	20020730	00:00
9063090	2002	8	572.40	20020828	02:00	570.52	20020818	04:00
9063090	2002	9	571.97	20020906	20:00	569.78	20020921	06:00
9063090	2002	10	572.20	20021029	13:00	568.17	20021005	04:00
9063090	2002	11	571.59	20021116	01:00	568.28	20021129	12:00
9063090	2002	12	571.65	20021217	19:00	567.99	20021221	01:00
9063090	2003	1	571.52	20030102	12:00	568.35	20030110	17:00
9063090	2003	2	571.17	20030216	07:00	568.09	20030204	14:00
9063090	2003	3	571.93	20030319	05:00	569.45	20030309	05:00
9063090	2003	4	573.44	20030417	09:00	568.64	20030405	11:00
9063090	2003	5	572.17	20030531	10:00	568.54	20030512	09:00
9063090	2003	6	572.17	20030612	17:00	570.49	20030626	22:00
9063090	2003	7	572.15	20030712	18:00	569.54	20030711	14:00
9063090	2003	8	572.31	20030827	22:00	570.38	20030825	05:00
9063090	2003	9	572.11	20030901	11:00	568.73	20030919	17:00
9063090	2003	10	571.49	20031002	18:00	568.21	20031015	08:00
9063090	2003	11	571.71	20031122	06:00	564.19	20031113	06:00

Table 2.3-9 Historical Max and Min Water Levels for Fermi 3 (Sheet 4 of 5)

Fermi Power Plant, MI
Station ID: 9063090

Station	Year	Mo	Max	Max Date	Time	Min	Min Date	Time
9063090	2003	12	571.98	20031205	17:00	568.17	20031201	18:00
9063090	2004	1	572.03	20040105	01:00	567.27	20040107	01:00
9063090	2004	3	572.92	20040316	09:00	568.02	20040312	05:00
9063090	2004	4	572.33	20040425	05:00	569.96	20040403	23:00
9063090	2004	5	573.13	20040530	20:00	570.40	20040524	15:00
9063090	2004	6	573.11	20040610	16:00	571.31	20040624	08:00
9063090	2004	7	572.63	20040725	16:00	571.09	20040714	15:00
9063090	2004	8	572.68	20040805	23:00	570.89	20040810	22:00
9063090	2004	9	573.21	20040908	20:00	571.14	20040909	06:00
9063090	2004	10	572.12	20041018	22:00	567.65	20041016	17:00
9063090	2004	11	572.69	20041124	17:00	568.08	20041128	15:00
9063090	2004	12	572.29	20041206	03:00	567.17	20041201	12:00
9063090	2005	1	572.87	20050105	21:00	568.89	20050106	21:00
9063090	2005	2	573.01	20050220	16:00	570.73	20050214	23:00
9063090	2005	3	573.58	20050323	11:00	570.40	20050301	12:00
9063090	2005	4	573.81	20050412	05:00	570.16	20050403	09:00
9063090	2005	5	573.42	20050513	18:00	571.46	20050524	14:00
9063090	2005	6	572.66	20050619	20:00	570.67	20050615	19:00
9063090	2005	7	572.38	20050702	04:00	570.79	20050726	08:00
9063090	2005	8	572.69	20050831	04:00	569.73	20050831	12:00
9063090	2005	9	572.61	20050924	04:00	568.24	20050929	06:00
9063090	2005	10	572.00	20051019	21:00	569.81	20051018	15:00
9063090	2005	11	572.35	20051114	23:00	566.54	20051106	18:00
9063090	2005	12	572.30	20051209	17:00	566.88	20051209	10:00
9063090	2006	1	572.09	20060116	09:00	567.72	20060118	16:00
9063090	2006	2	572.22	20060217	17:00	567.76	20060217	08:00
9063090	2006	3	572.55	20060321	05:00	568.75	20060314	03:00
9063090	2006	4	572.35	20060429	20:00	569.40	20060403	18:00
9063090	2006	5	572.55	20060514	20:00	570.37	20060511	14:00

Table 2.3-9 Historical Max and Min Water Levels for Fermi 3 (Sheet 5 of 5)

Fermi Power Plant, MI
Station ID: 9063090

Station	Year	Mo	Max	Max Date	Time	Min	Min Date	Time
9063090	2006	6	572.44	20060622	10:00	570.83	20060620	02:00
9063090	2006	7	572.44	20060703	01:00	570.80	20060702	05:00
9063090	2006	8	572.80	20060831	04:00	570.91	20060827	03:00
9063090	2006	9	573.63	20060902	16:00	569.82	20060924	18:00
9063090	2006	10	572.73	20061005	03:00	567.96	20061028	17:00
9063090	2006	12	573.15	20061201	09:00	565.49	20061201	20:00
9063090	2007	1	573.24	20070115	04:00	568.80	20070108	13:00
9063090	2007	2	573.22	20070213	18:00	568.61	20070203	22:00
9063090	2007	3	573.47	20070316	07:00	570.05	20070305	02:00
9063090	2007	4	573.19	20070411	17:00	568.82	20070404	14:00
9063090	2007	5	573.10	20070501	18:00	571.26	20070516	15:00
9063090	2007	6	572.68	20070609	02:00	570.84	20070621	10:00
9063090	2007	7	572.10	20070702	06:00	570.32	20070720	06:00
9063090	2007	8	572.51	20070818	01:00	569.88	20070817	16:00
9063090	2007	9	572.01	20070908	13:00	569.15	20070911	22:00
9063090	2007	10	572.34	20071025	20:00	568.60	20071019	22:00
9063090	2007	11	571.82	20071128	02:00	566.30	20071106	14:00
9063090	2007	12	571.61	20071202	00:00	566.40	20071223	21:00
9063090	2004	2	571.41	20040205	19:00	568.60	20040221	08:00

Source: Reference 2.3-19

Table 2.3-10 NOAA's Great Lakes Coastal Forecasting System, Data for Lake Erie

	Ambient Lake Water Temperature (°F)		Ambient Lake Current Velocity (m/s)	
Month	10th Percentile	90th Percentile	10th Percentile	Maximum
January	32	39	0.012	0.119
February	32	34	0.013	0.135
March	33	39	0.010	0.155
April	39	47	0.011	0.124
May	48	61	0.011	0.106
June	59	68	0.013	0.082
July	65	73	0.009	0.069
August	69	76	0.010	0.100
September	66	75	0.007	0.116
October	53	70	0.008	0.144
November	47	53	0.008	0.138
December	37	42	0.009	0.144

Source: Reference 2.3-9

Table 2.3-11 Extreme Recorded Lake Erie Water Levels

Station:	9063090	Begin Date:	19700713
Name:	Fermi Power Plant, MI	End Date:	0080109
Product:	High/Low	Units:	Feet
Datum:	IGLD 85	Quality:	Verified

Rank	Highest	Highest Date		Lowest	Lowest Date	
*1				563.64	19670216	07:00
1	576.22	19980409	14:00	564.19	20031113	06:00
2	575.46	19980217	21:00	564.66	20020310	02:00
3	575.35	19980321	02:00	565.49	20061201	20:00
4	575.33	19970313	21:00	565.60	20011026	00:00
5	575.32	19970228	01:00	565.73	20001217	17:00
6	575.21	19970607	19:00	566.30	20071106	14:00
7	574.93	19970412	07:00	566.36	19981111	09:00
8	574.78	19970722	10:00	566.40	20071223	21:00
9	574.76	19970501	22:00	566.49	20020201	16:00
10	574.74	19980507	18:00	566.54	20051106	18:00

* 1 is the lowest elevation of record that was noted on a Nuclear Generation Memorandum NP-00-0064 dated August 16, 2000. Elevation has also been confirmed by NOAA (National Oceanic & Atmospheric Administration) on 02/07/2008.

Source: Reference 2.3-19

Table 2.3-12 Possible Storm Induced Lake Level Increases

(feet)

Month	Lake Erie at Fermi Power Plant				
	20%	10%	3%	2%	1%
January	2.20	2.50	3.00	3.30	3.60
February	1.90	2.20	2.70	3.00	3.30
March	2.20	2.50	2.80	3.00	3.20
April	2.10	2.50	3.00	3.30	3.70
May	1.40	1.70	2.00	2.30	2.50
June	1.30	1.50	1.90	2.10	2.40
July	1.10	1.30	1.50	1.60	1.80
August	1.10	1.30	1.40	1.50	1.60
September	1.40	1.70	2.00	2.20	2.40
October	1.80	2.10	2.40	2.70	2.90
November	2.00	2.30	2.60	2.80	3.00
December	2.30	2.70	3.20	3.60	4.00

The rises shown here, should they occur, would be in addition to still water levels.
The maximum storm evaluated on this chart is a 100 year storm.

Source: Reference 2.3-22

Table 2.3-13 Detroit River Flows

(m^3/s) (Sheet 1 of 6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg Ann
1900	4300	4160	4190	5270	5300	5380	5490	5550	5550	5580	5640	5380	5149
1901	4960	4020	4500	3620	5010	5640	5780	5800	5690	5610	5580	5410	5135
1902	4250	4390	5100	5100	5300	5490	5720	5610	5470	5320	5320	5320	5199
1903	4280	4080	5130	5440	5440	5580	5690	5520	5580	5610	5550	5690	5299
1904	4530	4670	4590	5660	5690	5780	5830	5890	5830	5800	5750	5550	5464
1905	3820	4420	4870	5520	5720	5890	6000	6000	5920	5950	5800	5690	5467
1906	5490	4220	4790	5410	5830	5920	5950	5890	5750	5660	5690	5240	5487
1907	4790	4330	4980	5690	5800	5750	5920	5920	5890	5830	5690	5550	5512
1908	4330	4130	5010	5660	5800	5920	6000	6000	5720	5720	5520	5380	5433
1909	4980	3740	4250	5440	5580	5580	5610	5550	5520	5470	5380	4980	5173
1910	4700	3910	4960	5270	5490	5410	5320	5300	5270	5320	5270	4930	5096
1911	3820	3910	4640	4900	5130	5210	5210	5240	5130	5180	5150	5040	4880
1912	3960	3940	4590	4980	5270	5440	5490	5490	5550	5610	5660	5580	5130
1913	5300	4190	4560	5690	5720	5690	5750	5690	5580	5690	5660	5410	5411
1914	4700	4420	4560	5150	5440	5440	5440	5550	5520	5440	5490	5300	5204
1915	3770	4500	4530	5100	5240	5210	5270	5320	5240	5210	5210	5040	4970
1916	5040	4330	3940	5180	5550	5490	5640	5780	5660	5640	5640	5580	5289
1917	4500	4530	5350	5720	5830	5830	5970	6090	5800	5890	5830	4870	5518
1918	4330	4790	4870	5150	6200	6230	6170	6090	6060	5830	5950	5720	5616
1919	5780	5320	5550	5780	5830	5690	5690	5780	5690	5610	5660	5490	5656
1920	3480	3960	4790	5470	5440	5660	5750	5720	5720	5690	5470	5150	5192

Table 2.3-13 Detroit River Flows

(m³/s) (Sheet 2 of 6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg Ann
1921	5320	3710	5240	5300	5380	5410	5410	5350	5240	5320	5070	5180	5161
1922	4500	3960	4700	5100	5150	5520	5490	5470	5380	5320	5300	5070	5080
1923	4160	3850	4450	4870	4930	5270	5210	5210	5180	5180	5100	4620	4836
1924	4530	3450	4330	4500	4810	5070	5070	5130	5130	5040	4900	4420	4698
1925	4050	3740	4330	4390	4530	4730	4730	4670	4560	4620	4530	4300	4432
1926	3230	3170	3740	4330	4640	4590	4620	4640	4620	4700	4700	4640	4302
1927	3370	3570	4050	4790	4870	5040	5100	5040	4960	5010	4980	4900	4640
1928	4530	3910	3790	4980	5320	5320	5410	5520	5580	5690	5690	5690	5119
1929	5100	4640	5720	6170	6460	6400	6430	6310	6120	5920	5970	5350	5883
1930	4700	4760	5660	5720	5780	5720	5860	5780	5660	5640	5270	5100	5471
1931	4360	3280	3450	4960	4930	4930	4980	4840	4790	4810	4840	4730	4575
1932	4560	4640	3790	4470	4700	4700	4730	4700	4590	4500	4450	4530	4530
1933	4360	3770	4220	4530	4590	4810	4700	4590	4470	4420	4420	4160	4420
1934	3340	3430	4050	4450	4450	4470	4500	4530	4500	4500	4390	4450	4255
1935	3960	4450	4110	4530	4700	4530	4730	4730	4670	4620	4590	4020	4470
1936	3960	3770	4250	4590	4760	4900	4870	4790	4870	4870	4760	4560	4579
1937	4670	3680	4500	4730	4810	4670	4640	4640	4620	4730	4670	4300	4555
1938	3710	4330	4050	4870	4960	5040	5150	5210	5150	5180	5150	4930	4811
1939	4590	4190	4190	5100	5130	5210	5300	5320	5380	5320	5270	5070	5006
1940	3880	4050	4220	4810	4810	5070	5010	4980	5100	5070	5130	4980	4759
1941	4300	3680	4190	4670	5010	5010	5010	4900	4960	5040	5130	5040	4745

Table 2.3-13 Detroit River Flows
(m^3/s) (Sheet 3 of 6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg Ann
1942	4330	3230	4390	5210	5270	5440	5440	5380	5410	5210	5300	5070	4973
1943	4470	4190	5040	5320	5720	5720	5950	5970	5950	5890	5830	5610	5472
1944	4300	4670	4790	5550	5610	5720	5750	5640	5610	5640	5520	5520	5360
1945	4470	4450	5150	5320	5640	5720	5830	5720	5660	5780	5550	5440	5394
1946	5100	4760	5520	5720	5690	5780	5720	5640	5490	5380	5320	5270	5449
1947	4590	4300	5040	5660	5550	5690	5830	5830	5780	5660	5690	5490	5426
1948	5210	4960	5440	5580	5890	5660	5720	5660	5490	5240	5130	5040	5418
1949	5210	5100	4390	5150	5100	5070	5150	5150	5040	4930	4810	4790	4991
1950	4810	4300	4330	5100	4980	5100	5270	5300	5380	5380	5300	5270	5043
1951	4590	4730	5410	5610	5780	5890	6060	6120	6060	6120	6170	6290	5736
1952	6340	5950	6170	6400	6340	6460	6510	6570	6570	6340	6170	6090	6326
1953	5950	5830	6000	6000	6170	6290	6400	6340	6230	6060	6000	5830	6092
1954	4900	4670	5890	5830	5950	6060	6170	6090	6060	6230	6140	6000	5833
1955	5890	5380	5950	5890	5950	5950	6000	5780	5720	5610	5440	5320	5740
1956	4470	3960	4900	5350	5860	5550	5550	5660	5610	5440	5320	5150	5235
1957	4330	4360	4980	5070	5130	5130	5380	5240	5300	5100	5100	5040	5013
1958	4020	3740	4810	4450	5040	4960	4980	4930	4900	4810	4670	4590	4658
1959	3450	3740	4620	4700	4840	4870	4930	4960	4960	5040	5100	5150	4697
1960	5040	4300	4730	5440	5490	5720	5780	5830	5800	5780	5660	5320	5408
1961	5010	5180	5380	5380	5350	5320	5380	5410	5380	5410	5380	5210	5316
1962	4530	4130	5180	5240	5320	5380	5350	5300	5300	5150	5040	4670	5049

Table 2.3-13 Detroit River Flows

(m^3/s) (Sheet 4 of 6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg Ann
1963	4190	3740	4500	4810	4840	4930	4930	4930	4840	4790	4700	4530	4644
1964	3960	3680	4250	4330	4500	4500	4560	4620	4620	4590	4560	4420	4383
1965	3960	4080	4330	4760	4760	4840	4930	4960	5010	5150	5130	5130	4753
1966	4980	4760	5010	5180	5240	5240	5270	5210	5180	5040	5010	5130	5104
1967	4870	4590	5010	5380	5240	5410	5580	5520	5440	5410	5490	5440	5282
1968	4760	5150	5270	5240	5270	5440	5550	5640	5610	5660	5610	5580	5398
1969	4840	5490	5440	5660	5720	5830	5950	6030	5950	5890	5950	5720	5706
1970	4220	4810	5550	5690	5690	5800	5890	5860	5860	5830	5860	5800	5572
1971	5380	5100	5890	5950	5920	6060	6120	6140	6120	6030	5950	5860	5877
1972	5720	5440	5750	5780	5920	6060	6120	6230	6290	6290	6310	6170	6007
1973	6140	5660	6310	6260	6340	6460	6510	6540	6480	6430	6400	6260	6316
1974	6090	6060	6230	6230	6400	6460	6600	6510	6430	6290	6200	6060	6297
1975	5920	5860	5800	6140	6140	6290	6310	6310	6340	6120	5970	5920	6093
1976	4899	5380	6088	6173	6400	6315	6456	6343	6117	5975	5805	5239	5933
1977	4166	4787	5748	5579	5437	5465	5494	5437	5494	5607	5607	5417	5353
1978	4959	4798	5380	5607	5409	5550	5663	5720	5776	5805	5720	5491	5490
1979	4616	4729	5777	6060	6032	6060	6173	6201	6145	6003	6060	6003	5822
1980	5918	5663	5805	5947	5918	6003	6060	6060	6060	6003	5890	5833	5930
1981	4644	5663	5777	5777	5918	5833	5947	5918	6060	6032	5862	5720	5763
1982	4729	4701	5663	5607	5578	5692	5720	5805	5805	5748	5805	5862	5560
1983	5692	5692	5805	5890	6088	6173	6230	6201	6145	6088	6003	5663	5973

Table 2.3-13 Detroit River Flows

(m^3/s) (Sheet 5 of 6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg Ann
1984	4672	5890	5805	4049	5947	6315	6258	6286	6258	6230	6230	6230	5848
1985	5833	5777	6456	6400	6456	6485	6456	6485	6513	6513	6739	6343	6371
1986	5805	5805	6400	6428	6428	6569	6626	6683	6739	7079	6768	6541	6489
1987	6201	5720	6003	6258	6145	6173	6145	6088	6003	5890	5890	5890	6034
1988	5267	5182	5635	5777	5692	5663	5663	5578	5493	5550	5550	5522	5548
1989	5324	5097	5069	5434	5409	5465	5437	5465	5437	5380	5380	4502	5283
1990	5150	5280	5230	5320	5310	5400	5540	5510	5560	5540	5570	5560	5414
1991	5270	5230	5320	5570	5660	5740	5720	5700	5560	5430	5470	5600	5523
1992	5320	5300	5520	5620	5590	5560	5620	5600	5630	5570	5690	5590	5551
1993	5720	5030	5270	5580	5670	5870	6020	5970	5990	5910	5810	5790	5719
1994	4920	5280	5640	5710	5790	5800	5880	5890	5840	5790	5760	5700	5667
1995	5760	5180	5250	5490	5590	5620	5600	5610	5550	5420	5620	5450	5512
1996	4380	5330	5250	4680	5770	5890	5920	5920	5960	6010	5990	5960	5588
1997	5690	6100	6190	6050	6290	6240	6340	6390	6440	6210	6060	5970	6164
1998	5850	5800	5910	5920	5910	5930	5940	5830	5740	5630	5460	5420	5778
1999	5080	5320	5060	5180	5140	5250	5350	5310	5170	5090	5020	4980	5163
2000	4750	4950	5000	5000	5000	5080	5140	5120	5070	4990	4900	5080	5007
2001	5040	5050	4900	4810	4840	5030	4990	4900	4930	5090	5080	5190	4988
2002	5050	5080	5040	5070	5150	5240	5300	5220	5170	5130	5110	4940	5125
2003	4790	4700	4560	4770	4880	4930	4930	4890	4790	4830	4910	4940	4827
2004	4800	4790	5020	4990	5190	5300	5350	5290	5190	5150	5130	5210	5118

Table 2.3-13 Detroit River Flows

(m^3/s) (Sheet 6 of 6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg Ann
2005	5170	5040	5090	5160	5100	5120	5150	5090	5010	4990	4880	5000	5067
2006	4940	5090	5010	4970	5030	5070	5000	4970	4910	5030	4960	5010	4999
2007	5080	4730	4760	4960	4950	4960	4930	4850	4790	4690			

Provisional data from the US Army Corps of Engineers - Detroit District -
Source: Reference 2.3-25

Table 2.3-14 Estimated Characteristics of Western Basin Lake Erie Tributaries

Stream	Drainage Area (mi^2)	Average Discharge (cfs)	Suspended Solids (tons/yr)	Dissolved Solids (tons/yr)
Michigan				
Detroit River		181517	1570000	33580000
Huron River	888	565	1800	73000
River Raisin	1019	671	4700	91200
Others	1201	706	4000	25000
Ohio				
Ottawa River	181	106	1000	5000
Maumee River	6583	4838	2270000	1370000
Toussaint River	108	71	700	4000
Portage River	587	388	120000	91200
Sandusky River	1421	1059	270000	446400
Huron River	402	318	12000	50000
Others	347	283	60000	100000
Ontario				
Big Creek	42	35	300	1200
Others	193	141	1500	5000
TOTAL	12973	190699	4316000	35842000

Source: Reference 2.3-26

Table 2.3-15 Low Water Flow Rates for Western Basin Lake Erie Tributaries

Swan Creek at the Mouth, NE ¼ of the NE¼ of Section 16, T6S, R10E, Frenchtown Township, Monroe County, has a drainage area of 100 square miles. The lowest 95% and 50% exceedance, the Harmonic Mean and 90-day once in 10-year flow (90Q10) are estimated to be 0 cubic feet per second (cfs), 2.8 cfs, 4.6 cfs, and 0.9 cfs, respectively. The 50% and 95% exceedance and mean monthly flows are:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50%	12	19	82	70	32	11	2.8	3.2	3.2	8.6	13	17
95%	2.8	2.7	18	20	6.1	2.4	0	0	0	1	2.9	2.8
Mean	30	65	140	120	72	27	16	6	6.6	20	32	46

Stony Creek at the Mouth, NE ¼ of the NE ¼ of Section 25, T6S, R9E, Frenchtown Township, Monroe County, has a drainage area of 124 square miles. The lowest 95% and 50% exceedance, the Harmonic Mean and 90-day once in 10-year flow (90Q10) are estimated to be 6.4 cubic feet per second (cfs), 16 cfs, 30 cfs, and 11 cfs, respectively. The 50% and 95% exceedance and mean monthly flows are:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50%	36	43	120	110	64	40	21	16	18	25	31	48
95%	16	19	38	51	26	19	8.6	6.4	8.6	13	14	23
Mean	70	120	210	170	90	62	37	24	41	26	47	82

River Raisin at the Mouth, SE ¼ of the SW ¼ of Section 11, T7S, R9E, Frenchtown Township, Monroe County, has a drainage area of 1070 square miles. The lowest 95% and 50% exceedance, the Harmonic Mean and 90-day once in 10-year flow (90Q10) are estimated to be 51 cubic feet per second (cfs), 140 cfs, 250 cfs, and 75 cfs, respectively. The 50% and 95% exceedance and mean monthly flows are:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50%	460	560	1270	1110	580	390	210	150	140	190	300	430
95%	120	130	360	400	220	120	66	52	51	65	94	120
Mean	850	1140	1760	1520	960	650	360	240	250	310	510	770

Source: Reference 2.3-71 through Reference 2.3-73

Table 2.3-16 Monthly Flow Rates (Q) for Swan Creek

(estimated from 04163500 gage in cfs)

Stat	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
95%	1	2.9	2.8	2.8	2.7	18	20	6.1	2.4	0	0	0	0.8
90%	2.4	5.9	4.6	3.9	3.7	25	24	7.9	3.3	0.2	0.4	0.1	2
85%	3.2	6.7	5.3	4.7	4.3	32	28	10	4	0.5	0.5	0.6	3.1
80%	3.9	7.4	6.1	5.5	6.1	41	32	12	4.8	0.8	1	1.3	4
75%	4.8	8.1	6.8	6.5	9.3	47	36	15	5.7	0.9	1.4	1.5	5
70%	5.7	8.8	7.8	8.4	12	52	41	19	6.7	1.5	1.6	1.7	6.3
65%	6.5	9.9	9.7	9.5	13	59	47	21	7.7	1.9	2.1	2.1	7.7
60%	7.2	11	12	10	14	67	52	24	8.7	2.2	2.4	2.5	9.2
55%	7.9	12	15	11	15	75	59	28	9.7	2.5	2.9	2.9	11
50%	8.6	13	17	12	19	82	70	32	11	2.8	3.2	3.2	13
45%	9.4	15	21	13	21	90	81	35	12	3.4	3.6	3.6	16
40%	10	18	23	15	26	100	92	38	14	4.1	4	4.7	21
35%	11	23	26	17	35	110	100	45	16	5	4.6	5.5	26
30%	13	30	29	22	42	130	120	53	18	5.9	5.3	6.5	33
25%	16	36	39	27	59	140	140	63	21	6.8	6.1	7.6	42
20%	19	43	52	34	79	160	160	76	25	7.7	7.2	8.7	55
15%	25	53	68	46	100	200	200	94	31	9.7	8.5	11	77
10%	39	69	96	63	160	260	250	140	43	14	11	15	110
5%	73	100	160	110	280	500	400	280	73	29	18	25	190

Source: Q values are based on Drainage Ratio Method results from data gathered between 1954-1966 by MDEQ – Reference 2.3-28

Table 2.3-17 Monthly Flow Rates (Q) for Stony Creek

(estimated from 04175340 gage in cfs)

Stat	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
95%	13	14	23	16	19	38	51	26	19	8.6	6.4	8.6	12
90%	14	19	25	18	21	48	58	30	22	11	8.2	10	14
85%	16	22	29	20	24	61	64	34	25	14	9.1	10	18
80%	18	24	34	22	26	73	69	37	27	15	10	12	21
75%	20	25	36	24	27	81	73	42	29	16	12	13	23
70%	21	26	37	26	28	88	81	47	31	16	12	14	26
65%	22	27	39	28	33	95	88	51	33	18	13	15	28
60%	23	28	42	30	37	100	95	55	35	19	14	16	31
55%	24	29	45	33	40	110	100	59	37	20	15	17	35
50%	25	31	48	36	43	120	110	64	40	21	16	18	39
45%	26	32	53	39	47	130	120	68	42	22	17	21	44
40%	26	34	59	44	54	150	140	74	45	24	18	24	51
35%	27	36	68	52	64	170	150	81	48	25	21	26	59
30%	29	39	78	57	75	190	180	88	52	27	23	31	70
25%	31	44	94	61	94	230	200	97	58	29	26	38	84
20%	34	51	110	68	130	280	240	120	66	33	30	45	100
15%	36	70	140	89	190	350	270	140	82	41	33	56	130
10%	39	120	180	110	290	510	350	180	110	61	39	74	180
5%	47	150	270	250	630	820	530	260	180	94	60	110	310

Source: Q values are based on Drainage Ratio Method results from data gathered between 1954-1966 by MDEQ – Reference 2.3-28

Table 2.3-18 Monthly Flow Rates (Q) for River Raisin

(estimated from 04176500 gage in cfs)

Stat	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
95%	65	94	120	120	130	360	400	220	120	66	52	51	83
90%	81	120	150	150	200	470	480	260	160	80	67	65	110
85%	99	150	180	170	230	540	540	300	190	94	82	79	130
80%	110	170	210	220	270	630	620	330	210	110	95	90	160
75%	130	190	240	260	310	720	690	370	240	130	100	100	180
70%	140	210	270	300	350	820	760	410	270	150	110	110	210
65%	150	230	310	330	400	920	830	450	290	160	120	120	240
60%	160	250	340	380	450	1030	910	490	320	180	130	120	280
55%	170	270	380	420	500	1140	1000	530	350	190	140	130	320
50%	190	300	430	460	560	1270	1110	580	390	210	150	140	380
45%	200	330	490	510	630	1400	1230	640	420	230	160	150	440
40%	220	370	540	570	740	1540	1360	710	470	250	180	170	510
35%	230	430	610	650	880	1740	1530	800	530	270	190	180	600
30%	260	500	710	760	1030	2020	1740	910	590	310	210	200	720
25%	290	580	840	920	1250	2330	1990	1050	680	350	240	240	890
20%	330	710	1070	1110	1590	2690	2300	1260	810	420	290	280	1110
15%	400	920	1420	1460	2050	3120	2710	1540	1010	540	360	330	1430
10%	570	1250	1870	2020	2810	3700	3120	2080	1300	760	470	420	1940
5%	1040	1770	2750	3140	4350	4650	3860	2870	2080	1270	750	660	2930

Source: Q values are based on Drainage Ratio Method results from data gathered between 1954-1966 by MDEQ – Reference 2.3-28

Table 2.3-19 EPA Region 5 Sole Source Aquifers

State	Sole Source Aquifer Name	Federal Register Cit.	Public. Date	Approximate Distance to Fermi 3
IN	St. Joseph Aquifer System	53 FR 23682	06/23/88	120 Miles
MN	Mille Lacs Aquifer	55 FR 43407	10/29/90	570 Miles
OH	Pleasant City Aquifer	52 FR 32342	08/27/87	166 Miles
OH	Bass Islands Aquifer, Catawba Island	52 FR 37009	10/02/87	34 Miles
OH	Miami Valley Buried Aquifer	53 FR 15876	05/04/88	112 Miles
OH	OKI extension of the Miami Buried Valley Aquifer	53 FR 25670	07/08/88	112 Miles
OH	Allen County Area Combined Aquifer System	57 FR 53111	11/06/92	88 Miles
OH/MI/IN	Michindoh Glacial Aquifer	Pending	N/A	43 Miles

Source: Reference 2.3-28 and Reference 2.3-9

Table 2.3-20 Monroe County, Michigan Projected Groundwater Use Through 2060

Category	2000	2008	2013	2018	2020	2030	2040	2050	2060	Data Source
Total population of county, in thousands	146	158	166	174	177	194	213	234	258	FSAR Section 2.5
Domestic, self-supplied population, in thousands	49.64	53.79	56.38	59.08	60.20	66.12	72.61	79.75	87.59	Reference 2.3-10
Public supply, total population served, in thousands	96.30	104.36	109.37	114.62	116.79	128.27	140.87	154.72	169.92	Reference 2.3-10
Public supply, groundwater withdrawals, fresh, in Mgal/d	0.24	0.26	0.27	0.29	0.29	0.32	0.35	0.39	0.42	Reference 2.3-10
Domestic, groundwater self-supplied withdrawals, fresh, in Mgal/d	4.28	4.64	4.86	5.09	5.19	5.70	6.26	6.88	7.55	Reference 2.3-10
Industrial, groundwater self-supplied withdrawals, fresh, in Mgal/d	23	24.9	26.1	27.4	27.9	30.6	33.6	37.0	40.6	Reference 2.3-1
Irrigation, groundwater withdrawals, fresh, in Mgal/d	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	Reference 2.3-10
Livestock, groundwater withdrawals, fresh, in Mgal/d	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	Reference 2.3-10
Thermoelectric, groundwater withdrawals, fresh, in Mgal/d	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	Reference 2.3-16
Total groundwater withdrawals, fresh, in Mgal/d	28.42	30.72	32.15	33.65	34.27	37.55	41.16	45.11	49.46	

Table 2.3-21 Wayne County, Michigan Projected Groundwater Use Through 2060

Category	2000	2008	2013	2018	2020	2030	2040	2050	2060	Data Source
Total population of county, in thousands	2061.16	1967.62	1929.38	1891.88	1877.08	1804.82	1735.35	1668.54	1604.31	FSAR Section 2.5
Domestic, self-supplied population, in thousands	0.67	0.64	0.63	0.61	0.61	0.59	0.56	0.54	0.52	Reference 2.3-10
Public supply, total population served, in thousands	1360.08	1298.36	1273.12	1248.38	1238.61	1190.93	1145.09	1101.00	1058.62	Reference 2.3-10
Public supply, groundwater withdrawals, fresh, in Mgal/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Reference 2.3-10
Domestic, groundwater self-supplied withdrawals, fresh, in Mgal/d	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	Reference 2.3-10
Industrial, groundwater self-supplied withdrawals, fresh, in Mgal/d	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	Reference 2.3-1
Irrigation, groundwater withdrawals, fresh, in Mgal/d	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	Reference 2.3-10
Livestock, groundwater withdrawals, fresh, in Mgal/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Reference 2.3-10
Thermoelectric, groundwater withdrawals, fresh, in Mgal/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Reference 2.3-16
Total groundwater withdrawals, fresh, in Mgal/d	0.72	0.72	0.72	0.72	0.71	0.71	0.71	0.71	0.71	

Table 2.3-22 Monitoring Well/Piezometer Construction Data (Sheet 1 of 2)

Boring Number	Coordinates Plant North	Plant East	Ground Surface Elevation (NAVD 88)	Top of Casing Elevation (NAVD 88)	Top of Filter Elevation (NAVD 88)	Top of Screen Elevation (NAVD 88)	Bottom of Screen Elevation (NAVD 88)	Bottom of Filter Elevation (NAVD 88)	Bottom of Boring Elevation (NAVD 88)
MW-381 D	5304.6	1843	579.78	582.35	544.78	543.28	533.28	530.78	480.78
MW-381 S	5306.7	1838.4	579.88	582.52	573.88	572.08	571.08	570.38	570.38
MW-383 D	5805.4	3435.7	582.28	585.16	553.58	551.28	541.28	539.18	481.28
MW-383 S	5809.1	3432.7	582.38	584.15	576.38	574.28	569.28	568.38	565.88
MW-384 D	5537.6	4402.8	581.28	583.98	541.28	539.18	529.18	526.28	480.28
MW-384 S	5532.6	4403.9	581.38	583.66	576.78	575.28	565.28	564.38	564.38
MW-386 D	6336.7	5203.8	582.28	583.91	531.78	529.48	519.48	516.28	490.78
MW-386 S	6343.9	5203.6	582.38	584.18	569.88	565.98	560.98	560.38	560.38
MW-387 D	6660.2	4150.1	579.68	582.29	549.68	547.08	537.08	534.68	476.18
MW-387 S	6665.8	4148.2	579.28	582.16	573.48	571.28	566.28	565.28	563.08
MW-388 S	8082.4	2168.8	574.78	577.6	571.28	569.43	568.43	568.28	568.28
MW-390 S	7960.1	4245.7	578.88	582.09	573.88	571.88	566.88	566.38	562.38
MW-391 D	8240.3	5237.2	578.68	581.17	537.68	535.88	525.88	523.68	477.68
MW-391 S	8242.9	5232.9	578.58	581.39	575.58	570.58	560.58	560.38	559.58
MW-393 D	9367.4	2922.8	576.58	578.33	550.58	548.88	538.88	536.23	426.58
MW-393 S	9360	2918.2	576.48	579.35	572.38	570.28	567.28	566.68	566.68
MW-395 D	8900	4600.1	577.28	579.83	547.28	545.28	535.28	533.28	476.28
MW-395 S	8906.2	4599.7	577.28	579.9	570.88	568.78	563.78	562.88	562.88
P-382 S	5730.3	3132.4	576.38	578.46	571.78	569.88	561.98	559.88	559.88
P-385 D	6201.7	4390	580.08	583.13	514.68	511.78	501.78	501.08	477.58
P-385 S	6198.1	4385.6	580.18	583.25	572.18	570.68	565.68	563.18	563.18
P-389 S	7821.4	3889.3	576.88	579.18	572.48	570.38	560.38	559.88	559.88
P-392 S	8088.7	5841.5	580.58	583.19	575.08	572.88	562.88	562.58	562.58
P-396 S	8949.8	5248.8	578.38	581.22	572.88	570.88	560.88	560.38	558.88
P-397 S	8901.4	5748.5	575.98	578.95	567.48	564.98	554.98	554.48	554.48
P-398 D	9510.6	5352.1	577.88	580.55	528.88	527.38	517.38	514.98	476.88

Table 2.3-22 Monitoring Well/Piezometer Construction Data (Sheet 2 of 2)

Boring Number	Coordinates		Ground Surface Elevation (NAVD 88)	Top of Casing Elevation (NAVD 88)	Top of Filter Elevation (NAVD 88)	Top of Screen Elevation (NAVD 88)	Bottom of Screen Elevation (NAVD 88)	Bottom of Filter Elevation (NAVD 88)	Bottom of Boring Elevation (NAVD 88)
	Plant North	Plant East							
P-398 S	9504.3	5350.4	577.98	580.38	572.48	570.48	560.48	559.98	559.98
P-399 D	2565.59	5228.73	574.72	577.46	532.72	531.22	521.22	518.62	472.72
GW-01	5480.8	5881.1	578.98	580.66	551.98	550.98	545.98	545.98	545.98
GW-02	1631.8	4341.6	577.08	578.99	560.08	559.08	554.08	553.08	553.08
GW-03	1791.85	2236.85	577.88	580.65	561.88	560.38	555.38	555.38	555.38
GW-04	8075.4	2165.6	575.78	577.94	563.78	562.78	557.78	557.78	557.78
EFT-1 S	6366.2	5492.6	581.15	583.47	579.15	577.15	572.15	571.15	571.15
EFT-1 Im	6366	5492.6	581.15	583.46	566.65	564.65	559.65	559.65	559.65
EFT-1 D	6366.2	5492.4	581.15	583.46	553.15	550.65	545.65	545.65	545.65
EFT-2 S	6570.55	5734.62	582.61	581.93	580.61	578.61	573.61	572.61	572.61
EFT-2 D	6570.4	5734.4	582.61	581.72	551.61	549.61	544.61	544.11	544.11
MW-5d	7245.57	4893.81	581.84	581.54	564.84	562.84	560.84	559.84	557.84
CB-C5	6123	4663.4	580.98	580.77	503.88	496.98	491.98	488.78	449.98
EB/TSC-C2	6579.3	4697.2	581.37	581.12	546.57	544.37	539.37	536.87	530.87

Table 2.3-23 Surface Water Gauge Construction Data

Surface Water Gauge	Coordinates		June 29, 2007 - November 29, 2007			April 29, 2008 - May 29, 2008		
	Plant North	Plant East	Elevation @ 6.66' on Gauge (Plant)	Elevation @ 6.66' on Gauge (NAVD 88)	Elevation @ 0.00' on Gauge (NAVD 88)	Elevation @ 6.66' on Gauge (Plant)	Elevation @ 6.66' on Gauge (NAVD 88)	Elevation @ 0.00' on Gauge (NAVD 88)
GS-1	7897	3947.5	576.28	575.06	568.40	576.15	574.93	568.27
GS-2	9647.25	5299.97	576.42	575.20	568.54	575.01	573.79	567.13
GS-3	5447.53	4676.31	576.57	575.35	568.69	576.23	575.01	568.35
GS-4	8714.94	4471.81	576.40	575.18	568.52	Not Restored		
GS-5	3124.72	2345.66	570.68	569.46	562.80	574.49	573.27	566.61

Table 2.3-24 Water Level Data (Sheet 1 of 3)

Well Number	Hydrogeologic Unit Monitored	Piezometeric Water Level in Feet (NAVD 1988)											
		6/29/07	7/29/07	8/29/07	9/28 & 9/29/07	10/30/07	11/29/07	12/29/07	1/29/08	2/28/08	3/29/08	4/28/08	5/28/08
MW-381 D	Bass Islands	560.59	559.22	563.19	559.77	558.20	558.08	562.74	562.88	563.75	566.51	564.53	561.97
MW-383 D	Bass Islands	563.28	561.81	563.05	563.87	563.09	563.11	565.35	566.41	566.93	568.78	567.43	565.73
MW-384 D	Bass Islands	561.68	560.40	561.92	563.80	562.93	562.93	565.21	565.80	566.34	567.64	566.83	565.46
MW-386 D	Bass Islands	566.43	564.19	565.90	567.67	566.96	566.68	568.24	568.71	569.05	569.80	569.16	568.30
MW-387 D	Bass Islands/Overburden	567.75	565.82	567.19	570.80	570.38	570.59	571.55	571.81	572.05	572.54	571.96	571.35
MW-391 D	Bass Islands	566.80	565.65	567.27	567.28	566.60	566.35	567.69	568.20	568.45	568.95	568.45	567.69
MW-393 D	Bass Islands	570.07	568.10	571.45	569.27	568.78	570.68	572.53	572.26	572.42	573.85	572.74	571.56
MW-395 D	Bass Islands	571.89	571.59	572.51	572.10	571.76	572.06	572.61	572.72	572.90	573.18	572.66	572.27
P-385 D	Bass Islands	559.18	559.24	560.28	565.10	564.28	564.21	566.29	566.84	567.34	568.48	567.69	566.42
GW-03	Bass Islands	566.64	565.97	566.56	566.02	564.98	565.24	565.68	566.10	567.04	567.97	568.39	568.04
GW-04	Bass Islands	570.29	567.76	572.74	569.32	569.86	573.18	574.64	573.54	573.43	575.06	573.65	572.54
EFT-1 D	Bass Islands	569.96	568.60	569.68	570.60	570.12	570.23	571.16	571.35	571.53	572.39	571.52	570.90
EFT-2 D	Bass Islands	570.51	569.27	570.45	570.92	570.41	570.57	ND	ND	ND	ND	571.74	ND
CB-C5 (D)	Bass Islands	ND	ND	560.82	565.30	564.41	564.29	566.33	566.91	ND	ND	567.87	566.65
EB/TSC-C2 (D)	Bass Islands	ND	ND	ND	569.55	569.08	569.21	570.42	570.78	571.01	571.61	571.00	570.26
GW-01	Bass Islands/Overburden	ND	ND	ND	567.15	566.40	565.98	567.58	568.04	568.40	569.12	568.63	567.73
P-399 D	Bass Islands/Salina	563.72	562.73	564.80	563.36	562.45	562.30	564.73	565.08	565.80	566.96	566.39	564.98
P-398 D	Salina	552.74	552.11	553.55	552.48	551.57	551.07	553.00	553.83	554.15	554.74	554.67	553.48

Table 2.3-24 Water Level Data (Sheet 2 of 3)

Well Number	Hydrogeologic Unit Monitored	Piezometeric Water Level in Feet (NAVD 1988)											
		6/29/07	7/29/07	8/29/07	9/28 & 9/29/07	10/30/07	11/29/07	12/29/07	1/29/08	2/28/08	3/29/08	4/28/08	5/28/08
GS-5 A	Overburden/Bass Islands	566.05	565.43	565.80	565.42	564.95	565.60	ND	ND	ND	ND	ND	ND
GS-5 B	Overburden/Bass Islands	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	567.94	567.61
MW-5d	Overburden	573.03	572.33	573.18	572.76	573.45	572.74	573.25	573.35	573.34	573.78	573.26	572.91
GW-02	Overburden	566.94	565.90	568.18	566.31	565.74	565.60	568.07	568.69	569.11	570.85	570.81	569.59
EFT-1I	Overburden	572.55	573.01	573.26	573.73	573.38	572.57	571.96	571.73	571.57	571.32	571.69	571.99
MW-381 S	Overburden	571.59	572.90	575.05	575.61	575.88	575.98	576.61	576.87	576.88	577.06	577.17	576.67
MW-383 S	Overburden	573.56	572.58	574.23	573.10	572.64	573.17	575.48	575.93	575.67	576.13	575.93	574.99
MW-384 S	Overburden	574.38	573.77	574.83	573.98	573.96	574.03	575.03	575.39	575.02	575.66	575.20	574.61
MW-386 S	Overburden	571.59	571.43	571.31	572.48	572.23	571.73	571.30	570.68	570.90	570.96	571.53	571.75
MW-387 S	Overburden	571.86	571.66	572.04	571.37	571.09	571.05	571.20	571.03	571.51	572.26	572.30	572.13
MW-388 S	Overburden	569.16 (1)	569.00 (1)	569.86	569.98	569.88	570.24	572.62	573.17	573.31	574.01	573.47	572.50
MW-390 S	Overburden	572.52	572.22	573.08	572.67	572.34	572.64	573.14	573.24	573.41	573.67	573.15	572.78
MW-391 S	Overburden	572.34	572.05	572.91	572.50	572.16	572.47	572.97	573.07	573.24	573.51	572.98	572.61
MW-393 S	Overburden	568.37	570.43	571.05	571.51	572.02	573.53	575.35	574.18	574.12	576.12	574.95	573.93
MW-395 S	Overburden	572.27	571.98	572.84	572.42	572.09	572.40	572.90	573.00	573.17	573.44	572.91	572.55
P-382 S	Overburden	569.53	568.57	572.17	569.31	569.66	571.64	572.80	572.38	572.56	573.02	572.70	572.04
P-385 S	Overburden	571.92	571.71	572.10	571.45	571.14	571.11	571.26	571.07	571.57	572.32	572.36	572.18
P-389 S	Overburden	571.00	570.63	570.75	570.15	569.77	570.00	570.49	570.37	570.91	571.74	571.42	571.41

Table 2.3-24 Water Level Data (Sheet 3 of 3)

Well Number	Hydrogeologic Unit Monitored	Piezometeric Water Level in Feet (NAVD 1988)											
		6/29/07	7/29/07	8/29/07	9/28 & 9/29/07	10/30/07	11/29/07	12/29/07	1/29/08	2/28/08	3/29/08	4/28/08	5/28/08
P-392 S	Overburden	572.51	572.23	573.09	572.66	572.36	572.64	573.14	573.23	573.41	573.68	573.16	572.79
P-396 S	Overburden	572.29	571.99	572.86	572.44	572.11	572.41	572.91	573.00	573.17	573.43	572.91	572.54
P-397 S	Overburden	571.10	570.39	574.30	572.07	570.64	572.23	573.73	573.37	574.04	574.49	574.06	573.08
P-398 S	Overburden	572.23	571.81	572.74	572.21	571.91	572.06	572.65	573.06	572.99	573.26	573.01	572.61
EFT-1 S	Overburden	576.59	577.29	577.54	577.11	576.41	575.50	576.04	575.74	575.47	575.61	575.33	575.86
EFT-2 S	Overburden	577.69	577.42	577.27	576.90	576.38	575.88	575.12	575.03	574.56	574.63	574.25	576.36
GS-1 A	Surface Water	572.05	571.75	571.76	570.86	570.65	570.46	570.56	ND	ND	ND	ND	ND
GS-2 A	Surface Water	571.94	571.60	571.56	570.84	570.44	570.38	570.76	ND	ND	ND	ND	ND
GS-3 A	Surface Water	571.99	571.75	571.75	571.75	ND	571.13	571.27	ND	ND	ND	ND	ND
GS-4 A	Surface Water	572.02	571.69	ND	570.82	570.57	570.42	570.74	ND	ND	ND	ND	ND
GS-1 B	Surface Water	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	571.87	572.17
GS-2 B	Surface Water	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	571.81	572.03
GS-3 B	Surface Water	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	571.98	572.25

CB-C5 installed in Aug '07; EB/TSC-C2 installed in Sep '07; GW-01 located in Sep '07; "A" gauge stations are June 07 to November 2007 & "B" gauge stations are April & May 2008; ND equals No Data

Notes:

1. Water level at or below bottom of screen may not represent actual water level

Table 2.3-25 Overburden Hydraulic Conductivity

Monitoring Well/Piezometer	Monitored Strata	K (ft/day)
P-382 S	Quaternary	0.11
P-389 S	Quaternary	0.1315
MW-395 S	Quaternary	16.5
P-397 S	Quaternary	0.028
P-398 S	Quaternary	0.56
MW-383 S	Clay Fill	0.036
MW-384 S	Clay Fill	0.046
P-385 S	Rock Fill	1170
MW-387 S	Rock Fill	853
MW-390 S	Rock Fill	977
MW-391 S	Rock Fill	1776
P-392 S	Rock Fill	251
P-396 S	Rock Fill	308

Notes:
1. K values from Fermi 3 slug test analyses. Where multiple tests were performed, the average value is reported.

Table 2.3-26 Bedrock Aquifer Hydraulic Conductivity (Sheet 1 of 2)

Well #	Avg Depth (ft)	Average K (ft/day)	Comment
MW-381	30	9.03	0
	42	11.53	0
MW-383	36	2.76	0
	50	1.47	0
	67	0.11	0
	91	1.99	1
MW-384 D	48	25.08	1
	61	40.07	2
	64	31.83	2
	77.5	13.47	0
P-385 D	42	0.23	0
	73	2.59	1
	86	1.27	0
MW-386 D	34	3.39	0
	48	2.11	0
	59	4.02	1
	80	1.53	1
MW-387 D	38.8	33.88	2
	58	1.08	0
	72	0.42	0
MW-391 D	58	2.26	0
	74	0.37	0
	86	0.91	1
MW-393 D	33	2.80	1
	56	0.67	1
	73	0.22	0
	109	1.98	1
MW-395 D	37	17.57	0
	49	0.26	0
	66	0.15	0
	86	0.30	1
P-398 D	39	0.08	0
	56	0.81	0
	80	0.25	0
P-399 D	38	28.84	1
	49	9.82	2
	73	1.15	1

Table 2.3-26 Bedrock Aquifer Hydraulic Conductivity (Sheet 2 of 2)

Notes:
Data collected during Fermi 3 Subsurface Investigation, 2007.

Comments:
0 = No hydraulic connection with adjacent zones observed.
1 = Hydraulic connection with lower zone observed.
2 = Hydraulic connection with upper zone observe

Table 2.3-27 Net Basin Supply for Lake Erie

Yearly Lake Erie Net Basin Supply Averaged from 1948-2005

Component Method using overland precipitation depth (precipitation + runoff - evaporation) (m^3/sec)											
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1053	1366	1885	1962	1360	994	418	-92	-516	-755	-78	560

Mean Total per year (m^3/sec)	676
Total Volume per year (m^3)	2.13E+10
Total Volume per year(ft^3)	7.53E+11
Total Volume per year(BG)	5631

(BG) = Billion gallons

Yearly Lake Erie Net Basin Supply Averaged from 1948-2005

Component Method using overlake precipitation depth (precipitation + runoff - evaporation) (m^3/sec)											
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1080	1380	1900	1954	1293	926	322	-86	-460	-706	-18	607

Mean Total per year (m^3/sec)	678
Total Volume per year (m^3)	2.13E+10
Total Volume per year(ft^3)	7.55E+11
Total Volume per year(BG)	5648

(BG) = Billion gallons

Yearly Inflow for Lake Erie for 2005 (Detroit River via Upper Great Lakes and Tributaries) (expressed as m^3/sec)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4730	4800	4900	5090	5010	5050	5080	5000	4920	4900	4810	4810

Mean Total per year (m^3/sec)	4925
Total Volume per year (m^3)	1.55E+11
Total Volume per year(ft^3)	5.48E+12
Total Volume per year(BG)	41030

(BG) = Billion gallons

Net Total Supply (BG) = Net Basin Supply + Inflow	**46661**

Source: Reference 2.3-38 and Reference 2.3-39

Table 2.3-28 The Nine Sectors of Water Consumption in the Great Lakes Basin (Sheet 1 of 2)

Sector	Description
Public Water Supply	Water withdrawn for all uses by public and private water suppliers and delivered to users that do not supply their own water. (Water suppliers provide water for a variety of uses such as residential, commercial, industrial, and public water use.)
Self-Supply Domestic (residential, commercial, institutional)	Water used for normal household purposes. Also referred to as residential water use, this category includes water used for drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns. Commercial uses include water used by motels, hotels, restaurants, office buildings and institutions, both civilian and military. This category also includes water for mobile homes, hospitals, schools, fire fighting, air conditioning and other similar uses not covered under a public supply. In addition, this category includes amusement and recreational water uses such as snowmaking and water slides. The coefficient for domestic per capita water use is 75 gallons a day (U.S.) unless otherwise indicated by the reporting state or province.
Self-Supply Irrigation	Water artificially applied on lands to assist in the growing of crops and pastures or in the maintenance of recreational lands, such as parks and golf courses.
Self-Supply Livestock	Water used by horses, cattle, sheep, goats, hogs, poultry, and other commercially important animals. Water used in fish hatchery operations is also included here.
Self-Supply Industrial (manufacturing and mining)	Industrial water includes water used in the manufacture of metals, chemicals, paper, and allied products. Mining water use includes water used in the extraction or washing of minerals; for example solids, such as coal and ores, and liquids such as crude petroleum and natural gas. Water used in quarrying and milling is also included in the industrial category. Brine extraction from oil and gas operations is not included. Withdrawals and consumptive uses for industrial and mining purposes (including dewatering operations) recorded under another category (e.g., public supply) will not be recorded here. Water used in a closed cycle (recirculation) will not be reported as a withdrawal. Other situations should be evaluated on a case-by-case basis.
Self-Supply Thermoelectric Power (fossil fuel plants)	Water used by plants fueled by fossil fuels such as coal, oil or natural gas. Withdrawals and consumptive uses already recorded under another category (e.g., public supply) will not be reported here.
Self-Supply Thermoelectric Power (nuclear plants)	Water used by plants fueled by nuclear generation. Withdrawals and consumptive uses already recorded under another category (e.g., public supply) will not be reported here.
Self-Supply Hydroelectric Power	Water used to drive turbines that generate electric power. This category includes both instream uses where water is used on a once-through basis and offstream uses where water is recycled through pumped-storage systems. Neither use is considered a consumptive use.

Table 2.3-28 The Nine Sectors of Water Consumption in the Great Lakes Basin (Sheet 2 of 2)

Self-Supply Other	Water used for purposes not reported in categories one through nine. Examples include, but are not limited to, withdrawals for fish/wildlife, environmental, recreation, navigation, and water quality purposes. Specifically, water used to maintain levels for navigation, for recreation, for fish and wildlife habitat creation and enhancement (excluding fish hatchery operations included under Category 5), for flow augmentation (or diversion), for sanitation, pollution confinement, and other water quality purposes and agricultural activities (services) other than those directly related to irrigation such as field drainage are included. Water used in temporary or immediate emergency situations (e.g., fighting forest or peat fires) is also reported here.

Source: Reference 2.3-40

Table 2.3-29 Consumptive Use Coefficients (Sheet 1 of 2)

Water Use Catgory	ILLINOIS	INDIANA	MICHIGAN	MINNESOTA	NEW YORK	OHIO	ONTARIO	PENNSYLVANIA	QUEBEC	WISCONSIN
Public Supply	10-15%	15%	10-15%	10-15%	10%	10-15%	15%	10%	10-15%	10-15%
Self-Supply Domestic	10-15%	15%	10-15%	10-15%	10%	10-15%	15%	10%	10-15%	10-15%
Self-Supply Irrigation	90%	90%	90%	90%	90%	90%	78%	90%	90%	70%
Self-Supply Livestock	80%	80%	80%	80%	90%	80%	80%	80%	80%	90%
Self-Supply Industrial	Varies by plant & SIC code	6%	10-15%	Varies by plant & SIC code	25%	10%; salt mining is 90%	Varies by plant & SIC code	Varies by Plant & SIC code	10% for pulp & paper industry	10.2% for manufacturing & mining
Self-Supply Thermoelectric (Fossil Fuel)	Individually estimated based on the quantity of make-up water	2%	1-2% for plants using once-through cooling; individual analysis for wet cooling towers	2%	2%	Individually estimated based on the quantity of make-up water	0.9% based on reports of increased local lake evaporation due to discharge of heated water to lakes	NA (Pennsylvania has no facilities in the basin)	10%; estimates obtained from USGS report	0.5-1%
Self-Supply Thermoelectric (Nuclear)	Individually estimated based on the quantity of make-up water	NA (Indiana has no facilities in the basin)	1-2% for plants using once-through cooling; individual analysis for wet cooling towers	NA (MN has no facilities in the basin)	5%	14% based on reports of increased local lake evaporation due to discharge of heated water to lakes	0.9% based on reports of increased local lake evaporation due to discharge of heated water to lakes	NA (PA has no facilities in the basin)	NA (Quebec has no facilities in the basin)	0.5-1%
Hydroelectric	Coefficient for all states and provinces is 0%									

Table 2.3-29 Consumptive Use Coefficients (Sheet 2 of 2)

Water Use Catgory	ILLINOIS	INDIANA	MICHIGAN	MINNESOTA	NEW YORK	OHIO	ONTARIO	PENNSYLVANIA	QUEBEC	WISCONSIN
Self-Supply Other	Varies based on use	12%	Varies based on use	Varies based on use	Varies based on use	Varies based on use	Varies based on use	Varies based on use	Varies based on use	Varies based on use

Source: Reference 2.3-40
Information provided by the Great Lakes Commission

Table 2.3-30 2004 Basin Water Usage Report for Lake Erie

BASIN REPORT – Lake Erie	**Basin Total**	**Units: Mgal (US)/d** **Year of Data: 2004**

Total Report – All Facilities

Category	Withdrawls				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Supply	1105.82	263.00	152.30	1521.12	0.00	-1.41	200.22
Domestic Supply	12.33	0.00	96.41	108.74	0.00	0.00	15.02
Irrigation	1.42	38.41	32.16	71.99	0.00	0.00	36.14
Livestock	1.56	5.06	27.60	34.23	0.00	0.00	17.23
Industrial	698.31	123.05	61.05	882.42	0.00	0.00	107.41
Fossil Fuel Power	7147.98	831.49	0.43	7979.90	0.00	0.00	94.49
Nuclear Power	202.90	0.00	0.00	202.90	0.00	0.00	16.02
Hydroelectric Power	47,372.00	0.00	0.00	47,372.00	0.00	0.00	0.00
Other	0.68	9.11	0.50	10.29	5816.39	-10.10	0.00

The totals represent withdrawals and consumption for the state of Indiana, Michigan, New York, Ohio, Pennsylvania, and the province of Ontario, Canada

Consumptive use: that portion of water withdrawn or withheld from the Great Lakes basin and assumed to be lost or otherwise not returned to the Great Lakes basin due to evapotranspiration, incorporation into products, or other processes
Great Lakes surface water (GLSW): the Great Lakes, their connecting channels(the St. Clair River, the Detroit River, the Niagara River and the St. Mary's River), and the St. Lawrence River
Groundwater (GW): all subsurface water
Other surface water (OSW): tributary streams, lakes, ponds, and reservoirs within the Great Lakes basin
Interbasin diversion (positive): water transferred from the Great Lakes basin into another watershed
Interbasin diversion (negative): water transferred from another watershed into the Great Lakes basin
Intrabasin diversion (positive): water transferred out of one Great Lakes watershed into another
Intrabasin diversion (negative): water transferred into of one Great Lakes watershed into from another

Source: Reference 2.3-40 Information provided by the Great Lakes Commission

Table 2.3-31 2002 and 2003 Basin Water Usage Report for Lake Erie Water

SUMMARY REPORT – GREAT LAKES BASIN

Units: Mgal (US)/d
Year of Data: 2003

Water-Use by Basin – All Facilities

Basin	Withdrawls				Diversions		Consumptive
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	Use
Lake Superior	1145.13	41,942.74	30.87	43,118.74	0.00	-4007.75	78.32
Lake Michigan	9822.82	2241.64	691.47	12,755.92	0.00	1230.62	651.13
Lake Huron	25,958.52	13731.15	94.10	39,783.77	47.97	0.00	141.48
Lake Erie	49,440.31	1105.33	376.11	50,921.74	5816.39	-14.41	495.47
Lake Ontario	42,645.22	89,483.54	188.37	13,2317.13	-5802.39	40.77	351.51
St. Lawrence River	32,1257.25	232,485.48	141.16	553,883.88	0.00	0.00	194.83
Total:	450,269.24	380,989.88	1522.08	832,781.19	61.97	-2750.78	1912.74

BASIN REPORT – Lake Erie **Basin Total**

Units: Mgal (US)/d
Year of Data: 2002

Total Report – All Facilities

Category	Withdrawls				Diversions		Consumptive
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	Use
Public Supply	1204.70	264.38	167.26	1636.34	0.00	-0.53	215.25
Domestic Supply	12.33	0.00	95.93	108.26	0.00	0.00	14.97
Irrigation	1.80	42.98	37.20	81.98	0.00	0.00	45.15
Livestock	1.56	2.87	26.41	30.84	0.00	0.00	14.52
Industrial	726.22	107.01	62.81	896.03	0.00	0.00	108.55
Fossil Fuel Power	7312.13	702.15	0.41	8014.69	0.00	0.00	94.00
Nuclear Power	156.70	0.00	0.00	156.70	0.00	0.00	11.30
Hydroelectric Power	44,522.00	0.00	0.00	44,522.00	0.00	0.00	0.00
Other	0.80	4.08	0.30	5.18	5105.39	-11.35	0.00

Source: Reference 2.3-41 and Reference 2.3-42

Table 2.3-32 2001 and 2000 Basin Water Usage Report for Lake Erie

BASIN REPORT – Lake Erie | **Basin Total** | Units: Mgal (US)/d Year of Data: 2001

Total Report – All Facilities

Category	Withdrawls				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Supply	1227.57	293.80	153.31	1674.67	0.00	-0.64	219.57
Domestic Supply	12.33	0.00	96.40	108.73	0.00	0.00	15.03
Irrigation	1.61	39.75	33.25	74.61	0.00	0.00	38.58
Livestock	1.56	2.80	26.59	30.95	0.00	0.00	14.62
Industrial	805.54	134.39	66.86	1006.78	0.00	0.00	130.93
Fossil Fuel Power	7149.60	670.89	0.42	7820.91	0.00	0.00	92.53
Nuclear Power	180.11	0.00	0.00	180.11	0.00	0.00	13.83
Hydroelectric Power	38407.00	0.00	0.00	38407.00	0.00	0.00	0.00
Other	0.82	9.10	2.72	12.64	5105.39	-9.61	0.00

BASIN REPORT – Lake Erie | **Basin Total** | Units: Mgal (US)/d Year of Data: 2000

Total Report – All Facilities

Category	Withdrawls				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Supply	1188.85	286.18	150.11	1625.13	0.00	-0.57	213.87
Domestic Supply	12.70	2.39	96.74	111.83	0.00	0.00	15.51
Irrigation	1.09	32.73	32.52	66.34	0.00	0.00	31.04
Livestock	1.56	3.83	27.62	33.01	0.00	0.00	16.27
Industrial	802.04	139.65	79.08	1020.77	0.00	0.00	135.01
Fossil Fuel Power	7883.59	6.37	0.34	7890.30	0.00	0.00	94.10
Nuclear Power	178.96	0.00	0.00	178.96	0.00	0.00	20.64
Hydroelectric Power	40386.00	0.00	0.00	40386.00	0.00	0.00	0.00
Other	0.04	2.98	0.10	3.12	5105.39	-9.88	0.00

Source: Reference 2.3-43 and Reference 2.3-44

Table 2.3-33 1999 and 1998 Basin Water Usage Report for Lake Erie

BASIN REPORT – Lake Erie **Basin Totals** Units: Mgal (US)/d
Year of Data: 1999

Total Report – All Facilities

Category	Withdr	Diver	Consum	GLSW	OSW	GW	Intrabasin	Interbasin
Public Supply	1687.85	-0.56	221.87	1263.22	277.15	147.48	0.00	-0.56
Domestic Supply	111.22	0.00	15.42	12.70	2.41	96.11	0.00	0.00
Irrigation	76.72	0.00	65.44	1.42	42.11	33.19	0.00	0.00
Livestock	32.73	0.00	27.72	1.56	3.88	27.28	0.00	0.00
Industrial	1001.25	0.00	135.73	806.34	136.39	58.52	0.00	0.00
Fossil Fuel Power	9912.83	0.00	115.73	9906.74	5.75	0.34	0.00	0.00
Nuclear Power	178.31	0.00	20.50	178.31	0.00	0.00	0.00	0.00
Hydroelectric Power	43369.00	0.00	0.00	43369.00	0.00	0.00	0.00	0.00
Other	3.79	-10.05	0.00	0.12	3.58	0.09	4252.88	-10.05

BASIN REPORT – Lake Erie **Basin Totals** Units: Mgal (US)/d
Year of Data: 1998

Total Report – All Facilities

Category	Withdr	Diver	Consum	GLSW	OSW	GW	Intrabasin	Interbasin
Public Supply	1781.16	-38.63	236.15	1354.45	258.73	167.97	-38.07	-0.56
Domestic Supply	104.81	0.00	14.48	12.33	0.00	92.48	0.00	0.00
Irrigation	64.13	0.00	54.77	0.68	49.10	14.35	0.00	0.00
Livestock	31.71	0.00	25.79	1.54	2.08	28.09	0.00	0.00
Industrial	1055.56	0.00	140.37	827.46	157.96	70.14	0.00	0.00
Fossil Fuel Power	9990.54	0.00	97.73	9983.79	6.46	0.29	0.00	0.00
Nuclear Power	172.36	0.00	21.91	172.36	0.00	0.00	0.00	0.00
Hydroelectric Power	57849.00	0.00	0.00	57849.00	0.00	0.00	0.00	0.00
Other	5.12	5702.07	0.00	1.16	3.41	0.55	5711.25	-9.18

Source: Reference 2.3-45 and Reference 2.3-46

Table 2.3-34 Monroe County Water Usage (2000 – 2006) (Sheet 1 of 3)

Monroe County Water Use	2006	Water Withdrawn (MGD)		
	Great Lakes	Surface-Water	Groundwater	Total
Thermoelectric Power	1752.55	0.00	0.11	1752.66
Public Water Supply	13.02	0.72	0.12	13.86
Agricultural Irrigation	0.00	2.51	0.88	3.40

Monroe County Water Use	2005	Water Withdrawn (MGD)		
	Great Lakes	Surface-Water	Groundwater	Total
Thermoelectric Power	1808.34	0.00	0.09	1808.43
Public Water Supply	13.90	0.00	0.87	14.77
Agricultural Irrigation	0.00	2.45	0.86	3.31

Monroe County Water Use	2004	Water Withdrawn (MGD)		
	Great Lakes	Surface-Water	Groundwater	Total
Thermoelectric Power	1755.42	0.00	0.08	1755.49
Public Water Supply	12.64	0.65	0.17	13.46
Agricultural Irrigation	0.00	2.46	0.86	3.33
Self-Supply Industrial	0.00	1.36	8.63	9.99
Golf Course Irrigation	0.00	0.03	0.72	0.75

Table 2.3-34 Monroe County Water Usage (2000 – 2006) (Sheet 2 of 3)

Monroe County Water Use 2003	Water Withdrawn (MGD)			
	Great Lakes	Surface-Water	Groundwater	Total
Thermoelectric Power	1750.36	0.00	0.08	1750.44
Public Water Supply	12.04	0.57	0.20	12.81
Agricultural Irrigation	0.00	2.21	0.77	2.98
Self-Supply Industrial	0.00	1.86	7.73	9.59
Golf Course Irrigation	0.00	0.13	0.59	0.71

Monroe County Water Use 2002	Water Withdrawn (MGD)			
	Great Lakes	Surface-Water	Groundwater	Total
Thermoelectric Power	1701.42	0.00	0.09	1701.51
Public Water Supply	11.96	0.64	0.21	12.81
Agricultural Irrigation	0.00	3.22	1.13	4.35
Self-Supply Industrial	0.00	1.31	15.69	17.00
Golf Course Irrigation	0.00	0.37	0.37	0.74

Monroe County Water Use 2001	Water Withdrawn (MGD)			
	Great Lakes	Surface-Water	Groundwater	Total
Thermoelectric Power	1711.61	0.00	0.09	1711.70
Public Water Supply	11.65	0.71	0.23	12.59
Agricultural Irrigation	0.00	2.51	0.88	3.40
Self-Supply Industrial	0.00	1.67	14.33	16.00
Golf Course Irrigation	0.00	0.35	0.37	0.72

Table 2.3-34 Monroe County Water Usage (2000 – 2006) (Sheet 3 of 3)

Monroe County Water Use	2000	Water Withdrawn (MGD)		
	Great Lakes	Surface-Water	Groundwater	Total
Thermoelectric Power	1697.08	0.00	0.07	1697.16
Public Water Supply	11.81	0.68	0.23	12.73
Agricultural Irrigation	0.00	1.58	0.55	2.13
Self-Supply Industrial	0.00	1.78	15.65	17.42
Golf Course Irrigation	0.00	0.40	0.29	0.69

MGD = million gallons per day

Source Reference 2.3-35
The information is provided by the Michigan Department of Environmental Quality and was generated using data collected for the water use reporting program.

Table 2.3-35 2005 Monroe County Report

Industrial	Facility Name	Groundwater Use (MG)	Surface-Water Use (MG)	Great Lakes Use (MG)
Holcim (US) Inc.	Dundee Plant		286.7	
Stoneco	Denniston Quarry	155.58		
Sylvania Minerals		3073.88		

Golf Course Irrigation	Facility Name	Groundwater Use (MG)	Surface-Water Use (MG)	Great Lakes Use (MG)
Carleton Glen Golf Club			21	
Wyndridge Oaks Golf Course		8.091841		

Thermoelectric Power Generation	Facility Name	Groundwater Use (MG)	Surface-Water Use (MG)	Great Lakes Use (MG)
Consumers Energy Company	J R Whiting	32.29		77,440
Detroit Edison Company	Monroe			572,846
Detroit Edison Company	Fermi 2			18,756

Source: Reference 2.3-74

The information is provided by the Michigan Department of Environmental Quality and was generated using data collected for the water use reporting program.

Table 2.3-36 2006 Monroe County Report

Industrial	Facility Name	Groundwater Use (MG)	Surface-Water Use (MG)	Great Lakes Use (MG)
Holcim (US) Inc.	Dundee Plant		286.9	
Stoneco	Maybee Quarry	442.66		
Stoneco	Newport Quarry	222.65		
Stoneco	Ottawa Lake Quarry	1024.78		
Stoneco	Denniston Quarry	109.13		
Sylvania Minerals		4131.64		
Tenneco Inc.		17		

Golf Course Irrigation	Facility Name	Groundwater Use (MG)	Surface-Water Use (MG)	Great Lakes Use (MG)
Carleton Glen Golf Club			30.412	
Deme Acres Golf Course		6.55017		
Green Meadows Golf Course Inc		13.187718		
Maple Grove Golf Course		25.037445		
Monroe Golf & Country Club		12.688		
Raisin River Golf Club		15.69		
Sandy Creek Golf Course		33.9		
Whiteford Valley Golf Course		43.55		

Thermoelectric Power Generation	Facility Name	Groundwater Use (MG)	Surface-Water Use (MG)	Great Lakes Use (MG)
Consumers Energy Company	J R Whiting	39.02		81,490
Detroit Edison Company	Monroe			540,283
Detroit Edison Company	Fermi 2			17,906

Source: Reference 2.3-18

The information is provided by the Michigan Department of Environmental Quality and was generated using data collected for the water use reporting program.

Table 2.3-37 2006 Monroe County Water Capacity Report

Industrial	Facility Name	Groundwater Capacity	Units	Surface-Water Capacity	Units	Great Lakes Capacity	Units
Holcim (US) Inc.	Dundee Plant			0.585	MGD		
Stoneco	Maybee Quarry	11.52	MGD				
Stoneco	Newport Quarry	9.36	MGD				
Stoneco	Ottawa Lake Quarry	23.88	MGD				
Stoneco	Denniston Quarry	16.74	MGD				
Sylvania Minerals		30.53	MGD				
Tenneco Inc.		200	GPM				

Golf Course Irrigation	Facility Name	Groundwater Capacity	Units	Surface-Water Capacity	Units	Great Lakes Capacity	Units
Carleton Glen Golf Club				275	GPM		
Deme Acres Golf Course		155	GPM				
Green Meadows Golf Course Inc		850	GPM				
Maple Grove Golf Course		600	GPM				
Monroe Golf & Country Club		800	GPM				
Raisin River Golf Club		875	GPM				
Sandy Creek Golf Course		600	GPM				
Whiteford Valley Golf Course		750	GPM				

Thermoelectric Power Generation	Facility Name	Groundwater Capacity	Units	Surface-Water Capacity	Units	Great Lakes Capacity	Units
Consumers Energy Company	J R Whiting	0.864	MGD			325	MGD
Detroit Edison Company	Monroe					2,056	MGD
Detroit Edison Company	Fermi 2					45	MGD

Source: Reference 2.3-18.
The information is provided by the Michigan Department of Environmental Quality and was generated using data collected for the water use reporting program.

Table 2.3-38 Water Withdrawals Registered in Michigan

Type	No. of Facilities	Daily Withdrawals*
Agriculture	2334	243.24
Industrial	410	632.98
Public Water Works	1474	1891.36
Utilities	42	8564.94

*Millions of gallons/day

Source: Reference 2.3-34

Table 2.3-39 2006 Local Public Water Supply Entities Daily Consumption From the Western Basin of Lake Erie Within Fermi 3 Site Vicinity

County	System	Source	Pump Station Source: Wilfred L. Lepage facility		Approximate Distance & Direction from Fermi 3 Discharge		Average Daily Water Consumption (MGD)
			Pipe Size	Length(feet)			
Monroe	Frenchtown Township	Lake Erie	42”	1940	2735.9 meters	1.7 miles SE	2.218800
Monroe	Monroe	Lake Erie	30”	6174	1609.3 meters	1.0 mile SE	7.850200

Table 2.3-40 Projected Water Use – Monroe County

Category	2000	2008	2020	2030	2040	2050	2060
Total population of county, in thousands	145.95	158.16	176.99	194.39	213.49	234.47	257.52
Domestic, self-supplied population, in thousands	49.64	53.79	60.20	66.12	72.61	79.75	87.59
Public supply, total population served, in thousands	96.30	104.36	116.79	128.27	140.87	154.72	169.92
Public supply, ground-water withdrawals, fresh, in MGD	0.24	0.26	0.29	0.32	0.35	0.39	0.42
Domestic, ground-water self-supplied withdrawals, fresh, in MGD	4.28	4.64	5.19	5.70	6.26	6.88	7.55
Industrial, ground-water self-supplied withdrawals, fresh, in MGD	23	24.9	27.9	30.6	33.6	37.0	40.6
Irrigation, ground-water withdrawals, fresh, in MGD	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Livestock, ground-water withdrawals, fresh, in MGD	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Thermoelectric, ground-water withdrawals, fresh, in MGD	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Total ground-water withdrawals, fresh, in MGD	28.42	30.72	34.27	37.55	41.16	45.11	49.46

Source: Reference 2.3-35

Table 2.3-41 Projected Water Use – Wayne County

Category	2000	2008	2020	2030	2040	2050	2060
Total population of county, in thousands	2061.16	1967.62	1877.08	1804.82	1735.35	1668.54	1604.31
Domestic, self-supplied population, in thousands	0.67	0.64	0.61	0.59	0.56	0.54	0.52
Public supply, total population served, in thousands	1360.08	1298.36	1238.61	1190.93	1145.09	1101.00	1058.62
Public supply, ground-water withdrawals, fresh, in MGD	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Domestic, ground-water self-supplied withdrawals, fresh, in MGD	0.06	0.06	0.05	0.05	0.05	0.05	0.05
Industrial, ground-water self-supplied withdrawals, fresh, in MGD	0.08	0.08	0.08	0.08	0.08	0.08	0.1
Irrigation, ground-water withdrawals, fresh, in MGD	0.58	0.58	0.58	0.58	0.58	0.58	0.58
Livestock, ground-water withdrawals, fresh, in MGD	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Thermoelectric, ground-water withdrawals, fresh, in MGD	0.00	0.00	0.00	0.00	0.00	0.00	0
Total ground-water withdrawals, fresh, in MGD	0.72	0.72	0.71	0.71	0.71	0.71	0.71

Source: Reference 2.3-35

Table 2.3-42 Summary of GLENDA Data, March, April, and August 1996-2004 (Sheet 1 of 3)

	Station ID				
	ER58	**ER59**	**ER60**	**ER61**	**ER91M**
	Alkalinity, Total as $CaCO_3$ (mg/l)				
Minimum	79.5	78.5	78.0	72.0	76.5
Maximum	100.0	98.5	102.0	99.8	98.5
Average	87.1	87.8	84.0	85.5	84.8
No. of Samples	(n = 74)	(n = 71)	(n = 70)	(n = 74)	(n = 73)
	Ammonia-Nitrogen (mg/l)				
Minimum	0.02	0.02	0.05	0.03	0.02
Maximum	0.04	0.13	0.09	0.28	0.06
Average	0.03	0.08	0.07	0.16	0.04
No. of Samples	(n = 9)	(n = 8)	(n = 10)	(n = 8)	(n = 9)
	Chloride (mg/l)				
Minimum	9.7	9.6	7.4	7.5	9.1
Maximum	21.6	39.2	28.3	50.8	22.0
Average	14.1	16.7	13.3	14.8	13.4
No. of Samples	(n = 100)	(n = 96)	(n = 91)	(n = 100)	(n = 97)
	Chlorophyll-a (ug/l)				
Minimum	0.5	0.2	0.2	0.5	0.5
Maximum	11.8	13.6	8.1	7.6	8.4
Average	5.4	3.7	2.7	2.3	3.5
No. of Samples	(n = 111)	(n = 104)	(n = 102)	(n = 110)	(n = 106)
	Conductivity (umho/cm)				
Minimum	234	225	218	216	217
Maximum	344	397	352	384	331
Average	262	277	250	265	252
No. of Samples	(n = 86)	(n = 79)	(n = 86)	(n = 98)	(n = 98)
	Nitrogen, Total Kjeldahl (mg/l)				
Minimum	0.04	0.26	0.13	0.12	0.08
Maximum	0.37	0.38	0.33	0.46	0.28
Average	0.21	0.30	0.26	0.30	0.20
No. of Samples	(n = 13)	(n = 12)	(n = 14)	(n = 12)	(n = 13)

Table 2.3-42 Summary of GLENDA Data, March, April, and August 1996-2004 (Sheet 2 of 3)

	Station ID				
	ER58	**ER59**	**ER60**	**ER61**	**ER91M**
			Nitrogen, Total Oxidized (mg/l)		
Minimum	0.20	0.20	0.20	0.15	0.10
Maximum	1.85	4.21	1.22	2.42	2.30
Average	0.70	1.03	0.47	0.73	0.65
No. of Samples	(n = 99)	(n = 96)	(n = 91)	(n = 100)	(n = 97)
			Dissolved Oxygen (mg/l)		
Minimum	6.6	6.8	6.8	4.6	4.6
Maximum	16.2	15.3	15.0	15.8	15.6
Average	10.7	10.2	10.4	10.3	10.6
No. of Samples	(n = 81)	(n = 78)	(n = 77)	(n = 76)	(n = 93)
			pH (s.u.)		
Minimum	7.9	7.9	7.9	7.9	8.0
Maximum	8.9	8.8	8.7	8.6	8.9
Average	8.2	8.2	8.2	8.2	8.3
No. of Samples	(n = 77)	(n = 71)	(n = 74)	(n = 84)	(n = 83)
			Phosphorus, Orthophosphorus as P (mg/l)		
Minimum	0.002	0.002	0.004	0.003	0.001
Maximum	0.004	0.005	0.005	0.007	0.002
Average	0.003	0.004	0.004	0.005	0.001
No. of Samples	(n = 9)	(n = 8)	(n = 10)	(n = 8)	(n = 9)
			Phosphorus, Total as P (mg/l)		
Minimum	0.001	0.003	0.001	0.002	0.001
Maximum	0.075	0.170	0.045	0.370	0.048
Average	0.019	0.028	0.014	0.017	0.012
No. of Samples	(n = 200)	(n = 192)	(n = 182)	(n = 200)	(n = 194)
			Temperature (°C)		
Minimum	0.28	0.19	0.25	0.44	0.29
Maximum	26.87	26.73	26.94	26.58	27.46
Average	13.14	13.31	13.52	13.17	12.98
No. of Samples	(n = 69)	(n = 69)	(n = 66)	(n = 69)	(n = 69)

Table 2.3-42 Summary of GLENDA Data, March, April, and August 1996-2004 (Sheet 3 of 3)

	Station ID				
	ER58	**ER59**	**ER60**	**ER61**	**ER91M**
	Turbidity (NTU)				
Minimum	0.19	0.5	0.84	0.78	0.81
Maximum	45	92.4	15.5	76.9	27.6
Average	12.00	15.49	6.16	11.56	7.27
No. of Samples	(n = 84)	(n = 80)	(n = 83)	(n = 85)	(n = 88)

Source: Reference 2.3-69

Table 2.3-43 Lake Erie Sample Results from the Vicinity of the Fermi Site, August 2007 (Sheet 1 of 2)

Parameters	Sample ID: DQH0146-02 (G-EFPGS-SW-1082007.01)	Sample ID: DQH0146-03 (G-01-SW-1082007.01)
General Chemistry Parameters		
Biological Oxygen Demand - 5 day (mg/l)	<3.0	<3.0
Color (C.U.)	5.00	30.0
Nitrogen, Total Kjeldahl (mg/l)	0.562	1.38
Phosphorus, Total as P (mg/l)	0.04	0.140
Sulfate as SO4 (mg/l)	54.8	76.2
Chromium, Hexavalent (ug/l)	<20	<20
Alkalinity, Bicarbonate as HCO3 (mg/l)	205	132
Ammonia, Undistilled as N (mg/l)	<0.0500	<0.0500
Chemical Oxygen Demand (mg/l)	14.9	33.3
Chloride (mg/l)	20.0	81.0
Nitrate/Nitrite as N (mg/l)	0.286	0.0417
Total Dissolved Solids (mg/l)	180	360
Total Suspended Solids (mg/l)	8.00	14.0
Specific Conductance (umho/cm)	298	646
Total Alkalinity (mg/l)	168	110
Turbidity (S.U.)	ND	ND
Nitrite as N (mg/l)	0.0200	<0.010
Odor (S.U.)	ND	ND
Phosphorus, Orthophosphorus as P (mg/l)	<0.0200	0.0600
Nitrate as N (mg/l)	0.27	0.042
General Chemistry Parameters - DO		
Dissolved Oxygen (mg/l)	10.6	14.9
Microbiology		
Total Coliforms /100 ml	200	500
Fecal Coliforms /100 ml	<10	100
Fecal Streptococcus /100 ml	<10	<10
Total Metals		
Arsenic (ug/l)	ND	ND
Hardness by calculation as $CaCO_3$ (mg/l)	151	206

Table 2.3-43 Lake Erie Sample Results from the Vicinity of the Fermi Site, August 2007 (Sheet 2 of 2)

Parameters	Sample ID: DQH0146-02 (G-EFPGS-SW-1082007.01)	Sample ID: DQH0146-03 (G-01-SW-1082007.01)
Cadmium (ug/l)	<0.200	<0.200
Calcium (mg/l) (EPA 200.7)	40.1	50.8
Calcium (ug/l) (SW 6010B)	35000	51700
Chromium (ug/l)	<2.00	<2.00
Copper (ug/l)	<5.00	<5.00
Iron (ug/l)	302	315
Lead (ug/l)	<1.00	<1.00
Magnesium (mg/l) (EPA 200.7)	12.5	19.2
Magnesium (ug/l) (SW 6010B)	10500	19600
Mercury (ug/l)	<0.200	<0.200
Nickel (ug/l)	<5.00	<5.00
Potassium (ug/l)	1620	2220
Selenium (ug/l)	<5.00	<5.00
Silica (SiO_2) (ug/l)	1710	4450
Silver (ug/l)	<0.500	<0.500
Sodium (ug/l)	11700	50900
Zinc (ug/l)	16.0 **B8**	5.80 **B8**
Dissolved Metals		
Silica (SiO_2) (ug/l)	<1070	3690
General Chemistry Parameters		
Chlorophyll-a (mg/m^3)	4.2	5.30

B8 - Analyte was detected in the associated Method Blank within 10% of the reporting limit.

EPA 200.7 - Metals and Trace Elements by ICP/Atomic Emission Spectrometry

SW 6010B - US EPA SW-846 Method 6010B

ND – Not Detected

Table 2.3-44 Water Sample Results from Plum Creek, Sandy Creek and Swan Creek, Monroe and Wayne Counties, June 1993

Parameter	Plum Creek	Sandy Creek	Swan Creek
Hardness (mg/l)	320	270	255
NO_2 + NO_3 as N (mg/l)	5	7.2	2.9
Ammonia as N (mg/l)	0.05	0.03	0.13
Kjeldahl Nitrogen as N (mg/l)	0.77	0.9	1.4
Total Phosphorus (mg/l)	0.11	0.12	0.25

Source: Reference 2.3-65

Table 2.3-45 Temperature, Stream Characteristics and Flow Data, Swan Creek, Monroe County, June 1993

Parameter	Station 1 Sigler Rd	Station 2 N. Branch, Bell Rd	Station 3 Maxwell Rd
Air Temperature (°F)	64	64	64
Water Temperature (°F)	64	62	64
Average Stream Width (ft)	15	9	12
Average Stream Depth (ft)	1.5	0.75	0.5
Surface Velocity (ft/sec)	1	1.5	1
Estimated Flow (cfs)	22.5	10.125	6

Source: Reference 2.3-65

Table 2.3-46 Swan Creek and Stony Creek USGS NWIS Water Quality Data (Sheet 1 of 2)

	USGS Station Number			
	04175177 Swan Creek at Maxwell Road	04175229 Swan Creek at Labo Road	04175340 Stony Creek at Oakville	04175407 Stony Creek Near Woodland Beach
Sampling Period	**1990**	**1990-1991**	**1971-1973 and 1990-1991**	**1990-1991**
Temperature (°C)				
Average	22.0	22.2	16.7	20.5
No. of Samples	(n = 2)	(n = 3)	(n = 6)	(n = 5)
Hardness as $CaCO_3$ (mg/l)				
Average	290	430	326	322.5
No. of Samples	(n = 1)	(n = 2)	(n = 5)	(n = 4)
Turbidity (NTU)				
Average	20.0	14.5	14.5	3.5
No. of Samples	(n = 1)	(n = 2)	(n = 2)	(n = 4)
Color (Platinum Cobalt Units)				
Average	-	-	33.3	-
No. of Samples	-	-	(n = 3)	-
Conductivity, Specific conductance (microsiemen per cm at 25°C)				
Average	721.5	1011.7	690.3	697.4
No. of Samples	(n = 2)	(n = 3)	(n = 6)	(n = 5)
Dissolved Oxygen (mg/l)				
Average	7.1	4.8	8.1	8.0
No. of Samples	(n = 2)	(n = 3)	(n = 3)	(n = 5)
Nitrate as N (mg/l)				
Average	0.98	1.66	0.79	1.29
No. of Samples	(n = 2)	(n = 3)	(n = 1)	(n = 1)
Nitrite as N (mg/l)				
Average	0.02	0.18	0.01	0.01
No. of Samples	(n = 2)	(n = 3)	(n = 3)	(n = 5)
Chloride (mg/l)				
Average	74	95	47	55
No. of Samples	(n = 2)	(n = 3)	(n = 6)	(n = 5)

Table 2.3-46 Swan Creek and Stony Creek USGS NWIS Water Quality Data (Sheet 2 of 2)

	USGS Station Number			
	04175177 Swan Creek at Maxwell Road	**04175229 Swan Creek at Labo Road**	**04175340 Stony Creek at Oakville**	**04175407 Stony Creek Near Woodland Beach**
Sampling Period	**1990**	**1990-1991**	**1971-1973 and 1990-1991**	**1990-1991**
	Sulfate (mg/l)			
Average	64.00	198.33	67.25	87.40
No. of Samples	(n = 2)	(n = 3)	(n = 4)	(n = 5)
	Sodium (mg/l)			
Average	35	60	21	23
No. of Samples	(n = 1)	(n = 2)	(n = 3)	(n = 4)
	Potassium (mg/l)			
Average	7.6	8.4	2.6	3.1
No. of Samples	(n = 1)	(n = 2)	(n = 3)	(n = 4)
	Calcium (mg/l)			
Average	88	115	95	89
No. of Samples	(n = 1)	(n = 2)	(n = 3)	(n = 4)
	pH (s.u.)			
Average	8.3	7.8	8.1	8.4
No. of Samples	(n = 2)	(n = 3)	(n = 6)	(n = 5)
	Magnesium (mg/l)			
Average	18	35	23	25
No. of Samples	(n = 1)	(n = 2)	(n = 3)	(n = 4)

Source: Reference 2.3-31

Table 2.3-47 Water Sampling Results for Stony Creek and Palmer Drain, Monroe County, MI, September 1995 (Sheet 1 of 2)

Parameter	Stony Creek Oakville Waltz Rd	Station 1 Stony Creek - Rawsonville Rd	Station 2 London Sand Outfall	Station 3 Palmer Drain - Palmer Rd	Stony Creek - Timbers Rd	Station 4 Stony Creek - James Rd
Total Dissolved Solids (mg/l)	500	520	1750	1720	1130	1120
Total Suspended Solids (mg/l)	--	8	6	4 [K]	12	7
Hardness (mg/l)	--	308	1050	1070	725	735
Conductivity (umho/cm)	--	782	1908	1894	1393	1391
Nitrite (mgN/l)	--	0.003	0.002	.001 [T]	0.004	0.004
Nitrate + Nitrite (mgN/l)	--	0.34	.002 [T]	.003 [T]	0.133	0.25
Ammonia (mgN/l)	--	0.013	0.12	0.106	0.047	0.034
Kjeldahl Nitrogen (mgN/l)	--	.34 [HT]	.56 [HT]	.51 [HT]	.39 [HT]	.39 [HT]
Ortho Phosphorus (mgP/l)	--	0.009	0.004	0.004	0.004	.002 [T]
Total Phosphorus (mgP/l)	--	.037 [HT]	.01 [HT]	.009 [HT]	.029 [HT]	.030 [HT]
Total Silver (ug/l)	--	0.5 [K]	0.5 [K]	0.5 [K]	0.5 [K]	0.5 [K]
Total Arsenic (ug/l)	--	1.6	1.0 [K]	1.0 [K]	1.8	1.6
Total Barium (ug/l)	--	70	33	35	51	55
Total Calcium (mg/l)	--	84.2	277	289	197	200
Total Cadmium (ug/l)	--	0.2 [K]	0.2 [K]	0.2 [K]	0.2 [K]	0.2
Total Chromium (ug/l)	--	1.0 [K]	1.0 [K]	1.0 [K]	1.0 [K]	1.0 [K]
Total Copper (ug/l)	--	1.0 [K]	1.0 [K]	1.0 [K]	1.0 [K]	1.0 [K]
Total Mercury (ug/l)	--	0.2 [K]	0.2 [K]	0.2 [K]	0.2 [K]	0.2 [K]
Total Magnesium (ug/l)	--	23.7	86	84	56	57
Total Lead (ug/l)	--	1.0 [K]	1.0 [K]	1.0 [K]	1.0 [K]	1.0 [K]

Table 2.3-47 Water Sampling Results for Stony Creek and Palmer Drain, Monroe County, MI, September 1995 (Sheet 2 of 2)

Parameter	Stony Creek Oakville Waltz Rd	Station 1 Stony Creek - Rawsonville Rd	Station 2 London Sand Outfall	Station 3 Palmer Drain - Palmer Rd	Stony Creek - Timbers Rd	Station 4 Stony Creek - James Rd
Total Selenium (ug/l)	--	1.0 [K]	1.0 [K]	1.0 [K]	1.0 [K]	1.0 [K]
Total Zinc (ug/l)	--	4 [K]	4 [K]	4 [K]	4 [K]	5

K - not detected at the specified detection level

HT - recommended laboratory holding time exceeded prior to analysis

T - value reported is less than criteria of detection

-- - No DataSource: Reference 2.3-55

Table 2.3-48 Water Sampling Results for Stony Creek and Palmer Drain, Monroe County, MI, December 1995

Parameter	Station 1 Stony Creek Rawsonville Rd	Station 2 London Sand Outfall	Station 3 Palmer Drain Palmer Rd	Stony Creek Timbers Rd
Total Dissolved Solids (mg/l)	590 HT	1790 HT	1630 HT	910 HT
Conductivity (umho/cm)	908	1958	1863	1243
Temperature (°F)	32	37	37	33
pH (s.u.)	7.70	7.65	7.85	8.04
Dissolved Oxygen (mg/l)	14.8	2	6.7	13.4
Sulfide (mg/l)	0.02 K, HT	12 HT	0.23 HT	0.02 K, HT
Hydrogen sulfide (calculated) (ug/l)	ND	3500	45	ND

K - not detected at the specified detection level

HT - recommended laboratory holding time exceeded prior to analysis

T - value reported is less than criteria of detection

ND – Not Detected

Source: Reference 2.3-55

Table 2.3-49 Water Sampling Results for Stony Creek and Amos Palmer Drain, Monroe County, MI, July 1997

Parameter	Units	Station 1 Stony Creek	Station 2b Amos Palmer	Station 3 Stony Creek	Station 6 Stony Creek
Total Dissolved Solids	(mg/l)	580	1960	1280	1350
Total Suspended Solids	(mg/l)	22	4 K	13	30
Hardness	(mg/l)	345	1105	730	--
pH	(s.u.)	8.17	7.3	7.65	8.00
Conductivity	(umho/cm)	792	2035	1492	1529
Nitrite	(mgN/l)	0.012	.001 T	0.010	0.006
Nitrate + Nitrite	(mgN/l)	0.77	.004 T	0.32	0.31
Ammonia	(mgN/l)	0.032	0.033	0.011	0.032
Kjeldahl Nitrogen	(mgN/l)	0.51	0.35	0.011	0.43
Ortho Phosphorus	(mgP/l)	0.018	0.003	0.004	0.013
Total Phosphorus	(mgP/l)	0.059	0.009	0.035	0.048
Total Sulfide	(mg/l)	--	0.21	--	--
Total Sulfate	(mg/l)	49	931	501	539
Total Silver	(ug/l)	0.5 K	0.5 K	0.5 K	0.5 K
Total Arsenic	(ug/l)	2.3	1.1	2.2	2.0
Total Calcium	(mg/l)	96.3	298	197	207
Total Cadmium	(ug/l)	0.2 K	0.2 K	0.2 K	0.2 K
Total Copper	(ug/l)	1.2	1.0 K	1.0 K	1.1
Total Mercury	(ug/l)	0.2 K	0.2 K	0.2 K	0.2 K
Total Magnesium	(mg/l)	2.0 K	2.0 K	58	57
Total Lead	(ug/l)	1.1	1.0 K	1.0 K	1.0 K
Total Selenium	(ug/l)	49	931	1.0 K	1.0 K
Total Zinc	(ug/l)	4.1	4.0 K	4.0 K	6.0
Total Organic Carbon	(mg/l)	0.51	0.35	3.7	3.7

K - not detected at the specified detection level

T - value reported is less than criteria of detection

-- - No Data

Source: Reference 2.3-56

Table 2.3-50 River Raisin USGS NWIS Water Quality Data (Sheet 1 of 6)

	USGS Station Number		
	04175700	**04176000**	**04176500**
Sampling Period	**1970-1971**	**1970**	**1967-1995**
Temperature (°C)			
Minimum	18.5	17	0
Maximum	22.5	22	29
Average	21	19.5	13.16
No. of Samples	(n = 4)	(n = 2)	(n = 189)
Hardness as $CaCO_3$ (mg/l)			
Minimum	270	290	79
Maximum	290	300	410
Average	282.5	295	306
No. of Samples	(n = 4)	(n = 2)	(n=104)
Turbidity (Jackson Turbidity Units)			
Minimum	5	--	3
Maximum	10	--	50
Average	7.5	--	20.4
No. of Samples	(n = 2)		(n = 5)
Color (Platinum Cobalt Units)			
Minimum	20	25	40
Maximum	30	30	40
Average	25.0	27.5	40.0
No. of Samples	(n = 4)	(n = 2)	(n = 2)
Conductivity, Specific conductance (microsiemen per cm at 25°C)			
Minimum	530	590	200
Maximum	600	600	936
Average	565.00	595.00	675.24
No. of Samples	(n = 4)	(n = 2)	(n = 181)
Dissolved Oxygen (mg/l)			
Minimum	--	--	6
Maximum	--	--	18.2
Average	--	--	11.24
No. of Samples			(n = 180)

Table 2.3-50 River Raisin USGS NWIS Water Quality Data (Sheet 2 of 6)

	USGS Station Number		
	04175700	04176000	04176500
Sampling Period	1970-1971	1970	1967-1995
Phosphorus, Total (mg/l)			
Minimum	--	--	0.03
Maximum	--	--	0.39
Average	--	--	0.14
No. of Samples			(n = 98)
Orthophosphate (mg/l)			
Minimum	--	--	0.031
Maximum	--	--	0.368
Average	--	--	0.128
No. of Samples			(n = 49)
Nitrate as N (mg/l)			
Minimum	--	--	0.66
Maximum	--	--	9.92
Average	--	--	3.91
No. of Samples			(n = 9)
Nitrite as N (mg/l)			
Minimum	--	--	0.02
Maximum	--	--	0.08
Average	--	--	0.04
No. of Samples			(n = 8)
Ammonia as N (mg/l)			
Minimum	--	--	0.01
Maximum	--	--	0.81
Average	--	--	0.14
No. of Samples			(n = 65)
Chloride (mg/l)			
Minimum	4	22	11
Maximum	37	27	60
Average	23.5	24.5	38.0
No. of Samples	(n = 4)	(n = 2)	(n = 103)

Table 2.3-50 River Raisin USGS NWIS Water Quality Data (Sheet 3 of 6)

	USGS Station Number		
	04175700	04176000	04176500
Sampling Period	1970-1971	1970	1967-1995
Sulfate (mg/l)			
Minimum	50	--	17
Maximum	50	--	180
Average	50.00	--	83.5
No. of Samples	(n = 1)		(n = 100)
Sodium (mg/l)			
Minimum	--	--	4.7
Maximum	--	--	40
Average	--	--	19.02
No. of Samples			(n = 100)
Potassium (mg/l)			
Minimum	--	--	2.1
Maximum	--	--	22
Average	--	--	6.71
No. of Samples			(n = 100)
Calcium (mg/l)			
Minimum	--	--	24
Maximum	--	--	120
Average	--	--	88.5
No. of Samples			(n = 100)
pH (s.u.)			
Minimum	7.8	8	7.4
Maximum	8.4	8.1	9.5
Average	8.15	8.05	8.18
No. of Samples	(n = 4)	(n = 2)	(n = 150)
Iron (ug/l)			
Minimum	--	--	220
Maximum	--	--	11,000
Average	--	--	1406
No. of Samples			(n = 20)

Table 2.3-50 River Raisin USGS NWIS Water Quality Data (Sheet 4 of 6)

	USGS Station Number		
	04175700	**04176000**	**04176500**
Sampling Period	**1970-1971**	**1970**	**1967-1995**
Barium (ug/l)			
Minimum	--	--	0
Maximum	--	--	100
Average	--	--	56.6
No. of Samples			(n = 65)
Cadmium (ug/l)			
Minimum	--	--	0.5
Maximum	--	--	2
Average	--	--	0.56
No. of Samples			(n = 41)
Chromium (ug/l)			
Minimum	--	--	0.5
Maximum	--	--	20
Average	--	--	3.31
No. of Samples			(n = 47)
Copper (ug/l)			
Minimum	--	--	1
Maximum	--	--	6
Average	--	--	2.64
No. of Samples			(n = 25)
Lead (ug/l)			
Minimum	--	--	0.5
Maximum	--	--	4
Average	--	--	1.55
No. of Samples			(n = 29)
Manganese (ug/l)			
Minimum	--	--	3
Maximum	--	--	50
Average	--	--	18.2
No. of Samples			(n = 58)

Table 2.3-50 River Raisin USGS NWIS Water Quality Data (Sheet 5 of 6)

	USGS Station Number		
	04175700	04176000	04176500
Sampling Period	1970-1971	1970	1967-1995
Nickel (ug/l)			
Minimum	--	--	1
Maximum	--	--	9
Average	--	--	2.7
No. of Samples			(n = 36)
Strontium (ug/l)			
Minimum	--	--	80
Maximum	--	--	770
Average	--	--	434.5
No. of Samples			(n = 51)
Zinc (ug/l)			
Minimum	--	--	3
Maximum	--	--	30
Average	--	--	10.5
No. of Samples			(n = 29)
Selenium (ug/l)			
Minimum	--	--	0.5
Maximum	--	--	2
Average	--	--	0.58
No. of Samples			(n = 63)
Fecal Coliform (cfu/100ml)			
Minimum	--	--	22
Maximum	--	--	3200
Average	--	--	495.8
No. of Samples			(n = 35)
Phytoplankton (cells/ml)			
Minimum	--	--	110
Maximum	--	--	66000
Average	--	--	14074
No. of Samples			(n = 25)

Table 2.3-50 River Raisin USGS NWIS Water Quality Data (Sheet 6 of 6)

	USGS Station Number		
	04175700	**04176000**	**04176500**
Sampling Period	**1970-1971**	**1970**	**1967-1995**
Chlorophyll-a (mg/m^2)			
Minimum	--	--	0.1
Maximum	--	--	27.3
Average	--	--	10.15
No. of Samples			(n = 10)
Mercury (ug/l)			
Minimum	--	--	0.1
Maximum	--	--	0.5
Average	--	--	0.19
No. of Samples			(n = 21)

-- - No Data
Source: Reference 2.3-31

Table 2.3-51 River Raisin EPA STORET Water Quality Data from MDEQ (Sheet 1 of 6)

STORET Station No. 580046 Sampling Period 1995-2006	
Alkalinity, Bicarbonate as $CaCO_3$ (mg/l)	
Minimum	101
Maximum	182
Average	141.8
No. of Samples	(n = 4)
Alkalinity, Carbonate as $CaCO_3$ (mg/l)	
Minimum	16
Maximum	20
Average	18
No. of Samples	(n = 2)
Alkalinity, Total (mg/l)	
Minimum	94
Maximum	237
Average	163
No. of Samples	(n = 31)
Cadmium (ug/l)	
Minimum	0
Maximum	0.11
Average	0.030
No. of Samples	(n = 43)
Calcium (mg/l)	
Minimum	36.3
Maximum	96.4
Average	64.7
No. of Samples	(n = 42)
Carbon, Total Organic (mg/l)	
Minimum	3
Maximum	10
Average	6
No. of Samples	(n = 43)

Table 2.3-51 River Raisin EPA STORET Water Quality Data from MDEQ (Sheet 2 of 6)

STORET Station No. 580046	
Sampling Period 1995-2006	
Chloride (mg/l)	
Minimum	17
Maximum	88
Average	42
No. of Samples	(n = 43)
Chromium (ug/l)	
Minimum	0.096
Maximum	4.23
Average	1.11
No. of Samples	(n = 41)
Copper (ug/l)	
Minimum	1.6
Maximum	5.55
Average	3.0
No. of Samples	(n = 41)
Dissolved Oxygen (mg/l)	
Minimum	6
Maximum	10.2
Average	7.7
No. of Samples	(n = 5)
Hardness, Carbonate (mg/l)	
Minimum	134
Maximum	334
Average	236
No. of Samples	(n = 42)
Lead (ug/l)	
Minimum	0.275
Maximum	4.19
Average	0.97
No. of Samples	(n = 41)

Table 2.3-51 River Raisin EPA STORET Water Quality Data from MDEQ (Sheet 3 of 6)

STORET Station No. 580046	
Sampling Period 1995-2006	
Magnesium (mg/l)	
Minimum	10.5
Maximum	26.4
Average	18.6
No. of Samples	(n = 40)
Mercury (ng/l)	
Minimum	1.14
Maximum	12.04
Average	3.47
No. of Samples	(n = 41)
Nickel (ug/l)	
Minimum	1.91
Maximum	6.381
Average	3.29
No. of Samples	(n = 43)
Nitrogen, ammonia as NH_3 (mg/l)	
Minimum	0.004
Maximum	0.18
Average	0.06
No. of Samples	(n = 40)
Nitrogen, Kjeldahl (mg/l)	
Minimum	0.4
Maximum	1.4
Average	0.9
No. of Samples	(n = 43)
Nitrogen, Nitrate (NO_3) as NO_3 (mg/l)	
Minimum	0.032
Maximum	10.9
Average	2.2
No. of Samples	(n = 43)

Table 2.3-51 River Raisin EPA STORET Water Quality Data from MDEQ (Sheet 4 of 6)

STORET Station No. 580046	
Sampling Period 1995-2006	
Nitrogen, Nitrite (NO_2) + Nitrate (NO_3) as N (mg/l)	
Minimum	0.104
Maximum	1.73
Average	0.816
No. of Samples	(n = 4)
Nitrogen, Nitrite as NO_2 (mg/l)	
Minimum	0.008
Maximum	0.086
Average	0.023
No. of Samples	(n = 43)
pH (s.u.)	
Minimum	7.73
Maximum	8.78
Average	8.27
No. of Samples	(n = 43)
Phosphorus (mg/l)	
Minimum	0.033
Maximum	0.3
Average	0.10
No. of Samples	(n = 43)
Phosphorus, Orthophosphate as P (mg/l)	
Minimum	0.005
Maximum	0.102
Average	0.027
No. of Samples	(n = 43)
Potassium (mg/l)	
Minimum	2.3
Maximum	5.8
Average	3.8
No. of Samples	(n = 29)

Table 2.3-51 River Raisin EPA STORET Water Quality Data from MDEQ (Sheet 5 of 6)

STORET Station No. 580046	
Sampling Period 1995-2006	
Sodium, (mg/l)	
Minimum	9.9
Maximum	31.6
Average	20.7
No. of Samples	(n = 29)
Solids, Dissolved (mg/l)	
Minimum	214
Maximum	490
Average	365
No. of Samples	(n = 43)
Solids, Total Suspended (TSS) (mg/l)	
Minimum	5
Maximum	110
Average	21
No. of Samples	(n = 43)
Specific Conductance (umho/cm)	
Minimum	329
Maximum	758
Average	564
No. of Samples	(n = 43)
Sulfide (mg/l)	
Minimum	0.02
Maximum	0.02
Average	0.02
No. of Samples	(n = 2)
Sulfur, sulfate as SO_4 (mg/l)	
Minimum	23
Maximum	72
Average	47
No. of Samples	(n = 43)

Table 2.3-51 River Raisin EPA STORET Water Quality Data from MDEQ (Sheet 6 of 6)

STORET Station No. 580046	
Sampling Period 1995-2006	
Temperature, water (°C)	
Minimum	0.3
Maximum	28.4
Average	19.5
No. of Samples	(n = 42)
Turbidity (mg/l)	
Minimum	3.9
Maximum	150
Average	25.4
No. of Samples	(n = 31)
Zinc (ug/l)	
Minimum	1.8
Maximum	23.8
Average	5.9
No. of Samples	(n = 43)

Note:
Not detected results were not included in the averages

Source: Reference 2.3-37

Table 2.3-52 Rouge River USGS NWIS Water Quality Data (Sheet 1 of 4)

	USGS Station Number	
	04166100 Rouge River at Southfield, Michigan	04166000 Rouge River at Birmingham, Michigan
Sampling Period	**1966-1968 and 2001-2003**	**1966 and 2001-2006**
Temperature (°C)		
Minimum	-0.4	0.3
Maximum	22.6	25
Average	11.21	15.53
No. of Samples	(n = 19)	(n = 22)
Hardness as $CaCO_3$ (mg/l)		
Minimum	200	280
Maximum	490	480
Average	341.5	364.44
No. of Samples	(n = 22)	(n = 18)
Conductivity, Specific conductance (microsiemen per cm at 25°C)		
Minimum	710	788
Maximum	7470	2250
Average	1580.48	1226.26
No. of Samples	(n = 21)	(n = 23)
Dissolved Oxygen (mg/l)		
Minimum	6.8	5
Maximum	14.5	14.8
Average	9.98	9.15
No. of Samples	(n = 14)	(n = 21)
Total Phosphorus (mg/l)		
Minimum	0.004	0.005
Maximum	0.2	0.094
Average	0.069	0.053
No. of Samples	(n = 16)	(n = 12)
Orthophosphate as P (mg/l)		
Minimum	0.02	0.02
Maximum	0.03	0.02
Average	0.0267	0.02
No. of Samples	(n = 3)	(n=1)

Table 2.3-52 Rouge River USGS NWIS Water Quality Data (Sheet 2 of 4)

	USGS Station Number	
	04166100 Rouge River at Southfield, Michigan	04166000 Rouge River at Birmingham, Michigan
Sampling Period	**1966-1968 and 2001-2003**	**1966 and 2001-2006**
Organic Nitrogen (mg/l)		
Minimum	0.33	0.32
Maximum	1.1	0.74
Average	0.71	0.56
No. of Samples	(n = 8)	(n = 8)
Nitrate as N (mg/l)		
Minimum	0.28	0.38
Maximum	0.72	0.8
Average	0.45	0.48
No. of Samples	(n = 13)	(n = 7)
Nitrite as N (mg/l)		
Minimum	0.006	0.009
Maximum	0.028	0.028
Average	0.014	0.017
No. of Samples	(n = 13)	(n = 7)
Ammonia as N (mg/l)		
Minimum	0.04	0.04
Maximum	0.19	0.1
Average	0.084	0.0675
No. of Samples	(n = 8)	(n = 8)
Alkalinity as $CaCO_3$ (mg/l)		
Minimum	222	198
Maximum	343	351
Average	282.5	238.2
No. of Samples	(n = 2)	(n = 15)
Chloride (mg/l)		
Minimum	87	107
Maximum	2060	454
Average	317.9	229.11
No. of Samples	(n = 22)	(n = 18)

Table 2.3-52 Rouge River USGS NWIS Water Quality Data (Sheet 3 of 4)

	USGS Station Number	
	04166100 Rouge River at Southfield, Michigan	04166000 Rouge River at Birmingham, Michigan
Sampling Period	**1966-1968 and 2001-2003**	**1966 and 2001-2006**
	Sulfate (mg/l)	
Minimum	33.4	47.9
Maximum	102	177
Average	59.57	66.48
No. of Samples	(n = 18)	(n = 17)
	Sodium (mg/l)	
Minimum	65.6	54
Maximum	1320	256
Average	227.66	125.25
No. of Samples	(n = 17)	(n = 17)
	Potassium (mg/l)	
Minimum	2.73	2.4
Maximum	7.19	4.58
Average	4.2	3.86
No. of Samples	(n = 17)	(n = 17)
	Calcium (mg/l)	
Minimum	56.3	77.7
Maximum	137	136
Average	96.44	99.31
No. of Samples	(n = 17)	(n = 17)
	pH (s.u.)	
Minimum	6.8	7.5
Maximum	8.8	8.6
Average	7.86	7.99
No. of Samples	(n = 19)	(n = 23)
	Mercury (ng/l)	
Minimum	--	0.79
Maximum	--	1.41
Average	--	1.104
No. of Samples		(n = 5)

Table 2.3-52 Rouge River USGS NWIS Water Quality Data (Sheet 4 of 4)

	USGS Station Number	
	04166100 Rouge River at Southfield, Michigan	04166000 Rouge River at Birmingham, Michigan
Sampling Period	**1966-1968 and 2001-2003**	**1966 and 2001-2006**
	Iron (ug/l)	
Minimum	11	19
Maximum	129	76
Average	49.94	43.25
No. of Samples	(n = 17)	(n = 16)

-- - No Data

Source: Reference 2.3-31

Table 2.3-53 Huron River USGS NWIS Water Quality Data (Sheet 1 of 4)

	USGS Station Number					
	04169500	04170000	04170500	04172000	04173000	04174500
Sampling Period	**1966-1971**	**1970-2003**	**1970-2003**	**1970-1971**	**1970-1980**	**1970-1973**
Temperature (°C)						
Minimum	23	0.5	1.5	24	0	0
Maximum	25	26.4	27	26	28	27
Average	24	13.6	13.7	25	13.1	13.9
No. of Samples	(n = 3)	(n = 48)	(n = 44)	(n = 2)	(n = 58)	(n = 13)
Hardness as $CaCO_3$ (mg/l)						
Minimum	160	200	170	230	210	260
Maximum	220	290	300	320	280	280
Average	205	240	218	275	240	268
No. of Samples	(n = 6)	(n = 48)	(n = 46)	(n = 2)	(n = 21)	(n = 6)
Turbidity (Jackson Turbidity Units)						
Minimum	0	2	0	2	1	3
Maximum	1	2	8	4	5	20
Average	0.5	2	4	3	2	9
No. of Samples	(n = 2)	(n = 2)	(n=2)	(n = 2)	(n = 16)	(n = 6)
Color (Platinum Cobalt Units)						
Minimum	0	0	10	0	5	10
Maximum	35	30	10	40	30	30
Average	20	15	10	20	15	20
No. of Samples	(n = 2)	(n=2)	(n = 2)	(n=2)	(n = 16)	(n = 6)
Conductivity, Specific conductance (microsiemen per cm at 25°C)						
Minimum	410	546	400	500	460	410
Maximum	560	955	966	520	637	625
Average	468	673	620	510	540	558
No. of Samples	(n = 6)	(n = 48)	(n = 44)	(n = 2)	(n = 58)	(n = 14)
Dissolved Oxygen (mg/l)						
Minimum	--	6	5.8	--	6.4	8.1
Maximum	--	15.2	15.6	--	17.2	16.3
Average	--	10.2	10.26	--	10.9	11.8
No. of Samples		(n=45)	(n=42)		(n = 56)	(n = 12)

Table 2.3-53 Huron River USGS NWIS Water Quality Data (Sheet 2 of 4)

	USGS Station Number					
	04169500	04170000	04170500	04172000	04173000	04174500
Sampling Period	**1966-1971**	**1970-2003**	**1970-2003**	**1970-1971**	**1970-1980**	**1970-1973**
Biochemical Oxygen Demand, 5 days at 20°C (mg/l)						
Minimum	--	1	1.6	--	0.5	2.7
Maximum	--	150	320	--	5.2	8.9
Average	--	8.5	19.5	--	2.1	4.1
No. of Samples		(n=29)	(n=29)		(n = 54)	(n = 12)
Orthophosphate as P (mg/l)						
Minimum	--	<0.02	--	--	0	--
Maximum	--	<0.18	--	--	0.01	--
Average	--	--	--	--	0.0086	--
No. of Samples		(n = 18)			(n = 7)	
Organic Nitrogen (mg/l)						
Minimum	--	0.32	0.32	--	0.31	--
Maximum	--	1.6	1.8	--	0.78	--
Average	--	0.631	0.788	--	0.53	--
No. of Samples		(n = 39)	(n = 26)		(n = 14)	
Nitrate as N (mg/l)						
Minimum	--	0.02	0.15	--	0	0.03
Maximum	--	0.47	0.58	--	1.2	1.1
Average	--	0.21	0.271	--	0.189	0.34
No. of Samples		(n = 21)	(n = 10)		(n = 56)	(n = 12)
Nitrite as N (mg/l)						
Minimum	--	0.01	0.01	--	0	0
Maximum	--	0.12	0.05	--	0.04	0.04
Average	--	0.028	0.0175	--	0.014	0.017
No. of Samples		(n = 28)	(n = 12)		(n = 47)	(n = 9)
Ammonia as N (mg/l)						
Minimum	--	0.03	0.02	--	0.01	0.22
Maximum	--	0.4	0.4	--	1.6	0.98
Average	--	0.192	0.143	--	0.298	0.532
No. of Samples		(n = 29)	(n = 23)		(n = 56)	(n = 12)

Table 2.3-53 Huron River USGS NWIS Water Quality Data (Sheet 3 of 4)

	USGS Station Number					
	04169500	04170000	04170500	04172000	04173000	04174500
Sampling Period	1966-1971	1970-2003	1970-2003	1970-1971	1970-1980	1970-1973
Alkalinity as $CaCO_3$ (mg/l)						
Minimum	--	166	106	--	--	--
Maximum	--	266	246	--	--	--
Average	--	204.933	167	--	--	--
No. of Samples		(n = 15)	(n=11)			
Chloride (mg/l)						
Minimum	17	45	33	35	21	30
Maximum	34	141	132	38	47	53
Average	25.67	81.316	74.186	36.5	34	39.5
No. of Samples	(n = 6)	(n = 49)	(n = 46)	(n = 2)	(n = 21)	(n = 6)
Sulfate (mg/l)						
Minimum	29	21	22	--	28	57
Maximum	29	41.2	44	--	60	77
Average	29	30.85	30.7	--	45.74	64.25
No. of Samples	(n=1)	(n = 47)	(n = 46)		(n = 19)	(n = 4)
Sodium (mg/l)						
Minimum	--	28	26	--	13	13
Maximum	--	81.6	71.2	--	28	25
Average	--	45.6	41.45	--	18.21	17.25
No. of Samples		(n = 47)	(n = 44)		(n = 19)	(n = 4)
Potassium (mg/l)						
Minimum	--	1.4	1.4	--	1.6	2.3
Maximum	--	4.65	3.44	--	2.5	3
Average	--	2.49	2.1545	--	1.99	2.5
No. of Samples		(n = 47)	(n = 44)		(n = 19)	(n = 4)
Calcium (mg/l)						
Minimum	--	49	39	--	58	76
Maximum	--	76.9	79.8	--	75	79
Average	--	62.86	55.566	--	64.58	77.5
No. of Samples		(n = 47)	(n = 44)		(n = 19)	(n = 4)

Table 2.3-53 Huron River USGS NWIS Water Quality Data (Sheet 4 of 4)

	USGS Station Number					
	04169500	04170000	04170500	04172000	04173000	04174500
Sampling Period	**1966-1971**	**1970-2003**	**1970-2003**	**1970-1971**	**1970-1980**	**1970-1973**
pH (s.u.)						
Minimum	7.5	7.7	7.3	7.0	7.3	6.6
Maximum	8.4	8.4	8.7	8.0	8.6	8.6
Average	8.1	8.0	8.2	7.5	8.1	7.9
No. of Samples	(n = 6)	(n = 47)	(n = 43)	(n = 2)	(n = 58)	(n = 14)
Total Coliform (cfu/100 ml)						
Minimum	--	20	42	--	10	430
Maximum	--	3900	630	--	1100000	110000
Average	--	1212	189	--	26080	29005
No. of Samples		(n = 11)	(n = 7)		(n = 51)	(n = 11)
Fecal Coliforms (cfu/100ml)						
Minimum	--	32	42	--	--	--
Maximum	--	270	82	--	--	--
Average	--	84	62	--	--	--
No. of Samples		(n = 9)	(n = 3)			
Iron (ug/l)						
Minimum	--	32	17	--	0	30
Maximum	--	98	47	--	370	370
Average	--	57	26	--	57	147
No. of Samples		(n = 17)	(n = 14)		(n = 14)	(n = 3)
Manganese (ug/l)						
Minimum	--	12.6	3.7	--	10	20
Maximum	--	37	11.9	--	80	70
Average	--	22.9	6.8	--	47	40
No. of Samples		(n=17)	(n=13)		(n=6)	(n = 4)

-- - No Data
Source: Reference 2.3-31

Table 2.3-54 Huron River EPA STORET Water Quality Data from MDEQ (Sheet 1 of 6)

STORET Station No. 580364	
Sampling Period 1998-2005	
Alkalinity, Bicarbonate as $CaCO_3$ (mg/l)	
Minimum	154
Maximum	199
Average	176
No. of Samples	(n=4)
Alkalinity, Total (mg/l)	
Minimum	129
Maximum	210
Average	173
No. of Samples	(n=31)
Cadmium (ug/l)	
Minimum	0
Maximum	0.066
Average	0.032
No. of Samples	(n=43)
Calcium (mg/l)	
Minimum	47.2
Maximum	150
Average	81.1
No. of Samples	(n=43)
Carbon, Total Organic (mg/l)	
Minimum	5.5
Maximum	9
Average	7
No. of Samples	(n=43)
Chloride (mg/l)	
Minimum	41
Maximum	174
Average	95
No. of Samples	(n=43)

Table 2.3-54 Huron River EPA STORET Water Quality Data from MDEQ (Sheet 2 of 6)

STORET Station No. 580364 Sampling Period 1998-2005	
Chromium (ug/l)	
Minimum	0.094
Maximum	3.509
Average	0.893
No. of Samples	(n=43)
Copper (ug/l)	
Minimum	1.03
Maximum	3.63
Average	1.76
No. of Samples	(n=43)
Dissolved Oxygen (mg/l)	
Minimum	6.1
Maximum	8.3
Average	7.0
No. of Samples	(n=7)
Hardness, Carbonate (mg/l)	
Minimum	199
Maximum	522
Average	305
No. of Samples	(n=43)
Lead (ug/l)	
Minimum	0.475
Maximum	3.661
Average	1.881
No. of Samples	(n=43)
Magnesium (mg/l)	
Minimum	17.1
Maximum	37
Average	25.0
No. of Samples	(n=43)

Table 2.3-54 Huron River EPA STORET Water Quality Data from MDEQ (Sheet 3 of 6)

STORET Station No. 580364	
Sampling Period 1998-2005	
Mercury (ng/l)	
Minimum	0.4
Maximum	4.1
Average	1.84
No. of Samples	(n=44)
Nickel (ug/l)	
Minimum	2.03
Maximum	6.888
Average	3.43
No. of Samples	(n=43)
Nitrogen, ammonia as NH_3 (mg/l)	
Minimum	0.013
Maximum	0.186
Average	0.064
No. of Samples	(n=43)
Nitrogen, Kjeldahl (mg/l)	
Minimum	0.54
Maximum	1.05
Average	0.78
No. of Samples	(n=43)
Nitrogen, Nitrate as NO_3 (mg/l)	
Minimum	0.026
Maximum	1.48
Average	0.39
No. of Samples	(n=43)
Nitrogen, Nitrite + Nitrate as N (mg/l)	
Minimum	0.073
Maximum	0.54
Average	0.32
No. of Samples	(n=4)

Table 2.3-54 Huron River EPA STORET Water Quality Data from MDEQ (Sheet 4 of 6)

STORET Station No. 580364	
Sampling Period 1998-2005	
Nitrogen, Nitrite as NO_2 (mg/l)	
Minimum	0.005
Maximum	0.037
Average	0.012
No. of Samples	(n=42)
pH (s.u.)	
Minimum	7.64
Maximum	8.31
Average	8.06
No. of Samples	(n=42)
Phosphorus (mg/l)	
Minimum	0.018
Maximum	0.09
Average	0.054
No. of Samples	(n=42)
Phosphorus, Orthophosphate as P (mg/l)	
Minimum	0.002
Maximum	0.03
Average	0.012
No. of Samples	(n=42)
Potassium (mg/l)	
Minimum	2.8
Maximum	5.1
Average	3.7
No. of Samples	(n=28)
Sodium (mg/l)	
Minimum	35
Maximum	103
Average	53
No. of Samples	(n=28)

Table 2.3-54 Huron River EPA STORET Water Quality Data from MDEQ (Sheet 5 of 6)

STORET Station No. 580364	
Sampling Period 1998-2005	
Solids, Dissolved (mg/l)	
Minimum	410
Maximum	730
Average	542
No. of Samples	(n=42)
Solids, Total Suspended (TSS) (mg/l)	
Minimum	4
Maximum	175
Average	20
No. of Samples	(n=43)
Specific conductance (umho/cm)	
Minimum	633
Maximum	1129
Average	838
No. of Samples	(n=43)
Sulfur, sulfate as SO_4 (mg/l)	
Minimum	32
Maximum	285
Average	103
No. of Samples	(n=43)
Temperature, water (°C)	
Minimum	1
Maximum	28
Average	18
No. of Samples	(n=43)
Turbidity (mg/l)	
Minimum	3.3
Maximum	37
Average	10.4
No. of Samples	(n=31)

Table 2.3-54 Huron River EPA STORET Water Quality Data from MDEQ (Sheet 6 of 6)

STORET Station No. 580364	
Sampling Period 1998-2005	
Zinc (ug/l)	
Minimum	2.7
Maximum	54.6
Average	8.2
No. of Samples	(n=43)

Source: Reference 2.3-37

Table 2.3-55 Monroe County USGS Groundwater Monitoring Well Water Quality Data (Sheet 1 of 3)

USGS 415206083414401	
Sampling Dates 8/9/1979 and 12/11/1984	
Acid neutralizing capacity as $CaCO_3$ (mg/l)	
Average	205
No. of Samples	(n = 1)
Ammonia as N (mg/l)	
Average	0.3
No. of Samples	(n = 2)
Ammonia + Organic Nitrogen as N (mg/l)	
Average	2.7
No. of Samples	(n = 2)
Bicarbonate (mg/l)	
Average	250
No. of Samples	(n = 1)
Carbon Dioxide (mg/l)	
Average	9.2
No. of Samples	(n = 2)
Chloride (mg/l)	
Average	0.9
No. of Samples	(n = 2)
Nitrite as N (mg/l)	
Average	<0.01
No. of Samples	(n = 2)
Nitrate as N (mg/l)	
Average	0.00
No. of Samples	(n = 1)
Nitrite + Nitrate as N (mg/l)	
Average	<0.10
No. of Samples	(n = 2)
Organic Nitrogen (mg/l)	
Average	2.4
No. of Samples	(n = 2)

Table 2.3-55 Monroe County USGS Groundwater Monitoring Well Water Quality Data (Sheet 2 of 3)

USGS 415206083414401	
Sampling Dates 8/9/1979 and 12/11/1984	
Total Nitrogen (mg/l)	
Average	4.8
No. of Samples	(n = 1)
pH (s.u.)	
Average	7.7
No. of Samples	(n = 2)
Phosphate (mg/l)	
Average	0.31
No. of Samples	(n = 2)
Phosphorus (mg/l)	
Average	0.01
No. of Samples	(n = 2)
Temperature (°C)	
Average	10.8
No. of Samples	(n = 2)
Turbidity (NTU)	
Average	1
No. of Samples	(n = 2)
Sulfate (mg/l)	
Average	41.5
No. of Samples	(n = 2)
Arsenic (ug/l)	
Average	<1
No. of Samples	(n = 2)
Barium (ug/l)	
Average	150
No. of Samples	(n = 2)
Cadmium (ug/l)	
Average	<1
No. of Samples	(n = 1)

Table 2.3-55 Monroe County USGS Groundwater Monitoring Well Water Quality Data (Sheet 3 of 3)

USGS 415206083414401	
Sampling Dates 8/9/1979 and 12/11/1984	
Calcium (ug/l)	
Average	33
No. of Samples	(n = 2)
Chromium (ug/l)	
Average	20
No. of Samples	(n = 2)
Iron (ug/l)	
Average	130
No. of Samples	(n = 2)
Iron, suspended sediment, recoverable (ug/l)	
Average	60
No. of Samples	(n = 1)
Magnesium (mg/l)	
Average	18
No. of Samples	(n = 2)
Potassium (mg/l)	
Average	1.3
No. of Samples	(n = 2)
Sodium (mg/l)	
Average	23.5
No. of Samples	(n = 2)

Source: Reference 2.3-69

Table 2.3-56 USGS NWIS Groundwater Data (Sheet 1 of 4)

	USGS 415839083221501	USGS 415527083402001	USGS 415824083162901	USGS 415710083192501	USGS 420218083130401	USGS 420107083403201	USGS 420123083213801	USGS 420123083300001	USGS 420503083192101
Sampling Date	11/5/1991	1/23/1992	5/6/1992	4/28/1992	4/27/1992	4/28/1992	5/6/1992	5/5/1992	5/5/1992
Sampling Date - Nuclear Parameters				9/11/1991	9/12/1991	9/11/1991		9/9/1991	9/11/1991
Acid neutralizing capacity as $CaCO_3$ (mg/l)									
Average	225	236	280	226	251	213	229	220	184
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Carbon Dioxide (mg/l)									
Average	--	9.1	34	28	39	26	18	21	22
No. of Samples	--	(n = 1)	(n = 1)	(n = 1)	(n = 1)	(n = 1)	(n = 1)	(n = 1)	(n = 1)
Chloride (mg/l)									
Average	22	13	64	22	80	12	8.2	8.6	43
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Nitrite as N (mg/l)									
Average	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Nitrite + Nitrate as N (mg/l)									
Average	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.058	<0.050	<0.050
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Conductivity, Specific conductance (microsiemen per cm at 25°C)									
Average	1460	462	1430	2550	2150	1100	1490	1230	2380
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
pH (s.u.)									
Average	7.2	7.7	7.2	7.2	7.1	7.2	7.4	7.3	7.2
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Temperature (°C)									
Average	--	--	--	11.5	13.5	12	--	--	--
No. of Samples	--	--	--	(n=1)	(n=1)	(n=1)	--	--	--
Turbidity (NTU)									
Average	230	620	0.4	96	27	4.3	5	1	0.4

Table 2.3-56 USGS NWIS Groundwater Data (Sheet 2 of 4)

	USGS 415839083221501	USGS 415527083402001	USGS 415824083162901	USGS 415710083192501	USGS 420218083130401	USGS 420107083403201	USGS 420123083213801	USGS 420123083300001	USGS 420503083192101
Sampling Date	11/5/1991	1/23/1992	5/6/1992	4/28/1992	4/27/1992	4/28/1992	5/6/1992	5/5/1992	5/5/1992
Sampling Date - Nuclear Parameters				9/11/1991	9/12/1991	9/11/1991		9/9/1991	9/11/1991
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Sulfate (mg/l)									
Average	630	3.1	440	1400	950	340	590	410	1200
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(410)	(n=1)
Silica (mg/l)									
Average	10	15	13	13	8.2	8.7	13	18	15
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Arsenic (ug/l)									
Average	<1	<1	<1	<1	<1	<1	<1	<1	<1
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Barium (ug/l)									
Average	15	520	12	14	8	130	9	35	8
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Cadmium **(ug/l)**									
Average	<1	<1	<1	<3	<2	<1	<1	<1	<3
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Calcium (mg/l)									
Average	230	54	180	410	350	100	190	140	410
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Chromium (ug/l)									
Average	2	<1	<1	<1	2	<1	<1	<1	<1
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Copper (ug/l)									
Average	<1	<1	1	<1	1	<1.0	<1	<1	<1
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)

Table 2.3-56 USGS NWIS Groundwater Data (Sheet 3 of 4)

	USGS 415839083221501	USGS 415527083402001	USGS 415824083162901	USGS 415710083192501	USGS 420218083130401	USGS 420107083403201	USGS 420123083213801	USGS 420123083300001	USGS 420503083192101
Sampling Date	11/5/1991	1/23/1992	5/6/1992	4/28/1992	4/27/1992	4/28/1992	5/6/1992	5/5/1992	5/5/1992
Sampling Date - Nuclear Parameters				9/11/1991	9/12/1991	9/11/1991		9/9/1991	9/11/1991
Iron (ug/l)									
Average	21	16	190	190	370	22	460	14	35
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Lead (ug/l)									
Average	<1	<1	<1	<1	<1	<1	<1	<1	<1
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Magnesium (mg/l)									
Average	63	20	67	160	120	48	92	66	110
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Mercury (ug/l)									
Average	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Potassium (mg/l)									
Average	2.7	1.1	3.7	4.6	5.3	3.7	3.8	3.1	5.3
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Sodium (mg/l)									
Average	7.4	12	23	18	33	41	29	36	46
No. of Samples	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)	(n=1)
Tritium (picocuries/l)									
Average	--	--	--	<2	14	5	--	8	24
No. of Samples	--	--	--	(n=1)	(n=1)	(n=1)	--	(n=1)	(n=1)
Tritium 2-sigma (picocuries/l)									
Average	--	--	--	2.6	1.9	1.9	--	1.9	3.8
No. of Samples	--	--	--	(n=1)	(n=1)	(n=1)	--	(n=1)	(n=1)

Table 2.3-56 USGS NWIS Groundwater Data (Sheet 4 of 4)

	USGS 415839083221501	USGS 415527083402001	USGS 415824083162901	USGS 415710083192501	USGS 420218083130401	USGS 420107083403201	USGS 420123083213801	USGS 420123083300001	USGS 420503083192101
Sampling Date	11/5/1991	1/23/1992	5/6/1992	4/28/1992	4/27/1992	4/28/1992	5/6/1992	5/5/1992	5/5/1992
Sampling Date - Nuclear Parameters				9/11/1991	9/12/1991	9/11/1991		9/9/1991	9/11/1991
Deuterium/ Protium ratio, per mil									
Average	--	--	--	-52	-55	-68	--	-56.5	-60.5
No. of Samples	--	--	--	(n=1)	(n=1)	(n=1)	--	(n=1)	(n=1)
Oxygen-18/ Oxygen-16 ratio, per mil									
Average	--	--	--	-7.95	-8.35	-10.15	--	-8.5	-9.2
No. of Samples	--	--	--	(n=1)	(n=1)	(n=1)	--	(n=1)	(n=1)
Carbon-14 percent modern									
Average	--	--	--	--	--	4.7	--	15.2	--
No. of Samples	--	--	--	--	--	(n=1)	--	(n=1)	--
Sulfur- 34/ Sulfur-32 ratio, per mil									
Average	--	--	--	--	--	29	--	21.9	--
No. of Samples	--	--	--	--	--	(n=1)	--	(n=1)	--
Carbon-13/Carbon-12 ratio, per mil									
Average	--	--			--	-12.5	--	-17	--
No. of Samples	--	--			--	(n=1)	--	(n=1)	--

-- - No Data

Source: Reference 2.3-31

Table 2.3-57 Michigan Department of Agriculture Groundwater Quality Data

	Sample ID and Date					
	AG580033	AG580032	AG580010	AG580054	AG580053	AG580009
Parameter	04/16/91	04/16/91	07/18/90	09/11/91	09/26/91	07/18/90
Specific Conductance (umho/cm at 25°C)	>1980	1535	>1980	386	426	1111
Total Chloride In Water (mg/l)	<10	54	26	<10	12	<10
Total Fluoride as F (mg/l)	1.6	1.3	0.8	1.5	1.3	1.2
Total Hardness as $CaCO_3$ (mg/l)	>649	>649	>649	224	258	451
Total Sodium as Na (mg/l)	<10	15	<10	<10	<10	22
Total Iron as Fe (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Total Nitrate Nitrogen as N (mg/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Source: Reference 2.3-37

Table 2.3-58 Groundwater Arsenic Samples within approximately 5 mi of the Fermi Site

Sample Date	Owner	Location	Number of Samples	Average Concentration in mg/l
1985	Single Family Dwellings	South Rockwood	5	0.00910
1986 - 2007	Single Family Dwellings	Carleton	6	0.00200
1987 - 1988	Single Family Dwellings	Monroe	11	0.00229
6/25/1986	Single Family Dwelling	Carleton	1	0.00300
1/13/1999	C. Musson Construction	Monroe	1	0.00040
2002 - 2007	City of Monroe	Monroe	3	0.00100
1988	Detroit Edison	Monroe	1	<0.00500
8/31/1995	F & F Specialties, Inc.	Monroe	1	0.00015
1994 - 2005	Flatrock Village MHC	Carleton	7	0.00100
6/30/1998	Metro Specialties Inc	Monroe	1	0.00220
9/23/1993	Raisinville Elementary School	Monroe	1	0.00100
4/6/1988	St. Patricks School	Carleton	1	0.00250
1987	Treadwells MHP	Flat Rock	3	0.00200

Range of the source Arsenic Data used to obtain averages: 0.0004 to 0.018 mg/l

Note:
For the average concentrations, Non Detects were included in the average as 1/2 the detection limit.

Source: Reference 2.3-57

Table 2.3-59 Groundwater Nitrate Samples within approximately 5 mi of the Fermi Site (Sheet 1 of 2)

Date	Owner	City	Number of Samples	Average Concentration in mg/l
1983 - 2007	Single Family Dwellings	Monroe	298	0.4
1983 - 2005	Single Family Dwellings	Newport	44	0.7
1984 - 2001	Single Family Dwellings	S. Rockwood	11	0.1
1993 - 1998	Bible Fellowship Church	Monroe	9	0.6
1984 - 1987	Camp Lord Willing, Inc	Monroe	10	0.1
1998 - 2007	Canvasback Gun Club Inc.	Monroe	21	0.2
1983 - 2007	City of Monroe Water	Monroe	24	0.4
1983 - 1995	Detroit Edison / Enrico Fermi	Monroe	24	0.3
1994 - 2002	France Stone Co / Hanson Aggregates	Monroe	15	0.2
1989 - 2005	Green Meadows Golf Course	Monroe	26	0.3
1989 - 1998	Fraternal Order of Police	Monroe	5	0.1
1999 - 2002	Hanson Aggregates	Monroe	8	0.2
1989 - 1997	Holy Ghost Lutheran School	Monroe	7	0.1
1996 - 2006	Immanuel Lutheran Church	Monroe	13	0.2
1993 - 2006	Janssen Brothers Farms Inc	Monroe	8	0.2
1993 - 2003	Brest Bay Sportsmens Gun Club	Newport	10	0.2
1995 - 2001	Chuck Musson	Monroe	5	0.2
1989 - 2002	Frenchtown Estates MHP	Monroe	2	0.2
1986	Frenchtown Twp Library	Monroe	1	0.1
1996 - 2000	Metro Specialties Inc.	Monroe	7	0.2
1986 - 1998	Monroe Christian Church	Monroe	5	0.1
1993 - 2004	Liparoto`s Bakery	Monroe	13	0.4
1987 - 2003	Monroe Public Schools	Monroe	13	0.1
1988 - 1995	Raisinville Elementary School	Monroe	4	0.1
1999 - 2007	Monroe County	Monroe	8	0.5
1997 - 2007	Flat Rock Village MHP	Carleton	8	0.2
1989 - 1993	Lilac Bros Golf Course	Newport	3	0.1

Table 2.3-59 Groundwater Nitrate Samples within approximately 5 mi of the Fermi Site (Sheet 2 of 2)

Date	Owner	City	Number of Samples	Average Concentration in mg/l
2001	Sundance Enterprises	Monroe	1	0.2
1998	Sunset Acres (Back Well)	Monroe	2	0.3
1987 - 1995	Seven Day Adventist Church	Monroe	2	0.1
2000	Apartments	Monroe	1	0.1
1994	Monroe Missionary Baptist Church	Monroe	1	0.4
1986	Monroe Christian Church	Monroe	1	0.1
1993 - 1995	F & F Specialties, Inc	Monroe	2	0.1
1993 - 1994	FOP Raisinville	Monroe	2	0.1
1984 - 1996	Navarres Golf Range	Monroe	2	0.1

Range of Nitrate Data: 0.1 to 9.1 mg/l

Note:
For the average concentrations, Non Detects were included in the average as 1/2 the detection limit.

Source: Reference 2.3-57

Table 2.3-60 Groundwater VOC Samples within approximately 5 mi of the Fermi Site (Sheet 1 of 2)

Date	Owner	City	VOCs Detected *	Concentration (mg/l)
3/24/1995	Single Family Dwelling	Monroe	Toluene	0.0081
1/12/1995	Single Family Dwelling	Carleton	ND	
11/22/1993	Single Family Dwelling	Petersburg	ND	
6/13/1994	Flat Rock Village MHP	Carleton	Bromoform	0.0009
			Chlorodibromomethane	0.004
			Chloroform	0.0057
			Dichlorobromomethane	0.0048
			Total Trihalomethanes	0.0154
10/16/1995	Flat Rock Village MHP	Carleton	ND	
10/18/1995	Flat Rock Village MHP	Carleton	ND	
10/31/1995	Flat Rock Village MHP	Carleton	Chlorodibromomethane	0.0004
			Chloroform	0.0013
			Dichlorobromomethane	0.0004
			Total Trihalomethanes	0.0021
1/15/1999	C. Musson Construction	Monroe	ND	
12/17/1998	City of Monroe Water	Monroe	Toluene	0.0022
10/1/1993	Detroit Edison Monroe Pp, 3500 E Front	Monroe	ND	
4/1/1993	Enrico Fermi-Detroit Edison,	Monroe	Chlorodibromomethane	0.0036
	Plant Tap		Chloroform	0.0754
			Dichlorobromomethane	0.016
			Total Trihalomethanes	0.095
9/8/1995	F&F Specialities Inc.	Monroe	Chloroform	0.0002
			Total Trihalomethanes	0.0002
			Toluene	0.0002
8/19/1995	Liparotos Bakery	Monroe	Dichlorodifluoromethane	0.0012
			Methyl tert-butyl ether	0.001
10/30/1995	Liparotos Bakery	Monroe	Dichlorodifluoromethane	0.003
			Methyl tert-butyl ether	0.001

Table 2.3-60 Groundwater VOC Samples within approximately 5 mi of the Fermi Site (Sheet 2 of 2)

Date	Owner	City	VOCs Detected *	Concentration (mg/l)
9/28/1993	Raisinville Elementary School	Monroe	Bromoform	0.0077
			Chlorodibromomethane	0.0074
			Chloroform	0.0628
			Dichlorobromomethane	0.0196
			Total Trihalomethanes	0.0975
			Dichloroethylene 1,2-cis	0.0006

Notes:
Range of VOC data: Non Detect to 0.0975 mg/l
ND = No VOC chemicals detected above detection limit

* Chemicals included in the VOC analysis:

Benzene	Dichlorobutane,1,4-	Methylene Chloride
Bromobenzene	Dichlorodifluoromethane	Naphthalene
Bromochloromethane	Dichloroethane,1,1-	Propylbenzene, Normal-
Bromoform	Dichloroethane,1,2-	Styrene
Bromomethane	Dichloroethylene,1,1-	Tetrachloroethane,1,1,1,2-
Butylbenzene,Normal-	Dichloroethylene,1,2-CIS	Tetrachloroethane,1,1,2,2-
Butylbenzene, Sec-	Dichloroethylene,1,2-TRANS	Tetrachloroethylene
Butylbenzene,Tert-	Dichloropropane,1,2-	Tetrahydrofuran
Carbon Tetrachloride	Dichloropropane,1,3-	Toluene
Chlorobenzene	Dichloropropane,2,2-	Total Trihalomethanes
Chlorodibromomethane	Dichloropropene,1,1-	Trichlorobenzene,1,2,3-
Chloroethane	Dichloropropene,1,3-CIS	Trichlorobenzene,1,2,4-
Chloroform	Dichloropropene,1,3-TRANS	Trichloroethane,1,1,1-
Chloromethane	Ethylbenzene	Trichloroethane,1,1,2-
Chlorotoluene (Combined)	Fluorotrichloromethane	Trichloroethylene
Dibromo-3-Chloropropane,1,2	Hexachlorobutadiene	Trichloropropane,1,2,3-
Dibromoethane,1,2- (EDB)	Hexachloroethane	Trimethylbenzene,1,2,4-
Dibromomethane	Isopropyl Benzene	Trimethylbenzene,1,3,5-
Dichlorobenzene,1,2-	Isopropyl Toluene, Para-	Vinyl Chloride
Dichlorobenzene,1,3-	Methyl Ethyl Ketone	Xylene, Ortho-
Dichlorobenzene,1,4-	Methyl Isobutyl Ketone	Xylenes (Total)
Dichlorobromomethane	Methyl Tert-Butyl Ether	

Source: Reference 2.3-57

Table 2.3-61 Chemical Analyses of Groundwater by the Detroit Edison Company, 1970

Well Number	Chloride (mg/l)	Sulfate (mg/l)	pH (s.u.)	Specific Conductance (µmho/cm)	Hardness as $CaCO_3$ (mg/l)
6S/10E-18P1	17	630	7.0	1640	936
6S/10E-18R1	103	270	7.0	1400	680
6S/10E-19B1	42	110	7.1	915	480
6S/10E-19B3	32	60	7.0	1090	572
6S/10E-19G1	45	170	7.1	915	468
6S/10E-19R1	54	150	7.1	1084	520
6S/10E-20E1	208	350	7.0	1840	900
6S/10E-28F1	20	300	7.1	1170	732

Source: Reference 2.3-49

Table 2.3-62 Chemical Analyses of Groundwater by the Detroit Edison Company, 1969

Boring Number	Depth (ft)	Chloride (ppm)	Sulfate (ppm)	pH (s.u.)
201	30.0	33	1685	7.65
201	85.0	34	1747	7.60
204	18.0	43	1661	8.00
205	17.4	45	1865	8.10
205	117.2	424	1790	7.30
207	19.8	356	1776	7.40
207	20.0	51	1747	7.70
208	27.2	1164	1168	7.90
208	110.0	183	1282	8.10
209	92.0-102.0	102	1771	8.10
209	97.0-107.0	156	1738	8.05
209	102.0-112.0	91	1738	8.00
209	132.0-142.0	116	1757	7.80
209	147.0-152.0	122	1800	8.10
209	151+	115	1757	8.10
209	210+	162	1771	7.90
210	20.4-30.5	603	1738	7.60
210	30.4-40.5	547	1728	7.65
210	40.4-50.5	1145	1709	8.00
210	50.4-60.5	362	1742	8.00
210	60.4-70.5	198	1709	8.10
210	70.4-80.5	65	1752	7.70
210	80.4-90.5	156	1699	8.00
210	90.4-100.0	21	1718	7.50
210	67+	48	1747	7.70

Source: Reference 2.3-49

Table 2.3-63 Groundwater Sample Results from the Fermi Site, 2007 (Sheet 1 of 2)

	Sample ID Numbers			
Parameters	**DQH0227-01**	**DQH0227-02**	**DQH0227-03**	**DQH0227-04**
General Chemistry Parameters				
Biological Oxygen Demand - 5 day (mg/l)	<3.0	<3.0	<3.0	<3.0
Color (C.U.)	5	5.00	5	10
Nitrogen, Total Kjeldahl (mg/l)	<0.500	<0.500	0.552	<0.500
Phosphorus, Total as P (mg/l)	0.02	0.04	0.06	0.04
Sulfate as SO_4 (mg/l)	266	248	1150	189
Chromium, Hexavalent (ug/l)	<20	<20	<20	<20
Alkalinity, Bicarbonate as HCO_3 (mg/l)	231	213	207	212
Ammonia, Undistilled as N (mg/l)	<0.0500	<0.0500	0.275	<0.0500 [M14]
Carbon Dioxide (mg/l)	15	22	23.0 [E]	11
Chemical Oxygen Demand (mg/l)	<10.0	<10.0	18.5	11.1
Chloride (mg/l)	11	24	26	34
Nitrate/Nitrite as N (mg/l)	<0.0100	0.0452	<0.0100	0.0456
Solids, Total Dissolved (mg/l)	590	610	1930	550
Solids, Total Suspended (mg/l)	15	<4.00	206	11.00
Specific Conductance (umho/cm)	877	879	2130	813
Total Alkalinity (mg/l)	190	176	170	174
Turbidity (S.U.)	1	1.00	3	1.00
Nitrite as N (mg/l)	<0.010	<0.010	<0.010	<0.010
Odor (S.U.)	ND	ND	ND	ND
Phosphorus, Ortho as P (mg/l)	<0.0200	0.0200	<0.0200	<0.0200
Nitrate as N (mg/l)	<0.0100	0.0450	<0.0100	0.046
General Chemistry Parameters - DO				
Dissolved Oxygen (mg/l)	2.41	3.12	10.4	2.11
Microbiology				
Total Coliforms /100 ml	40	<100	<100	200
Fecal Coliforms /100 ml	<10	10	<10	<10
Fecal Streptococcus /100 ml	<10	<10	<10	<10
Total Metals				
Arsenic (ug/l)	ND	ND	ND	ND
Hardness by Calculation as $CaCO_3$ (mg/l)	431	417	1550	365
Cadmium (ug/l)	<0.200	<0.200	<0.200	<0.300 [RL1]
Calcium (mg/l) (EPA 200.7)	114	113	374	94.2
Calcium (ug/l) (SW 6010B)	115000	116000	395000	96600
Chromium (ug/l)	<2.00	<2.00	<2.00	<2.00

Table 2.3-63 Groundwater Sample Results from the Fermi Site, 2007 (Sheet 2 of 2)

	Sample ID Numbers			
Parameters	**DQH0227-01**	**DQH0227-02**	**DQH0227-03**	**DQH0227-04**
Copper (ug/l)	<5.00	<5.00	<5.00	<5.00
Iron (ug/l)	479	608	1800	1030
Lead (ug/l)	<1.00	<1.00	3.21	<1.00
Magnesium (mg/l) (EPA 200.7)	35.4	32.6	149	31.5
Magnesium (ug/l) (SW 6010B)	35300	33100	146000	31900
Mercury (ug/l)	<0.200	<0.200	<0.200	<0.200
Nickel (ug/l)	<5.00	<7.00 RL1	<12.0 RL1	<5.00
Potassium (ug/l)	3190	3230	5350	3390
Selenium (ug/l)	<5.00	<5.00	<5.00	<10.0 RL1
Silica (SiO_2) (ug/l)	7090	7580	19200	7720
Silver (ug/l)	<0.500	<0.500	<0.500	<0.500
Sodium (ug/l)	15300	21400	20400	24800
Zinc (ug/l)	6.78 B8	<10.0 RL1	55.1 B8	4.99 B8
Dissolved Metals				
Silica (SiO_2) (ug/l)	5420	6470	10700	5970

B8 - Analyte was detected in the associated Method Blank within 10% of the reporting limit.

E - Concentration exceeds the calibration range and therefore result is semi-quantitative.

M - The MS, MSD, and/or RPD are outside of acceptance limits due to matrix interference. See Blank Spike (LCS).

M14 - The MS/MSD recoveries are outside of laboratory established control limits.

RL1 -Reporting limit raised due to sample matrix effects.

-- - No Data

ND - Not Detected

EPA 200.7 - Metals and Trace Elements by ICP/Atomic Emission Spectrometry

SW 6010B - EPA SW-846 Method 6010B

Table 2.3-64 Groundwater Sample Results from the Fermi Site, 2007 (Sheet 1 of 3)

	Sample ID Numbers						
Parameters	DQH0662-01	DQH0662-02	DQH0662-03	DQH0662-04	DQH0662-05	DQH0662-06	DQH0662-07
General Chemistry Parameters							
Biological Oxygen Demand - 5 day (mg/l)	<3.0	<3.0	<3.0	<3.0	4.0	<3.0	<3.0
Color (C.U.)	1.0 H	5.0 H	30.0 H	20.0 H	5.00 H	5 H	--
Nitrogen, Total Kjeldahl (mg/l)	0.646	<0.500	1.12	0.858	1.02	0.905	<0.500
Phosphorus, Total as P (mg/l)	0.0200	0.0200	<0.0200	0.0200	0.02	0.02	<0.0200
Sulfate as SO_4 (mg/l)	1530	1630	1710	1720	1480	1620	<1.00
Chromium, Hexavalent (ug/l)	<20	<20	<20	<20	<20	<20	<20
Alkalinity, Bicarbonate as HCO_3 (mg/l)	568	476	530	506	271	266	--
Ammonia, Undistilled as N (mg/l)	<0.0500	<0.0500	0.405	0.315	0.351	0.32	<0.0500
Carbon Dioxide (mg/l)	--	--	--	--	--	--	--
Chemical Oxygen Demand (mg/l)	18.1	18.5	15.1	<10.0	<10.0	<10.0	<10.0
Chloride (mg/l)	39.0	38.0	35.0	36.0	61	47	<5.00
Nitrate/Nitrite as N (mg/l)	0.0861	0.24	0.0316	0.264	0.0175	<0.0100	0.141
Solids, Total Dissolved (mg/l)	2640	2820	2990	3110	2340	2340	139
Solids, Total Suspended (mg/l)	<4.00	<4.00	10.0	7	11	16	<4.00
Specific Conductance (umho/cm)	2820	2900	3040	3080	2720	2770	2870
Total Alkalinity (mg/l)	466	390	435	415	222	218	--
Turbidity (S.U.)	ND H	ND H	1.00 H	1.00 H	1.00 H	1.00 H	--
Nitrite as N (mg/l)	0.040	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010
Odor (S.U.)	1.00 H	ND H	ND H	ND H	ND H	ND H	--
Phosphorus, Ortho as P (mg/l)	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200

Table 2.3-64 Groundwater Sample Results from the Fermi Site, 2007 (Sheet 2 of 3)

	Sample ID Numbers						
Parameters	**DQH0662-01**	**DQH0662-02**	**DQH0662-03**	**DQH0662-04**	**DQH0662-05**	**DQH0662-06**	**DQH0662-07**
Nitrate as N (mg/l)	0.046	0.230	0.0320	0.26	0.018	<0.0100	0.14
General Chemistry Parameters -	**DO**						
Dissolved Oxygen (mg/l)	2.73	3.26	2.13	2.12	1.06	1.04	6.68
Microbiology							
Total Coliforms /100 ml	<10	<10	<10	Inconclusive	<100	<100	<10
Fecal Coliforms /100 ml	<10	<10	<10	<10	<10	<10	<10
Fecal Streptococcus /100 ml	<10	<10	50	50	<10	<10	<10
Total Metals							
Arsenic (ug/l)	ND	ND	ND	ND	ND	ND	ND
Hardness by Calculation as $CaCO_3$ (mg/l)	2140	2160	2250	2240	1950	2080	<6.62
Cadmium (ug/l)	<1.00 [RL1]	<1.00 [RL1]	<1.00 [RL1]	<1.00 [RL1]	<1.00 [RL1]	<1.00 [RL1]	<1.00 [RL1]
Calcium (mg/l) (EPA 200.7)	554	552	604	607	500	534	<1.00
Calcium (ug/l) (SW 6010B)	577000	574000	626000	634000	476000	441000	<1000
Chromium (ug/l)	<5.00 [RL1]	<5.00 [RL1]	<5.00 [RL1]	<5.00 [RL1]	<5.00 [RL1]	<5.00 [RL1]	<5.00 [RL1]
Copper (ug/l)	24.7	13.5	<5.00	<5.00	<5.00	<5.00	<5.00
Iron (ug/l)	<100	<100	6730	5450	451	331	<100
Lead (ug/l)	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Magnesium (mg/l) (EPA 200.7)	184	189	180	176	171	182	<1.00
Magnesium (ug/l) (SW 6010B)	191000	195000	190000	186000	164000	152000	<1000
Mercury (ug/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Nickel (ug/l)	12.4	7.24	<5.00	<5.00	<5.00	<5.00	<5.00

Table 2.3-64 Groundwater Sample Results from the Fermi Site, 2007 (Sheet 3 of 3)

	Sample ID Numbers						
Parameters	**DQH0662-01**	**DQH0662-02**	**DQH0662-03**	**DQH0662-04**	**DQH0662-05**	**DQH0662-06**	**DQH0662-07**
Potassium (ug/l)	3990	5400	4110	3910	4060	3770	<1000
Selenium (ug/l)	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Silica (SiO_2) (ug/l)	14800 **A-01**	17400 **A-01**	18900 **A-01**	18500 **A-01**	13500	9730	<1070
Silver (ug/l)	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
Sodium (ug/l)	33500	32300	31900	33700	31400	18700	<1000
Zinc (ug/l)	23.4 **RL1, B8**	<20.0 **RL1**	23.2 **RL1, B8**	<20.0 **RL1**	23.0 **RL1, B8**	29.8 **RL1, B8**	24.7 **RL1, B8**
Dissolved Metals							
Silica (SiO_2) (ug/l)	19300 **A-01**	22900 **A-01**	23700 **A-01**	22900 **A-01**	11600	11200	<1070

A-01 - The Relative Percent Difference between the Total and the Dissolved result exceeds 20 percent

B8 - Analyte was detected in the associated Method Blank within 10% of the reporting limit.

E - Concentration exceeds the calibration range and therefore result is semi-quantitative.

H - Sample analysis performed past method-specified holding time

M - The MS, MSD, and/or RPD are outside of acceptance limits due to matrix interference. See Blank Spike (LCS).

M14 - The MS/MSD recoveries are outside of laboratory established control limits.

RL1 - Reporting limit raised due to sample matrix effects.

ND - Not Detected

EPA 200.7 - Metals and Trace Elements by ICP/Atomic Emission Spectrometry

SW 6010B - EPA SW-846 Method 6010B

Table 2.3-65 Groundwater Sample Results from the Fermi Site, 2007 (Sheet 1 of 2)

	Sample ID Numbers		
Parameters	**DQH0538-01**	**DQH0538-02**	**DQH0538-03**
General Chemistry Parameters			
Biological Oxygen Demand - 5 day (mg/l)	<3.0	23	<3.0
Color (C.U.)	<1.00	60	10.0
Nitrogen, Total Kjeldahl (mg/l)	<0.500	1.39	0.500
Phosphorus, Total as P (mg/l)	0.02	<0.0200	0.0200
Sulfate as SO_4 (mg/l)	366	413	574
Chromium, Hexavalent (ug/l)	<20	<20	<20
Alkalinity, Bicarbonate as HCO_3 (mg/l)	315	1560	293
Ammonia, Undistilled as N (mg/l)	<0.0500	0.737	0.153
Carbon Dioxide (mg/l)	48	--	16.0 [E]
Chemical Oxygen Demand (mg/l)	53.3	42.7	12
Chloride (mg/l)	79	78	28
Nitrate/Nitrite as N (mg/l)	0.0131	0.122	<0.0100
Solids, Total Dissolved (mg/l)	984	1850	1150
Solids, Total Suspended (mg/l)	<4.0	57	8.00
Specific Conductance (umho/cm)	1290	2480	1380
Total Alkalinity (mg/l)	258	1280	240
Turbidity (S.U.)	ND	2.00	1.00
Nitrite as N (mg/l)	<0.010	<0.010	<0.010
Odor (S.U.)	ND	ND	ND
Phosphorus, Ortho as P (mg/l)	<0.0200	<0.0200	<0.0200
Nitrate as N (mg/l)	0.013	0.12	<0.0100
General Chemistry Parameters - DO			
Dissolved Oxygen (mg/l)	1.8	2.95	1.74
Microbiology			
Total Coliforms /100 ml	30	<100	<10
Fecal Coliforms /100 ml	<10	<10	<10
Fecal Streptococcus /100 ml	<10	<10	10
Total Metals			
Arsenic (ug/l)	ND	2.4	ND
Hardness by Calculation as $CaCO_3$ (mg/l)	700	1730	907
Cadmium (ug/l)	<1.00 [RL1]	<1.00 [RL1]	<1.00 [RL1]

Table 2.3-65 Groundwater Sample Results from the Fermi Site, 2007 (Sheet 2 of 2)

	Sample ID Numbers		
Parameters	**DQH0538-01**	**DQH0538-02**	**DQH0538-03**
Calcium (mg/l) (EPA 200.7)	181	443	229
Calcium (ug/l) (SW 6010B)	169000	444000	226000
Chromium (ug/l)	<5.00 RL1	<5.00 RL1	<5.00 RL1
Copper (ug/l)	<5.00	<5.00	<5.00
Iron (ug/l)	210	21900	1230
Lead (ug/l)	<1.00	1.08	<1.00
Magnesium (mg/l) (EPA 200.7)	60.1	151	81.3
Magnesium (ug/l) (SW 6010B)	56000	152000	80800
Mercury (ug/l)	<0.200	<0.200	<0.200
Nickel (ug/l)	<5.00	<5.00	<5.00
Potassium (ug/l)	2450	1780	3070
Selenium (ug/l)	<5.00	<5.00	<5.00
Silica (SiO_2) (ug/l)	6680	21200	11100
Silver (ug/l)	<0.500	<0.500	<0.500
Sodium (ug/l)	42600	31200	18700
Zinc (ug/l)	<20.0 RL1	26.2 RL1, B8	<20.0 RL1
Dissolved Metals			
Silica (SiO_2) (ug/l)	6730	24300	11900

B8 - Analyte was detected in the associated Method Blank within 10% of the reporting limit.

E - Concentration exceeds the calibration range and therefore result is semi-quantitative.

M - The MS, MSD, and/or RPD are outside of acceptance limits due to matrix interference. See Blank Spike (LCS).

M14 - The MS/MSD recoveries are outside of laboratory established control limits.

RL1 - Reporting limit raised due to sample matrix effects.

-- - No Data

ND - Not Detected

EPA 200.7 - Metals and Trace Elements by ICP/Atomic Emission Spectrometry

SW 6010B - EPA SW-846 Method 6010B

Table 2.3-66 Groundwater Sample Results from the Fermi Site, 2007 (Sheet 1 of 3)

	Sample ID Numbers					
Parameters	DQH0079-01	DQH0785-01	DQH0566-01	DQH0146-01	DQH0150-01	DQH0150-02
General Chemistry Parameters						
Biological Oxygen Demand - 5 day (mg/l)	<3.0	22	3.0	<6.0	<3.0	<6.0
Color (C.U.)	5	30	5.00	5	10	15
Nitrogen, Total Kjeldahl (mg/l)	0.804	1.30	0.609	<0.500	1.47	<0.500
Phosphorus, Total as P (mg/l)	0.04	<0.0200	0.0200	0.02	<0.0200	<0.0200
Sulfate as SO_4 (mg/l)	2410	933	1080	336	644	240
Chromium, Hexavalent (ug/l)	<20	<20	<20	<20	<20	<20
Alkalinity, Bicarbonate as HCO_3 (mg/l)	510	395	251	202	218	231
Ammonia, Undistilled as N (mg/l)	<0.0500	0.778	0.35	0.118	0.104	<0.0500
Carbon Dioxide (mg/l)	--	60.0 [E]	5.00 [E]	15.0	24 [E]	24
Chemical Oxygen Demand (mg/l)	31.1	21	80.1	11.1	28	10.4
Chloride (mg/l)	145	45	128	23.0	83	47
Nitrate/Nitrite as N (mg/l)	0.51	<0.0100	<0.0100	<0.0100	4.66	0.0262
Solids, Total Dissolved (mg/l)	4110	1760	1680	730	1390	580
Solids, Total Suspended (mg/l)	<4.00	4.00	6.00	24.0	<4.00	<4.00
Specific Conductance (umho/cm)	4280	2540	2060	999	1650	824
Total Alkalinity (mg/l)	418	324	206	166	180	190
Turbidity (S.U.)	ND	1.00	1.00	ND	ND	ND
Nitrite as N (mg/l)	<0.010	<0.010	<0.010	<0.010	0.07	<0.010
Odor (S.U.)	ND	ND	ND	ND	ND	ND
Phosphorus, Ortho as P (mg/l)	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200

Table 2.3-66 Groundwater Sample Results from the Fermi Site, 2007 (Sheet 2 of 3)

	Sample ID Numbers					
Parameters	**DQH0079-01**	**DQH0785-01**	**DQH0566-01**	**DQH0146-01**	**DQH0150-01**	**DQH0150-02**
Nitrate as N (mg/l)	0.51	<0.0100	<0.0100	<0.0100	4.6	0.026
General Chemistry Parameters - DO						
Dissolved Oxygen (mg/l)	6.22	2.26	1.29	1.29	7.76	2.77
Microbiology						
Total Coliforms /100 ml	<10	<1	100	<10	<10	<10
Fecal Coliforms /100 ml	<10	<10	<10	<10	<10	<10
Fecal Streptococcus /100 ml	<10	<10	<10	<10	<10	<10
Total Metals						
Arsenic (ug/l)	ND	ND	ND	2	ND	ND
Hardness by Calculation as $CaCO_3$ (mg/l)	2930	1170	829	521	1030	409
Cadmium (ug/l)	0.516 **RL1**	<1.00 **RL1**	<0.200	<0.200	<0.200	<0.200
Calcium (mg/l) (EPA 200.7)	564	282 **M**	206 **M**	137	284	110
Calcium (ug/l) (SW 6010B)	671000	285000	222000 **M**	133000	305000	114000
Chromium (ug/l)	<2.00	<5.00 **RL1**	2.69	<2.00	<2.00	<2.00
Copper (ug/l)	6.12	<5.00	<5.00	<5.00	<5.00	<5.00
Iron (ug/l)	1050	1150	689	444	203	691
Lead (ug/l)	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Magnesium (mg/l) (EPA 200.7)	369	113 **M**	76.3 **M**	43.5 **M**	78.7	32.5
Magnesium (ug/l) (SW 6010B)	348000	111000	81700 **M**	42200	81100	33600
Mercury (ug/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Nickel (ug/l)	13.7	<10.0 **RL1**	8.84	<5.00	<14.0 **RL1**	<7.00 **RL1**

Table 2.3-66 Groundwater Sample Results from the Fermi Site, 2007 (Sheet 3 of 3)

	Sample ID Numbers					
Parameters	**DQH0079-01**	**DQH0785-01**	**DQH0566-01**	**DQH0146-01**	**DQH0150-01**	**DQH0150-02**
Potassium (ug/l)	16600	15500	5250	2960	3390	1520
Selenium (ug/l)	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Silica (SiO_2) (ug/l)	23300	15100	8430	8160	7190	6360
Silver (ug/l)	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
Sodium (ug/l)	88200	43300	147000	17200	34600	13200
Zinc (ug/l)	73.3 **RL1, B8**	<20.0 **RL1**	7.15 **B8**	6.63 **B8**	6.57 **B8**	4.82 **B8**
Dissolved Metals						
Silica (SiO_2) (ug/l)	25800	14800	8820	7230	7060	6220

B8 - Analyte was detected in the associated Method Blank within 10% of the reporting limit.

E - Concentration exceeds the calibration range and therefore result is semi-quantitative.

M - The MS, MSD, and/or RPD are outside of acceptance limits due to matrix interference. See Blank Spike (LCS).

M14 - The MS/MSD recoveries are outside of laboratory established control limits.

RL1 - Reporting limit raised due to sample matrix effects.

-- - No Data

ND - Not Detected

EPA 200.7 - Metals and Trace Elements by ICP/Atomic Emission Spectrometry

SW 6010B - EPA SW-846 Method 6010B

Table 2.3-67 Summary of Water Quality Impairments in the Vicinity of the Fermi Site (Sheet 1 of 3)

Appendix A
Table of Water Quality Impairments

Water Body	Program	Impairment	Receiving or background
Lake Erie	Area of Concern/ Lake Management Plan	Restrictions on fish and wildlife consumption Degraded fish and wildlife populations Fish tumors or other deformities and animal deformities or reproduction problems Degradation of benthos Restrictions on dredging activities Eutrophication or undesirable algae Recreational water quality impairments Degradation of aesthetics Degradation of phytoplankton and zooplankton populations Loss of fish and wildlife habitat	Receiving Water Body
Lake Erie(Monroe and Wayne Counties)	2006 303(d) list	PCBs (TMDL completion year 2012) TCDD (dioxins) (TMDL completion year 2012)	Receiving Water Body
Lake Erie (Monroe County	2006 303(d) list	Pathogens (TMDL due in 2007)	Receiving Water Body
Detroit River	2006 303(d) list	PCBs (TMDL completion year 2012) TCDD (dioxins) (TMDL completion year 2012) Mercury (TMDL completion year 2011) Pathogens (combined sewer overflows) (TMDL completion year 2011) Fish consumption advisories for PCBs, TCDD (dioxins), and mercury (TMDL completion year 2012)	Background Water Body
River Raisin Watershed	2006 303(d) list	PCBs (TMDL completion year 2010)	Background Water Body
River Raisin (Monroe County)	2006 303(d) list	Mercury (TMDL completion year 2011) Fish consumption advisory for PCBs (TMDL completion year 2010)	Background Water Body

Table 2.3-67 Summary of Water Quality Impairments in the Vicinity of the Fermi Site (Sheet 2 of 3)

Appendix A
Table of Water Quality Impairments

Water Body	Program	Impairment	Receiving or background
River Raisin South Branch	2006 303(d) list	Pathogens, combined sewer overflows, total dissolved solids, chlorides, turbidity, and siltations (TMDL completion year 2008) Fish consumption advisory for PCBs (TMDL completion year 2010)	Background Water Body
River Raisin	Area of Concern	PCB Contamination Restrictions on fish and wildlife consumption Degredation of fish and wildlife populations Degradation of benthos Eutrophication or undesirable algae Degradation of aesthetics Loss of fish and wildlife habitat Loss of flora Bird or animal deformities or reproductive problems Restrictions on dredging activities Beach closings or restrictions on body contact	Background Water Body
Rouge River (Oakland and Wayne Counties)	2006 303(d) list	Mercury (TMDL completion year 2011) Fish consumption advisory for PCBs (TMDL completion year 2008) Pathogens, dissolved oxygen, poor fish and macroinvertebrate communities (TMDL completion years 2007 and 2011)	Background Water Body

Table 2.3-67 Summary of Water Quality Impairments in the Vicinity of the Fermi Site (Sheet 3 of 3)

Appendix A
Table of Water Quality Impairments

Water Body	Program	Impairment	Receiving or background
Rouge River Watershed	Area of Concern	Restrictions on swimming and other water-related activities Loss of fish and wildlife habitat Degradation of fish communities Degradation of benthos Degradation of wildlife populations Eutrophication or growth of undesirable algae Degradation of aesthetics Restrictions on fish consumption Bird or animal deformities or reproduction problems Restrictions on dredging activities Fish tumors or other deformities Tainting of fish and wildlife flavor Restrictions to navigation	Background Water Body
Huron River	2006 303(d) list	Dissolved oxygen (TMDL completion year 2013)	Background Water Body
Huron River Watershed	2006 303(d) list	PCBs (TMDL completion year 2010)	Background Water Body

Table 2.3-68 Parameters Sampled at Fermi Intake in October 2003 (Sheet 1 of 4)

Parameter	Results	Units
pH (Field)	7.17	pH Units
Chlorine, Total (Field)	<0.02	mg/l
Field Temperature °C	12	deg. C
Cyanide, Amenable	<0.005	mg/l
Cyanide, Total	<0.005	mg/l
HEM; Oil & Grease	<5	mg/l
Mercury	2.61	ng/l
Acrolein	<0.005	mg/l
Acrylonitrile	<0.001	mg/l
Benzene	<0.001	mg/l
Bromoform	<0.001	mg/l
Bromomethane	<0.001	mg/l
Carbon Tetrachloride	<0.001	mg/l
Chlorobenzene	<0.001	mg/l
Chlorodibromomethane	<0.001	mg/l
Chloroethane	<0.001	mg/l
2-Chloroethyl Vinyl Ether	<0.01	mg/l
Chloroform	<0.001	mg/l
Chloromethane	<0.001	mg/l
Dichlorobromomethane	<0.001	mg/l
l,l-Dichloroethane	<0.001	mg/l
l,2-Dichloroethane	<0.001	mg/l
l,l-Dichloroethylene	<0.001	mg/l
trans-1,2-Dichloroethene	<0.001	mg/l
l,2-Dichloropropane	<0.001	mg/l
cis-1,3-Dichloropropene	<0.001	mg/l
trans-1,3-Dichloropropene	<0.001	mg/l
Ethylbenzene	<0.001	mg/l
Methylene Chloride	<0.001	mg/l
1, 1, 2, 2-Tetrachloroethane	<0.001	mg/l
Tetrachloroethene	<0.001	mg/l
Toluene	<0.001	mg/l
1, 1, l-Trichloroethane	<0.001	mg/l
l,l,2-Trichloroethane	<0.001	mg/l
Trichloroethene	<0.001	mg/l
Vinyl Chloride	<0.001	mg/l
BOD, (5-Day)	1.1	mg/l
BOD, Carbonaceous (5-Day)	1.6	mg/l
Bromide	<0.1	mg/l

Table 2.3-68 Parameters Sampled at Fermi Intake in October 2003 (Sheet 2 of 4)

Parameter	Results	Units
Chemical Oxygen Demand	9.0	mg/l
Color (Apparent)	5.0	A.C.U.
Fluoride	0.20	mg/l
Nitrogen, Ammonia	0.16	mg/l
Nitrogen, Total Kjeldahl	0.68	mg/l
Nitrogen, Nitrate+Nitrite	0.44	mg/l
Nitrogen, Organic	<1.0	mg/l
* Carbon, Total Organic	2.4	mg/l
Phenolics, Total	<0.05	mg/l
Phosphorus, Total	0.04	mg/l
Residue,Dissolved @ 180°C	184	mg/l
Residue, Suspended	57	mg/l
Sulfate	27	mg/l
Sulfide	<0.05	mg/l
* Sulfite	<1.0	mg/l
Aluminum, Total	0.34	mg/l
Antimony, Total	<0.001	mg/l
Arsenic, Total	<0.001	mg/l
Barium, Total	0.019	mg/l
Beryllium, Total	<0.001	mg/l
Boron, Total	<0.1	mg/l
Cadmium, Total	<0.0002	mg/l
Chromium, Total	<0.01	mg/l
Cobalt, Total	<0.01	mg/l
Copper, Total	0.0012	mg/l
Iron, Total	0.45	mg/l
Lead, Total	<0.001	mg/l
Magnesium, Total	9.3	mg/l
Manganese, Total	0.017	mg/l
Molybdenum, Total	<0.1	mg/l
Nickel, Total	<0.005	mg/l
Selenium, Total	<0.001	mg/l
Silver, Total	<0.0005	mg/l
Thallium, Total	<0.001	mg/l
Tin, Total	<1	mg/l
Titanium, Total	<0.1	mg/l
Zinc, Total	0.01	mg/l
Acenaphthene	<0.005	mg/l

Table 2.3-68 Parameters Sampled at Fermi Intake in October 2003 (Sheet 3 of 4)

Parameter	Results	Units
Acenaphthylene	<0.005	mg/l
Anthracene	<0.005	mg/l
Benzo (a) Anthracene	<0.005	mg/l
Benzo (a) pyrene	<0.005	mg/l
Benzo (b) Fluoranthene	<0.005	mg/l
Benzo (g,h,i,) Perylene	<0.005	mg/l
Benzo (k) Fluoranthene	<0.005	mg/l
Benzidine	<0.05	mg/l
Bis (2-Chloroethyl) Ether	<0.005	mg/l
Bis (2-Chloroethoxy)Methane	<0.005	mg/l
Bis (2-Chloroisopropyl)Ether	<0.005	mg/l
Bis (2-ethylhexyl)Phthalate	<0.005	mg/l
4-Bromophenyl Phenylether	<0.005	mg/l
Butyl Benzyl Phthalate	<0.005	mg/l
4-Chloro-3-Methylphenol	<0.005	mg/l
2-Chloronaphthalene	<0.005	mg/l
2-Chlorophenol	<0.005	mg/l
4-ChlorophenylphenylEther	<0.005	mg/l
Chrysene	<0.005	mg/l
Dibenzo (a,h) Anthracene	<0.005	mg/l
Di-n-Butylphthalate	<0.005	mg/l
1,2-Dichlorobenzene	<0.005	mg/l
1,3-Dichlorobenzene	<0.005	mg/l
1,4-Dichlorobenzene	<0.005	mg/l
3,3'-Dichlorobenzidine	<0.02	mg/l
2,4-Dichlorophenol	<0.005	mg/l
Diethylphthalate	<0.005	mg/l
2,4-Dimethylphenol	<0.005	mg/l
Dimethylphthalate	<0.005	mg/l
4,6-Dinitro2-	<0.02	mg/l
Methylphenol	<0.02	mg/l
2,4-Dinitrophenol	<0.005	mg/l
2,4-Dinitrotoluene	<0.005	mg/l
2,6-Dinitrotoluene	<0.005	mg/l
Di-n-Octylphthalate	<0.005	mg/l
1,2-Diphenylhydrazine	<0.005	mg/l
Fluoranthene	<0.005	mg/l
Fluorene	<0.005	mg/l
Hexachlorobenzene	<0.005	mg/l

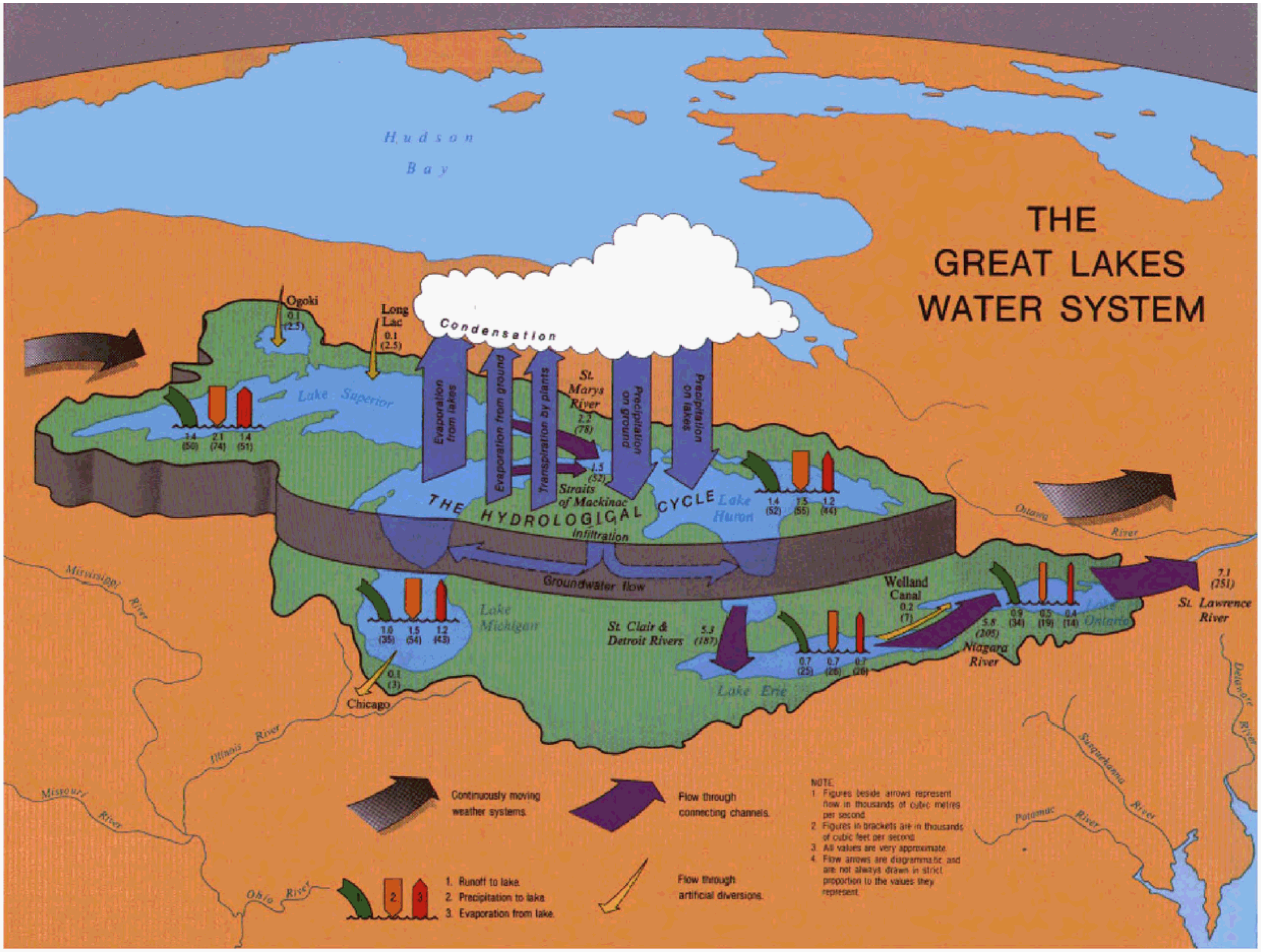
Table 2.3-68 Parameters Sampled at Fermi Intake in October 2003 (Sheet 4 of 4)

Parameter	Results	Units
Hexachlorobutadiene	<0.005	mg/l
Hexachlorocyclopentadiene	<0.005	mg/l
Hexachloroethane	<0.005	mg/l
Indeno (1,2,3-cd) pyrene	<0.005	mg/l
Isophorone	<0.005	mg/l
Naphthalene	<0.005	mg/l
Nitrobenzene	<0.005	mg/l
2-Nitrophenol	<0.02	mg/l
4-Nitrophenol	<0.005	mg/l
N-Nitroso-di-methylamine	<0.005	mg/l
N-Nitroso-di-Phenylamine	<0.005	mg/l
N-Nitrosodi-n-Propylamine	<0.02	mg/l
Pentachlorophenol	<0.005	mg/l
Phenanthrene	<0.005	mg/l
Phenol	<0.005	mg/l
pyrene	<0.005	mg/l
2,4,6-Trichlorophenol	<0.005	mg/l
1,2,4-Trichlorobenzene	<0.005	mg/l
2, 3, 7, 8-Tetrachlorodibenzo-	<0.005	mg/l
p-dioxin(estimated)		
PCB-1016	<0.0001	mg/l
PCB-1221	<0.0001	mg/l
PCB-1232	<0.0001	mg/l
PCB-1242	<0.0001	mg/l
PCB-1248	<0.0001	mg/l
PCB-1254	<0.0001	mg/l
PCB-1260	<0.0001	mg/l
Surfactants	0.036	mg/l

Figure 2.3-1 Great Lakes Drainage Basin

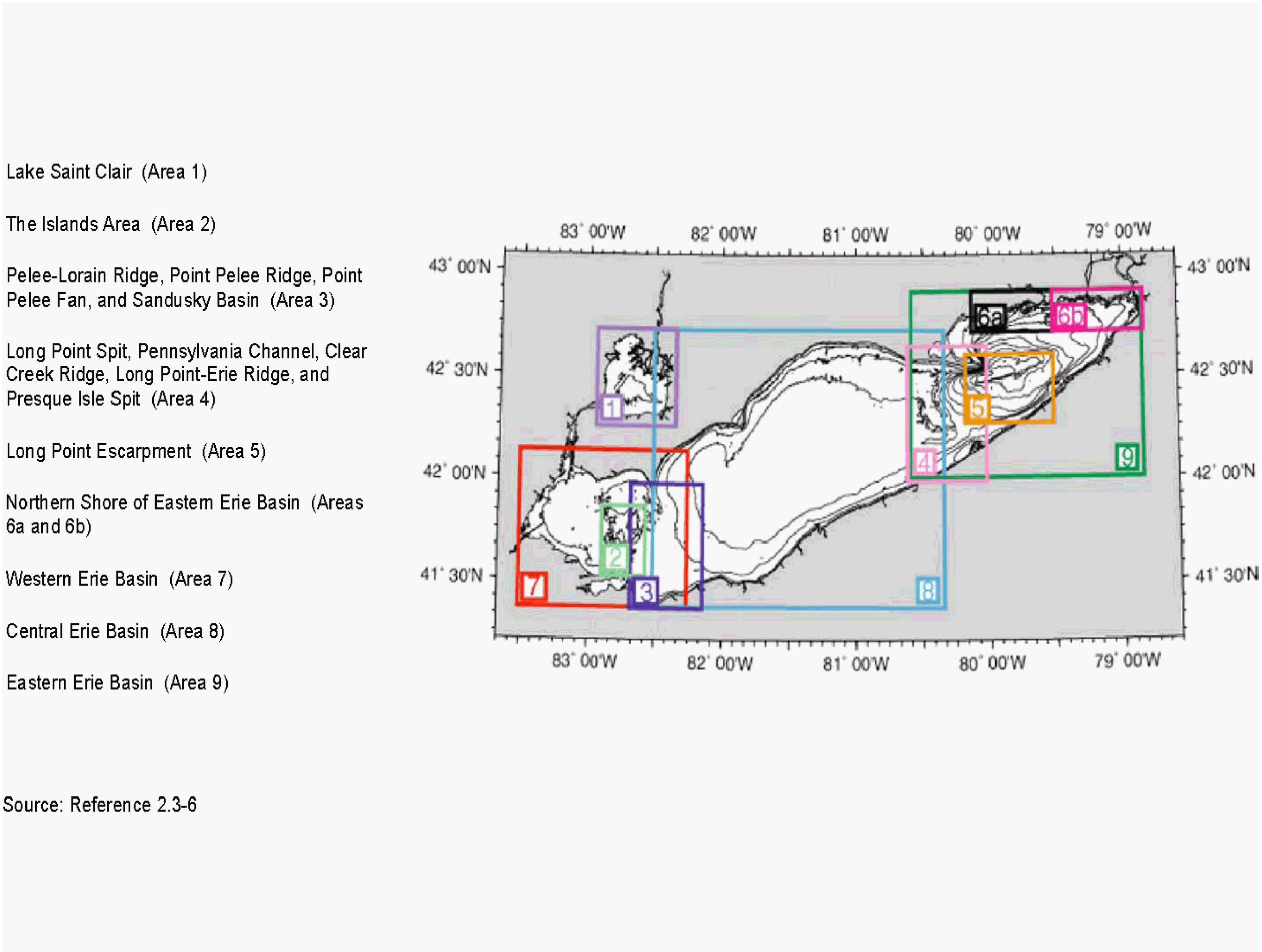
Source: Reference 2.3-17

Figure 2.3-2 Great Lakes Water System



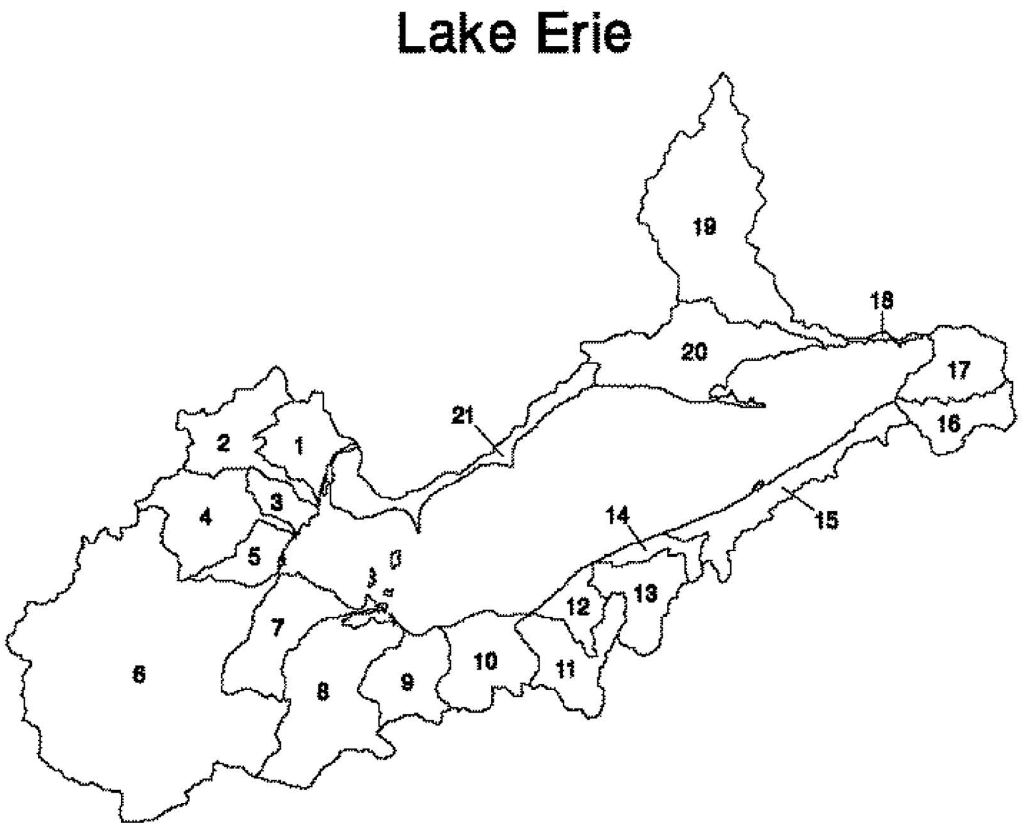
Source: Reference 2.3-2

Figure 2.3-3 Central, Eastern and Western Basin Areas of Lake Erie



Source: Reference 2.3-6

Figure 2.3-4 Lake Erie Subbasin Areas

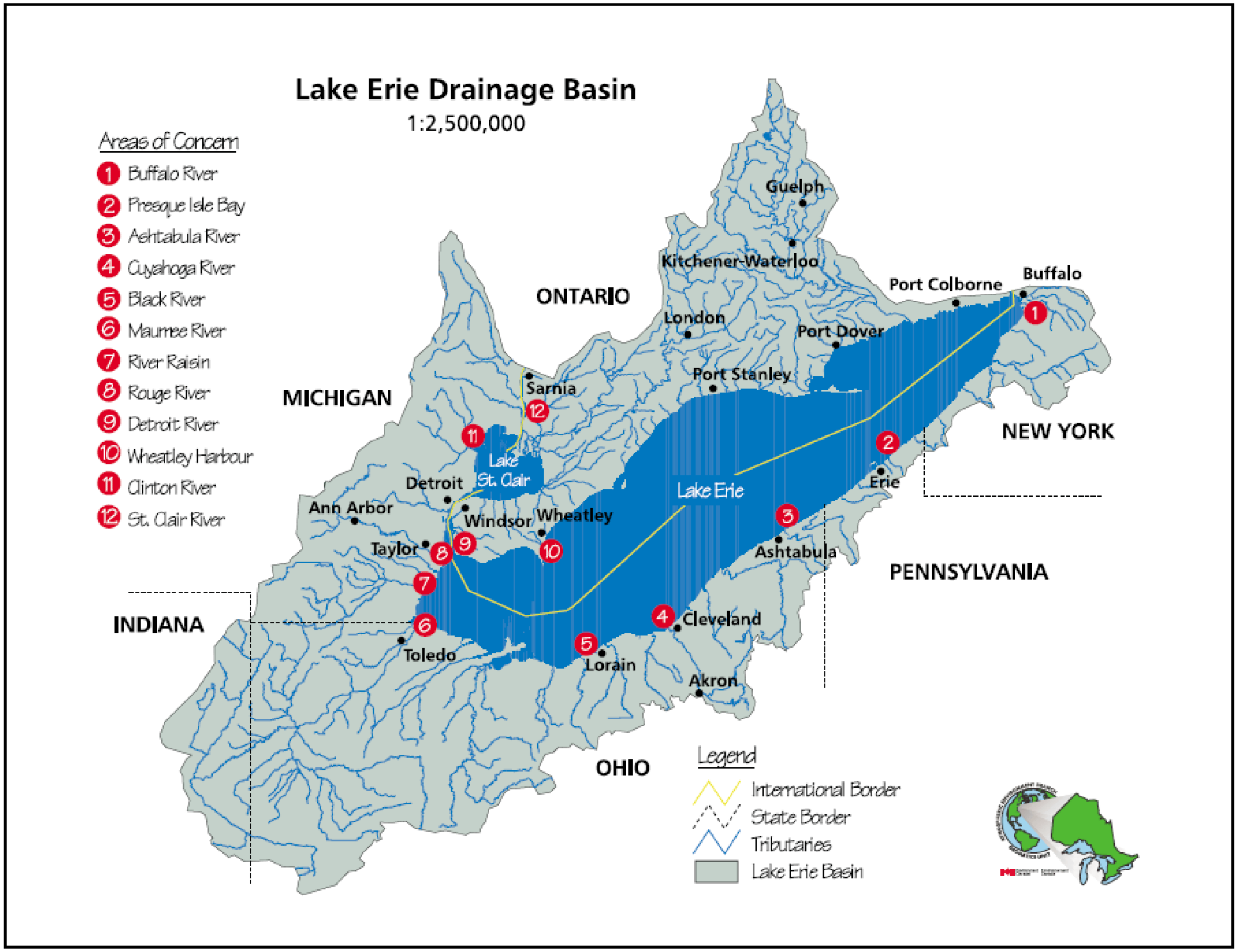


Lake Erie Subbasin Area for use in Large Basin Runoff Model
Digital Areas in square meters

Subbasin	Area
1	1.70000E+09
2	2.33100E+09
3	7.23000E+08
4	2.76400E+09
5	1.01500E+09
6	1.68060E+10
7	2.48200E+09
8	4.60700E+09
9	1.94600E+09
10	2.29400E+09
11	2.07000E+09
12	9.62000E+08
13	1.82200E+09
14	6.77000E+08
15	2.26200E+09
16	1.42700E+09
17	1.87400E+09
18	1.19000E+08
19	6.69300E+09
20	4.01700E+09
21	2.01100E+09
Total	6.06020E+10

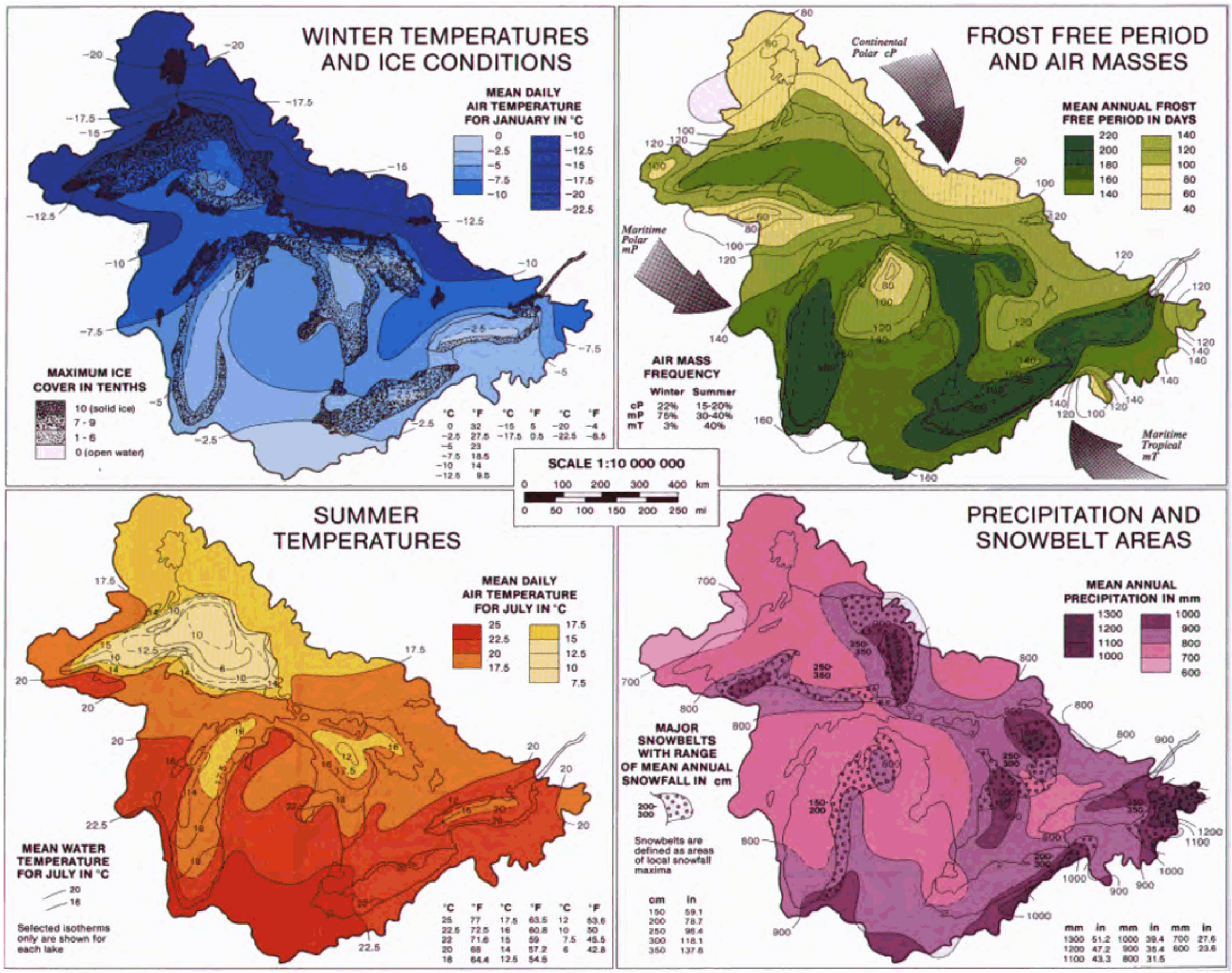
Source: Reference 2.3-7

Figure 2.3-5 Major Tributaries of Lake Erie



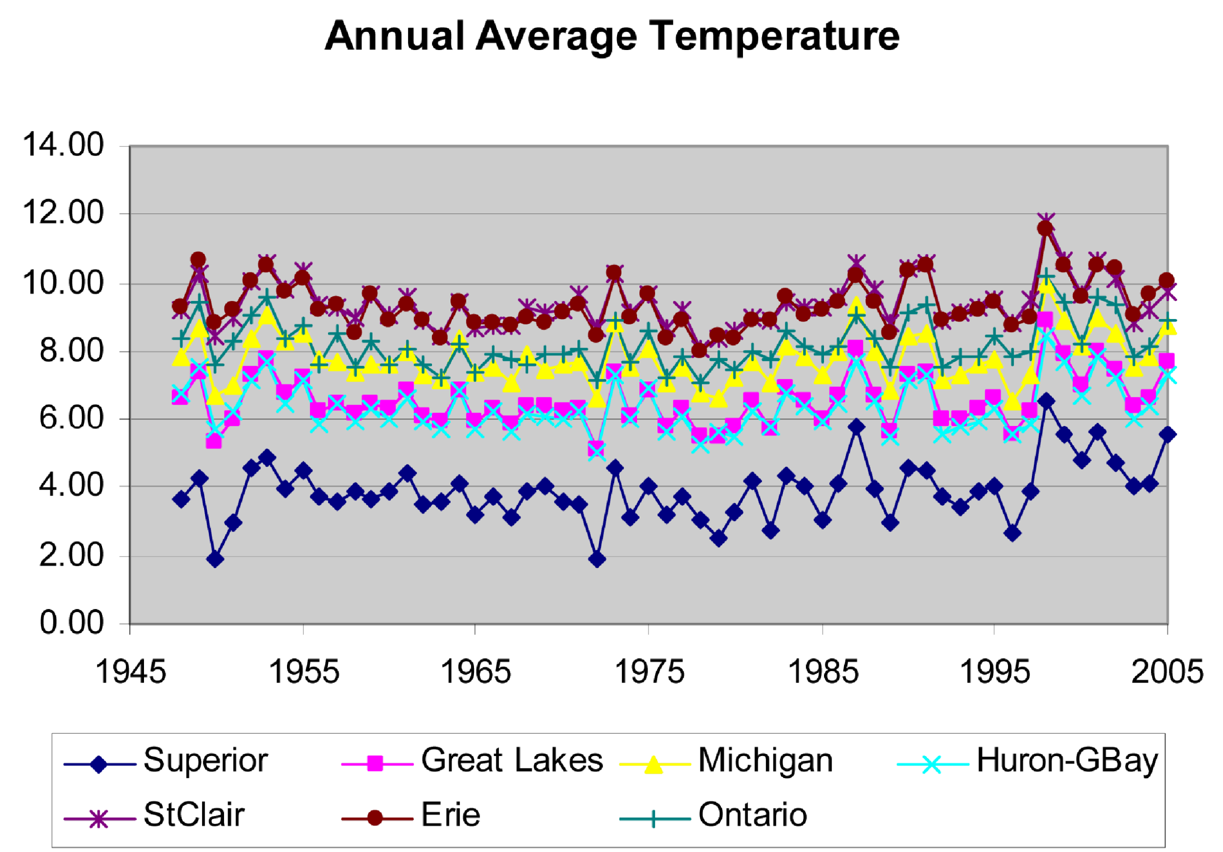
Source: Reference 2.3-10

Figure 2.3-6 Climate Variations in the Great Lakes Region



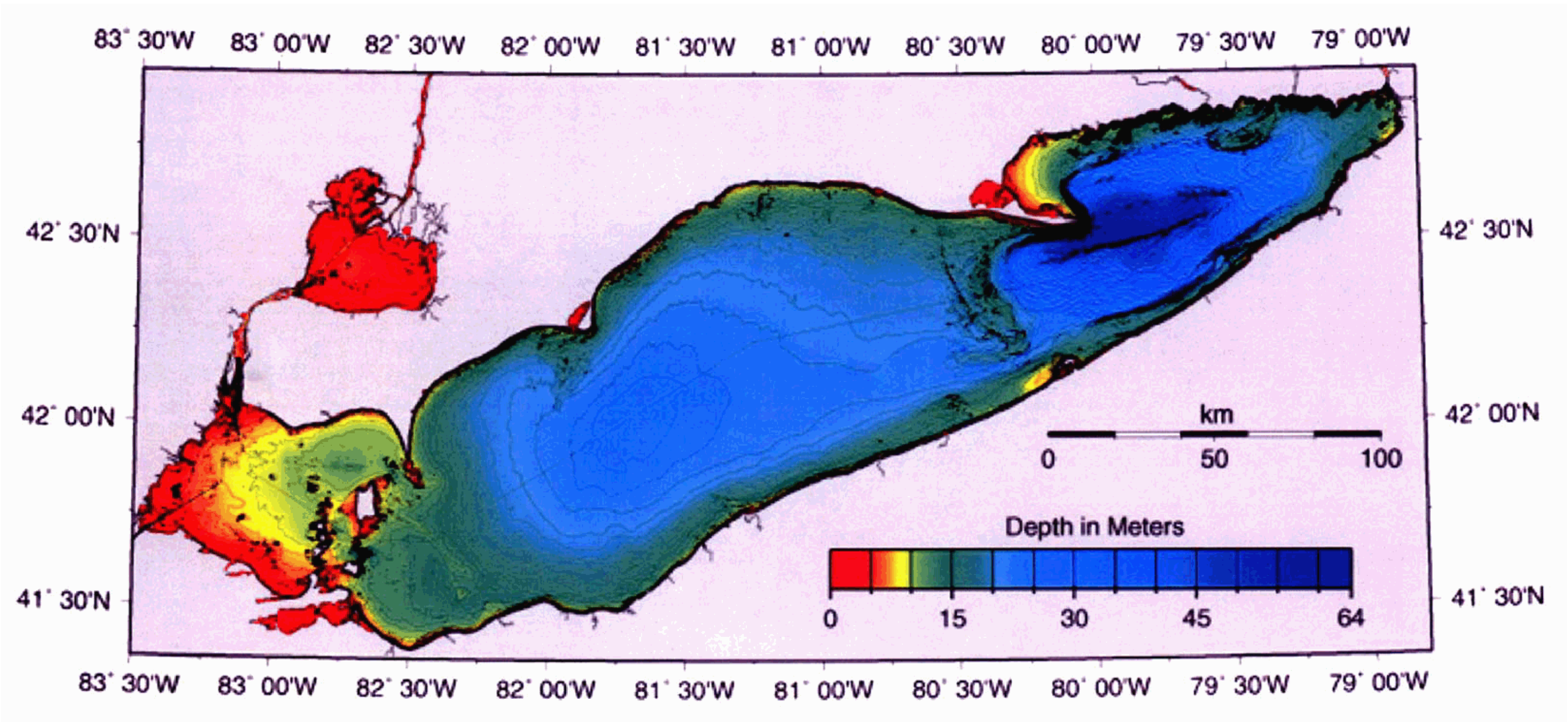
Source: Reference 2.3-33

Figure 2.3-7 Air Temperatures for Great Lake System (Celsius)



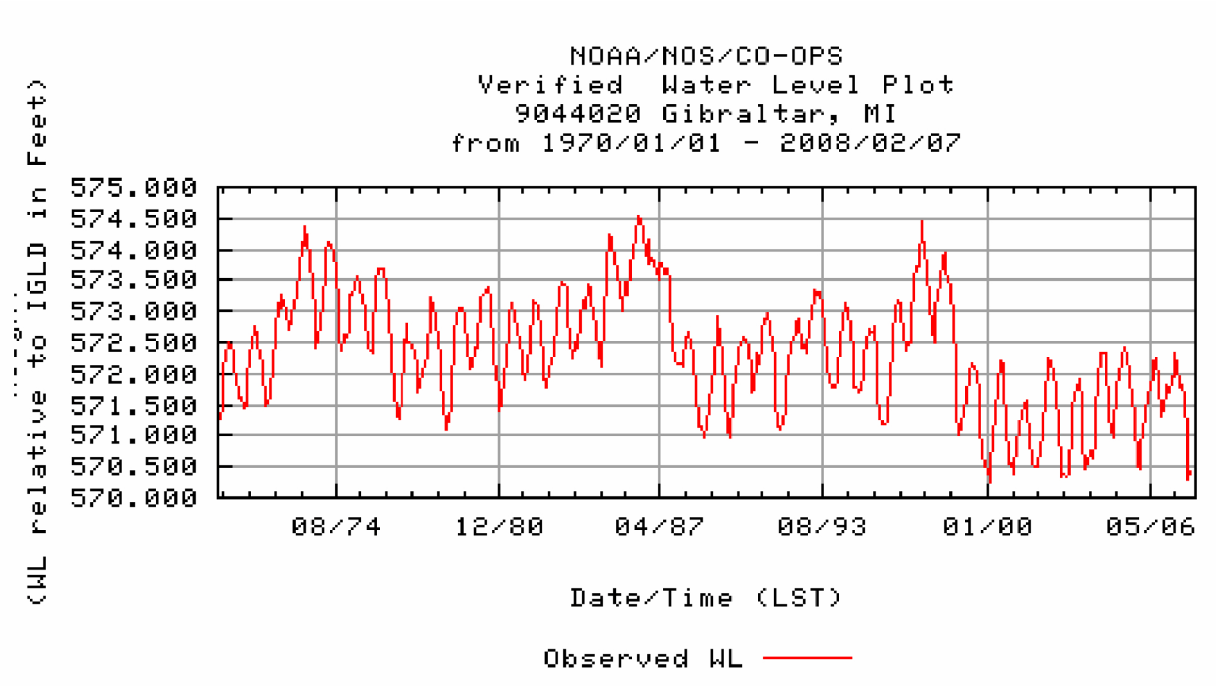
Source: Reference 2.3-7

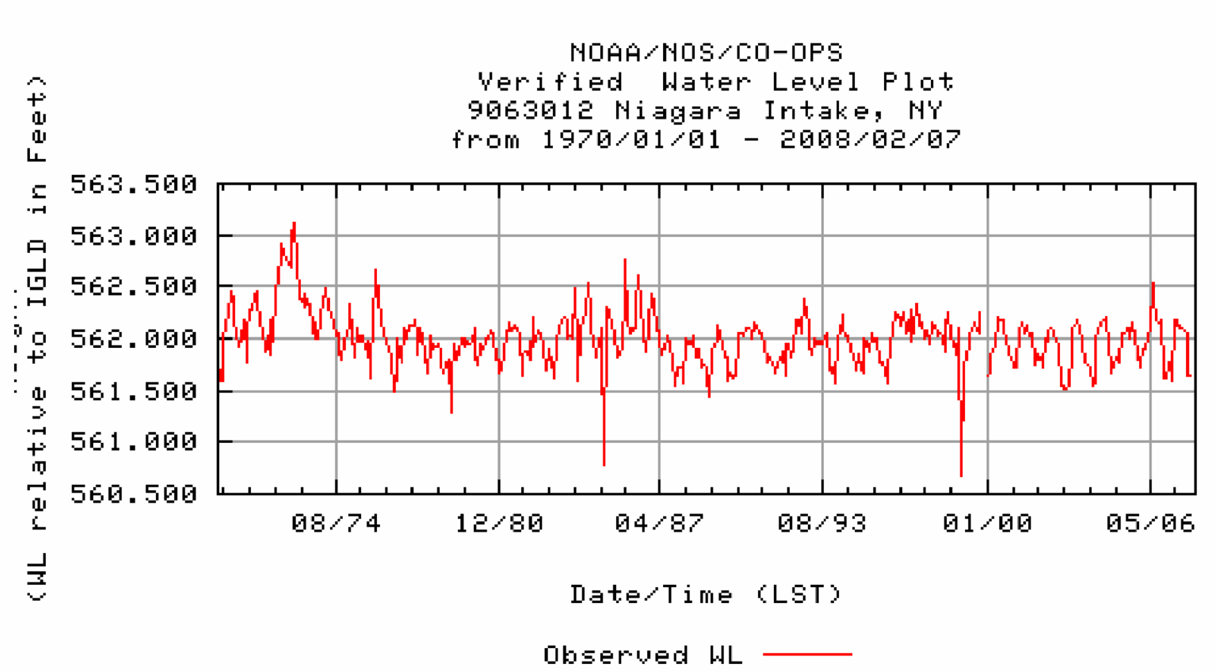
Figure 2.3-8 Bathymetry of Lake Erie and Lake Saint Clair



Source: Reference 2.3-11

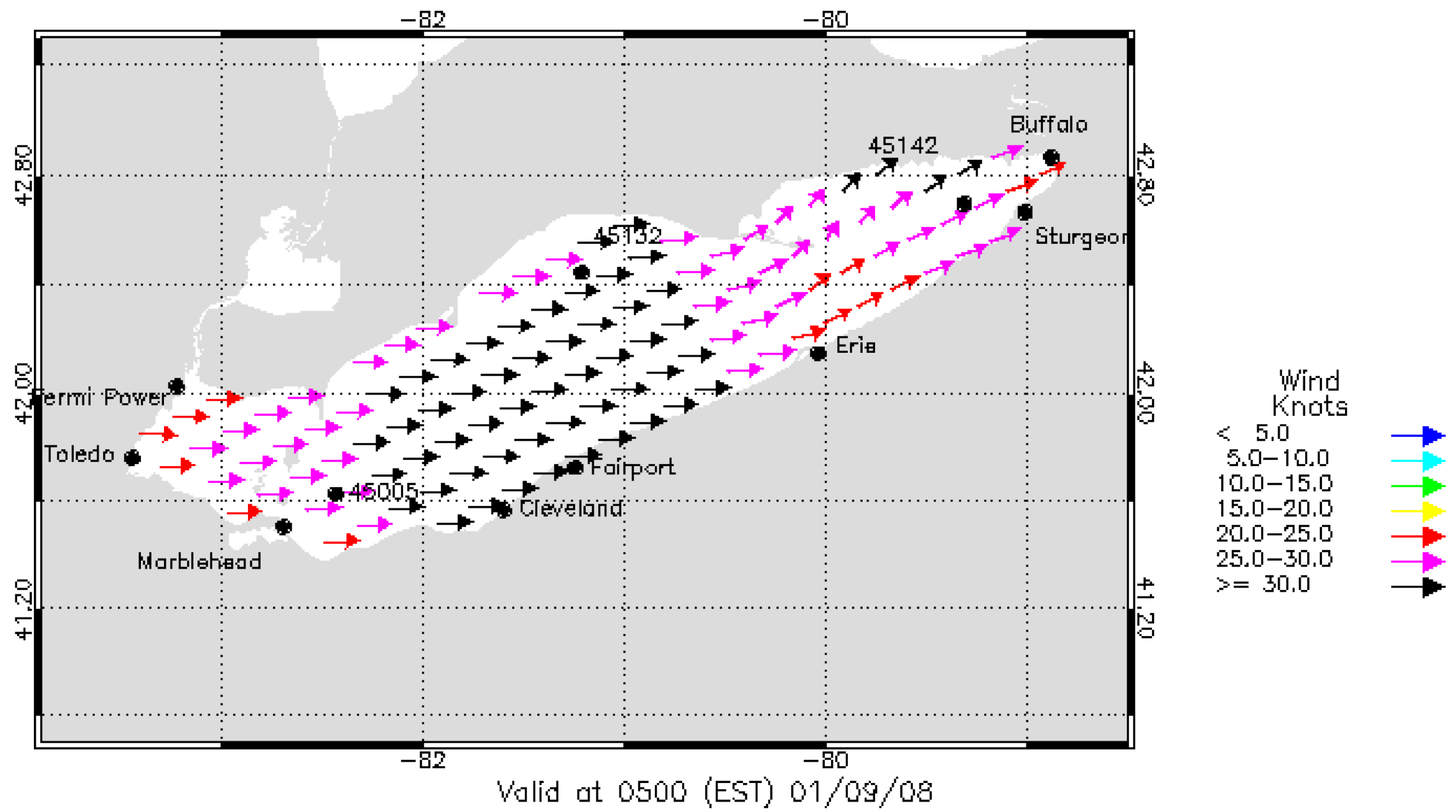
Figure 2.3-9 Historical Inflow and Outflow Water Level Elevations for Lake Erie (IGLD 85)





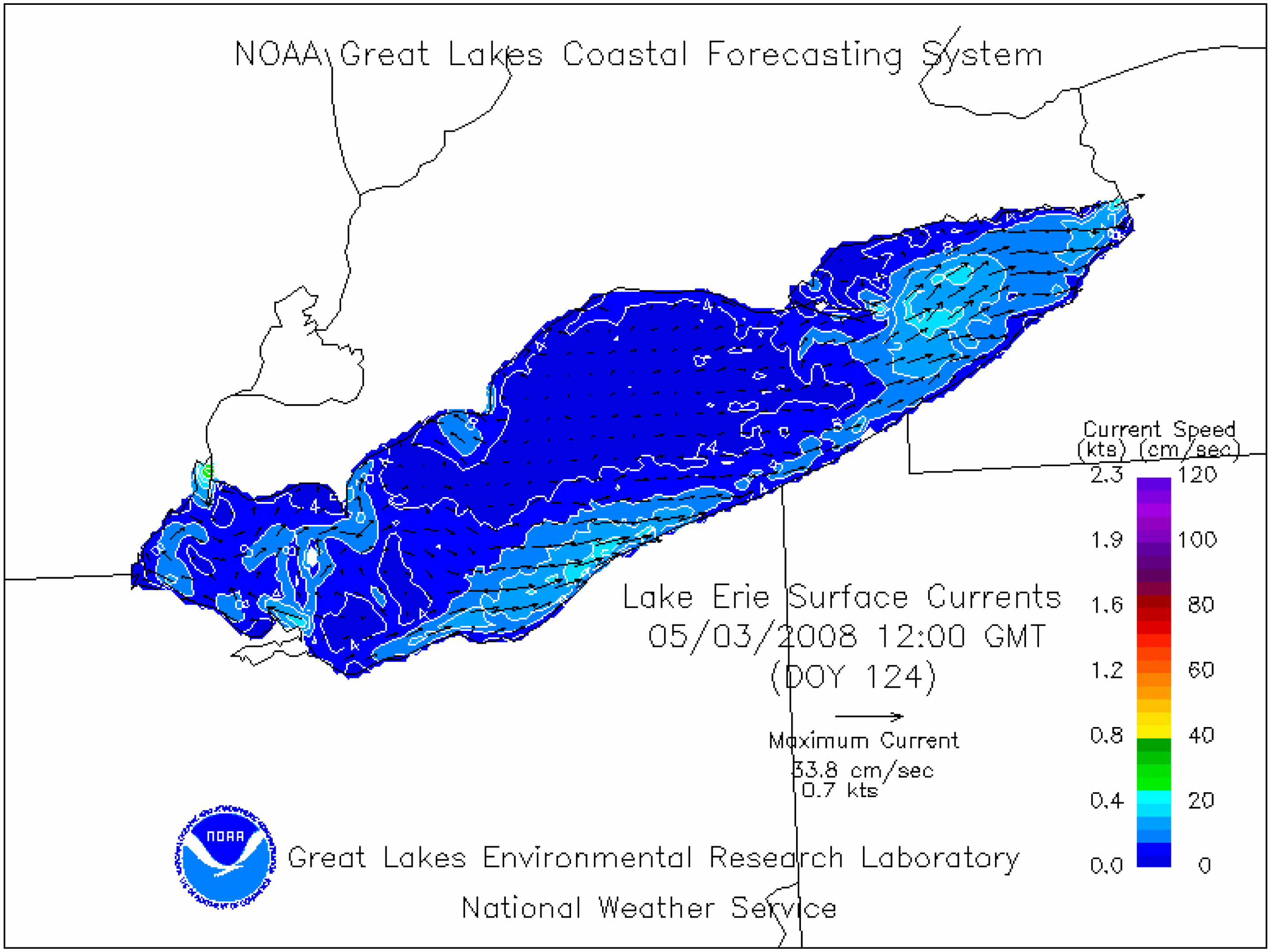
Source: Reference 2.3-20

Figure 2.3-10 Typical Wind Current Pattern for Lake Erie



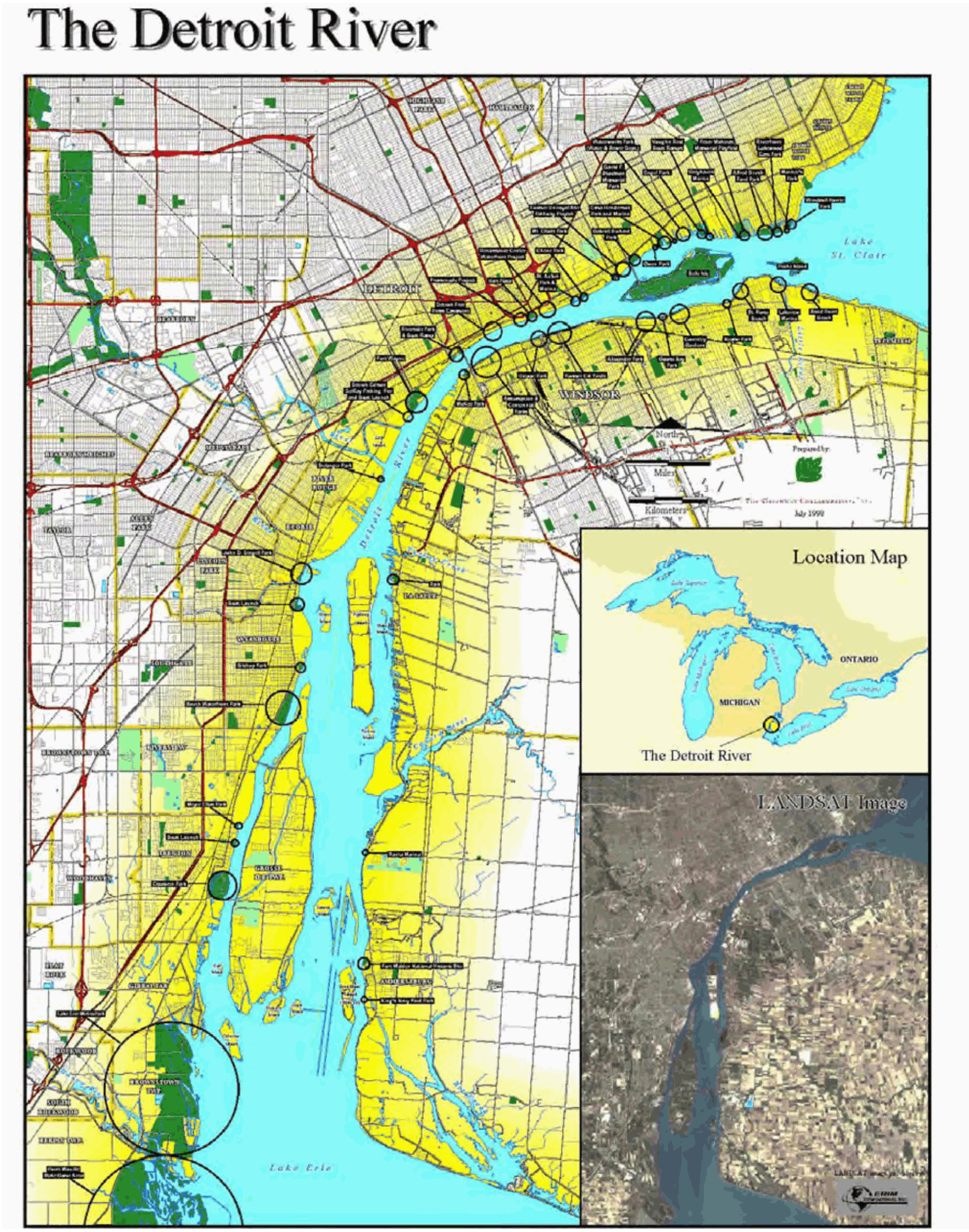
Source: Reference 2.3-21

Figure 2.3-11 Typical Water Current Pattern for Lake Erie



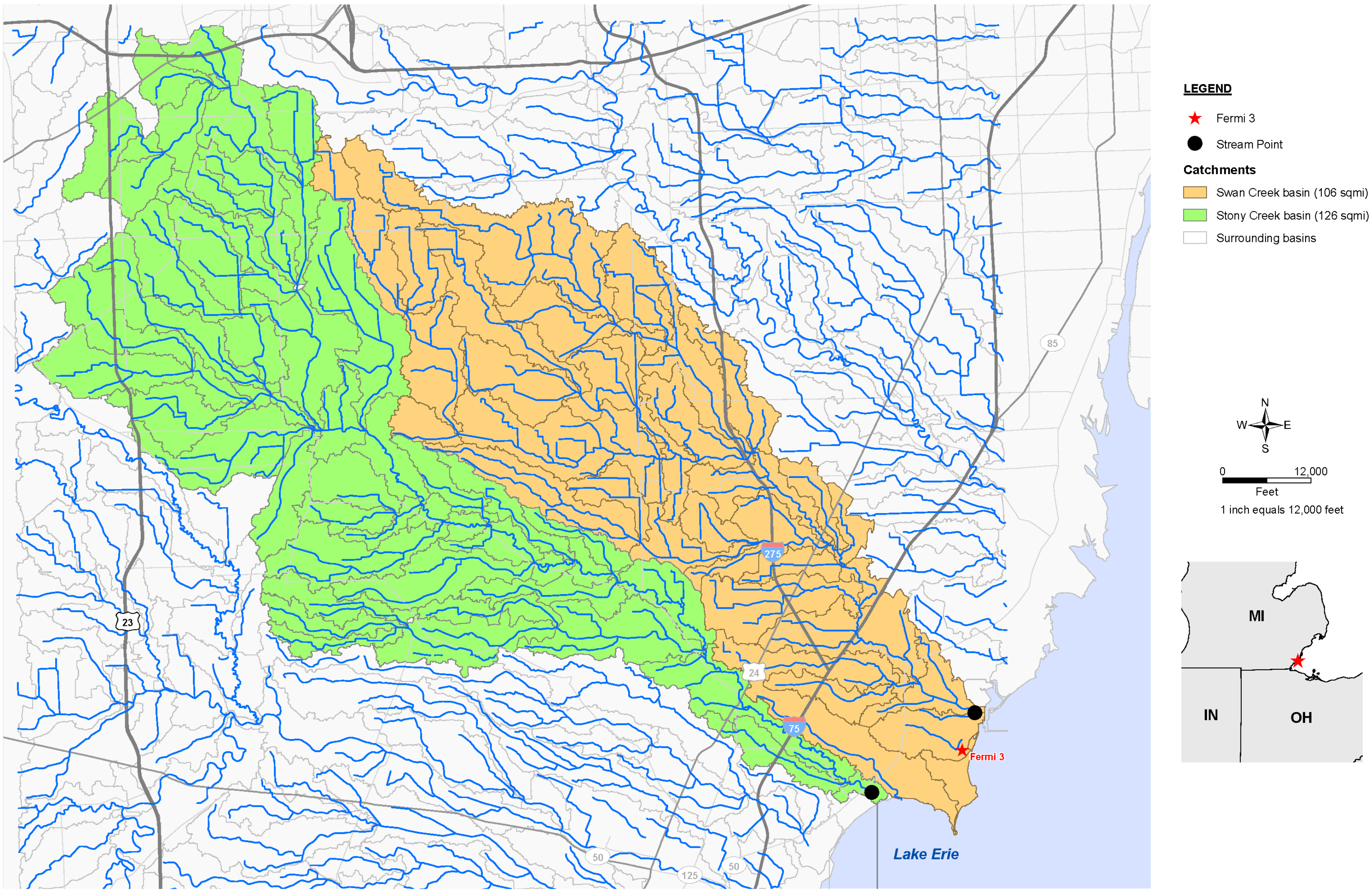
Source: Reference 2.3-9

Figure 2.3-12 Map of Detroit River



Source: Reference 2.3-23

Figure 2.3-13 Swan Creek and Stony Creek Watershed Basins



Source: Reference 2.3-75

Figure 2.3-14 Shore Barrier Plan and Sections

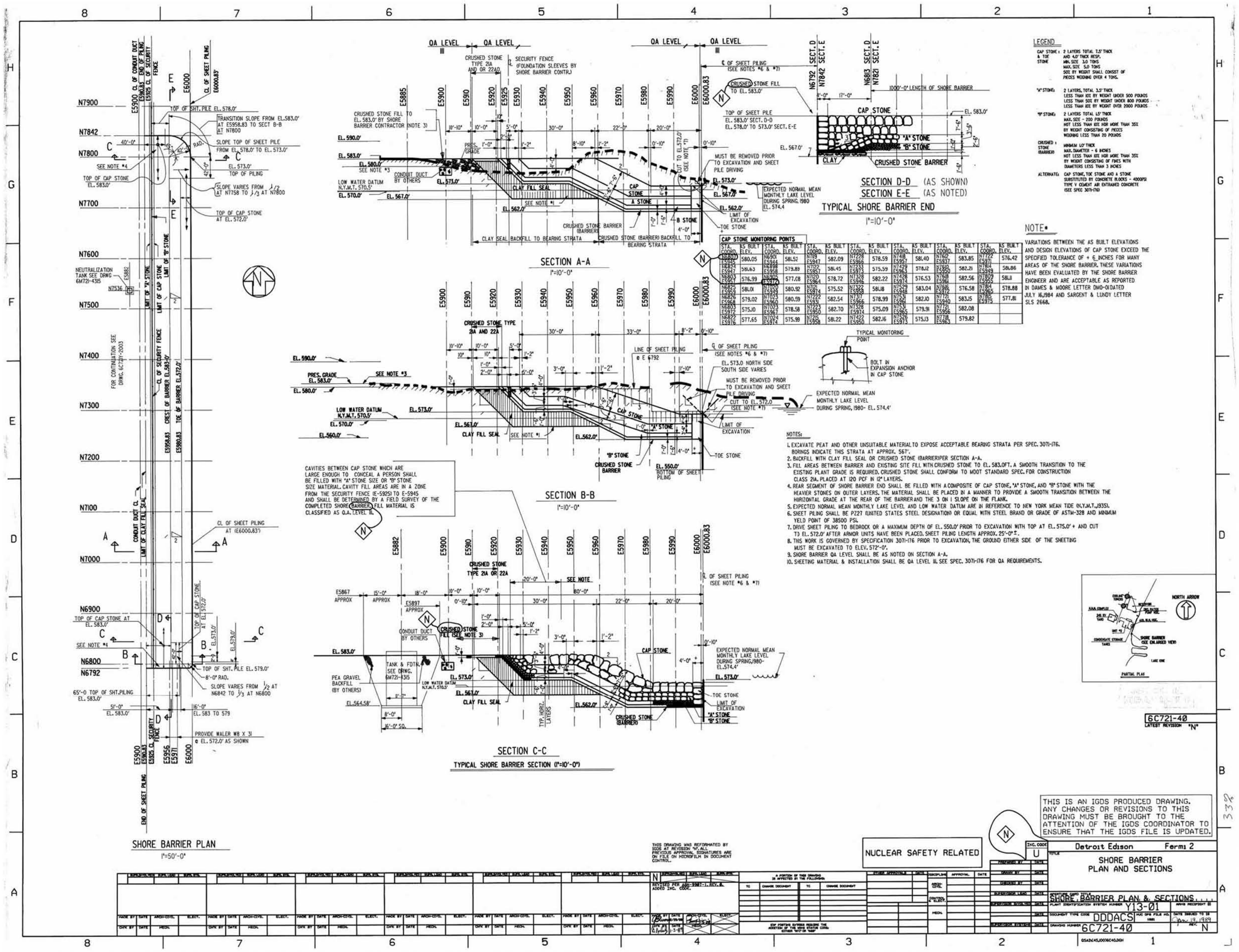
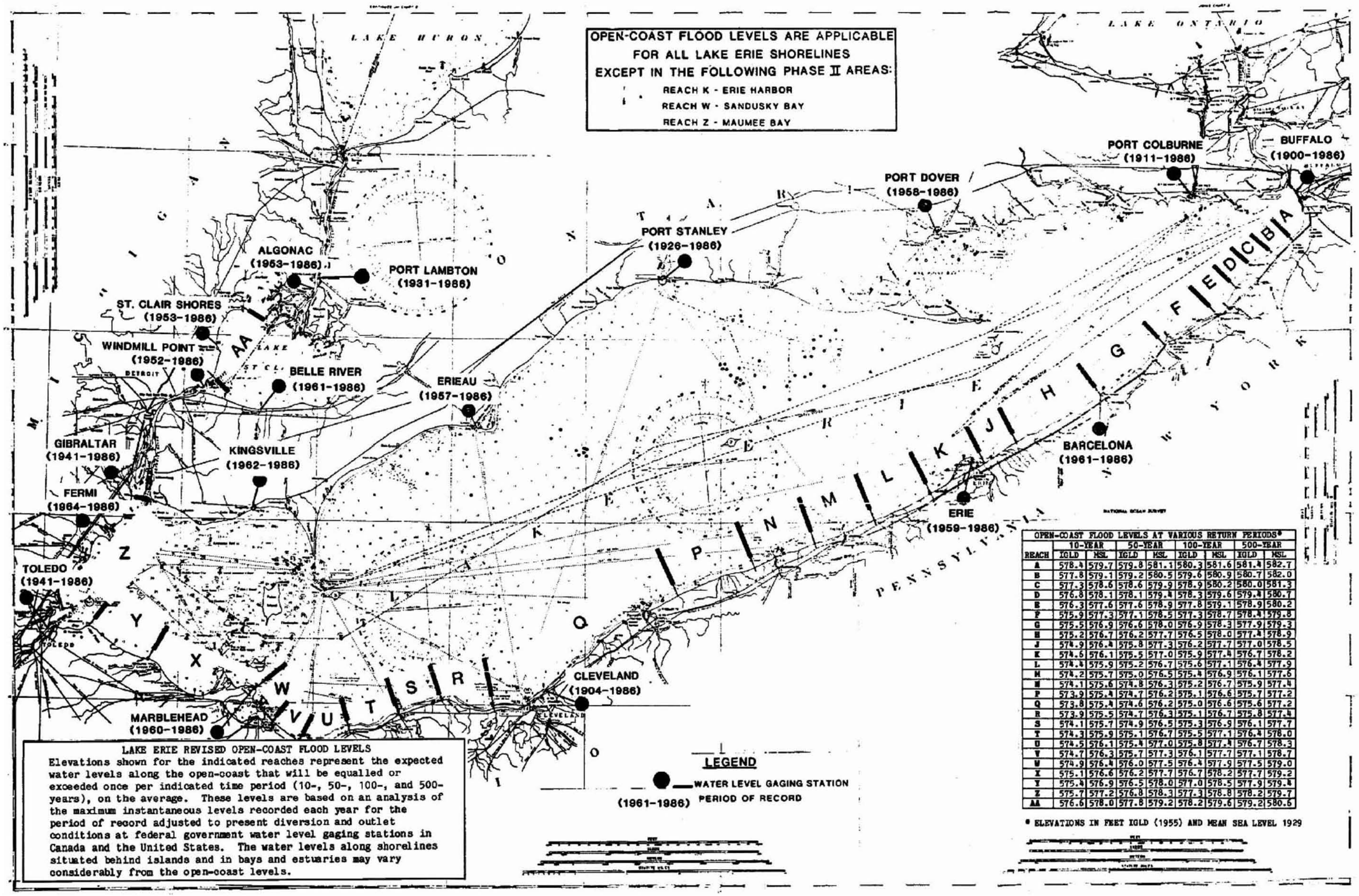


Figure 2.3-15 FEMA Flood Insurance Rate Map



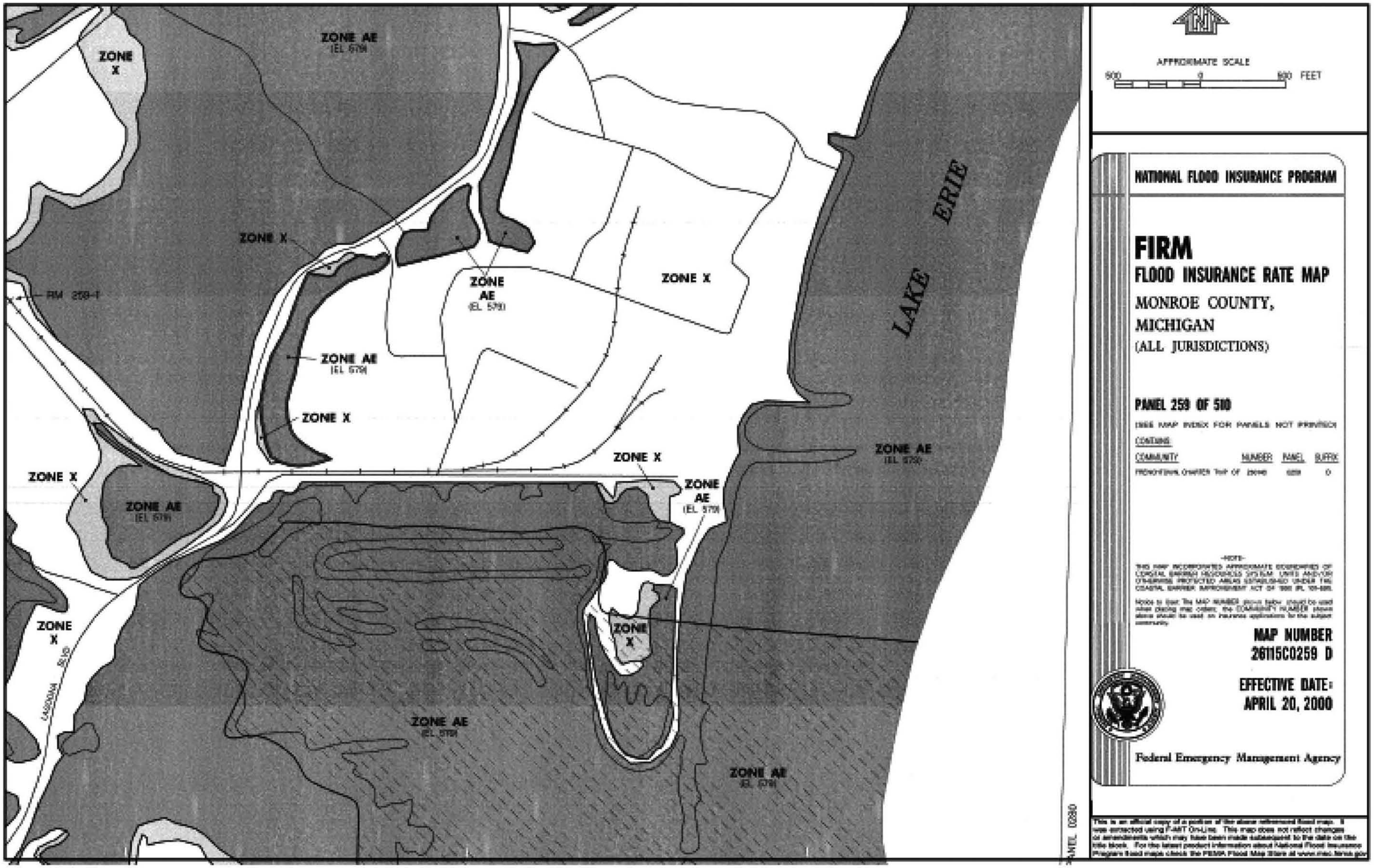
OPEN-COAST FLOOD LEVELS AT VARIOUS RETURN PERIODS*

REACH	10-YEAR IGLD	10-YEAR MSL	50-YEAR IGLD	50-YEAR MSL	100-YEAR IGLD	100-YEAR MSL	500-YEAR IGLD	500-YEAR MSL
A	578.4	579.7	579.8	581.1	580.3	581.6	581.4	582.7
B	577.8	579.1	579.2	580.5	579.6	580.9	580.7	582.0
C	577.3	578.6	578.6	579.9	578.9	580.2	580.0	581.3
D	576.8	578.1	578.1	579.4	578.3	579.6	579.4	580.7
E	576.3	577.6	577.6	578.9	577.8	579.1	578.9	580.2
F	575.9	577.3	577.1	578.5	577.3	578.7	578.4	579.8
G	575.5	576.9	576.6	578.0	576.9	578.3	577.9	579.3
H	575.2	576.7	576.2	577.7	576.5	578.0	577.4	578.9
J	574.9	576.4	575.8	577.3	576.2	577.7	577.0	578.5
K	574.6	576.1	575.5	577.0	575.9	577.4	576.7	578.2
L	574.4	575.9	575.2	576.7	575.6	577.1	576.4	577.9
M	574.2	575.7	575.0	576.5	575.4	576.9	576.1	577.6
N	574.1	575.6	574.8	576.3	575.2	576.7	575.9	577.4
P	573.9	575.4	574.7	576.2	575.1	576.6	575.7	577.2
Q	573.8	575.4	574.6	576.2	575.0	576.6	575.6	577.2
R	573.9	575.5	574.7	576.3	575.1	576.7	575.8	577.4
S	574.1	575.7	574.9	576.5	575.3	576.9	576.1	577.7
T	574.3	575.9	575.1	576.7	575.5	577.1	576.4	578.0
U	574.5	576.1	575.4	577.0	575.8	577.4	576.7	578.3
V	574.7	576.3	575.7	577.3	576.1	577.7	577.1	578.7
W	574.9	576.4	576.0	577.5	576.4	577.9	577.5	579.0
X	575.1	576.6	576.2	577.7	576.7	578.2	577.7	579.2
Y	575.4	576.9	576.5	578.0	577.0	578.5	577.9	579.4
Z	575.7	577.2	576.8	578.3	577.3	578.8	578.2	579.7
AA	576.6	578.0	577.8	579.2	578.2	579.6	579.2	580.6

* ELEVATIONS IN FEET IGLD (1955) AND MEAN SEA LEVEL 1929

Source: Reference 2.3-5

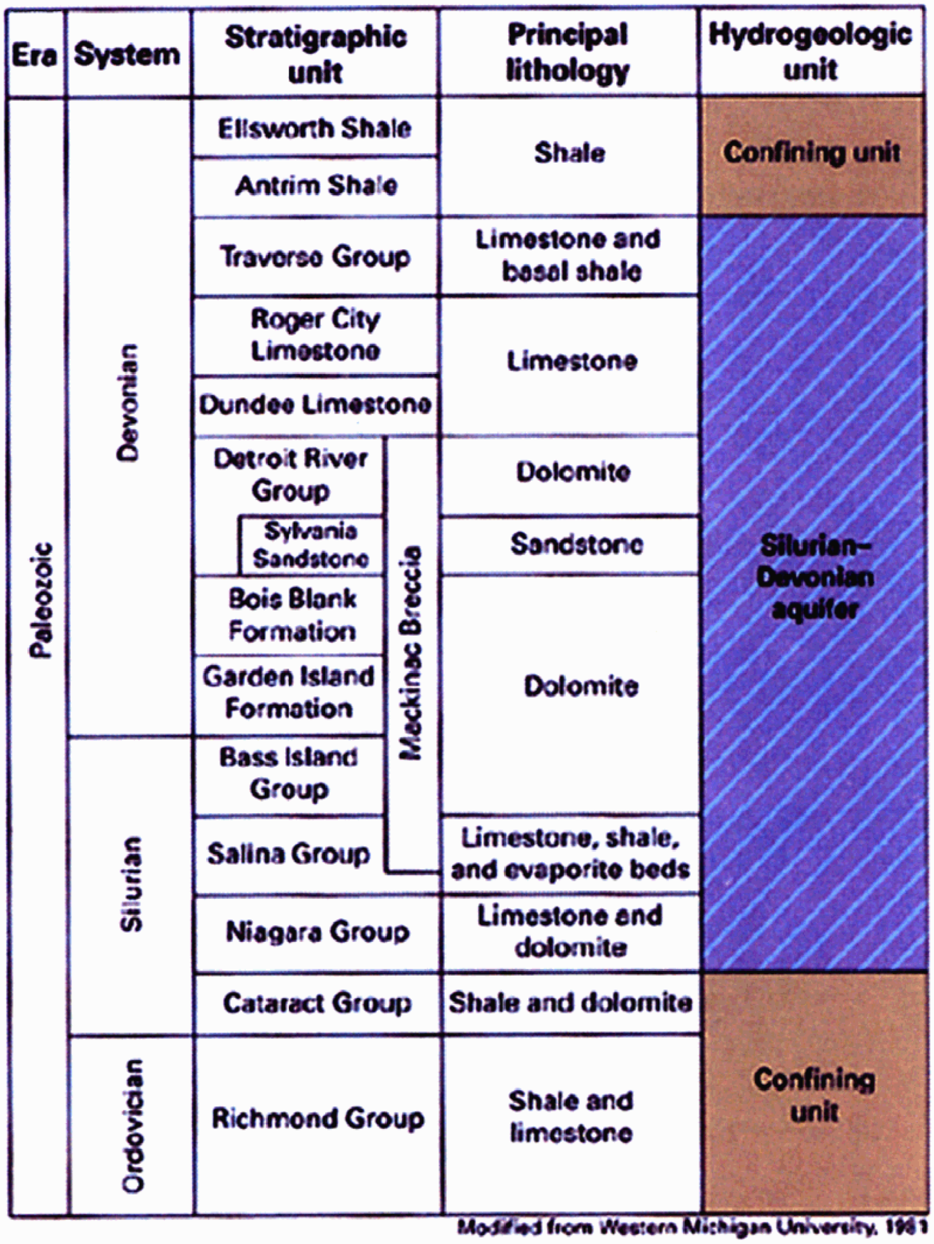
Figure 2.3-16 FEMA Flood Insurance Rate Map



Source: Reference 2.3-32

Figure 2.3-17 Site Map

Figure 2.3-18 Regional Aquifer System ‘



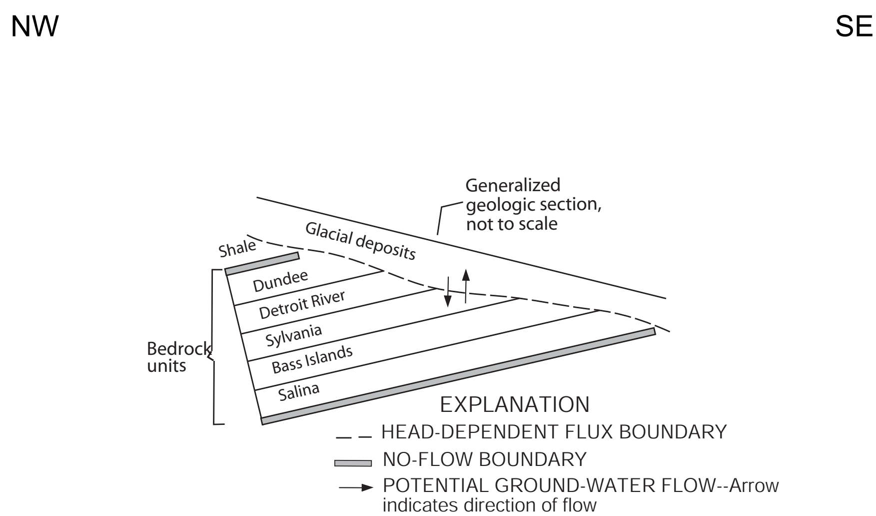
Era	System	Stratigraphic unit		Principal lithology	Hydrogeologic unit
Paleozoic	Devonian	Ellsworth Shale		Shale	Confining unit
		Antrim Shale			
		Traverse Group		Limestone and basal shale	Silurian–Devonian aquifer
		Roger City Limestone		Limestone	
		Dundee Limestone			
		Detroit River Group	Mackinac Breccia	Dolomite	
		Sylvania Sandstone		Sandstone	
		Bois Blank Formation		Dolomite	
		Garden Island Formation			
	Silurian	Bass Island Group			
		Salina Group		Limestone, shale, and evaporite beds	
		Niagara Group		Limestone and dolomite	
		Cataract Group		Shale and dolomite	Confining unit
	Ordovician	Richmond Group		Shale and limestone	

Modified from Western Michigan University, 1981

Figure 76. *The Silurian–Devonian aquifer in Michigan consists primarily of dolomite and limestone with interbedded sandstone, shale, and evaporite beds. The Mackinac Breccia results from collapse of Devonian rocks after dissolution of some of the underlying Silurian evaporite beds.*

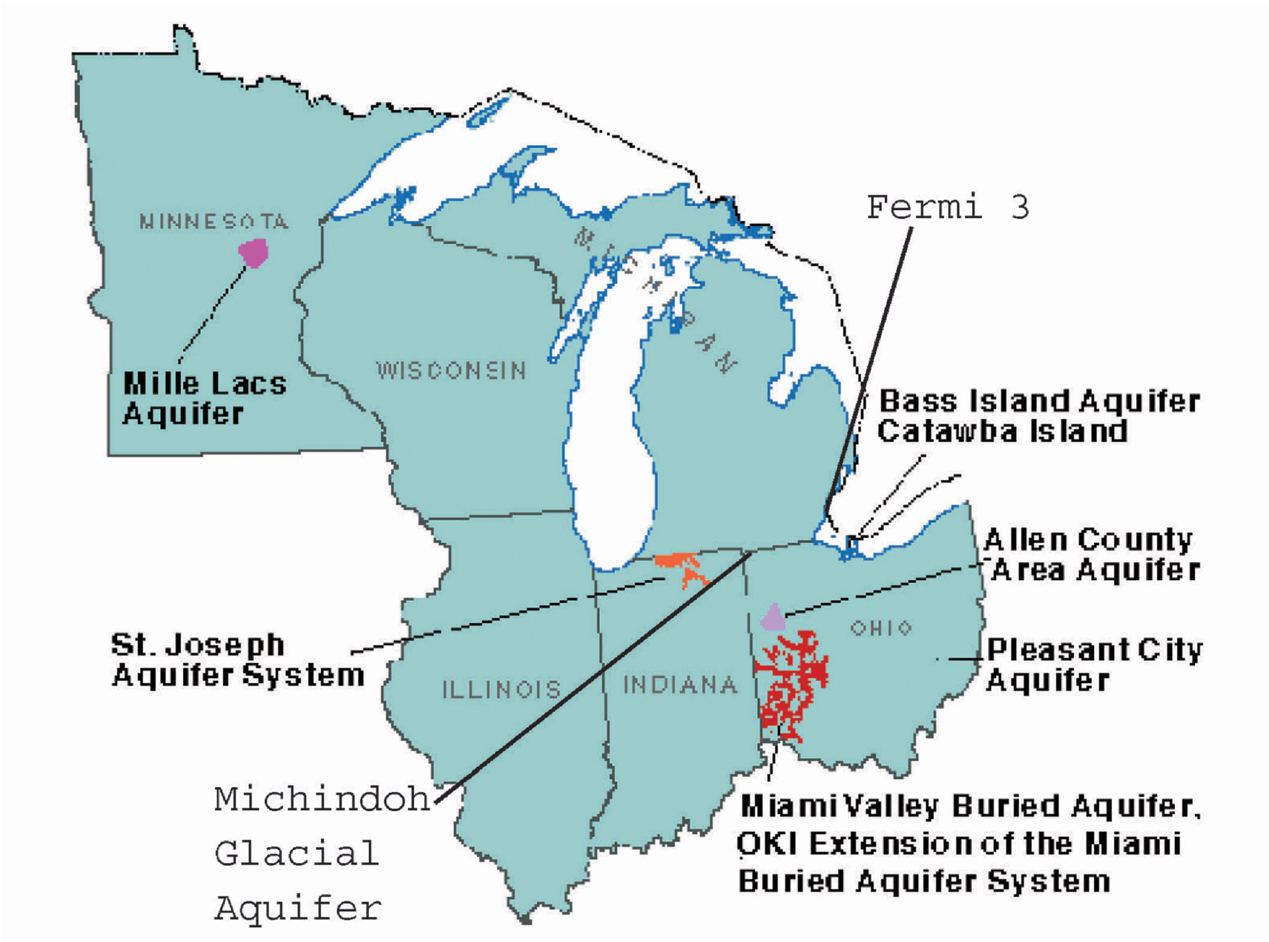
Source: Reference 2.3-4

Figure 2.3-19 Conceptual Cross-Section of Regional Aquifer System



Source: Reference 2.3-1

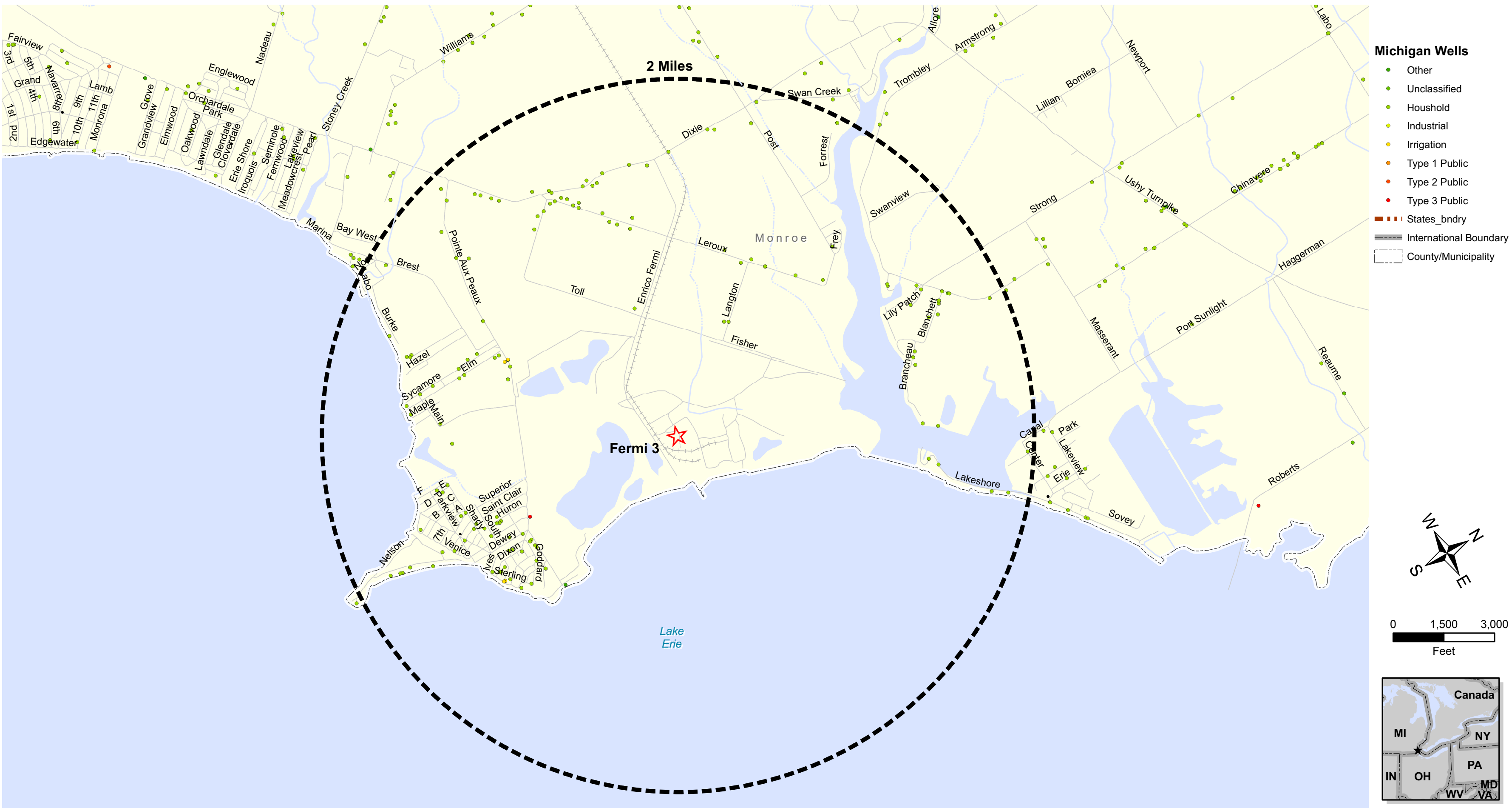
Figure 2.3-20 Sole Source Aquifers



Source: Reference 2.3-8 and Reference 2.3-9

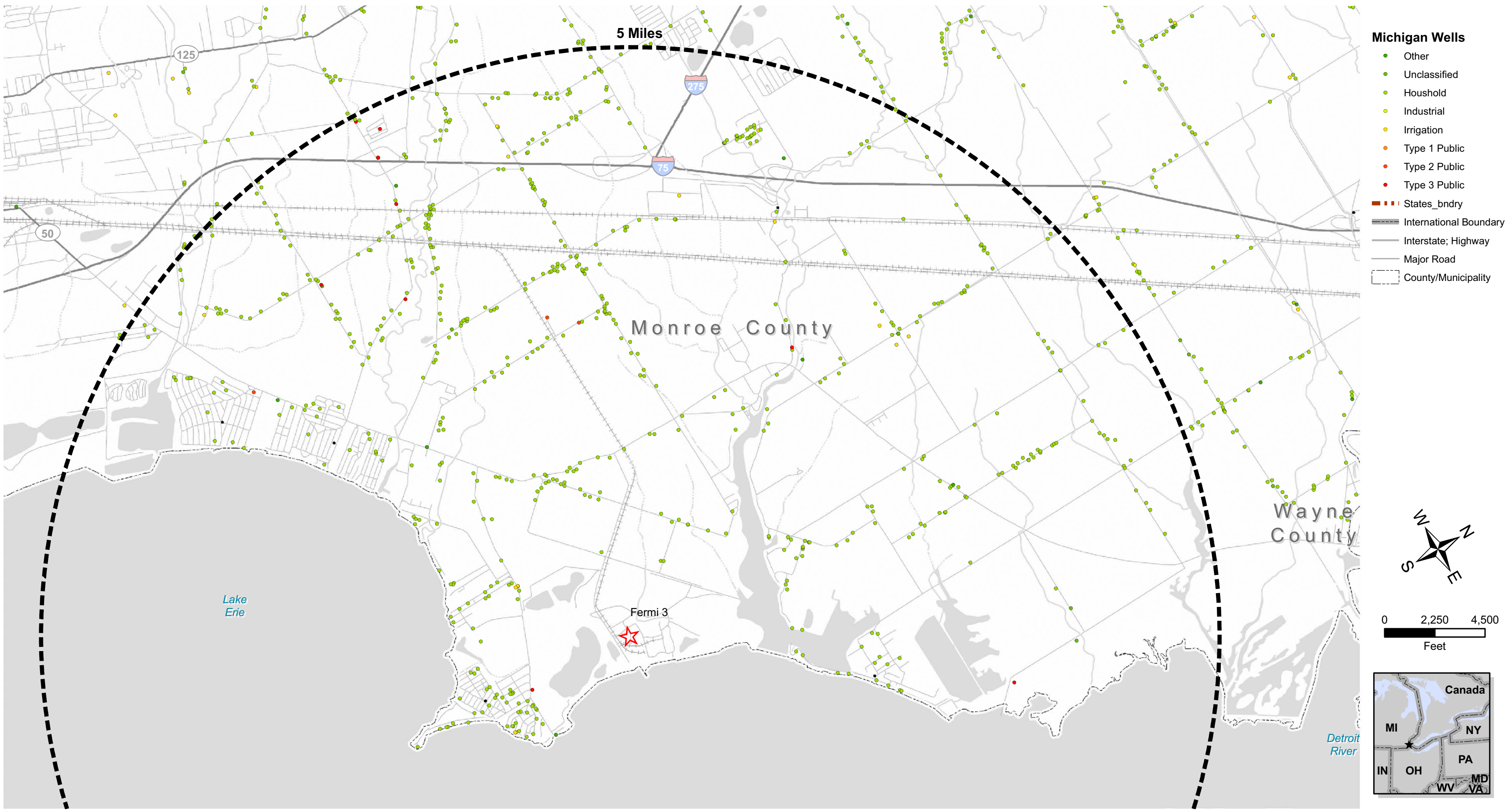
Figure 2.3-21 Quarries of Monroe County, Michigan

Figure 2.3-22 All Wells Within 2 Miles



Source: Reference 2.3-14

Figure 2.3-23 All Wells Within 5 Miles

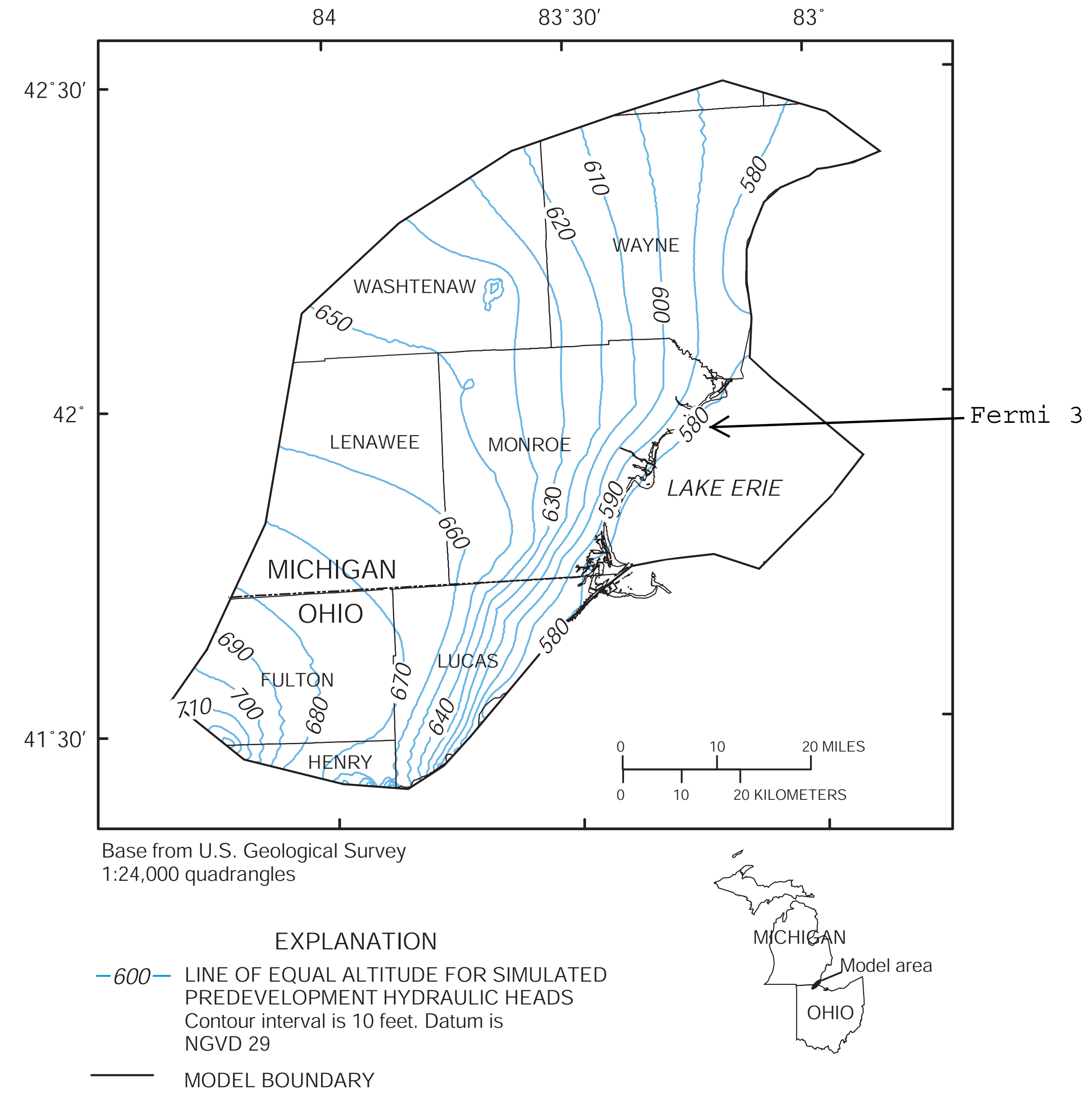


Source: Reference 2.3-14

Figure 2.3-24 All Wells Within 25 Miles

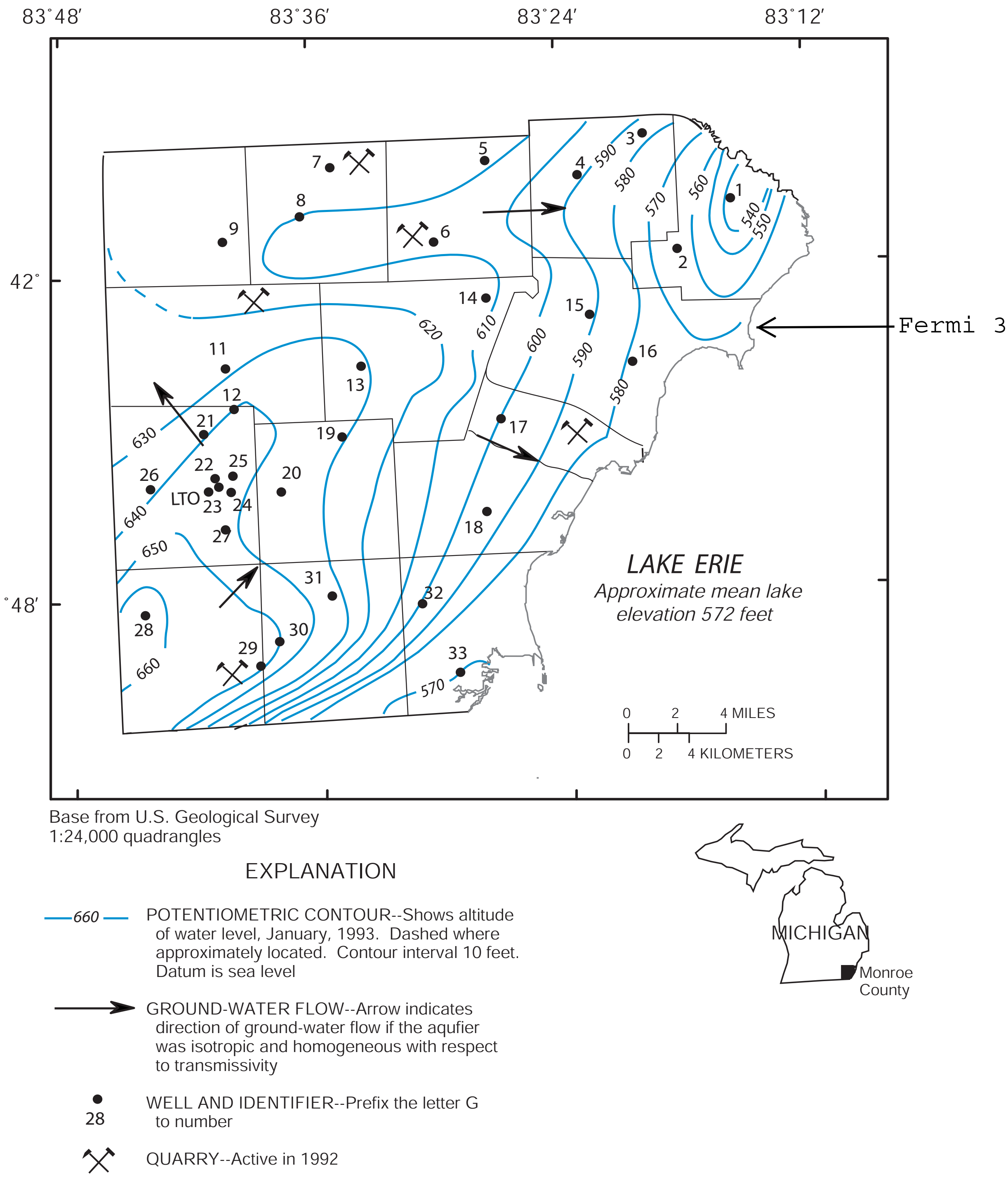
Source: Reference 2.3-14 and Reference 2.3-15

Figure 2.3-25 Simulated Pre-Development Water Levels in Bedrock Aquifer



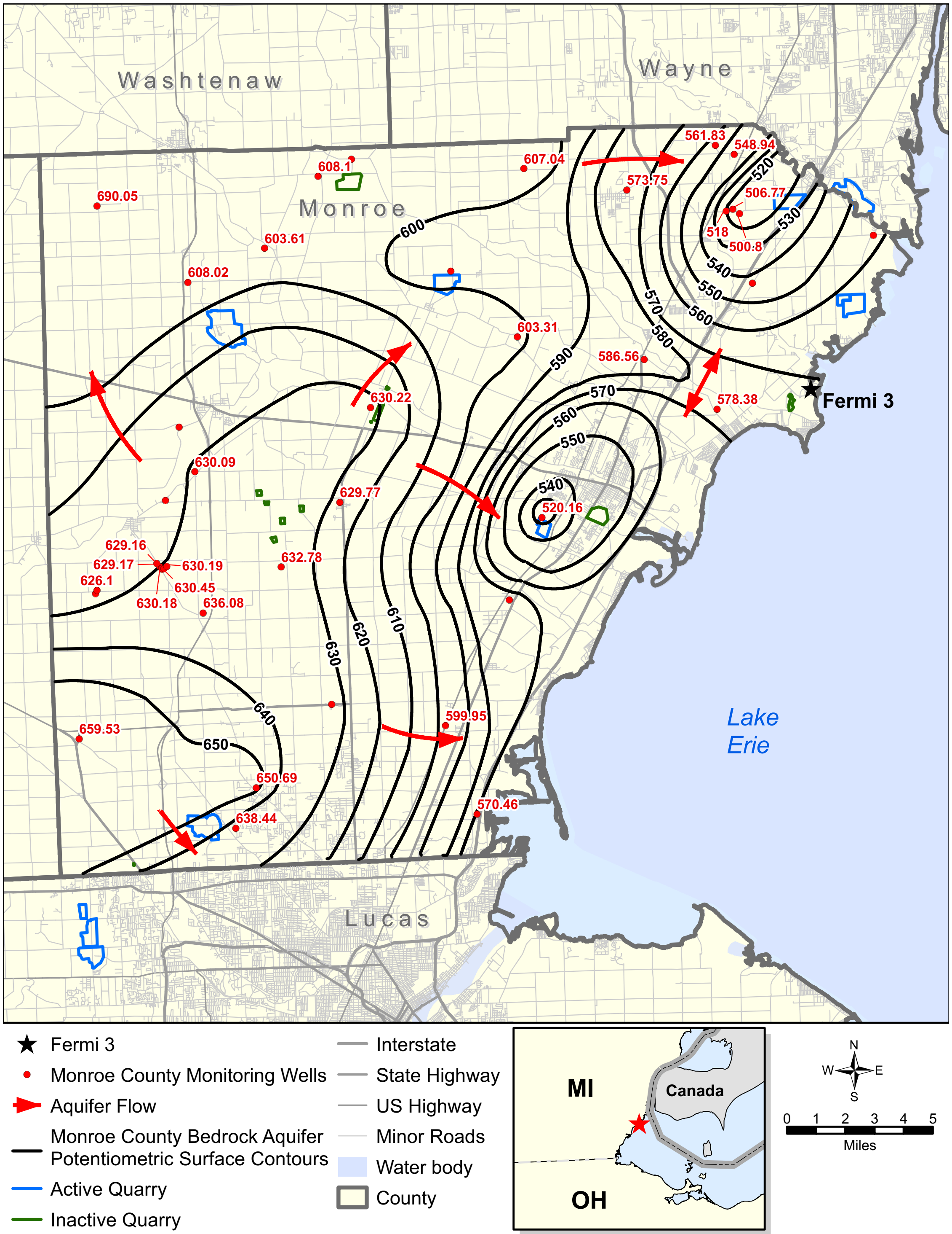
Source: Reference 2.3-1

Figure 2.3-26 1993 Bedrock Aquifer Potentiometric Surface in Monroe County, MI



Source: Reference 2.3-1

Figure 2.3-27 2008 Bedrock Aquifer Potentiometric Surface in Monroe County, MI



Source: Reference 2.3-18

Figure 2.3-28 Overburden Water Table Map 06/29/2007

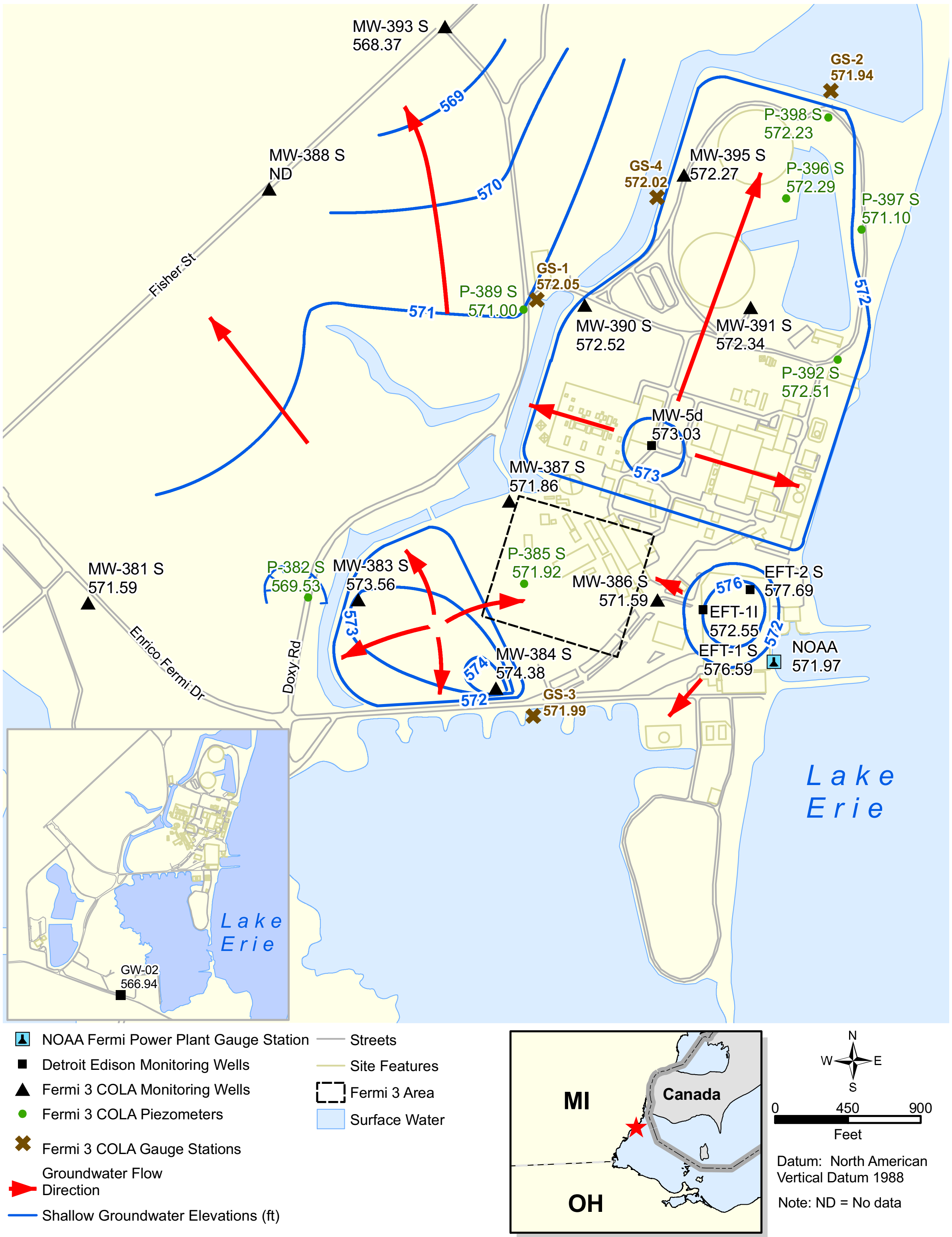


Figure 2.3-29 Overburden Water Table Map 09/28/2007-09/29/2007

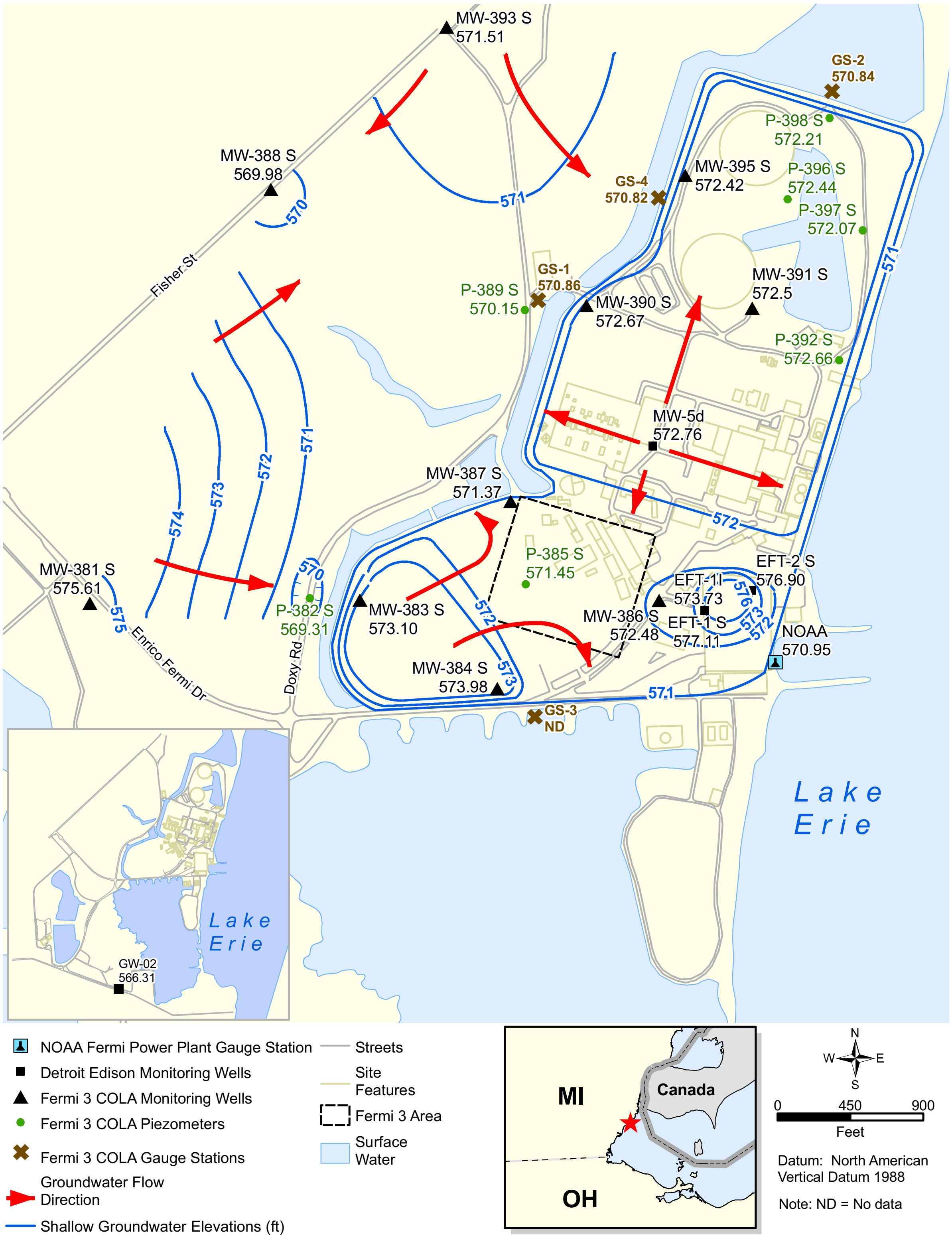


Figure 2.3-30 Overburden Water Table Map 12/29/2007

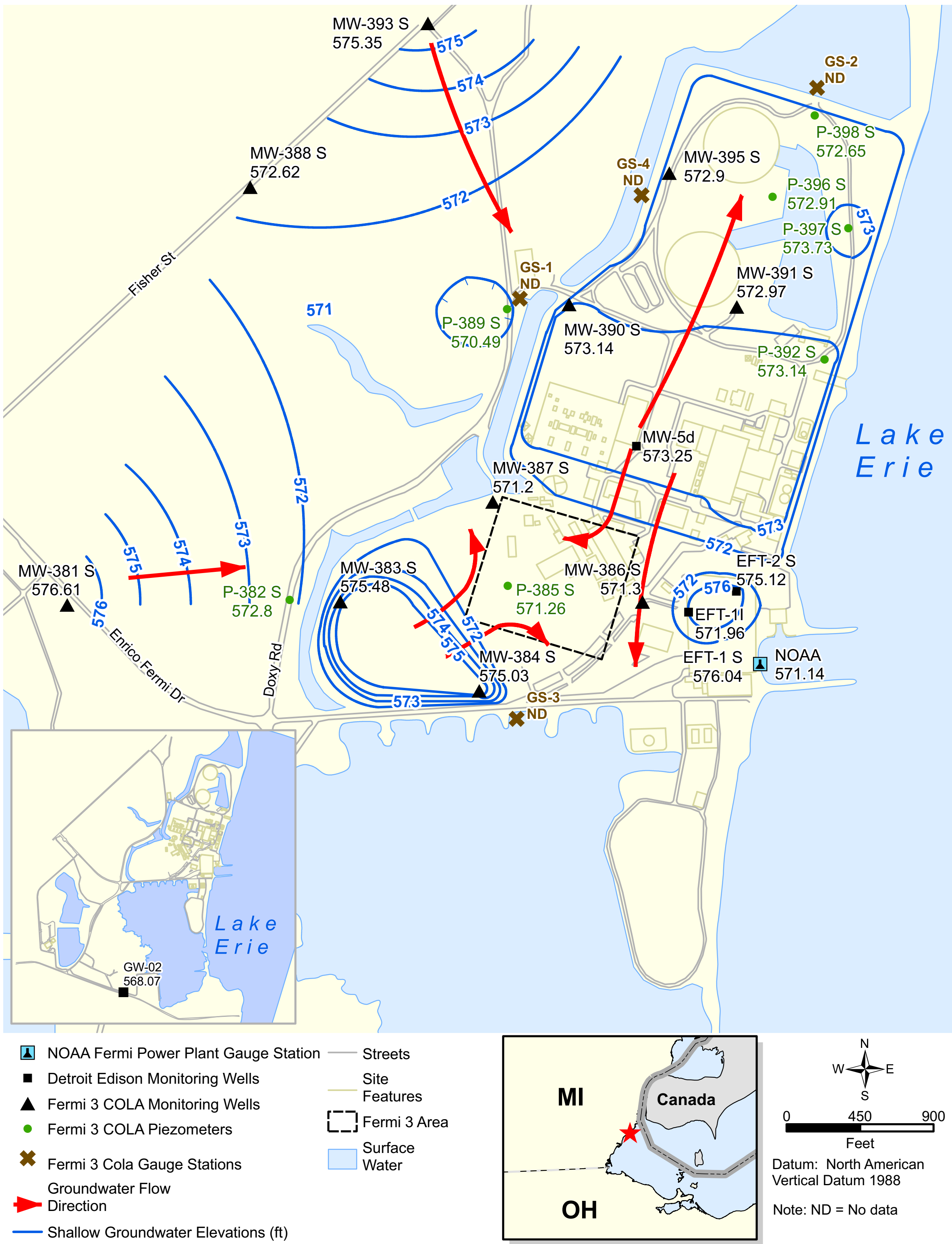


Figure 2.3-31 Overburden Water Table Map 03/29/2008

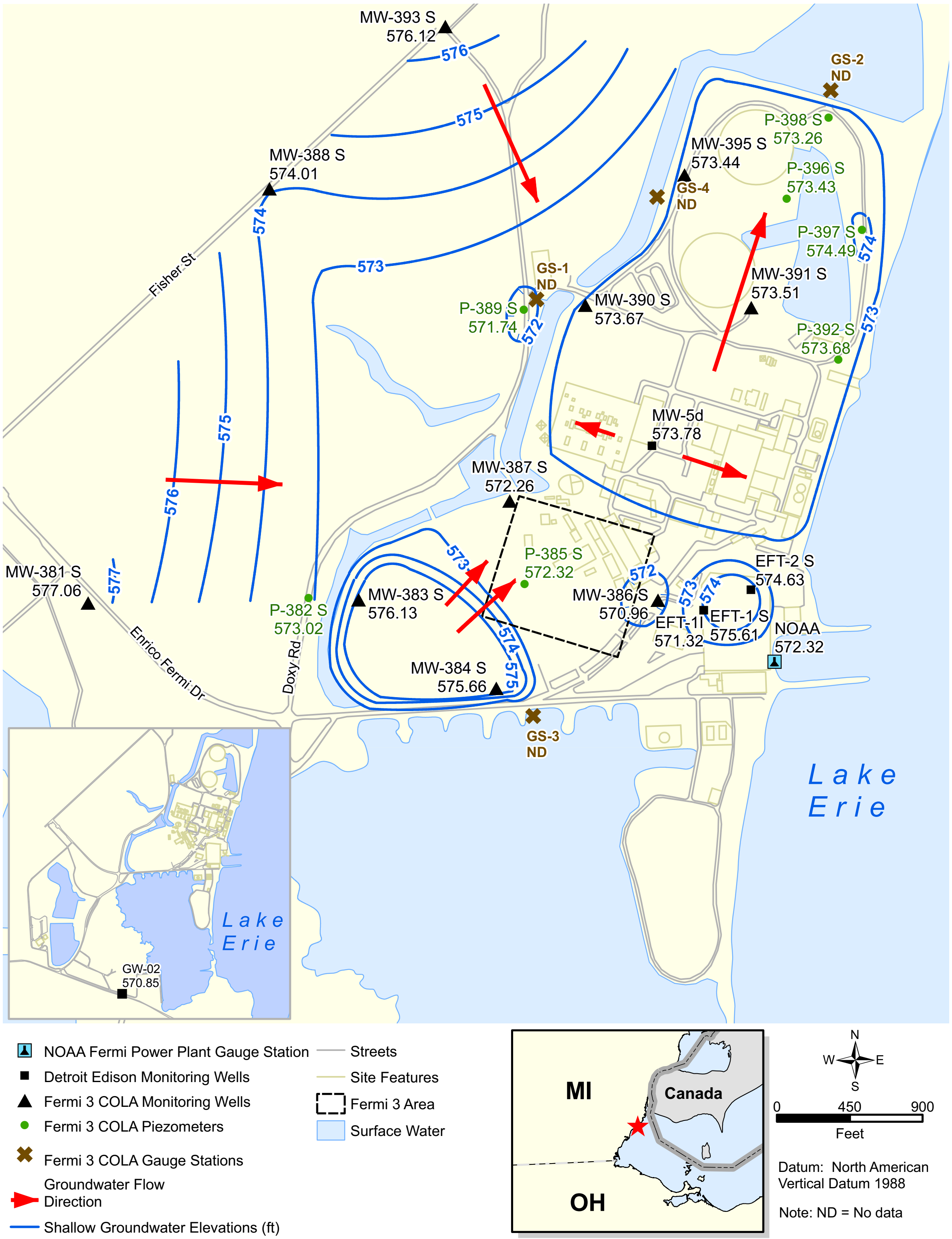


Figure 2.3-32 Bass Islands Aquifer Potentiometric Surface Map 06/29/2007

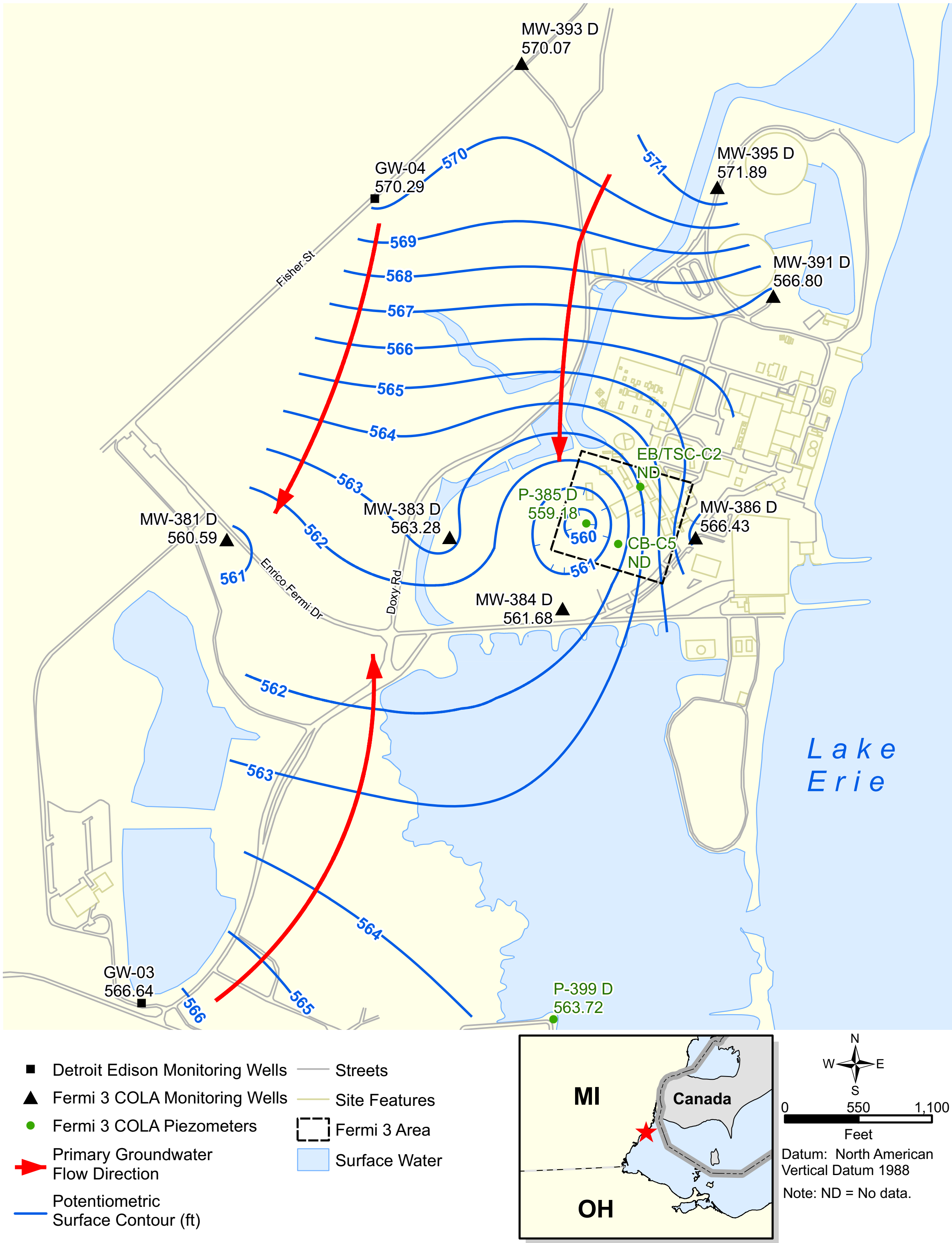


Figure 2.3-33 Bass Islands Aquifer Potentiometric Surface Map 09/28/2007-09/29/2007

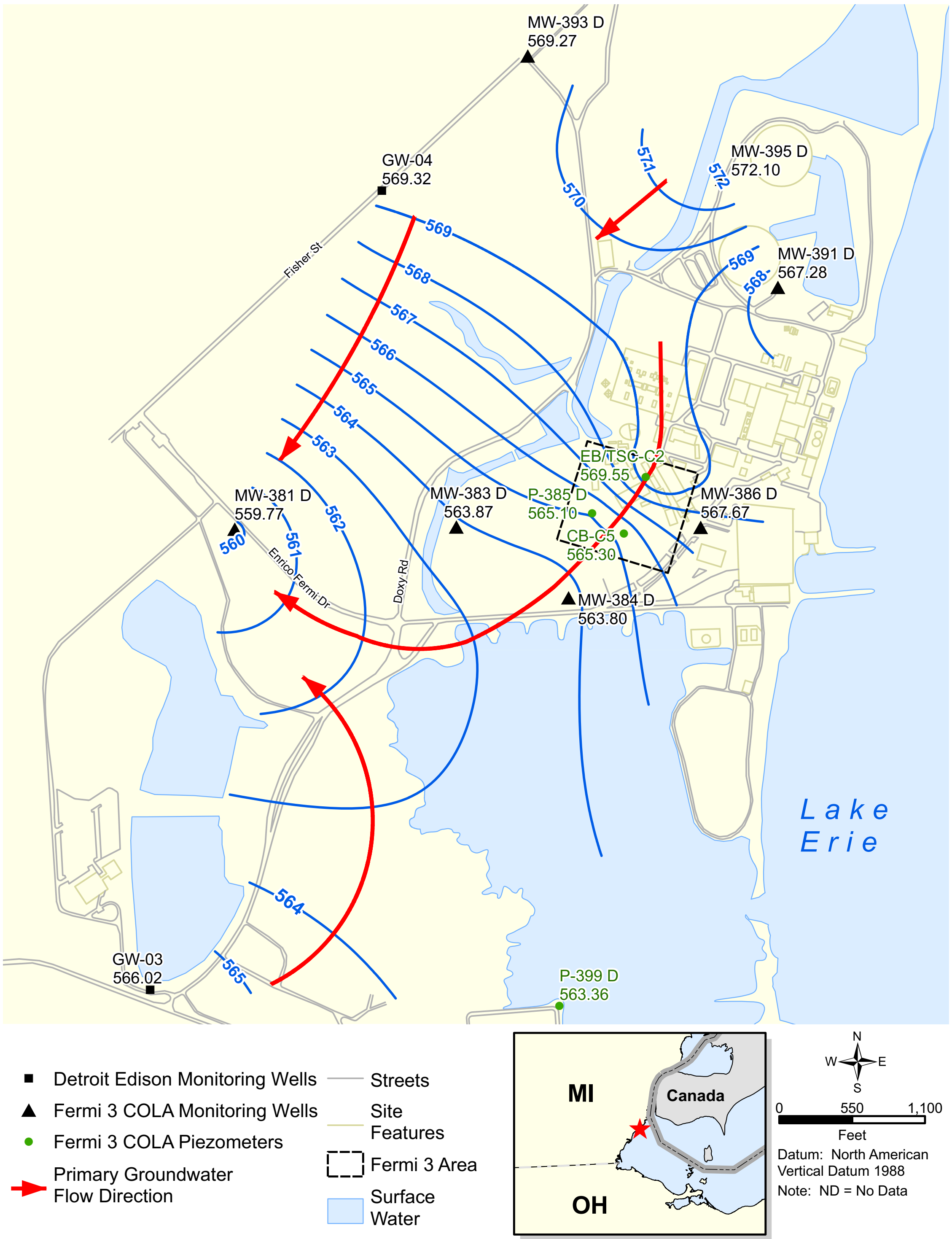


Figure 2.3-34 Bass Islands Aquifer Potentiometric Surface Map 12/29/2007

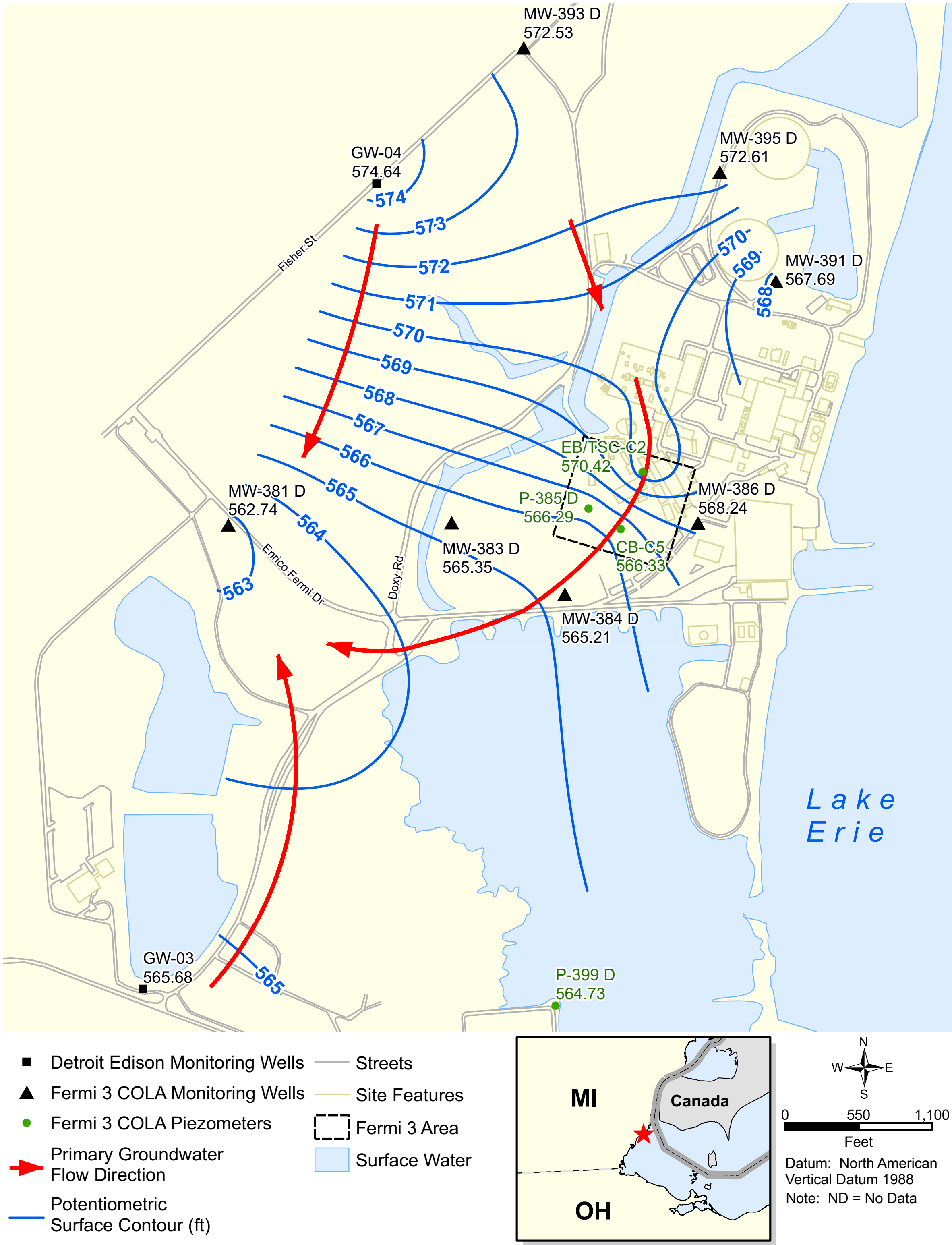


Figure 2.3-35 Bass Islands Aquifer Potentiometric Surface Map 03/29/2008

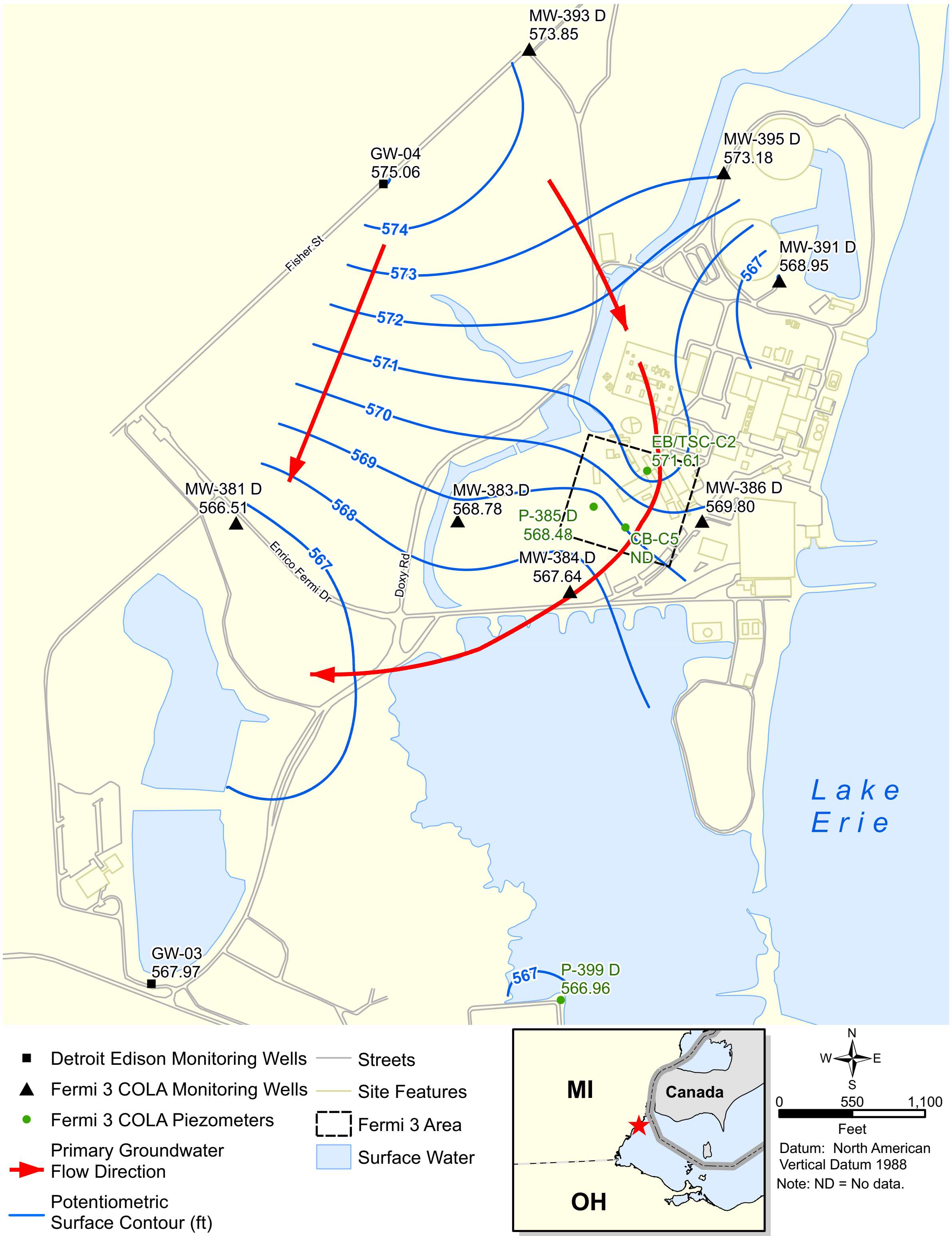


Figure 2.3-36 Fermi 3 Paired Hydrographs

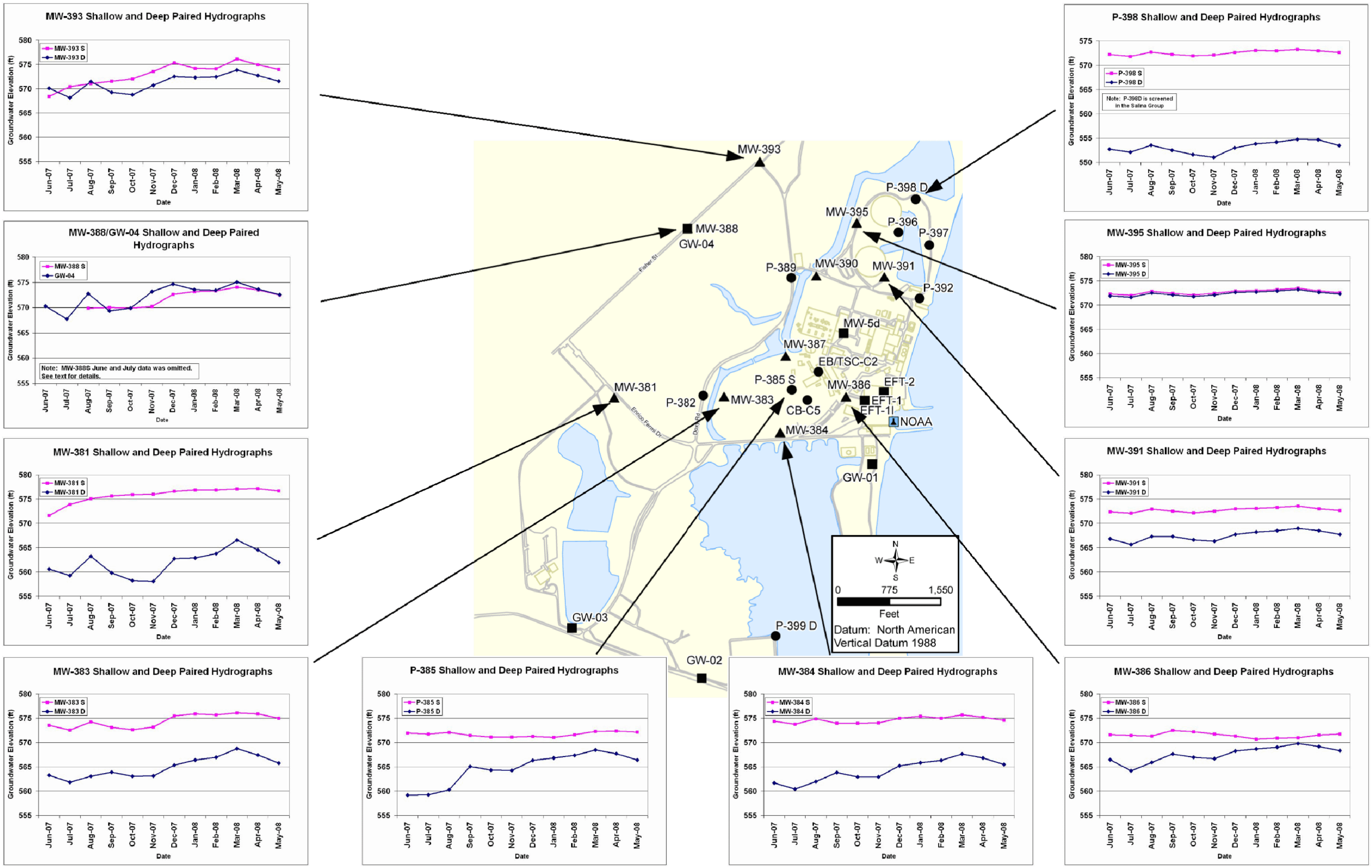
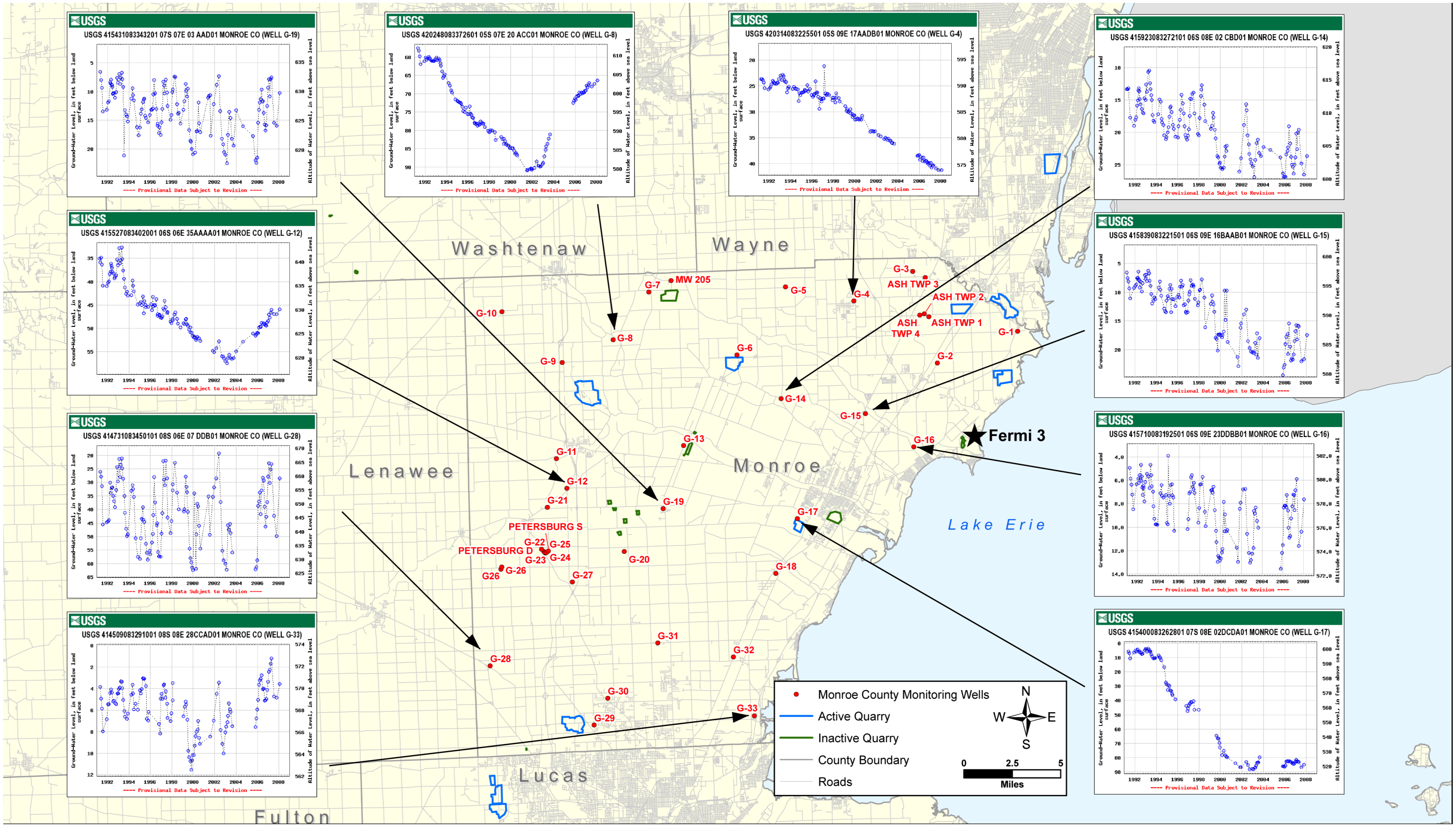


Figure 2.3-37 Monroe County Water Level Hydrographs



Source: Reference 2.3-18

Figure 2.3-38 Fermi 3 Overburden Hydraulic Conductivity

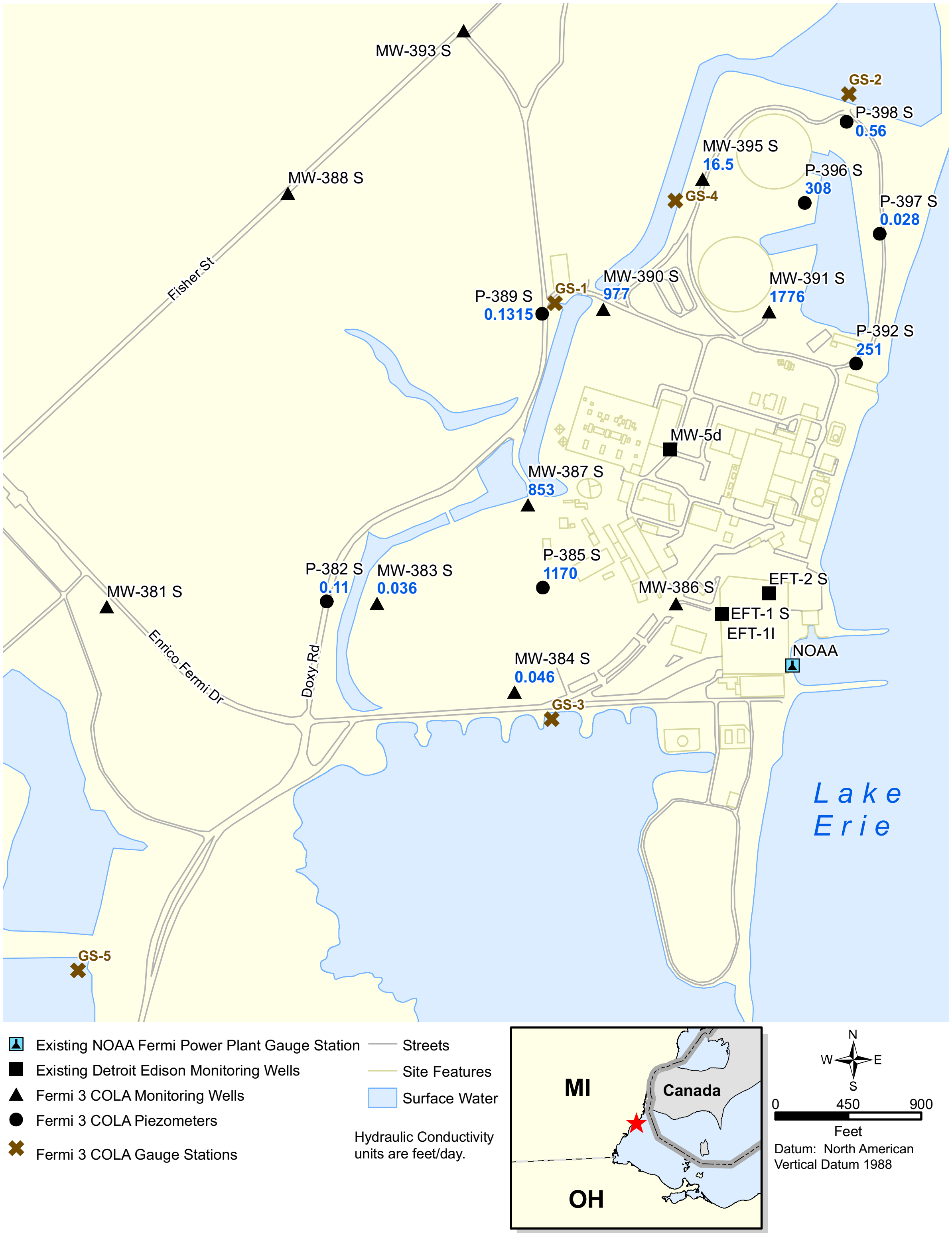


Figure 2.3-39 Fermi 3 Bedrock Hydraulic Conductivity

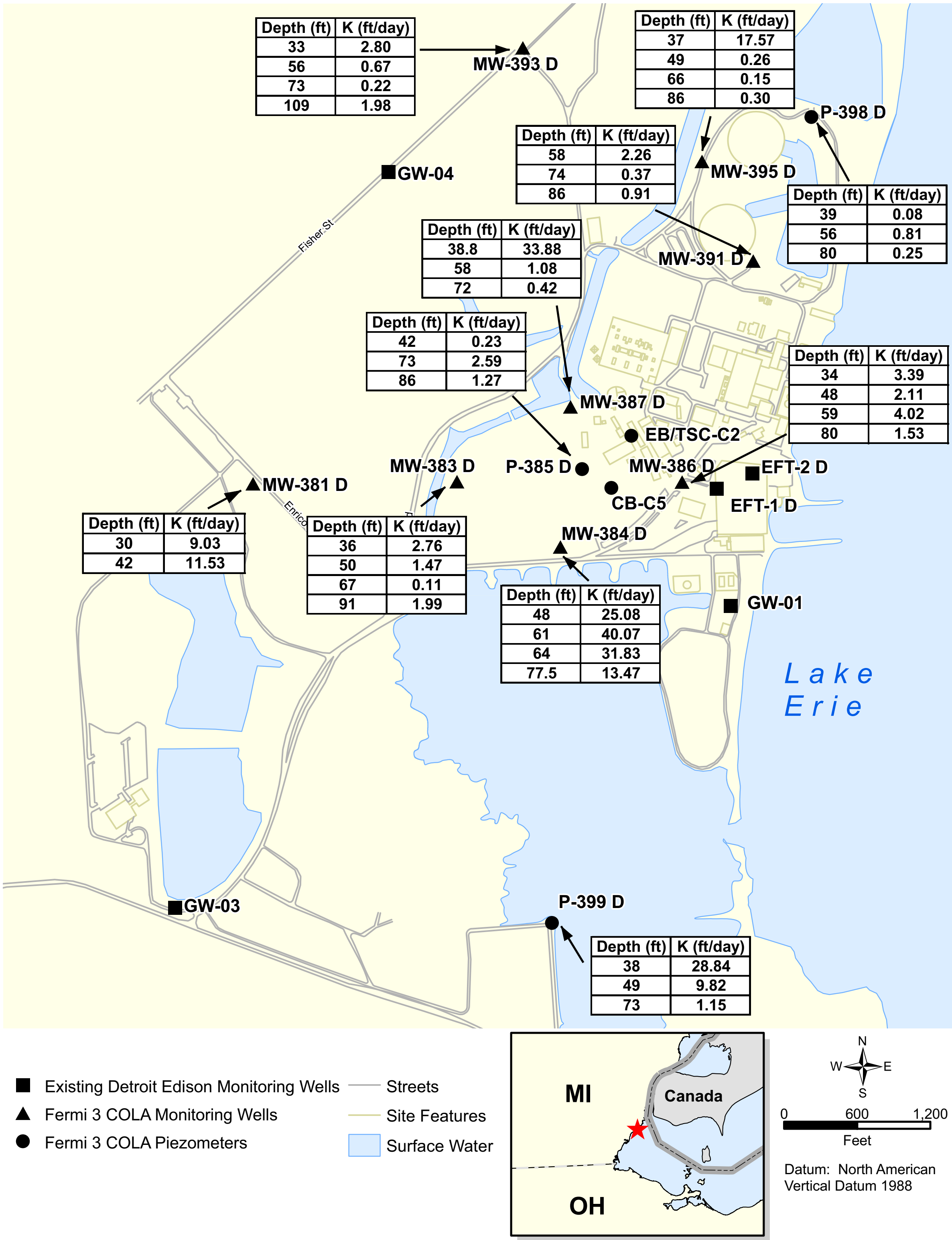


Figure 2.3-40 Groundwater Model Grid Refinement

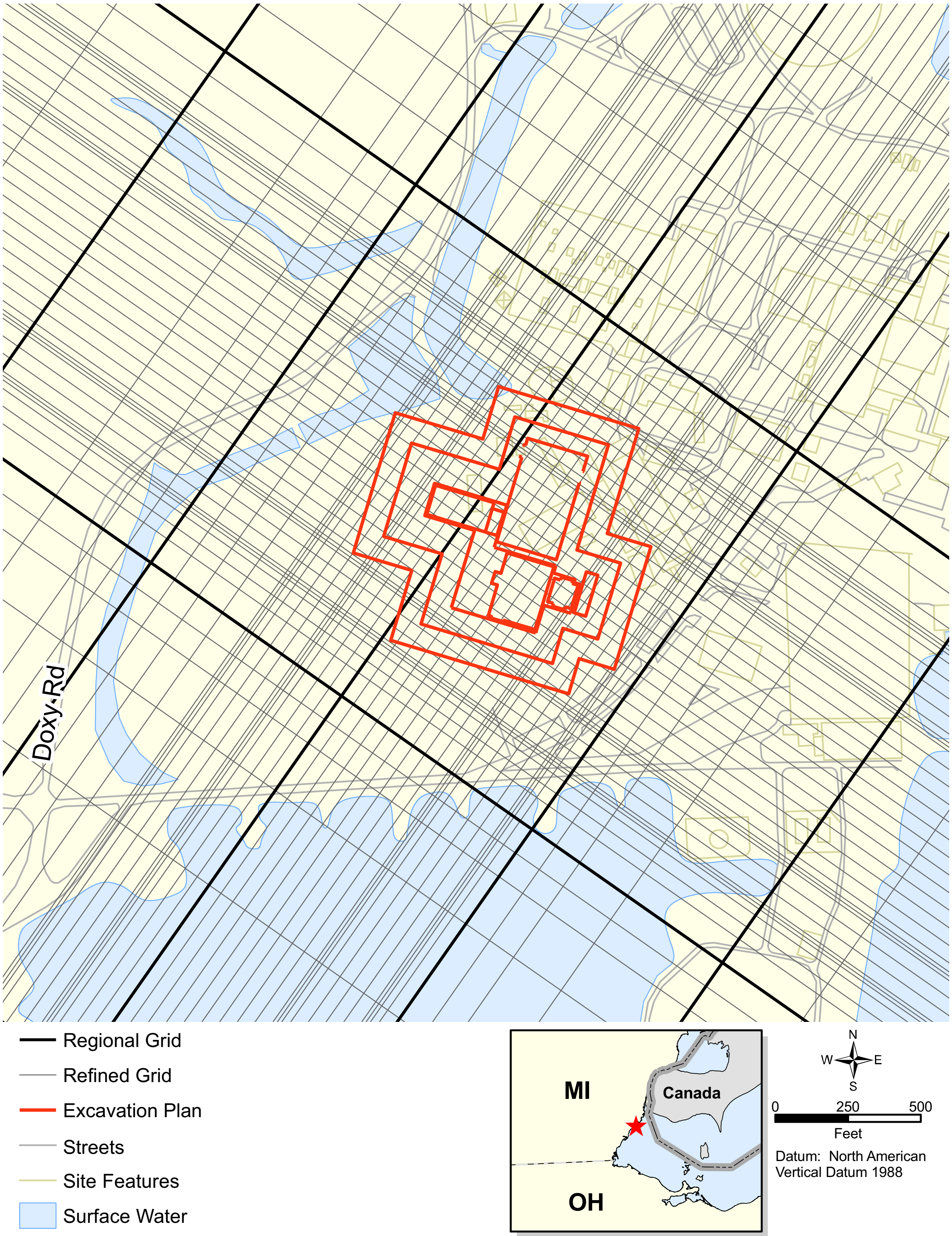


Figure 2.3-41 Dewatering Bass Islands Group: Drawdown Contours - Reinforced Diaphragm Concrete Wall With Grouted Base Combination

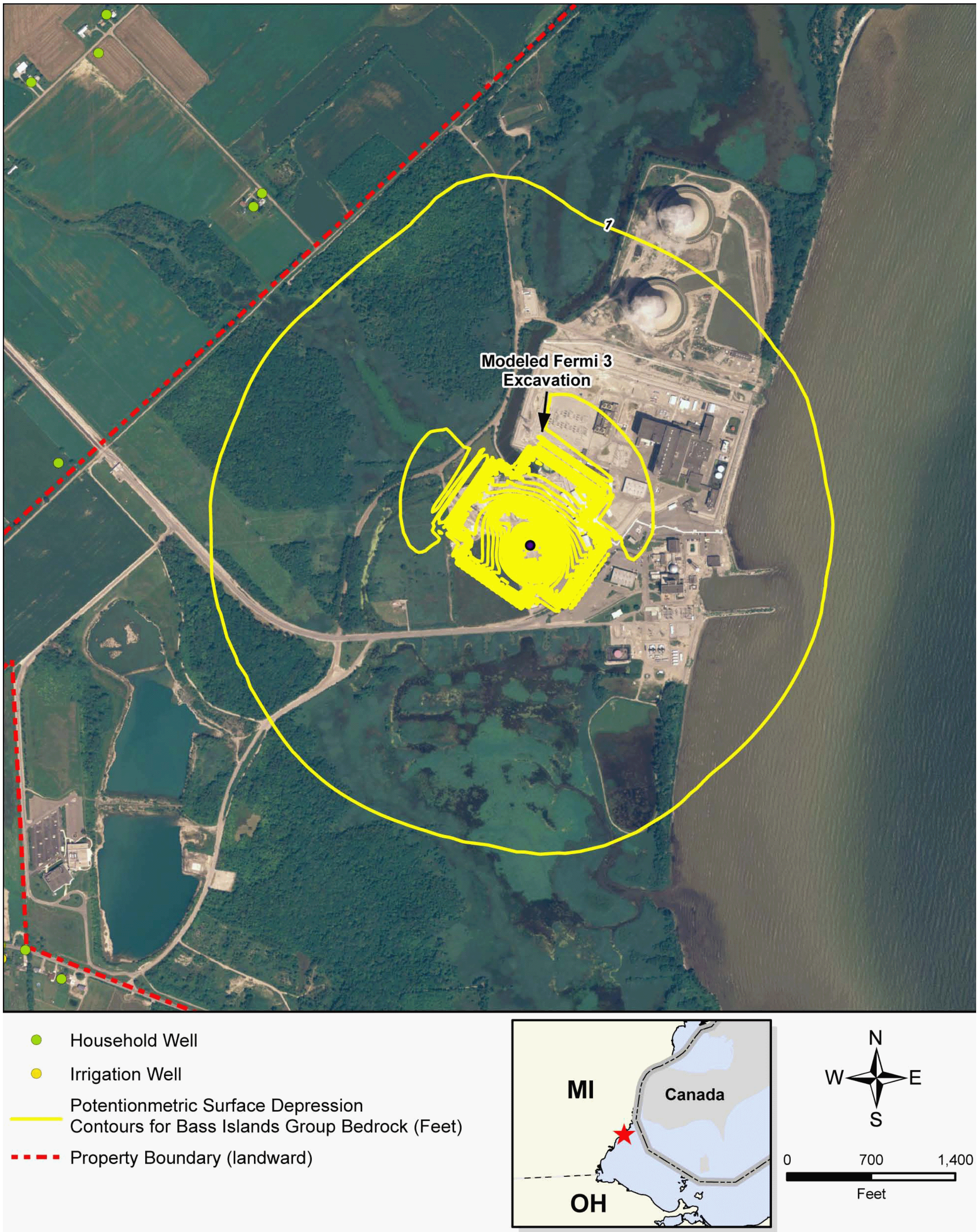


Figure 2.3-42 Dewatering Bass Islands Group: Drawdown Contours – Grout Curtain/Freeze Wall Combination with a Grouted Base

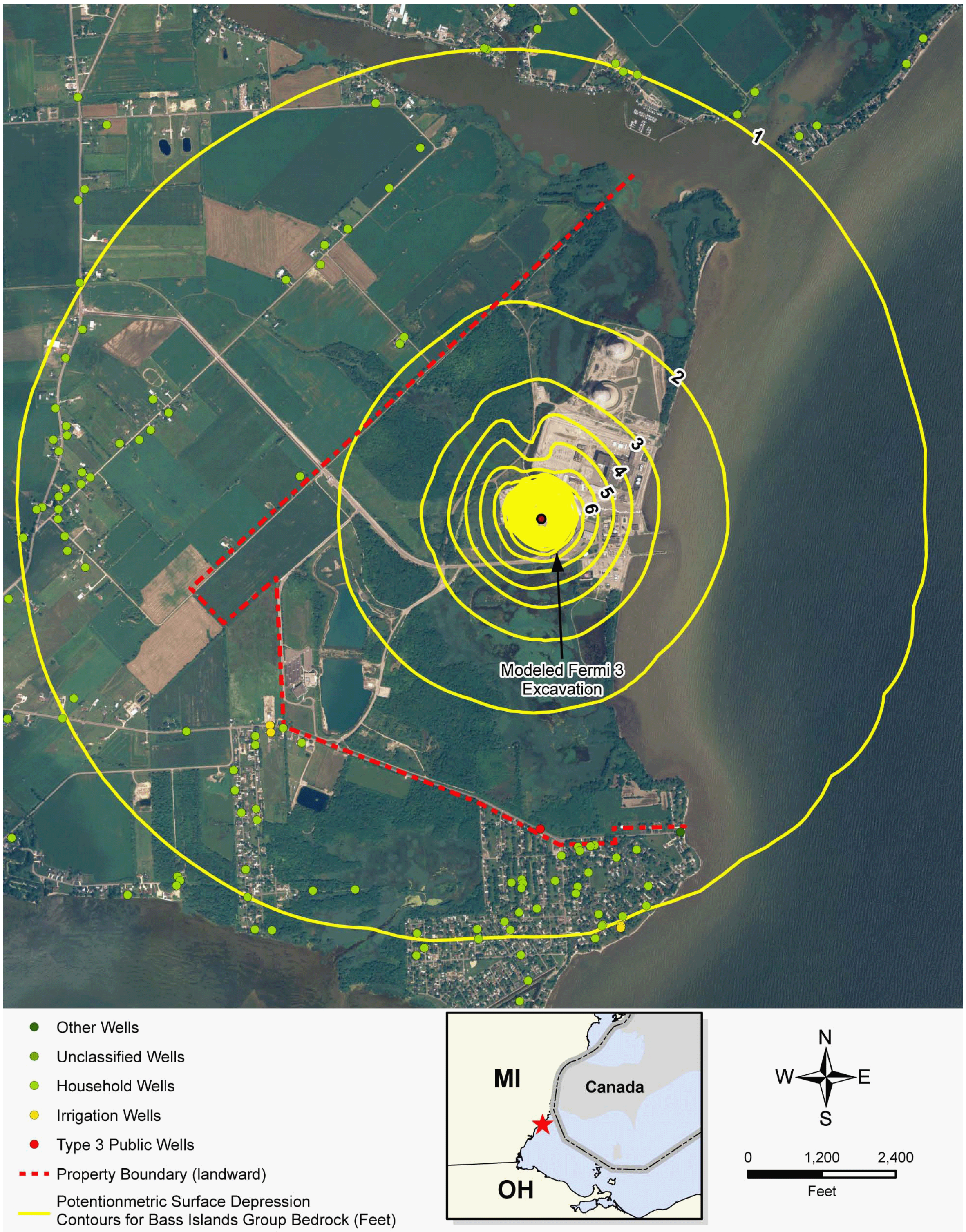


Figure 2.3-43 Effective Monitoring Intervals For Bedrock Wells At The Fermi Site

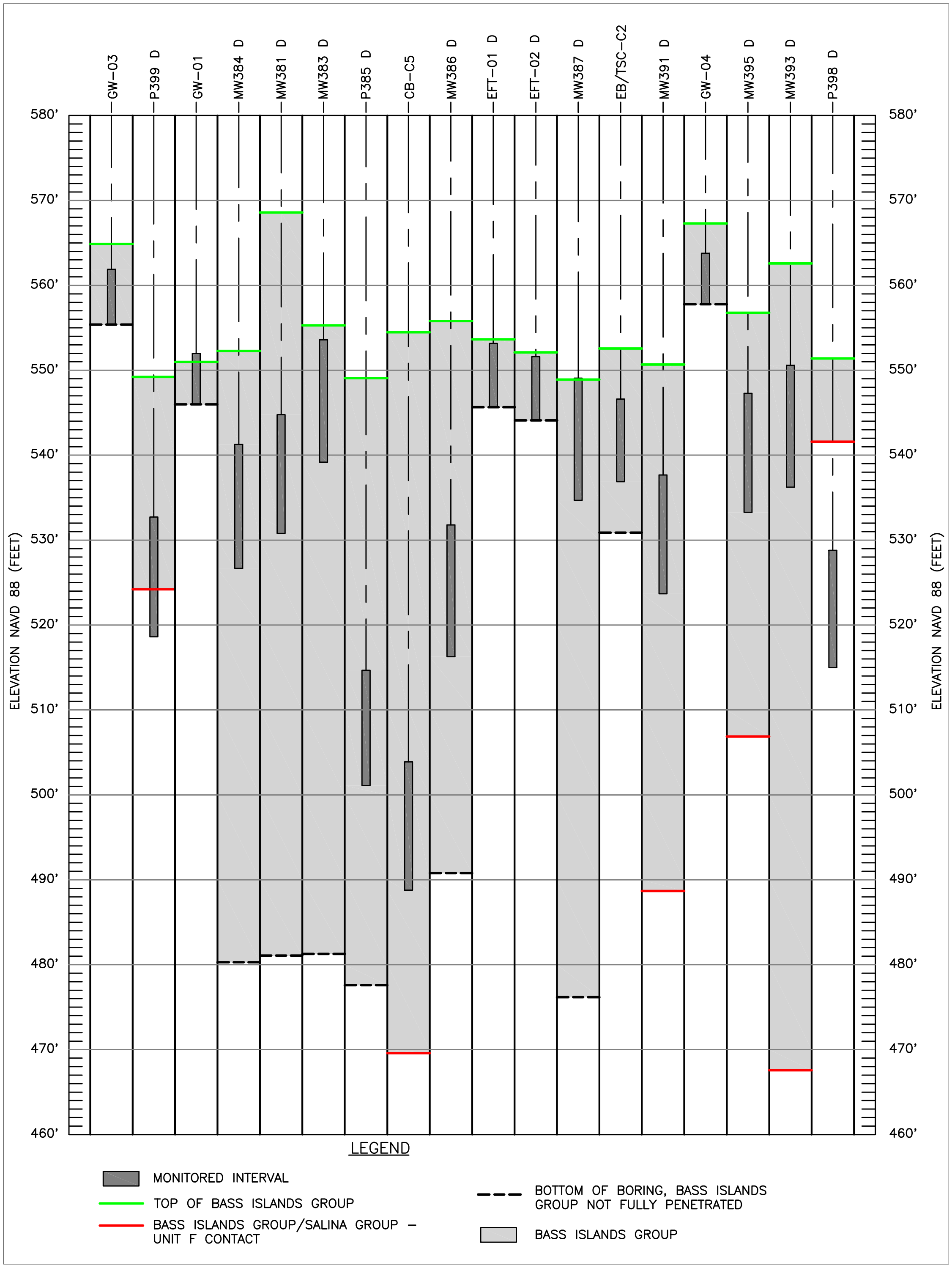
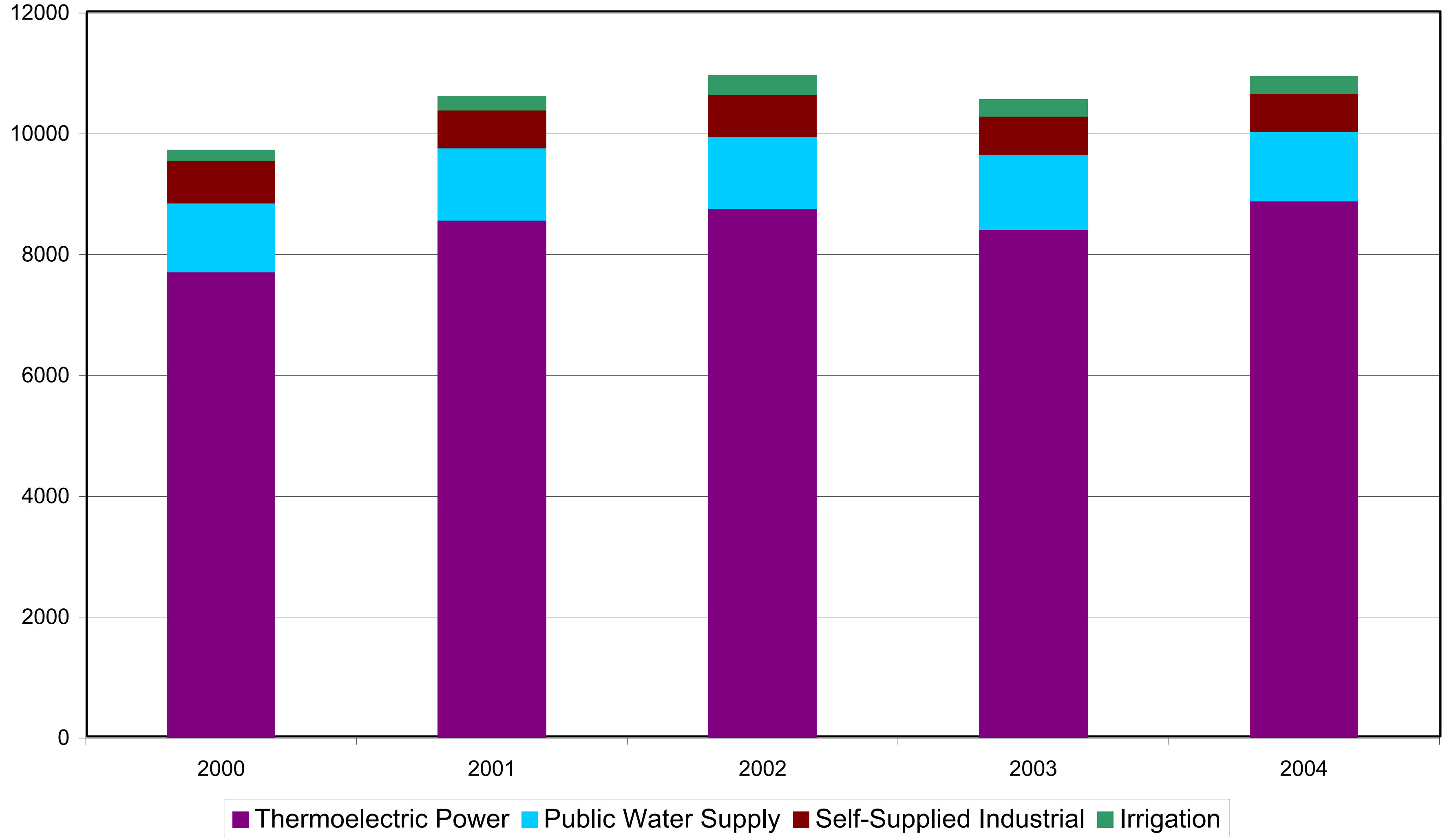
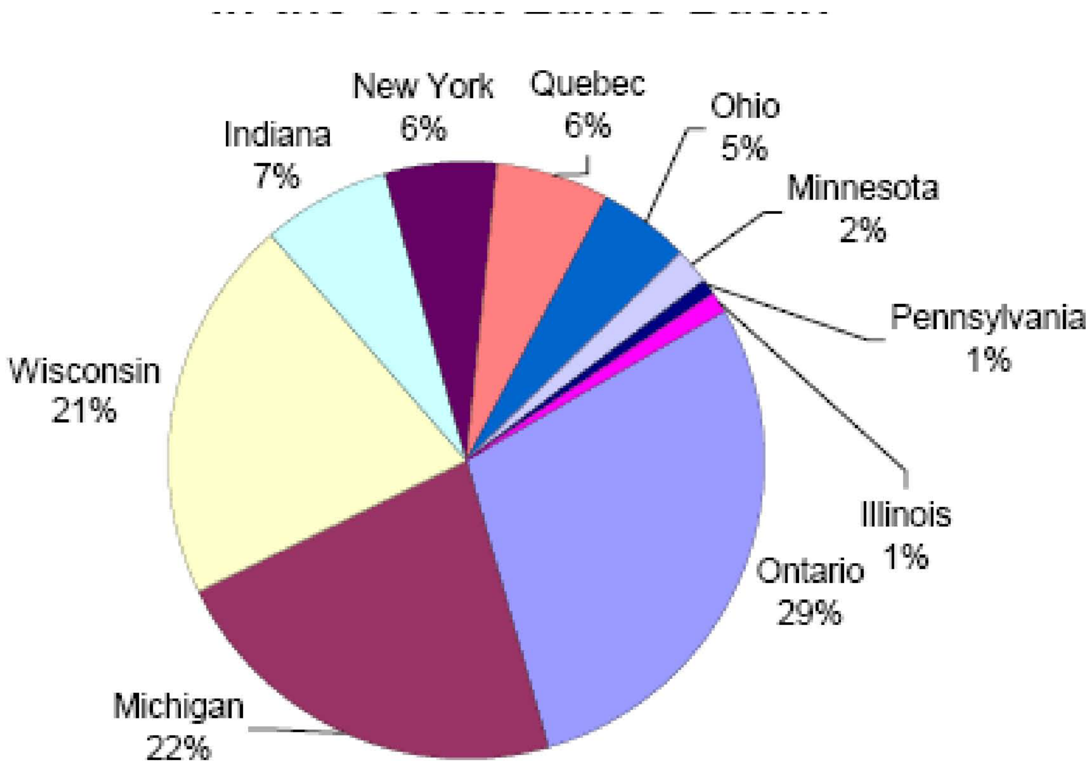


Figure 2.3-44 Total Water Withdrawals by Sector in Michigan (MGD) 2000-2004



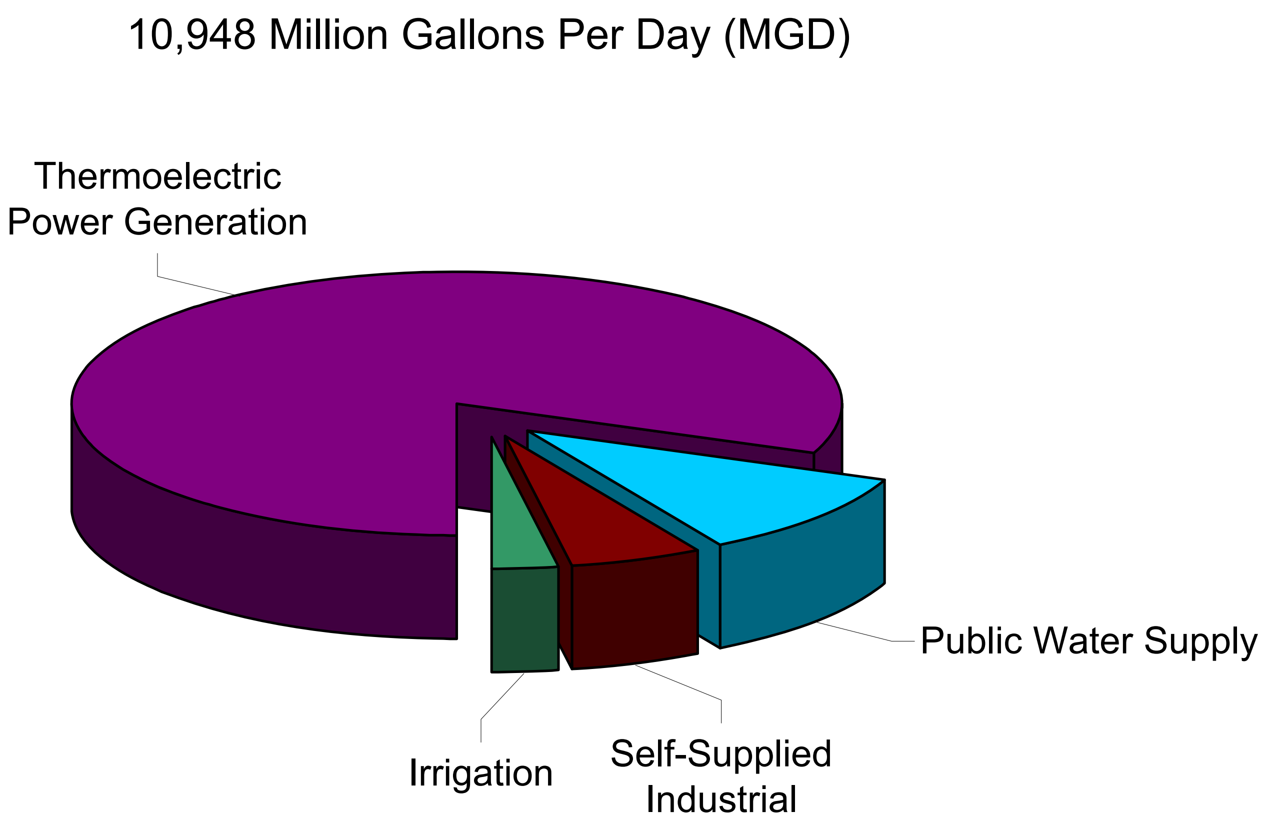
Source: Reference 2.3-35

Figure 2.3-45 Non-Consumptive Water Use in the Great Lakes Basin



Source: Reference 2.3-34

Figure 2.3-46 Total Water Withdrawals by Sector in Michigan (MGD) 2004



Source: Reference 2.3-35

Figure 2.3-47 Permitted Outfalls Located at the Fermi Site

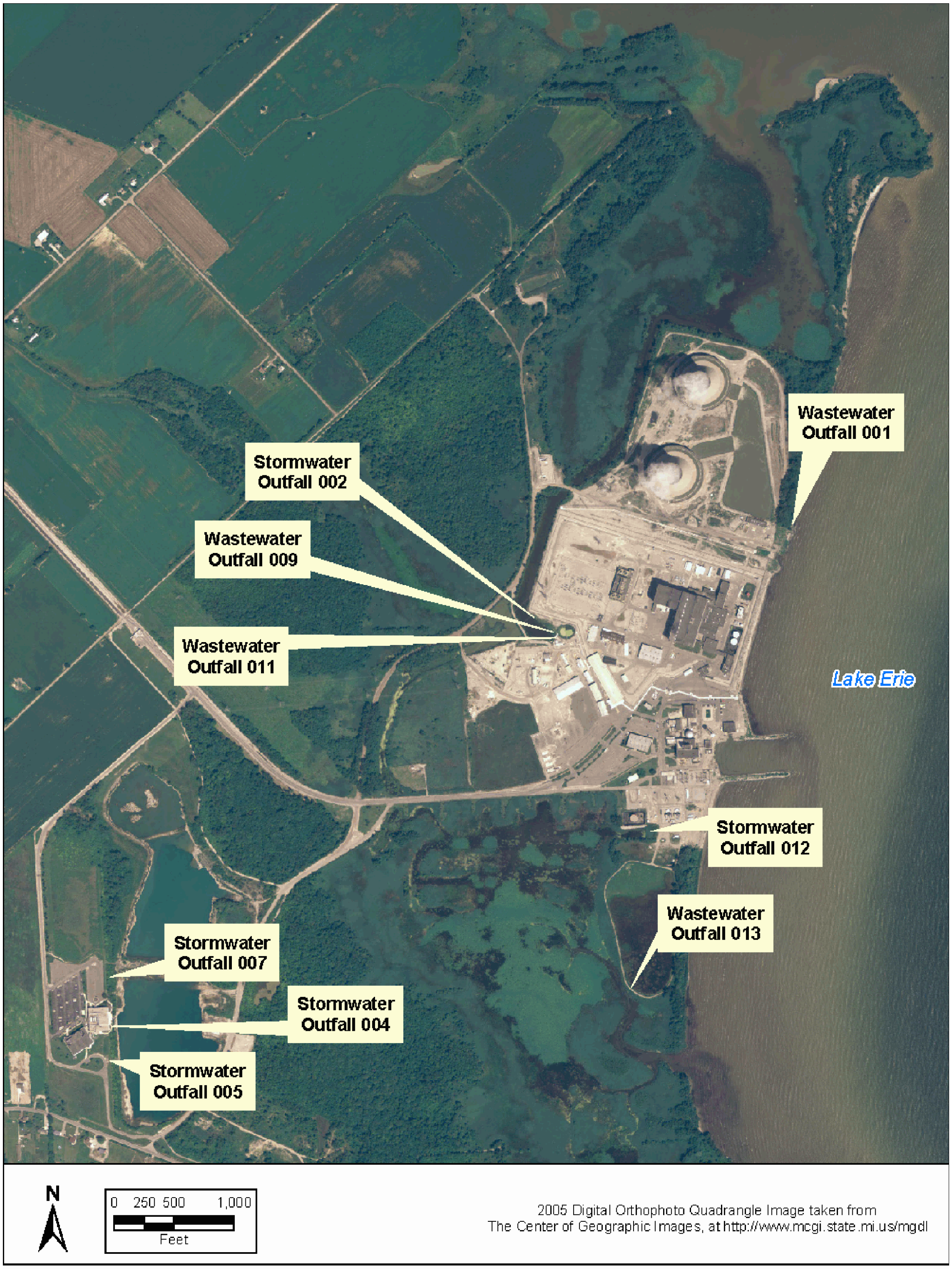


Figure 2.3-48 Surface-Water Resources in the Vicinity of the Fermi Site

Figure 2.3-49 GLENDA Sampling Station

Approximate Scale: 1” = 3.5 miles

Figure 2.3-50 Mercury Concentrations at Fermi's General Service Water Intake

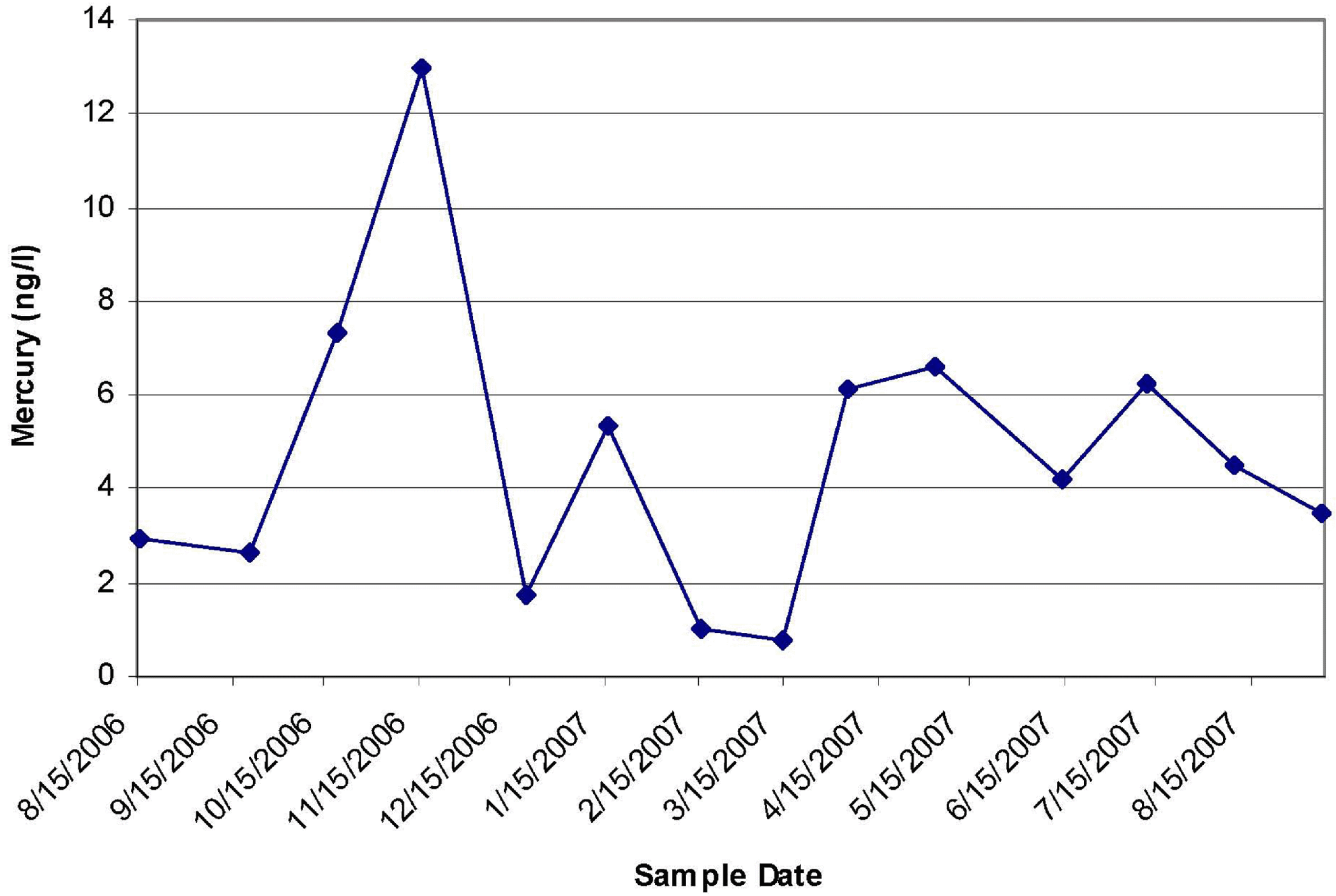
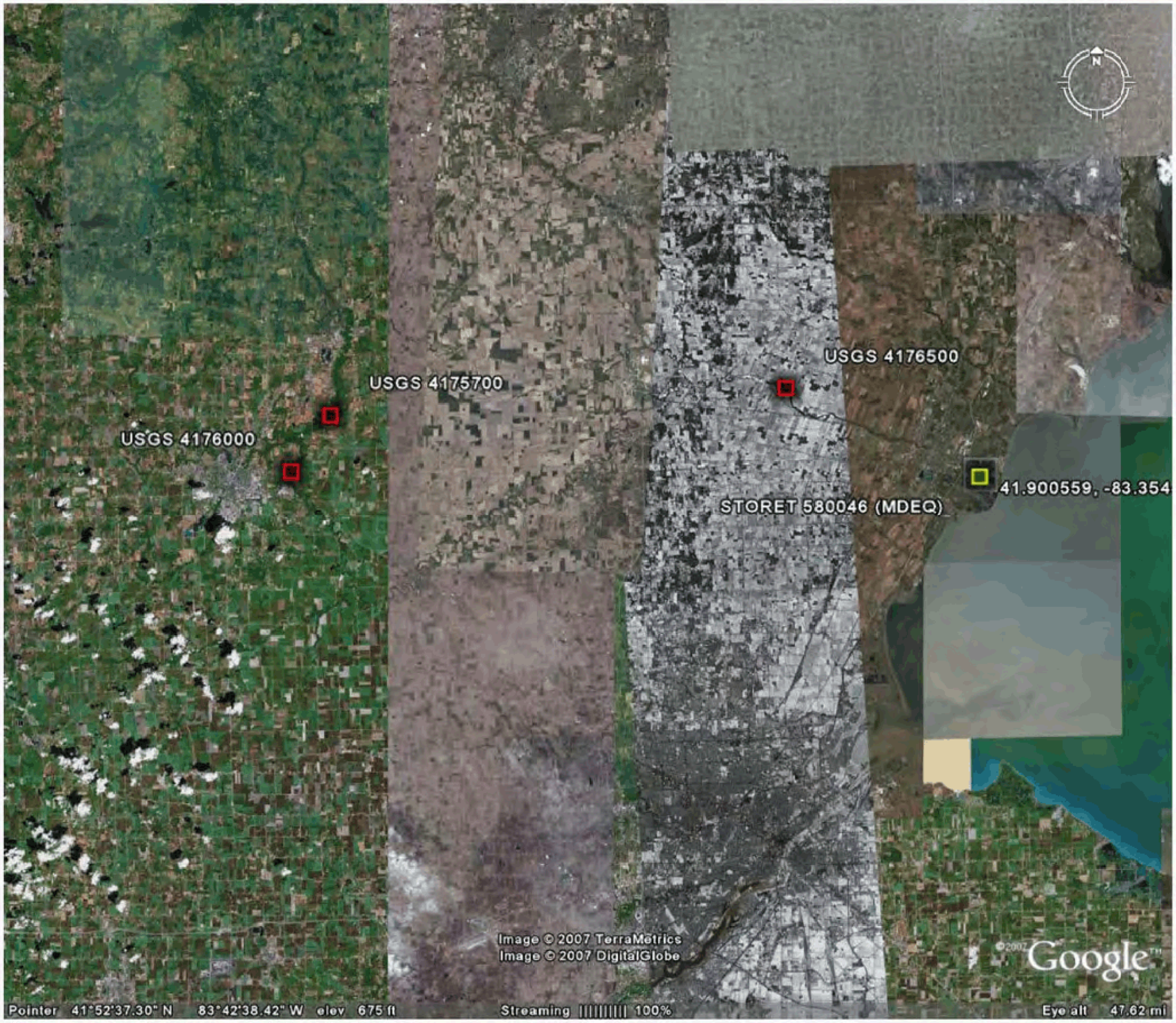


Figure 2.3-51 Swan Creek and Stony Creek USGS Sampling Stations

Approximate scale: 1" = 3.5 miles

Figure 2.3-52 River Raisin USGS and EPA STORET (MDEQ) Sampling Stations

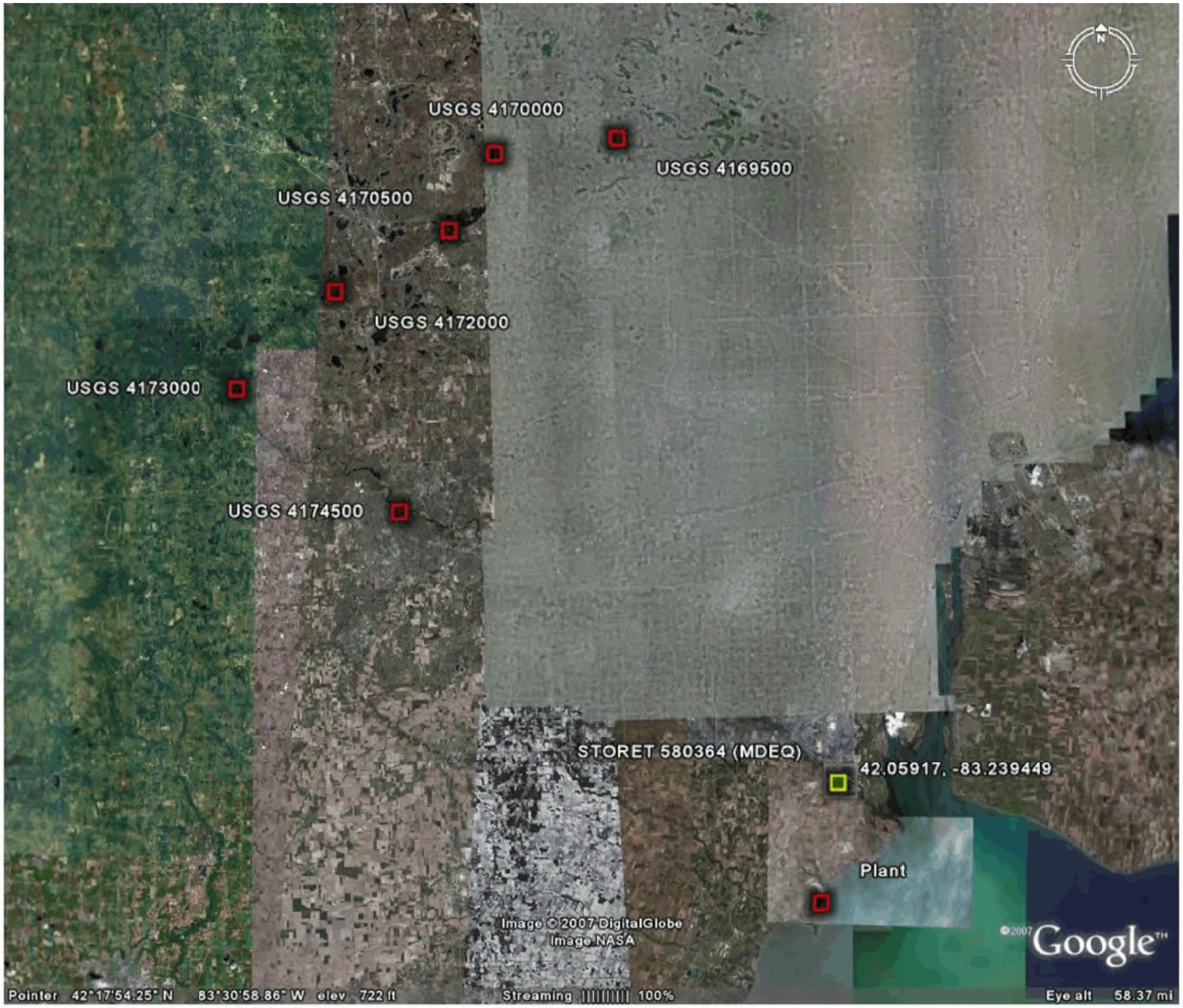


Approximate scale: 1” = 8.5 miles

Figure 2.3-53 Rouge River USGS Sampling Stations

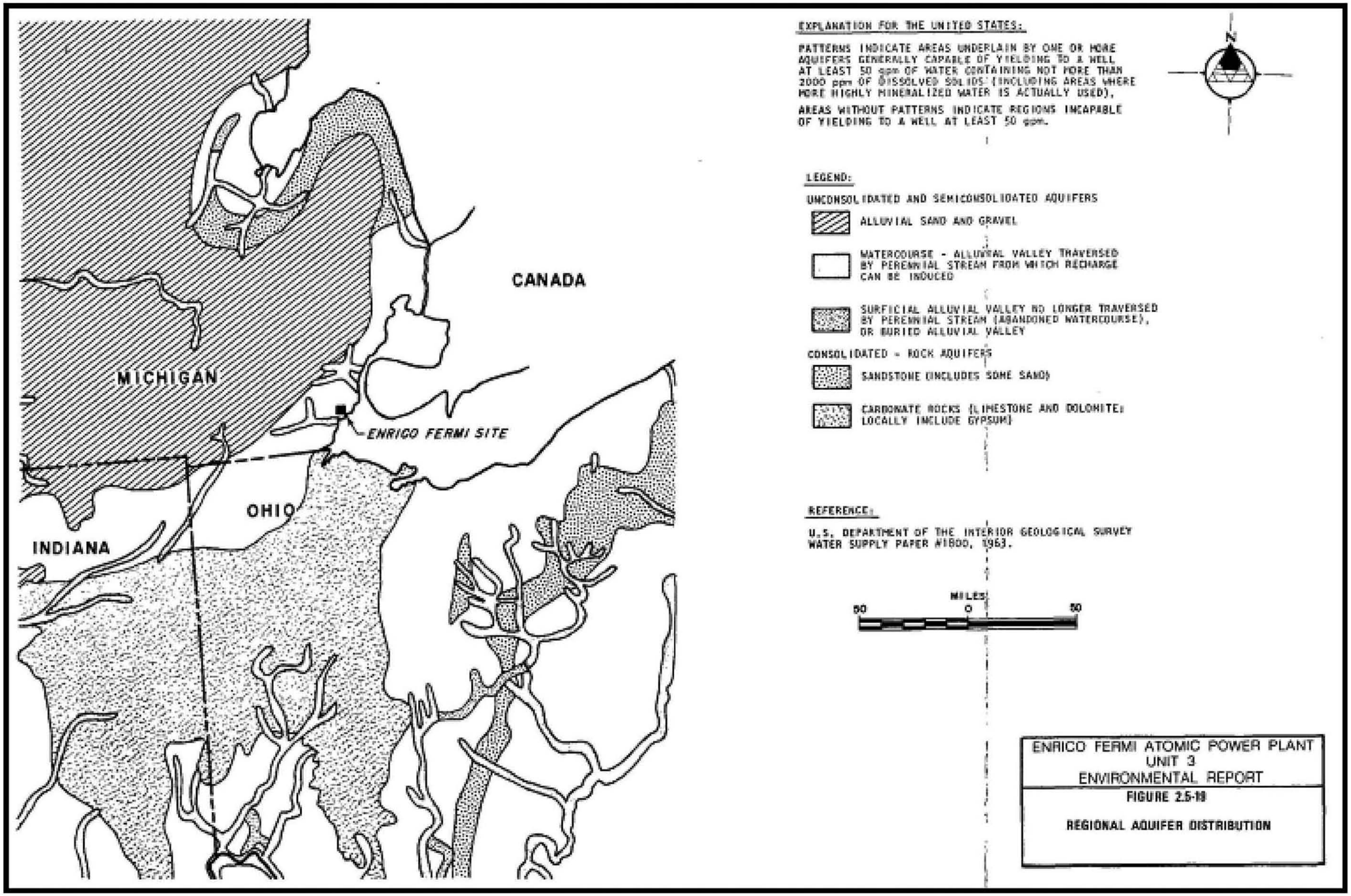
Approximate scale: 1" = 11 miles

Figure 2.3-54 Huron River USGS and EPA STORET (MDEQ) Sampling Stations



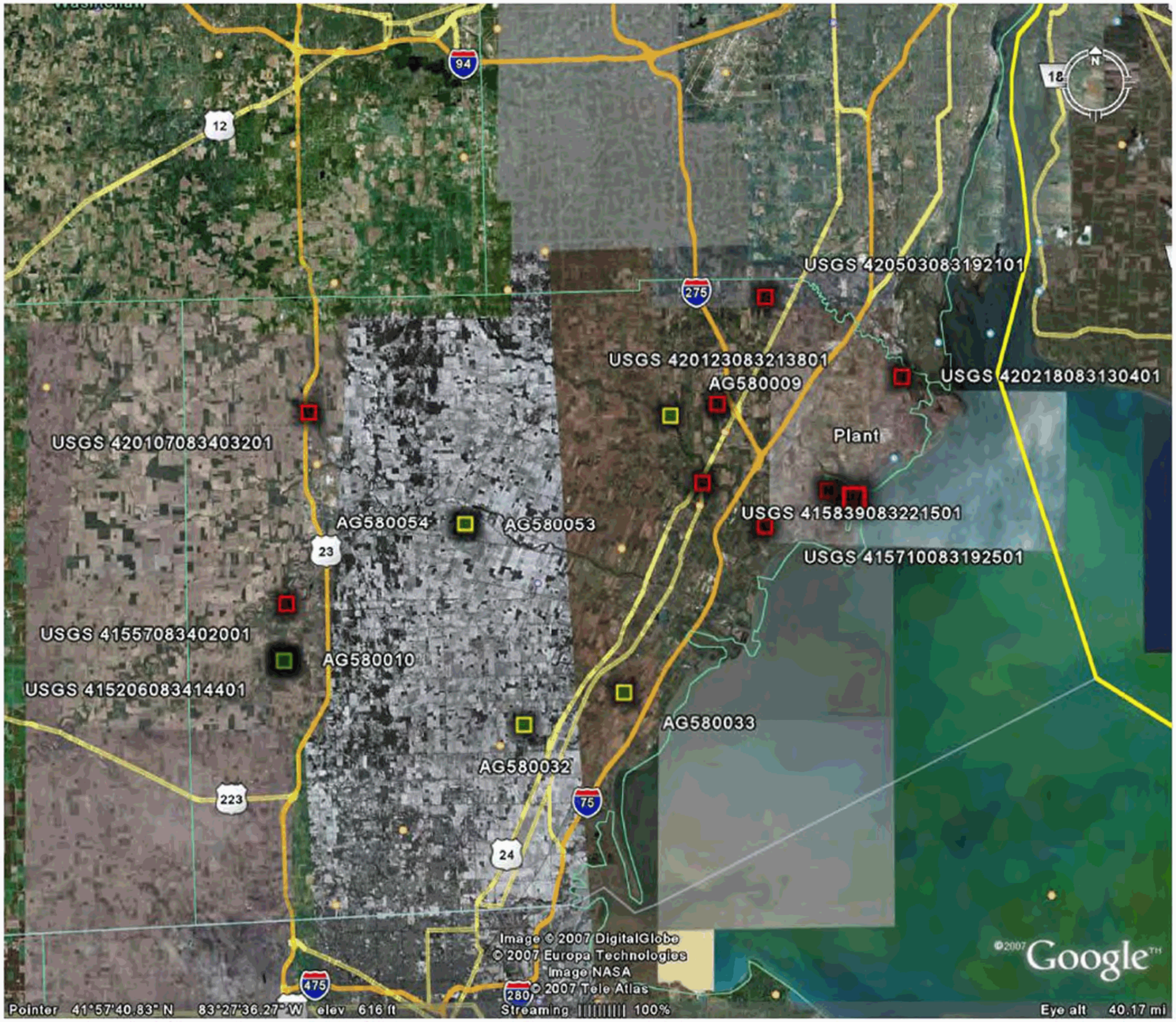
Approximate scale: 1" = 11 miles

Figure 2.3-55 Regional Aquifer Distribution



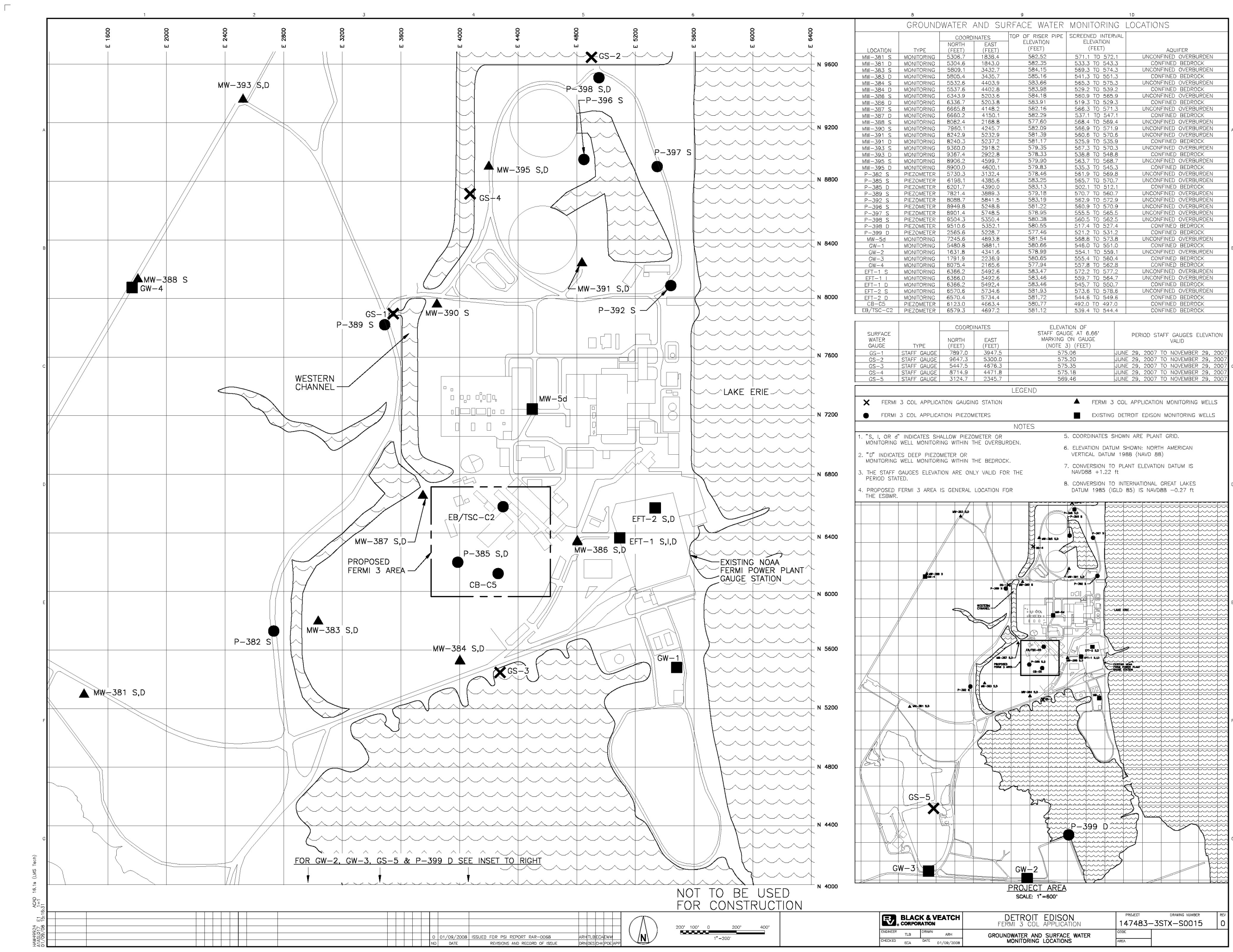
Source: Reference 2.3-49

Figure 2.3-56 USGS and Michigan Department of Agriculture Groundwater Sample Locations



Approximate scale 1" = 8.5 miles

Figure 2.3-57 Groundwater Well Sampling Locations (Surface-Water Samples Collected at GS-1 and Area of Plant Gauging Station)



GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

LOCATION	TYPE	COORDINATES NORTH (FEET)	COORDINATES EAST (FEET)	TOP OF RISER PIPE ELEVATION (FEET)	SCREENED INTERVAL ELEVATION (FEET)	AQUIFER
MW-381 S	MONITORING	5306.7	1838.4	582.52	571.1 TO 572.1	UNCONFINED OVERBURDEN
MW-381 D	MONITORING	5304.6	1843.0	582.35	533.3 TO 543.3	CONFINED BEDROCK
MW-383 S	MONITORING	5809.1	3432.7	584.15	569.3 TO 574.3	UNCONFINED OVERBURDEN
MW-383 D	MONITORING	5805.4	3435.7	585.16	541.3 TO 551.3	CONFINED BEDROCK
MW-384 S	MONITORING	5532.6	4403.9	583.66	565.3 TO 575.3	UNCONFINED OVERBURDEN
MW-384 D	MONITORING	5537.6	4402.8	583.98	529.2 TO 539.2	CONFINED BEDROCK
MW-386 S	MONITORING	6343.9	5203.6	584.18	560.9 TO 565.9	UNCONFINED OVERBURDEN
MW-386 D	MONITORING	6336.7	5203.8	583.91	519.3 TO 529.3	CONFINED BEDROCK
MW-387 S	MONITORING	6665.8	4148.2	582.16	566.3 TO 571.3	UNCONFINED OVERBURDEN
MW-387 D	MONITORING	6660.2	4150.1	582.29	537.1 TO 547.1	CONFINED BEDROCK
MW-388 S	MONITORING	8082.4	2168.8	577.60	568.4 TO 569.4	UNCONFINED OVERBURDEN
MW-390 S	MONITORING	7960.1	4245.7	582.09	566.9 TO 571.9	UNCONFINED OVERBURDEN
MW-391 S	MONITORING	8242.9	5232.9	581.39	560.6 TO 570.6	UNCONFINED OVERBURDEN
MW-391 D	MONITORING	8240.3	5237.2	581.17	525.9 TO 535.9	CONFINED BEDROCK
MW-393 S	MONITORING	9360.0	2918.2	579.35	567.3 TO 570.3	UNCONFINED OVERBURDEN
MW-393 D	MONITORING	9367.4	2922.8	578.33	538.8 TO 548.8	CONFINED BEDROCK
MW-395 S	MONITORING	8906.2	4599.7	579.90	563.7 TO 568.7	UNCONFINED OVERBURDEN
MW-395 D	MONITORING	8900.0	4600.1	579.83	535.3 TO 545.3	CONFINED BEDROCK
P-382 S	PIEZOMETER	5730.3	3132.4	578.46	561.9 TO 569.8	UNCONFINED OVERBURDEN
P-385 S	PIEZOMETER	6198.1	4385.6	583.25	565.7 TO 570.7	UNCONFINED OVERBURDEN
P-385 D	PIEZOMETER	6201.7	4390.0	583.13	502.1 TO 512.1	CONFINED BEDROCK
P-389 S	PIEZOMETER	7821.4	3889.3	579.18	570.7 TO 560.7	UNCONFINED OVERBURDEN
P-392 S	PIEZOMETER	8088.7	5841.5	583.19	562.9 TO 572.9	UNCONFINED OVERBURDEN
P-396 S	PIEZOMETER	8949.8	5248.8	581.22	560.9 TO 570.9	UNCONFINED OVERBURDEN
P-397 S	PIEZOMETER	8901.4	5748.5	578.95	555.5 TO 565.5	UNCONFINED OVERBURDEN
P-398 S	PIEZOMETER	9504.3	5350.4	580.38	560.5 TO 562.5	UNCONFINED OVERBURDEN
P-398 D	PIEZOMETER	9510.6	5352.1	580.55	517.4 TO 527.4	CONFINED BEDROCK
P-399 D	PIEZOMETER	2565.6	5228.7	577.46	521.2 TO 531.2	CONFINED BEDROCK
MW-5d	MONITORING	7245.6	4893.8	581.54	568.8 TO 573.8	UNCONFINED OVERBURDEN
GW-1	MONITORING	5480.8	5881.1	580.66	546.0 TO 551.0	CONFINED BEDROCK
GW-2	MONITORING	1631.8	4341.6	578.99	554.1 TO 559.1	UNCONFINED OVERBURDEN
GW-3	MONITORING	1791.9	2236.9	580.65	555.4 TO 560.4	CONFINED BEDROCK
GW-4	MONITORING	8075.4	2165.6	577.94	557.8 TO 562.8	CONFINED BEDROCK
EFT-1 S	MONITORING	6366.2	5492.6	583.47	572.2 TO 577.2	UNCONFINED OVERBURDEN
EFT-1 I	MONITORING	6366.0	5492.6	583.46	559.7 TO 564.7	UNCONFINED OVERBURDEN
EFT-1 D	MONITORING	6366.2	5492.4	583.46	545.7 TO 550.7	CONFINED BEDROCK
EFT-2 S	MONITORING	6570.6	5734.6	581.93	573.6 TO 578.6	UNCONFINED OVERBURDEN
EFT-2 D	MONITORING	6570.4	5734.4	581.72	544.6 TO 549.6	CONFINED BEDROCK
CB-C5	PIEZOMETER	6123.0	4663.4	580.77	492.0 TO 497.0	CONFINED BEDROCK
EB/TSC-C2	PIEZOMETER	6579.3	4697.2	581.12	539.4 TO 544.4	CONFINED BEDROCK

SURFACE WATER GAUGE	TYPE	COORDINATES NORTH (FEET)	COORDINATES EAST (FEET)	ELEVATION OF STAFF GAUGE AT 6.66' MARKING ON GAUGE (NOTE 3) (FEET)	PERIOD STAFF GAUGES ELEVATION VALID
GS-1	STAFF GAUGE	7897.0	3947.5	575.06	JUNE 29, 2007 TO NOVEMBER 29, 2007
GS-2	STAFF GAUGE	9647.3	5300.0	575.20	JUNE 29, 2007 TO NOVEMBER 29, 2007
GS-3	STAFF GAUGE	5447.5	4676.3	575.35	JUNE 29, 2007 TO NOVEMBER 29, 2007
GS-4	STAFF GAUGE	8714.9	4471.8	575.18	JUNE 29, 2007 TO NOVEMBER 29, 2007
GS-5	STAFF GAUGE	3124.7	2345.7	569.46	JUNE 29, 2007 TO NOVEMBER 29, 2007