NRC000006F

DTE Energy®

Detroit Edison

United States Nuclear Regulatory Commission Official Hearing Exhibit	
In the Matter of:	DTE ELECTRIC CO. (Fermi Nuclear Power Plant, Unit 3)
	Commission Mandatory Hearing
Docket #:	05200033
Exhibit #:	NRC000006F-MA-CM01
Identified:	2/4/2015
Admitted:	2/4/2015
Withdrawn:	
Rejected:	
Stricken:	
Other:	

Fermi 3 Combined License Application

Part 3: Environmental Report

Revision 2

February 2011

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Tables

Figures

Figures

Figures

Figures

Figures

Figures

Figures

Figures

Figures

Figures

Figures

Figures

Acronyms

ACES	Automated Coastal Engineering System
ADG	Ancillary Diesel Generators
AHS	auxiliary heat sink
ALARA	as low as reasonably achievable
ANFO	ammonium nitrate fuel oil
ANS	American Nuclear Society
ANSS	Advanced National Seismic System
AOC	Area of Concern
APE	area of potential effect
AQCR	Air Quality Control Region
ARD	Automatic Ringdown Circuits
ASCE	American Society of Civil Engineers
ASHRAE	American Society Heating, Refrigerating, and Air-Conditioning
ASME	American Society of Mechanical Engineers
AST	Above ground Storage Tank
ASTM	American Society for Testing and Materials
BCA	Benefit-cost Analysis
BCD	Binary-coded Decimal
BMP	Best Management Practice
BOC	Break Outside Containment
bpf	blows per foot
BR	Breathing Rates
BTP	Branch Technical Position
BUI	Beneficial Use Impairment
BWR	Boiling Water Reactor
BYP	Bypass
CAFO	Confined Animal Feeding Operations
CB	Control Building

Acronyms

CBG	Census Block Group
CCID	Core-Concrete Interaction Dry
CCIW	Core-Concrete Interaction Wet
CCP	Coal Combustion Products
CDC	Center for Disease Control
CEDE	Committed Effective Dose Equivalent
CEM	U.S. Army Corps of Engineers Coastal Engineering Manual
CEQ	Council of Environmental Quality
CEUS	Central and Eastern United States
CEW	Coastal Emergent Wetland
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIR	catch-and-immed iate-release
CIRC	Circulating Water System
CMBBZ	Central Metasedimentary Belt Boundary Zone
CNO	Chief Nuclear Officer
CO_2	Carbon Dioxide
COCORP	Consortium for Continental Reflection Profiling
COL	Combined License
COLA	COL Application
COOP	NWS Cooperative Observation Program
CPE	Catch Per Effort
CPT	Cone Penetrometer Tests
CRHAVS	Control Room Habitability Area HVAC Subsystem
CORMIX	Cornell Mixing Zone Expert System
CS&TS	Condensate Storage and Transfer System
CSDRS	Certified Seismic Design Response Spectra
CST	Condensate Storage Tank

Acronyms

CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DA	Developed Area
dBA	decibel (A-weighted)
DBA	Design Basis Accident
DBT	Design-Basis Tornado
DC	Design Certification
DCD	Design Control Document
DCH	Direct Containment Heating
DDE	Deep Dose Equivalent
DE	Deaggregation Earthquakes
DEM	Digital Elevation Model
DFO	Canada Department of Fisheries and Oceans
DOD	Department of Defense
DOE	Department of Energy
D-RAP	Design Reliability Assurance Program
DRIWR	Detroit River International Wildlife Refuge
DTM	Digital Terrain Model
EAB	Exclusion Area Boundary
ECCS	Emergency Core Cooling Systems
EDA	Endangered Species Act
EDTA	Ethylenediaminetetraacetic acid
EDE	Effective Dose Equivalent
EFH	Essential Fish Habitat
EFU	Emergency Filter Unit
EIA	Energy Information Administration
EIS	Environmental Impact Statement
ELF-EMF	Extremely Low Frequency Electric and Magnetic Fields

Acronyms

EMF	Electromagnetic Fields
EMS	Environmental Management System
ENC	Electronic Navigational Charts
ENS	Emergency Notification System
EOF	Emergency Operations Facility
EOP	Emergency Operating Procedures
EPA	Environmental Protection Agency
EPC	Engineer, Procure, and Construct
EPRI	Electric Power Research Institute
EPZ	Emergency Planning Zone
EQD	Equipment Qualification Document
ER	Environmental Report
ERDS	Emergency Response Data System
ESF	Engineered Safety Features
ESP	Early Site Permit
ESRP	Environmental Standard Review Plan
ETE	Evacuation Time Estimate”
EVE	Ex-Vessel Steam Explosion
ETR	energy transfer ratio
FAA	Federal Aviation Administration
FBC	Fluidized Bed Combustion
FCS	Forest: Coastal Shoreline
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FES	Final Environmental Statements
FFD	Fitness for Duty
FGD	Flue Gas Desulphurization
FICN	Federal Interagency Committee on Noise

Acronyms

FIRS	foundation input response spectra
FLH	Forest: Lowland Hardwood
fps	feet per second
FPS	Fire Protection System
FS	Factor of Safety
FWL	Forest: Woodlot
FWSC	Fire Water Service Complex
FWPCA	Federal Water Pollution Control Act
GE	General Electric
GEC	Greenwood Energy Center
GEH	GE-Hitachi Nuclear Energy Americas, LLC
GEIS	Generic Environmental Impact Statement
GFTZ	Grenville Front tectonic zone
GIA	Glacial Isostatic Adjustment
g/kWh	grams per kilowatt-hour
GLCFS	Great Lakes Coastal Forecasting System
GLENDA	Great Lakes Environmental Database
GLERL	NOAA Great Lakes Environmental Research Laboratory
GLIN	Great Lakes Information Network
GMRS	Ground Motion Response Spectra
gpd	gallons per day
gpm	gallons per minute
GOF	Grassland: Idle/Old Field/Planted
GPS	Global Positioning System
GRC	Grassland: Row Crop
GRW	Grassland: Right-of-Way
GTG	Generic Technical Guidelines
GW	gigawatts

Acronyms

GWG	Generic Writer's Guide
GWMS	Gaseous Waste Management System
HCLPFs	High Confidence Low Probability of Failure
HEPA	High Efficiency Particulate Air
HFE	Human Factors Engineering
HP	High-Pressure
HSI	Human System Interface
HVAC	Heating, Ventilation, and Air Conditioning
HWCS	Hydrogen Water Chemistry System
I&C	Instrumentation and Control
IAEA	International Atomic Energy Agency
IC/PCC	Isolation Condenser/Passive Containment Cooling
IGCC	Integrated Gas-Fired Combined Cycle
ICRP	International Commission on Radiation Protection
INEEL	Idaho National Engineering and Environmental Laboratory
IPCS	Integrated Plant Computer System
ISFSI	Independent Spent Fuel Storage Installation
ISO	Independent Service Operator
IE	NRC Inspection and Enforcement
IEEE	Institute of Electrical and Electronics Engineers
IGLD	International Great Lakes Datum
IPCS	Integrated Plant Computer System
IRB	Independent Review Body
ISI	In service Inspection
IST	In service Testing
JD	Jurisdictional Determination
JPM	Job Performance Measures
ksf	kips per square foot

Acronyms

ksi	kips per square inch
kV	kilovolt
kV/m	kilovolt per meter
LaMP	Lake Management Plan
lb	pound
LCD	Local Climatological Data
LCO	Limiting Conditions for Operation
LEOFS	Lake Erie Observational Forecast System
LES	Louisiana Energy Services
LFL	Lower Flammability Limit
LGF	Landfill Gas-Fired
LLD	Lower Limit of Detection
LLMW	Low Level Mixed Waste
LLRW	Low-level Radioactive Waste
LOCA	Loss of Coolant Accident
LP	Low-Pressure
LPGS	Liquid Pathway Generic Study
LPR	Lakes, Ponds, Rivers
LPZ	Low Population Zone
LWA	Limited Work Authorization
LWMS	Liquid Waste Management System
LWR	Light Water Reactor
MAP	Michigan Association of Planning
MBTA	Migratory Bird Treaty Act
MCAC	Michigan Climate Action Control
MCR	Main Control Room
MDA	Michigan Department of Agriculture
MDCT	mechanical draft cooling tower
MDEQ	Michigan Department of Environmental Quality

Acronyms

MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
MEI	maximally exposed individual
MGD	Million Gallons per Day
Midwest ISO	Midwest Independent System Operator
MISO	
MNFI	Michigan Natural Features Inventory
mph	miles per hour
MR	Maintenance Rule
MRCC	Midwestern Regional Climate Center
mrem	millirem
MSDS	Material Safety Data Sheet
MSIV	Main Steam Isolation Valve
msl	mean sea level
MSLB	Main Steam Line Break
MSLBA	Main Steam Line Break Accident
MTU	metric tons of uranium
MW	megawatt
MWd/MTU	megawatt-day per metric ton of uranium
MWe	megawatts electric
MWt	megawatts thermal
MWS	Makeup Water System
NACE	National Association of Corrosion Engineers
NAAQS	National Ambient Air Quality Standards
NASS	National Agricultural Statistics Service
NAVD	North American Vertical Datum
NCDC	National Climatic Data Center
NCEER	National Center for Earthquake Engineering Research

Acronyms

NCI	National Cancer Institute
NDCT	Natural Draft Cooling Tower
NDE	Nondestructive Examination
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NGDC	National Geophysical Data Center
NI&C	Nuclear Instrumentation and Control
NMSZ	New Madrid seismic zone
NML	Noise Monitoring Locations
NOAA	National Oceanic and Atmospheric Administration
NOx	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPHS	normal plant heat sink
NRC	U. S. Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTSB	National Transportation Safety Board
NWIS	National Water Information System
NWS	National Weather Service
O&M	operation and maintenance
OATC	Operator-At-The Controls
OBE	Operating Basis Earthquake
OCA	Owner Controlled Area
ODCM	Offsite Dose Calculation Manual
OGS	Offgas System
OHLHS	Overhead Heavy Load Handling Systems

Acronyms

OJT	On-The-Job Training
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs
OPVB	Overpressure-Vacuum Breaker
OPW1	Overpressure-Early Containment Heat Removal Loss
OPW2	Overpressure-Late Containment Heat Removal Loss
OSA	Office of the State Archaeologist
OSC	Operational Support Center
OSHA	Occupational Safety and Health Act
OSRO	Onsite Safety Review Organization
PAF	Protected rea fence
PCB	polychlorinated biphenyls
pcf	pounds per cubic foot
PCP	Process Control Program
PCTMS	Plant Cooling Tower Makeup System
PEER	Pacific Earthquake Engineering Research
PEM	Palustrine Emergent Marsh
PESP	Pesticide Environmental Stewardship Program
PFO	Forested Wetland
PGP	Procedures Generation Package
PIP	Plant Investment Protection
PIPP	Pollution Incident Prevention Plan
PMF	Probable Maximum Flood
PMP	probable maximum precipitation
PMWP	probable maximum winter precipitation
ppm	parts per million
PS	Public Service
PSCAR	Post-shutdown Decommissioning Activities Report
PSHA	probabilistic seismic hazard analysis

Acronyms

PSS	Scrub-shrub wetland
PSWS	Plant Service Water System
PWR	Pressurized Water Reactor
PWS	Potable Water System
PWSS	Pretreated Water Supply System
QA	Quality Assurance
QAPD	Quality Assurance Program Description
QC	Quality Control
RAP	Remedial Action Plan
RASA	USGS Regional Aquifer-System Analysis
RAT	Reserve Auxiliary Transformers
RB	Reactor Building
RB/FB	Reactor Building/Fuel Building
RCC	Resource Conservation Challenge
RCCWS	Reactor Component Cooling Water System
RCRA	Resource Conservation and Recovery Act
RCS	Reactor Coolant System
RCTS	Resonant Column Torsional Shear
rem	Roentgen Equivalent Man
REMP	Radiological Environmental Monitoring Program
RERP	Radiological Emergency Response Preparedness
RG	Regulatory Guide
RIMS II	Regional Input-Output Modeling System
RO	Reactor Operator
RO	Reverse Osmosis
ROI	Region of Interest
ROW	Right-of-Way
RP	Radiation Protection

Acronyms

RPT	Radiation Protection Technician
RQD	Rock Quality Designation
RRAC	Rouge River Advisory Council
RTNSS	Regulatory Treatment of Non-Safety Systems
RWCU	Reactor Water Cleanup
SAMAs	Severe Accident Mitigation Alternatives
SARA	Superfund Amendments and Reauthorization Act
SASW	spectra analysis of surface waves
scfm	standard cubic feet per minute
scfw	standard cubic feet per week
SDG	standby diesel generators
SDWIS	Safe Drinking Water Information System
SEI	Structural Engineering Institute
SEMCOG	Southeast Michigan Council of Governments
SESC	Soil Erosion and Sedimentation Control
SHB	Shrubland
SHEEF	Seismic Hazard Earthquake Epicenter File
SHPO	State Historic Preservation Officer
SOG	Seismic Owners Group
Sox	Oxides of Sulphur
SPCC	Spill Prevention Control and Countermeasures
SPT	standard penetration test
SRP	Standard Review Plan
SS	site-specific
SSA	Sole Source Aquifer
SSCs	structures, systems, and components
SSE	Safe Shutdown Earthquake
STA	Shift Technical Advisor

Acronyms

STORET	STOrage and RETrieval database
SUNSI	sensitive unclassified non-safeguards information
SWDS	Sanitary Waste Discharge System
SWMS	Solid Waste Management System
SWS	Station Water System
SWST	station water storage tank
T&E	threatened and endangered
TB	Turbine Building
TB	Turbine Bypass
TBS	Turbine Bypass System
TCCWS	Turbine Component Cooling Water System
TCDD	2,3,7,8-Tetrachlorodibenzo-p-Dioxin
TDS	Total Dissolved Solids
TEDE	Total Effective Dose Equivalent
TKT	Thicket
TLD	thermoluminescent dosimeter
TMACOG	Toledo Metropolitan Area Council of Governments
TMDL	Total Maximum Daily Load
TRC	Total Residual Chlorine
TSC	Technical Support Center
TSL	Technical Specification Leakage
TSS	Total Suspended Solids
UAT	Unit Auxiliary Transformer
UFC	Uranium fuel Cycle
UFL	Upper Flammability Limit
UFSAR	Updated Final Safety Analysis Report
UHRS	Uniform Hazard Response Spectra
UHS	Ultimate Heat Sink

Acronyms

USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
V&V	verification and validation
Vp	compression wave velocity
Vs	shear wave velocity
VOC	volatile organic compound
WHC	Wildlife Habitat Council
WQC	Water Quality Certification
WQS	Water Quality Standards
WVSZ	Wabash Valley seismic zone
WWTP	Wastewater Treatment Plant

Chapter 1 Introduction

Environmental Reports (ERs) are documents submitted to the Nuclear Regulatory Commission (NRC) by a license applicant to aid the NRC in complying with Section 102(2) of the National Environmental Policy Act (NEPA). This ER is submitted as Part 3 of the Application for a Combined License (COLA) for a new nuclear power plant at the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site in Monroe County, Michigan in compliance with the requirements contained within 10 CFR 52, Subpart C, for Combined Licenses.

This report was prepared in accordance with the guidance provided in NUREG-1555, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants" and Regulatory Guide 4.2, Revision 2, "Preparation of Environmental Reports for Nuclear Power Stations." The organization and format of this report follows the general format guidelines specified by NUREG-1555, as follows:

- Chapter 1: Introduction
- Chapter 2: Environmental Description
- Chapter 3: Plant Description
- Chapter 4: Environmental Impacts of Construction
- Chapter 5: Environmental Impacts of Station Operations
- Chapter 6: Environmental Measurement and Monitoring Programs
- Chapter 7: Environmental Impacts of Postulated Accidents Involving Radioactive Materials
- Chapter 8: Need for Power
- Chapter 9: Alternatives to the Proposed Action
- Chapter 10: Environmental Consequences of the Proposed Action

Chapter 1 provides a brief introductory description of the proposed project and the site location and identification of the applicant (Section 1.1). This Chapter also identifies and assesses environmentally related authorizations required by Federal, State, regional, local, and affected Native American tribal agencies as a prerequisite to plant licensing and construction (Section 1.2).

1.1 The Proposed Project

Detroit Edison (the Applicant) proposes to construct and operate a new nuclear power plant at the Fermi site. The proposed unit is to be designated as Fermi 3. Federal action resulting in the issuance of a Combined License (COL) by the Nuclear Regulatory Commission under 10 CFR 52, Subpart C, "Combined Licenses for Nuclear Power Plants" is anticipated.

Purpose

The purpose of the project is fourfold:

1. Generate at least 1535 ± 50 megawatts (MW) of electricity for sale that will reliably aid in satisfying the forecasted energy and capacity needs of Detroit Edison customers located in the Detroit Edison Service Territory;
2. Provide new baseload electric generation capacity as early as 2021 to compensate for the expected retirement of existing, aging baseload generating units and diminishing availability of the Midwest Independent Service Operator regions baseload generation capacity;
3. Provide price stability by minimizing reliance on imported power into the Detroit Edison service territory; and
4. Utilize an electric generation technology that is less subject to price fluctuations resulting from either fuel or regulatory drivers, provides fuel diversity, and reduces reliance on fossil fuel and their attendant environmental impacts.

The above purpose is in-line with Detroit Edison's mission to provide reliable and affordable electrical power.

Need

Construction of a new electric generating facility is needed to provide reliable, affordable power to address Michigan's expected future peak electric demand.

Chapter 8 of the Environmental Report provides detailed discussion outlining the need for power and the related benefits to be generated by the proposed facility. The need for power was assessed by balancing the current and forecasted demand against the current and forecasted supply, while demonstrating that an adequate reserve margin is maintained. Reference Chapter 8 and Chapter 9 for a complete description of:

- Section 8.1 – Description of the power system, an overview of the pertinent service area, and a discussion of regional relationships;
- Section 8.2 – Description of the analysis performed to determine current and forecasted energy needs in the State of Michigan;
- Section 8.3 – Description of the analysis performed to determine energy supply resources;
- Section 8.4 – Description of the assessment of the need for power; and
- Section 9.1 – Description of the no-action alternative.

The need for power assessment is derived from the Michigan 21st Century Electric Energy Plan (Plan). The Plan was prepared and issued by the Michigan Public Service Commission pursuant to Executive Directive No. 2006-02. The Plan reached several significant conclusions including:

- Michigan's peak electric demand is forecasted to grow at approximately 1.2 percent per year for the next 20 years;
- There is a need for additional electric generating resources in order to preserve electric reliability and provide affordable energy over the next 20 years. This modeling outcome is confirmed even in the presence of increased use of energy efficiency and renewable resources;
- The projected electric demand will not be satisfied through the expansion of transmission nor access to external markets; and
- There is need for regulated baseload capacity to prevent natural gas prices from driving up wholesale costs and market prices for an increasing number of hours each year.

The above conclusions were based upon key factors such as the current age of baseload units and newer electric generating units' reliance on natural gas. As indicated above, the Plan concluded that the State of Michigan has a current need for new baseload capacity and the need is projected to increase. Michigan's current baseload generating units are an average of more than 48 years old. The average age of Detroit Edison's coal-fired generation units is 44 years old. The last new baseload plant in the State of Michigan began commercial operation more than 18 years ago. The assessment assumes that older, less efficient units, totaling 3755 MW of capacity, will be retired by 2025.

Further, new baseload electric production is needed due to the fact that recently constructed electric generation units in Michigan have been limited to natural gas-fired facilities. Natural gas-fired units currently represent approximately 29 percent of Michigan's generating capacity. Dependence upon natural gas-fired units has exposed Michigan to volatile electricity prices driven by fluctuating fuel market prices.

1.1.1 **Ownership and Applicant**

The Applicant applying for a COL for the proposed nuclear power plant at the Fermi site is the Detroit Edison Company, a wholly owned subsidiary of DTE Energy, and is the owner of the proposed project. Detroit Edison is the licensed operator of the existing Fermi 2 nuclear power plant and will be responsible for construction and operation of the proposed project. Detroit Edison is the proposed licensee.

1.1.2 **Site Location**

The proposed location of the new nuclear power plant is the existing Fermi site. The Fermi site, the area within the Fermi property boundary, consists of approximately 1260 acres in eastern Monroe County, Michigan. The Fermi site is situated along the western shoreline of Lake Erie. It is approximately 24 miles northeast of Toledo, Ohio, 30 miles southwest of Detroit, Michigan, and 7 miles from the United States/Canada international border. Figure 2.1-3 and Figure 2.1-4 provide illustrations of the Fermi site. Figure 2.1-3 illustrates the property boundary that encompasses the approximately 1260 acres comprising the Fermi site. Figure 2.1-4 illustrates the Fermi 3 site plan.

1.1.3 Reactor Information

The Applicant proposes to construct and operate an ESBWR designed by GE-Hitachi Nuclear Energy Americas, LLC (GEH) at the Fermi site in Monroe County, Michigan. According to the ESBWR Design Control Document (DCD), the reactor has a rated core thermal power of 4500 megawatts thermal (MWt) and a gross electrical output of approximately 1605 ± 50 megawatts electric (MWe). The reactor's standard net estimated electrical power output is approximately 1535 MWe (Reference 1.1-1). The NRC accepted the ESBWR Design Certification Application for review in a letter dated December 1, 2005 and expects review of the Application to continue through 2010 (Reference 1.1-2).

1.1.4 Cooling System Information

As discussed in Chapter 3, the GEH ESBWR reactor design proposes to dissipate waste heat from the Main Condenser and transfers this heat to the Normal Power Heat Sink (NPHS). The Fermi 3 NPHS consists of a hyperbolic natural draft cooling tower. The Auxiliary Heat Sink consists of mechanical draft cooling towers.

The Fermi Station Water System (SWS) provides the necessary makeup water for the cooling systems utilized by Fermi 3 from Lake Erie. The SWS withdraws water via an intake bay formed by two rock groins extending into Lake Erie.

Cooling tower blowdown water is discharged to Lake Erie through a new wastewater discharge outfall located in Lake Erie.

1.1.5 Transmission System Information

Onsite

A new transmission corridor has been identified on the Fermi site. This new transmission corridor will be approximately 170 feet wide and will include two sets of towers carrying both rerouted 345 kV lines serving Fermi 2 and the new 345 kV lines serving Fermi 3. The new transmission lines are needed to transmit power from the Fermi 3 generator to the Fermi 3 switchyard at the intersection of Toll Road and Fermi Drive. Onsite 120 kV support for Fermi 2 will be routed underground along the disturbed Fermi Drive corridor.

The two 345 kV transmission lines exiting the Fermi 2 switchyard are owned by ITC*Transmission*; however, the two 345 kV transmission lines to leave the Fermi 3 Power Plant are to be owned by Detroit Edison up to the proposed new Fermi 3 switchyard. Detroit Edison will continue to own the land on the Fermi site housing the new transmission corridor, but expects to contract with ITC*Transmission* to maintain these transmission lines and towers.

Offsite

The International Transmission Company (ITC*Transmission*) proposes to service the Fermi 3 station through the installation of three new 345 kV transmission lines from the Fermi site to the Milan Substation. The new lines for Fermi 3 will run in a common corridor with transmission lines for Fermi 2, to a point just east of I-75. From the intersection of this Fermi site corridor and I-75, the three Fermi-Milan lines will run west and north for approximately 12 miles in a corridor shared with other non-Fermi lines. From this point, all non-Fermi lines turn north and continue on to their respective destinations and the three Fermi-Milan lines will continue west through an estimated 300-foot corridor for approximately 10 miles to the Milan substation. The ITC*Transmission* system transfers power from power plants to local distribution systems. The ITC*Transmission* system also carries power resulting from transfers from power plants to loads across the Eastern Interconnection. The 345 kV transmission system and associated corridors including the proposed route for Fermi 3 are exclusively owned and operated by ITC*Transmission*. The Applicant has no control over the construction or operation of the transmission system. The interconnection point is between Fermi 3 and the switchyard. It is assumed that the Milan Substation may also be expanded from its current size of 350 by 500 feet to an area approximately 1,000 by 1,000 feet to accommodate the three new transmission lines from Fermi 3. (Reference 1.1-3)

1.1.6 **Proposed Action and Constraints**

The action proposed by the applicant is the construction and operation of a new nuclear power unit on the Fermi site. The 10 CFR 52 licensing process is being followed to obtain a combined license. The combined licensing process includes Design Certification for the ESBWR by the NRC. The Applicant has not identified any constraints to the review process at the time of submittal of this application. Prior to commencement of construction, numerous other permits and approvals are required from Federal, State and local agencies. The permits and approvals required for the construction and operation of a new unit are discussed in Section 1.2. During the permitting processes, opportunities are provided for public participation.

Detroit Edison undertook statistical analysis at the county and Census Block Group level and concluded that the areas near the Fermi site do not qualify as low income or minority areas according to the standard definitions adopted for environmental justice evaluations. Detroit Edison has also had discussions with Monroe County officials and citizens confirming these conclusions and indicating their belief that there are no environmental justice or subsistence living concerns. Given the lack of populations qualifying as low income or minority near the Fermi site and the input from citizens and county officials, no discussions have been held beyond those summarized here. Additional information on low income and minority populations is provided in Subsection 2.5.4, Subsection 4.4.3, and Subsection 5.8.3.

1.1.7 **Major Activity Start and Completion Dates**

The Applicant seeks a COL permitting the construction and operation of a new facility at any time during the lifetime of the license. Subject to required regulatory approvals and a decision to build, the following are estimated dates related to construction and operation of Fermi 3:

First Structural Concrete:	December 2013
Pre-Operational Testing:	December 2018
Fuel Load:	June 2019
Commercial Operation:	June 2020

1.1.8 Summary of Procedures in Conducting the Environmental Review

This ER follows the content and organization of NUREG-1555, “Standard Review Plans for Environmental Reviews for Nuclear Power Plants.” As part of its responsibilities under the National Environmental Policy Act, the NRC is required to perform a review of the impacts of construction and operation of the proposed unit on the environment. This ER supports that review, which is performed by the NRC under 10 CFR 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” The NRC will use the NUREG-1555 guidance to prepare the Environmental Impact Statement for the COLA. NUREG-1555 is designed to meet the requirements of 10 CFR 51.

The ER has been developed in accordance with 10 CFR 52.79 and specifically includes information required by 10 CFR 51.45, 10 CFR 51.50, 10 CFR 51.52, and 10 CFR 51.53. The NRC has established three significance levels for environmental impacts: SMALL, MODERATE, and LARGE. In general, one of these three significance levels was assigned to each impact evaluated and resolved in the ER. The definitions of the three significance levels are defined in NUREG-1555 as follows:

- SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

1.1.9 Special Circumstances Applicable to Review

As indicated in Subsection 1.1.2, the proposed site is in close proximity to the United States/Canada international border. As a result, the proposed project presents the potential for transboundary environmental impacts. Therefore, the Applicant conducted a reasonable search for relevant, current information associated with identifiable potential affects to the Canadian environment. The results of that reasonable research and environmental assessment of the proposed project’s potential transboundary environmental impacts are included within Chapter 4 and Chapter 5.

1.1.10 References

1.1-1 GE-Hitachi Nuclear Energy, “ESBWR Design Control Document – Tier 2,” Revision 6, August 2009.

1.1-2 U.S. Nuclear Regulatory Commission, “Background on New Nuclear Plant Designs,” http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/new-nuc-plant-des-bg.html, accessed 7 September 2007.

1.1-3 ITC*Transmission*, “System Impact Study Report (MISO G867),” Generation Interconnection in Monroe County, MI, July 21, 2008.

1.2 Status of Review, Approvals, and Consultations

Construction and operation of a new facility at the Fermi site requires compliance with numerous environmental regulations and obtaining the necessary associated permits and consultations. A search for regulations and environmental permits or authorizations required by Federal, State, regional, local, and affected Native American tribal agencies that are applicable to the construction and operation of a new facility was conducted. A listing of the environmental permits, consultations, and approvals identified through the research is presented in Table 1.2-1. The structure of Table 1.2-1 is based primarily on NUREG-1555 guidance. Because the permits identified as being required for construction and operation will not be obtained until Detroit Edison makes a decision to proceed with the development of the site, many of the numbers and expiration dates associated with these permits do not currently exist and are not included.

Detroit Edison has not pursued necessary Federal, State, or local authorizations. Detroit Edison will obtain necessary authorizations prior to initiating regulated activities associated with the construction and operation of a new unit.

The Department of Energy's (DOE) Standard Contract for disposal of spent nuclear fuel in 10 CFR 961 is being modified by the DOE. The Nuclear Energy Institute is actively engaged with the DOE in revising the language in the Standard Contract. Detroit Edison is monitoring progress in this effort.

The following sections identify the environmental concerns and provide an evaluation of potential administrative problems that could delay or prevent agency authorization. Further, the following sections provide a summary of the necessary permitting actions to be taken under the Federal Water Pollution Control Act and the Coastal Zone Management Act of 1972.

The Applicant requested comment from the agencies identified in Table 1.2-1 regarding environmental concerns and potential administrative problems that could delay or prevent the issuance of necessary permits or authorizations. Comments were received from various Federal, State, and local agencies, including:

- National Oceanic Atmospheric Administration, National Marine Fisheries Service
- Federal Aviation Administration
- U.S. Department of Transportation
- U.S. Department of Homeland Security, U.S. Coast Guard
- Michigan Department of Environmental Quality
- Michigan Department of Transportation
- Michigan State Historic Preservation Office
- Michigan Department of Community Health
- Michigan Department of Natural Resources

- City of Monroe, Michigan
- Frenchtown Township, Michigan
- Monroe County, Michigan
- Wyandot of Anderdons

The agencies' responses did not identify any significant environmental concerns or potential administrative problems that could delay or prevent agency authorization.

In addition to the requests for agency comment, the Applicant contacted various State, local, and regional planning authorities. A list of the planning authorities contacted during the preparation of this COLA is contained in Table 1.2-2. In addition, the Applicant sent letters to the U.S. Fish and Wildlife Service (USFWS), the Michigan Department of Natural Resources (MDNR), the State Historic Preservation Officer (SHPO), and appropriate tribal representatives to obtain information on any threatened or endangered species, or cultural resource concerns with the proposed project. Furthermore, as part of this project, numerous other contacts were made with State, local and regional agencies and offices.

1.2.1 Permitting Actions under the Federal Water Pollution Control Act Sections 401 and 402

Water Quality Certification (WQC) under Section 401 of the Federal Water Pollution Control Act (FWPCA) is required to authorize activities that impact state waters resulting from Federal actions. Activities undertaken by Detroit Edison that likely require Federal action, and therefore require a Section 401 WQC, include the discharges to navigable waters from the project due to construction and operation activities including the installation or modification of a water intake structure, wastewater outfall, and the construction of a barge slip. Efforts to obtain any necessary Section 401 WQC from the Michigan Department of Environmental Quality (MDEQ) will occur once activities resulting in a potential discharge to navigable waters are definitively identified. Further, the necessary Section 401 WQC will be obtained in a timely manner.

Construction and operational activities associated with a new nuclear unit at the Fermi site will require multiple permits for compliance with Section 402 of the FWPCA. FWPCA Section 402 permits will be received from the MDEQ, as authorized by the Environmental Protection Agency as of October 17, 1973 (Reference 1.2-1). It is expected that the State of Michigan will authorize construction activities at the Fermi site triggering Section 402 of the FWPCA under General Permits. However, the discharge of excavation dewatering water may require that an Individual Permit be obtained under Section 402 of the FWPCA.

Operational activities associated with a new nuclear unit would require either the modification of National Pollutant Discharge Elimination System (NPDES) permit MI0037028, under which the existing Fermi 2 facility operates, or obtaining a new NPDES permit. Efforts to obtain authorizations for compliance with FWPCA Section 402 have not begun. Submittal of an NPDES permit application is appropriate when sufficient preliminary design information for the proposed project is available to support the application. The necessary FWPCA Section 402 permits will be obtained in a timely manner.

1.2.2 **Compliance with the Federal Coastal Zone Management Act of 1972**

The Federal Coastal Zone Management Act (CZMA) of 1972 imposes requirements on applicants for a federal license who propose activities with the potential to affect a state's coastal zone. The CZMA requires an applicant to certify to the licensing agency that the proposed activity will be consistent with the state's federally-approved coastal zone management program. The State of Michigan's Coastal Zone Management Program was approved by the U.S. Department of Commerce and is administered by the MDEQ, Environmental Science and Services Division. Detroit Edison will certify to the NRC that the proposed project is consistent with Michigan's federally-approved Coastal Zone Management Plan. Detroit Edison anticipates that the MDEQ will concur with the certification.

1.2.3 **References**

1.2-1 U.S. Environmental Protection Agency, "Approval of Modifications to Michigan's Approved Program to Administer the National Pollutant Discharge Elimination System Permitting Program Resulting From the Reorganization of the Michigan Environmental Agencies," 62 Federal Register 61169 – 61173, 1997.

Table 1.2-1 Federal, State and Local Environmental Authorizations (Sheet 1 of 9)

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
FEDERAL AUTHORIZATIONS					
U.S. Army Corps of Engineers (USACE)	Section 10 of the Rivers and Harbors Act of 1899	Section 10 Permit			Structures and/or work that may affect navigability of any navigable waters of the US. Structural alterations may include barge slip construction and the installation or modification to existing intake and outfall structures.
USACE	33 U.S.C. 1344, Federal Water Pollution Control Act, Section 404	Section 404 Permit			Discharge of dredge or fill material within waters of the US, including wetlands.
Department of Transportation	49 CFR 107, Subpart G	Hazardous Materials Certificate of Registration	Reg. No: 061206 551 076OQ[1]	06/30/2009	Shipment of radioactive and hazardous materials.
Federal Aviation Administration (FAA)	14 CFR 77.13, Federal Aviation Act	Notice of Proposed Construction or Alteration			Notice required before erecting structures with a height greater than 200' or impacting navigable airspace. (construction cranes, cooling towers, transmission lines).
National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service	Threatened and Endangered Species Act, 16 U.S.C. 1536	Endangered Species Act Biological Consultation (marine species)			Consultation regarding the potential impact to threatened or endangered marine species.
Nuclear Regulatory Commission (NRC)	10 CFR 52, Subpart C	Combined License			Construction activities associated with a nuclear power facility.
NRC	10 CFR 30	Byproduct license			Approval to possess special nuclear material.
NRC	10 CFR 70	Special Nuclear Materials License			Approval to possess fuel and source material.

Table 1.2-1 Federal, State and Local Environmental Authorizations (Sheet 2 of 9)

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
NRC	10 CFR 40	Domestic Licensing of Source Material			Approval to possess source material.
NRC	Coastal Zone Management Act, 16 U.S.C. 1451 et. seq.	Certification of Consistency			Obtaining a Federal license or permit.
NRC/Environmental Protection Agency	Resource Conservation and Recovery Act, Atomic Energy Act, 40 CFR 266	Low Level Mixed Waste Conditional Exemption			Allows the storage and treatment of low-level mixed waste.
U.S. Coast Guard	14 U.S.C. 81, 83, 85, 633 33 CFR 66	Authorization to Impact Navigation/Private Aids to Navigation			The interference of existing navigation aids or the placement and use of private aids to navigation in navigable waters of the U.S.
U.S. Fish and Wildlife Service (USFWS)	Threatened and Endangered Species Act, 16 U.S.C. 1539	Endangered Species Act Biological Consultation (non-marine species)			Consultation regarding the potential impacts to federally threatened and endangered species.
USFWS	Migratory Bird Treaty Act, 16 U.S.C. 703	Migratory Bird Treaty Act Consultation			Consultation regarding the potential impacts to protected migratory birds.
USFWS	Bald and Golden Eagle Protection Act, 16 U.S.C. 668	Bald and Golden Eagle Protection Act Consultation			Consultation regarding the potential impacts to bald and golden eagles.
STATE AUTHORIZATIONS					
Michigan Department of Community Health	MCL 333.13522	X-ray Equipment Registration			Possession of a radiation machine.
Michigan Department of Environmental Quality (MDEQ) - Waste and Hazardous Materials Division	MCL R299.9303 et. seq.	Hazardous Waste Management, Site Identification Number	MID 087 056 685[1]		A generator shall not treat or store, dispose of, or transport or offer for transport, hazardous waste without having received a site identification number from the regional administrator.

Table 1.2-1 Federal, State and Local Environmental Authorizations (Sheet 3 of 9)

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
MDEQ - Waste and Hazardous Materials Division	MCL 29.5c	Review, Approval, and Certification of Aboveground Storage Tank Systems			Regulation of installation of new Aboveground Storage Tank (AST) systems with individual tanks having a storage capacity of more than 1,100 gallons of flammable liquid or combustible liquid.
MDEQ - Waste and Hazardous Materials Division	MCL R299.9822	Low-Level Mixed Waste Conditional Exemption			Low level mixed waste storage and treatment conditional exemption eligibility and standards.
MDEQ - Waste and Hazardous Materials Division	MCL 333.13505	Radioactive Material Registration			Possession of radioactive materials.
MDEQ - Air Quality Division	The Natural Resources and Environmental Protection Act, Public Act 451 of 1994, as amended, Part 55 (Air Pollution Control) MCL R336.1201	Permit to Install			Construction of any air emission source.
MDEQ - Air Quality Division	Public Act 451 of 1994, as amended, Part 55 (Air Pollution Control) MCL R336.1210 - R336.1218 40 CFR 70	Air Permit			Operation of a source of air pollutants.
MDEQ - Environmental Science and Services Division	Coastal Zone Management Act, 16 U.S.C. 1451 et. seq.	Preliminary Coastal Zone Management Act Concurrence Consultation			Obtaining a Federal license or permit.

Table 1.2-1 Federal, State and Local Environmental Authorizations (Sheet 4 of 9)

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
MDEQ - Land and Water Management Division	MCL 324.30306 et. seq. 33 U.S.C. 1344, Federal Water Pollution Control Act, Section 404	Wetland Protection Permit			Any projects on or in wetlands regulated by the State of Michigan.
MDEQ - Land and Water Management Division	MCL 324.32501 et. seq.	Great Lakes Bottomlands Permit			Dredging, filling, modifying, constructing, enlarging, or extending of structures in Great Lakes waters or below the OHWM of the Great Lakes; or connecting any natural or artificial waterway, canal, or ditch with any Great Lake including Lake St. Clair.
MDEQ - Water Bureau	MCL 324.32723	Water Withdrawal Permit			Withdrawals from the Great Lakes and connecting waterways of over 5,000,000 gallons per day.
MDEQ - Water Bureau	MCL 324.32705	Water Withdrawal Registration			Development of the withdrawal capacity on the property of an additional 100,000 gallons of water per day from the waters of the state.
MDEQ - Water Bureau	MCL 324.4101 et. seq.	Wastewater Facilities Construction Permit/Part 41 Construction Permit			Construction or modification of sewers, pumping stations, force mains, and treatment plants.
MDEQ - Water Bureau	33 U.S.C. 1251 et. seq. MCL 324.3101 et. seq. MCL 324.3301 et. seq.	National Pollutant Discharge Elimination System (NPDES) Permit			Discharge of waste, waste effluent and certain categories of storm water runoff into the surface waters of Michigan during operation of the facility.

Table 1.2-1 Federal, State and Local Environmental Authorizations (Sheet 5 of 9)

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
MDEQ - Water Bureau	MCL R323.2190	NPDES Permits, Stormwater Construction Permit			A Permit by Rule may be obtained to authorize storm water discharges from a construction site greater than or equal to 5 acres.
MDEQ - Water Bureau	33 U.S.C. 1251 et. seq. MCL 324.3101 et. seq.	NPDES General Dredging Dewatering Water Permit	General Permit Number MIG690000		Discharges of dredging dewatering water resulting from the removal of uncontaminated sediment from a waterway.
MDEQ - Water Bureau	33 U.S.C. 1251 et. seq. MCL 324.3101 et. seq.	NPDES General Hydrostatic Pressure Test Water	Permit Number MIG6790000	4/1/2013	Discharges from the hydrostatic pressure testing of new and existing piping, tanks, vessels, and other associated equipment which have been physically cleaned and/or provided with effluent treatment.
MDEQ - Water Bureau	33 U.S.C. 1341	Section 401 Water Quality Certification			The construction or operation of a facility which may result in any discharge into the navigable waters that will require a Federal license or permit.
Michigan Department of Transportation (MDOT)	MCL 257.716 et. seq.	Transport Permit			Movement over state highways of vehicles or loads that exceed the size or weight limitations specified by law.
MDOT - Multi-Modal Transportation Services Bureau	MCL 259.481 et. seq.	Tall Structures Act Permit			Construction of an object which has the potential to affect navigable airspace (height in excess of 200' or within 20,000' of an airport).
MDOT	MCL 247.171 et. seq.	Construction Permits (Right of Way Permit)			Activities by businesses or private parties and utility companies wishing to use the highway right-of-way for operations other than normal vehicular or pedestrian travel are required to obtain a permit from MDOT.

Table 1.2-1 Federal, State and Local Environmental Authorizations (Sheet 6 of 9)

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
Michigan State Historic Preservation Office (SHPO)	National Historic Preservation Act, Section 106 Review, 36 CFR 800	Consultation			Consultation concerning the potential impacts to cultural resources.
Michigan Department of Natural Resources (MDNR)	MCL 324.36501 et. seq.	Consultation			Consultation regarding the potential impacts to threatened and endangered species.
MDNR	MCL 324.36501 et. seq.	Endangered Species Permit			Taking or harming of state listed endangered species.
TRIBAL AUTHORIZATIONS					
N/A[2]					
LOCAL AUTHORIZATIONS					
City of Monroe, Michigan	33 U.S.C. 1251 et. seq. Michigan Water Resource Act Codified Ordinances of Monroe, Michigan, Streets, Utilities and Public Services Code, Chapter 1042, Division 2 Section 1042.15	Monroe Metropolitan Water Pollution Control Facility Industrial Pretreatment Permit	Permit No. 1020[1]		Treatment of wastewater to comply with categorical pretreatment standards and local limits.
City of Monroe, Michigan/ Frenchtown Township	Codified Ordinances of Monroe, Michigan, Streets, Utilities and Public Services Code, Chapter 1042, Division 15 Section 1042.71	Sanitary Sewer Service Connection Permit			Required before a person uncovers, makes any connection with or opening into, uses, alters, or disturbs any public sewer or appurtenance to.

Table 1.2-1 Federal, State and Local Environmental Authorizations (Sheet 7 of 9)

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 6, Section 6.04 and Article 27.00, Section 27.06	Site Plan and Development Approval			Review of planned construction activities. Requires submittal of application for Site Plan Approval which requires review of items such as engineering. The approval process may also result in the issuance of permits such as a grading permit issued under the authority of the Building Official.
Frenchtown Township		Engineering Review			Review of detailed engineering construction plans addressing water, sanitary, storm water drainage, grading and paving for the site.
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200	Occupancy Permit			Occupancy of the building.
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 4, Section 4.40 and Article 24, Section 24.05	Building Permit			Permit authorizing the construction, removal, moving, alteration, or use of a building or construction of any driveway or parking lot constructed of hard surface materials.
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 20	Special Approval of Activities within either the Floodway or Floodway Fringe.			Approval of activities within the Floodway Area or Floodway Fringe Area of the Floodway or Floodplain District.
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 4, Section 4.10	Temporary Building Used During Construction			Use of a portable structure as a temporary building during construction.

Table 1.2-1 Federal, State and Local Environmental Authorizations (Sheet 8 of 9)

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 26, Section 26.04	Landscape Development Plan			Submittal of a Landscape Development that illustrates areas of existing trees or wood lots, which shall be removed, and those that will be retained.
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 4, Section 4.21.2	Excavation Permit			Activities that propose to fill an area of 20,000 square feet or greater or any excavation and removal regardless of area involved except for mineral mining operations, farm ponds, and landscape ponds.
Monroe County, Michigan, Office of On-site Water Supply/ Frenchtown Township	Codified Ordinances of Monroe, Michigan, Monroe County Environmental Health/Sanitary Code, Chapter III - Water Supplies	Well Permit			Construction of water supply wells, irrigation wells, heat exchange wells, industrial wells for water supply, test wells to obtain information regarding groundwater quantity or quality, recharge well, dewatering well, fresh water well at oil or gas well drilling site.
Monroe County, Michigan, Drain Commissioner	Local Ordinance	Engineering Review			Review of surface water flow during Operation.
Monroe County, Michigan, Drain Commissioner	NREPA Part 91, of Act 451 of the Michigan Public Acts of 1994 MCL 324.9101 et. seq.	Soil Erosion and Sedimentation Control (SESC) Permit			Any earth change that disturbs one or more acres, or is within 500 feet of a lake or stream.
Monroe County, Michigan, Drain Commissioner	Act No. 40 of 1956	Drain Culvert Permit			Permit to construct in a drain.

Table 1.2-1 Federal, State and Local Environmental Authorizations (Sheet 9 of 9)

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
Monroe County, Michigan, Health Department/ Frenchtown Township	Monroe County Environmental Health/Sanitary Code, Chapter III, Section 302. Part 127 of Michigan Public Health Code, 1978 PA 368, as amended	Water Supply Permit			Any new construction or extensive change affecting the basic unit or the suction line on any water supply system within Monroe County, Michigan.

Note:

All necessary permits will be applied for in a timely manner. New permits may not be obtained in certain instances due to potential authorization of construction and operational activities through the modification of existing permits possessed by the Fermi Station.

1. Permits authorizing current activities associated with operations on the Fermi site. When practical, existing permits will be modified to authorize activities associated with the construction or operation of a new nuclear facility on site.
2. There are no Native American tribes with jurisdictional authority over activities at the Fermi site.

Table 1.2-2 State, Local and Regional Planning Authorities

ENTITY CONTACTED
STATE AUTHORITIES
N/A
REGIONAL AUTHORITIES
Planning Analyst, Southeast Michigan Council of Governments (SEMCOG)
Vice President of Environmental Planning, Toledo Metropolitan Area Council of Governments (TMACOG)
LOCAL AUTHORITIES
Director, Monroe County Planning
Business Consultant, Monroe County Industrial Development Corporation
Building Official, Frenchtown Township

Chapter 2 Environmental Description

Chapter 2 describes the existing environmental conditions at the Enrico Fermi Nuclear Power Plant (Fermi) site, the site vicinity, and the surrounding region. The environmental descriptions provide sufficient detail to identify those environmental resources that may be affected by the construction and operation of the proposed Fermi 3. This chapter is divided into eight sections:

- Station Location (Section 2.1)
- Land (Section 2.2)
- Water (Section 2.3)
- Ecology (Section 2.4)
- Socioeconomics (Section 2.5)
- Geology (Section 2.6)
- Meteorology and Air Quality (Section 2.7)
- Related Federal Project Activities (Section 2.8)

The following definitions and figures are provided as additional information related to content of the Chapter 2 sections:

- Fermi 3 region – the area within a 50-mile radius around the Fermi 3 site (Figure 2.1-1)
- Fermi 3 vicinity – the area within a 7.5-mile radius around the Fermi 3 site (Figure 2.1-2)
- Fermi 3 site – the Detroit Edison property that comprises the Exclusion Area Boundary (Figure 2.1-3)

2.1 Station Location

The Fermi site is located in Monroe County in southeastern Michigan, about 20 miles north of the Michigan/Ohio border. The U.S./Canada international border runs through Lake Erie about 7 miles east of the Fermi site. The Fermi site is on the west bank of Lake Erie, approximately 24 miles northeast of Toledo, Ohio and 30 miles southwest of Detroit, Michigan. The River Raisin is located about 6 miles southwest of the Fermi site. Figure 2.1-1 shows the location of the Fermi site in relation to the counties and larger cities and towns in the region, which is the area within a radius of 50 miles from the center of Fermi 3. The Fermi site lies within portions of Sections 16, 17, 20, and 21 of Township 6 South, Range 10 East in the Frenchtown Township, Monroe County, Michigan. Stony Point, Michigan is about 2 miles south of the Fermi site. The town of Monroe, Michigan is approximately 8 miles southwest.

The vicinity evaluated in this Environmental Report is a 7.5-mile radius circle around Fermi 3 in accordance with NUREG-1555 guidance for large, irregularly shaped sites, which specifies that the vicinity should encompass a 6-mile band around the plant property (the vicinity may differ as specified in certain sections based on the topic being evaluated). Figure 2.1-2 shows Fermi 3 in relation to the features of the surrounding 7.5-mile vicinity. The vicinity of Fermi 3 is mostly agricultural. The proposed Fermi 3 Exclusion Area Boundary (EAB) is shown on Figure 2.1-3 and Figure 2.1-4. The EAB is depicted as a circle with a 2928 foot radius from the centerline of the Fermi 3 reactor.

The Universal Transverse Mercator NAD83 Zone 17T coordinates for the location of the Fermi 3 reactor are approximately N4,647,900 meters (41°57'39" North latitude) and E312,600 meters (83°15'43" West longitude).

The property boundary shown on Figure 2.1-3 encompasses the 1260 acres that comprise the Fermi site. There are no apparent erosion issues on the Lake Erie shore of Michigan near the Fermi site that would reduce the site acreage. A site area of 1260 acres is used throughout this report.

Interstate 75 (I-75) is the major transportation route in the vicinity, running in a north-south direction west of the Fermi site. I-75 begins at the Canadian border in Ontario and ends in Florida almost at Miami (Reference 2.1-1). I-75 is approximately 4 miles west of the Fermi site at the closest point. Several other highways are present in the site vicinity, including I-275 to the northwest and North Dixie Highway (also called State Highway M-50 or US Turnpike Road) and US 24 to the west. Public transportation by Lake Erie Transit is available within the city of Monroe, Michigan just outside the site vicinity, and dial-a-ride doorstep service is provided in the Frenchtown Township within the site vicinity (Reference 2.1-2).

Major rail lines near the Fermi site include Canadian National and Norfolk Southern lines, both of which run in a roughly north-south direction about 3 miles west of the Fermi site. There is a rail spur off the Canadian National main line into the Fermi site for large and heavy equipment transport (Reference 2.1-3).

Natural features of note in the vicinity include Lake Erie as the prominent feature just east of the Fermi site. The area also includes Stony Point, the 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 just 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.

The Fermi site, including the 120 kV and 345 kV transmission switchyard sites, are owned and operated by Detroit Edison, while the transmission system (including switchyard equipment) from the switchyard outward from the Fermi site is owned and maintained by the International Transmission Company (ITC*Transmission*). There are easements on Fermi property granted to ITC*Transmission* for the 345 kV and 120 kV transmission lines as they leave their respective switchyards. Transmission lines over the Fermi site and along the entire transmission corridor routes run within ITC*Transmission* easements.

Figure 2.1-3 and Figure 2.1-4 provide aerial photos of the Fermi site showing its property boundary and closer views of existing and proposed onsite structures, respectively. Air and water effluent release locations for Fermi 3 and distances from each location to the nearest point on the Fermi site boundary are shown in Table 2.1-1. The closest points are locations in Lake Erie.

Figure 2.1-5 shows an oblique aerial view of the main developed portion of the Fermi site. The Fermi 3 proposed location is the large parking area visible in the southwestern-most portion of the developed area seen on Figure 2.1-5. There are no other industrial structures within the site or immediate area. No recreational facilities or residential structures are present within the site boundary.

2.1.1 **References**

2.1-1 Interstate-Guide.com, "Interstate 75," http://www.interstate-guide.com/i-075.html, accessed 31 March 2008.

2.1-2 Lake Erie Transit, Transit Services, "Frenchtown Dial-A-Ride," www.lakeerietransit.com/transitservices.html, accessed 22 June 2007.

2.1-3 Michigan Railroads.com, Your Homepage for Michigan Railroading, Railroad Page, "CN North America," http://www.michiganrailroads.com/MichRRs/Railroads/CNHomePage.htm, accessed 21 January 2008.

Table 2.1-1 Distances from Fermi 3 Effluent Release Locations to Boundary

Location	Distance to Nearest Fermi Site Boundary
Air	
Reactor Building	1976 feet
Radwaste Building	2182 feet
Fuel Building	1980 feet
Service Building	1882 feet
Turbine Building	1944 feet
Water	
Unit 3 Cooling Tower Outfall	305 feet

Figure 2.1-1 Site Region within 50-Mile Radius

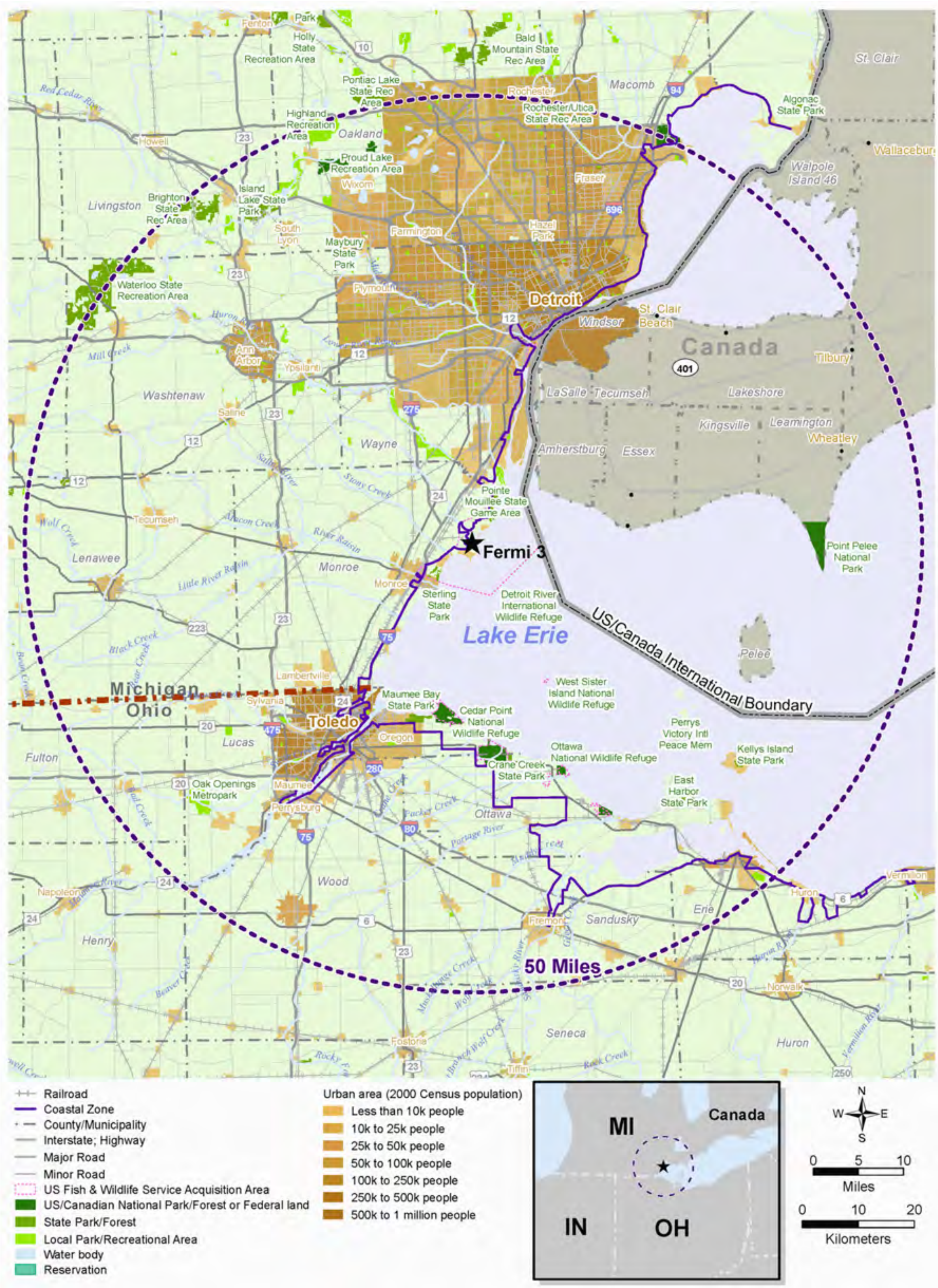


Figure 2.1-2 Site Vicinity within 7.5-Mile Radius

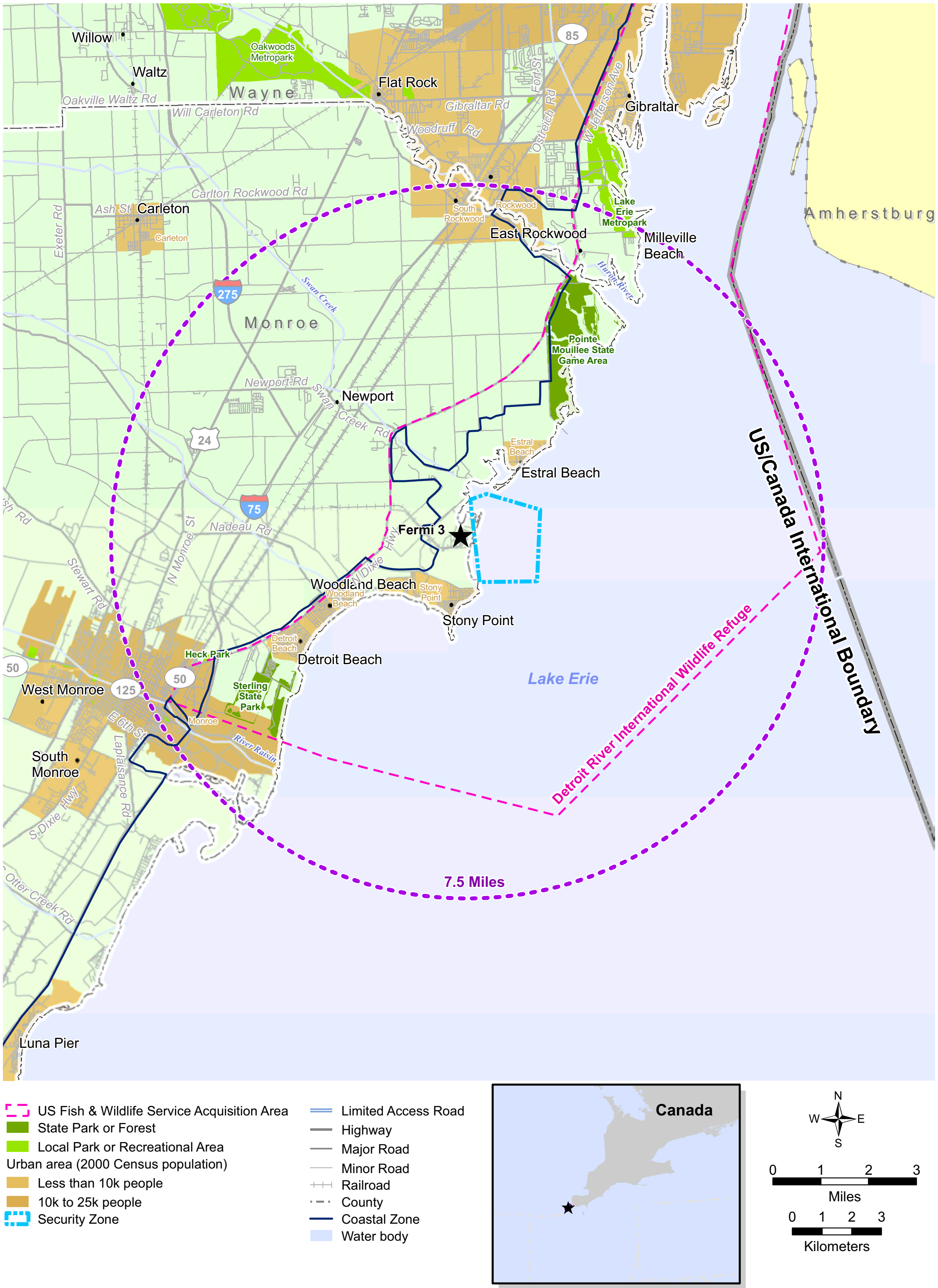


Figure 2.1-3 Fermi Property Boundary

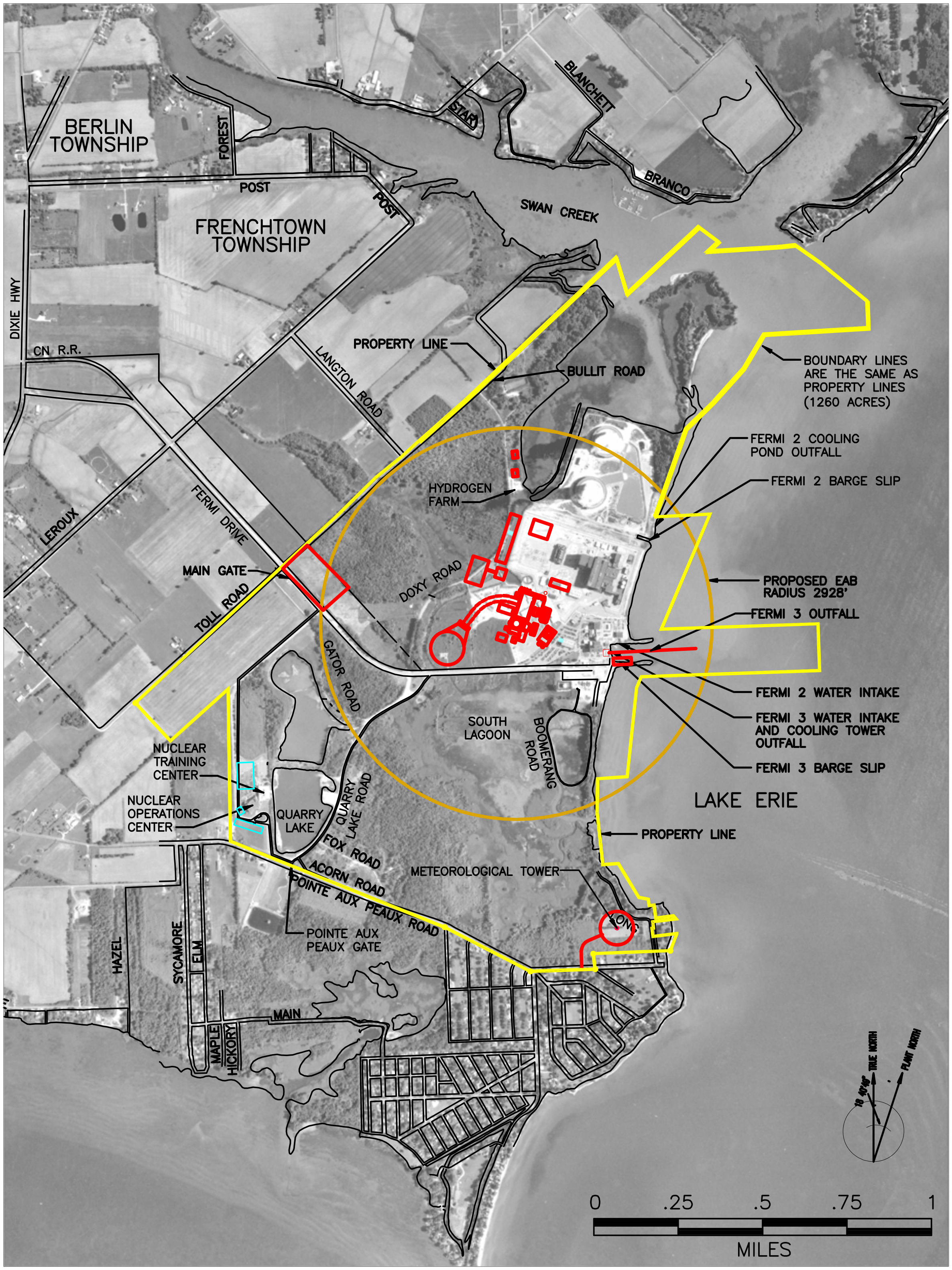


Figure 2.1-4 Fermi 3 Site Plan

Figure 2.1-5 Aerial View of Main Plant Area Looking North, Fermi Site

2.2 Land

This section describes, in general terms, the Fermi 3 site and its surroundings, with the site and vicinity described in Subsection 2.2.1, the transmission corridors described in Subsection 2.2.2, and the 50-mile region surrounding Fermi discussed in Subsection 2.2.3. For this Fermi 3 COL Environmental Report, consistent with the criteria described in NUREG-1555, Section 2.2.1, the vicinity evaluated is the 7.5-mile area as discussed in Section 2.1.

Fermi 3 is located on the existing 1260 acre Fermi site within the Frenchtown Township, Monroe County, Michigan, approximately 30 miles southwest of the southern suburbs of Detroit, Michigan, and about 24 miles northeast of the northern extent of Toledo, Ohio. Monroe County extends about 10 miles north, 25 miles west, and 25 miles southwest of the site. The county lies on the southeastern edge of Michigan and is bordered on the east by Lake Erie, on the north by Wayne County, Michigan, on the west by Lenawee County, Michigan, and on the south by Lucas County, Ohio.

Land use analysis for this section is based on review of appropriate existing literature, information acquired through visits to the Fermi site and contact with staff members, and information from local planning and agricultural contacts. Based on review of these documents in comparison to current information, it was concluded that land use in the vicinity of Fermi 3 has not changed significantly since Fermi 2 was constructed. Land use is not expected to change substantially during the timeframe of the COL application.

2.2.1 The Site and Vicinity

2.2.1.1 The Site

Land use on the Fermi site is split mainly into developed areas and swamp or wetland areas. Most of the forested areas on the site are subject to flooding, and, therefore, are considered woody wetlands. Wetland (including forested areas) and Open Water areas comprise about 60 percent of the total site area. The majority of the Fermi site that is not developed is included as part of the Detroit River International Wildlife Refuge (DRIWR) at the time of this COL application. The DRIWR encompasses a 656 acre portion of the Fermi site that contains habitat for common species of southeast Michigan as well as some wetland and water-dependent species such as the bald eagle (Reference 2.2-1). Detroit Edison has had a cooperative agreement with the U.S. Fish and Wildlife Service (USFWS) since 2003 that allows the USFWS to assist in managing the refuge areas while Detroit Edison retains ownership and control of the entire site. The agreement between Detroit Edison and the USFWS for management of the DRIWR is anticipated to be revised as a result of the addition of Fermi 3 to the site.

The northern and southern areas of the Fermi site feature large lagoons, while the western portions contain some forested areas and Quarry Lake. The eastern portion of the Fermi site adjacent to Lake Erie contains the power plant structures, as shown on Figure 2.1-4. To prevent flooding, the developed areas were elevated during the construction of Fermi 2 using crushed limestone taken from the southwest portion of the Fermi site (Quarry Lake). Site elevations range from the level of Lake Erie to approximately 25 feet above lake level on the western edge of the site

(Reference 2.2-2). Topography on the Fermi site is relatively level in the undeveloped areas, with an elevation range of approximately 10 feet over the site according to U.S. Geological Service (USGS) topographic maps.

The property boundary shown on Figure 2.1-3 encompasses the 1260 acres that make up the Fermi site. There are no significant erosion issues on the Lake Erie shore at the Fermi site that would affect the site acreage. A shore barrier was installed in conjunction with Fermi 2 construction to stabilize the shore along the eastern side of the site.

Detroit Edison is the licensed owner and operator of the Fermi site and currently controls the site for the purpose of generating electricity. However, some of the area within the site boundary is also used for other purposes, such as occasional ecological study by the USFWS and habitat restoration activities by state agencies or nonprofit groups. The DRIWR encompasses 656 acres of the existing 1260 acre site; the approximate boundaries of the refuge are shown on Figure 2.4-6.

Acreages of general land use categories onsite are shown in Table 2.2-1. The area previously developed for Fermi 2 plus that still occupied by deactivated Fermi 1 totals 172 acres.

There is one active railroad spur and one navigable waterway that traverse portions of the site. No public roads run through the Fermi site. Other than the decommissioned Fermi 1 structures and the existing Fermi 2 structures, there are no other industrial, commercial, or institutional structures on the site. The northwestern portion of the site also contains the security firing range. Several residences along Pointe Aux Peaux Road are present just outside the southeast property line near the village of Stony Point (Figure 2.1-3).

Detroit Edison does not allow access to Fermi property for recreational purposes. The site is posted with notifications around the perimeter to ensure awareness of access restrictions by the public.

Detroit Edison has acquired and will maintain surface ownership of all the land within the Fermi site property boundary. Detroit Edison owns and controls 99.93 percent of the mineral rights within the Fermi property; including all of the mineral rights within the EAB. One third party, the Michigan Department of Natural Resources (MDNR), owns 0.88 acre of mineral rights in the far southeast portion of the Fermi site near the location of the new meteorological tower. This very small mineral rights holding by the MDNR is in an area removed from the portions of the site that will be affected by the majority of Fermi 3 site preparation, preconstruction, construction, or operation; therefore, Detroit Edison owns and effectively controls the mineral rights in the Fermi 3 power block and associated exclusion area. There is no activity at the Fermi site or in adjacent areas involving exploration for, drilling for, or otherwise extracting minerals. The geological character of the subsurface structure and the land use in the vicinity of the Fermi site indicate that commercial mineral production appears unlikely in the foreseeable future. There are no mineral resources adjacent to or within the site boundary presently being exploited or of known commercial value, nor are such resources expected to be developed in the future.

Under Michigan law, minerals can be owned by the surface property owner or by a different party (Reference 2.2-3). In Michigan, a 1998 law allows landowners to petition the state to purchase the state-owned minerals beneath their land as long as the land has no pending lease or development. The state must sell the minerals to the surface landowner at fair market value at the landowner's request unless the state wants to reserve minerals to prevent damage in environmentally sensitive areas or for some other legitimate reason. A deed restriction is then added to the property that prohibits the mineral rights from being severed from the surface rights in the future (Reference 2.2-4). Since Detroit Edison owns the entire Fermi site and the associated exclusion areas for Fermi 2 and Fermi 3, Detroit Edison effectively controls mineral rights to the site with respect to this law.

Near the northeast corner of the Fermi site in the area of the Fermi 2 cooling towers, there is a former barge slip that was used to offload equipment during Fermi 2 construction (Figure 2.1-3). The Fermi 2 water intake is east of the Fermi 3 location and is situated between the two groins protruding into Lake Erie. Fermi 2 discharges about 20,000 to 30,000 gallons per minute into Lake Erie from the existing circulating water basin depending on the season.

The environment of the former Fermi 2 barge slip and offloading area is cleared gravel with some trees and weedy vegetation along a sandy inlet area with no permanent structures. The barge slip area used for Fermi 2 deliveries would require substantial dredging and other preparation work before it could be used for equipment delivery. Fermi 2 components were delivered and offloaded at the barge slip.

The Fermi site, including onsite waterways, roads, and railroads, is closed to public use. No additional waterways, highways, roads, or railroads would be closed to public use as a result of Fermi 3 preparation, construction, or operation activities. There are no current plans for site modifications such as a visitor's center, parks, or similar designations on the Fermi site.

In the eastern portion of the Fermi site near Boomerang Road and Lake Erie, there is a 492-foot communication tower on land leased by Detroit Edison to the tower operator for communication use.

Natural Resources Conservation Service (NRCS) maps show areas of prime farmland around the southwestern edge of the Fermi site in the agricultural field designated for Fermi 3 construction laydown on Figure 2.1-4. This part of the Fermi site is owned by Detroit Edison and is used as cropland. Since a large portion of the Fermi site is committed to industrial development and has been previously disturbed by site-related activities, the majority of the site would likely be exempted from the definition of prime farmland (Reference 2.2-5). The NRCS classifies most of the undeveloped areas of the Fermi site as "prime farmland if drained" (Reference 2.2-6). Parts of the approximately 60 acre parcel of agricultural land are designated prime farmland and the parcel is currently used as farmland, so this parcel would most likely still be considered prime farmland even though it is part of the Fermi site. The prime farmland designation continues on a small portion of the Fermi site undeveloped area west of the Nuclear Operations Center and Nuclear Training Center; however, this small area is not farmed. Potential construction impacts to prime farmland on the Fermi site are addressed in Section 4.1.

The Fermi site falls under the jurisdiction of the Coastal Zone Management Act of 1972, which has the goal of attaining and maintaining a healthy coast through a balance of conservation and responsible development. States have their own approved coastal management programs under the Act, and Michigan was one of the first states to have its coastal management program approved in 1978. Michigan's coastal zone boundary generally extends a minimum of 1000 feet inland from the Ordinary High Water Mark of the Great Lakes and connecting channels, or further to include coastal lakes, river mouths and bays, floodplains, coastal wetlands, designated sand dune areas, public parks, recreation and natural areas, and urban areas (Reference 2.2-7). To the east of the Fermi site going into Lake Erie, the coastal zone extends to the international boundary between the United States and Canada (Reference 2.2-8). Landward boundaries of the coastal zone in the United States portion of the Fermi 50 mile region and in the Fermi vicinity are shown on Figure 2.1-1 and Figure 2.1-2.

Monroe County’s Comprehensive Plan, currently being updated from the 1985 version, shows land use at the Fermi site as industrial. The Fermi property is zoned PS (Public Service District) by Frenchtown Township, which is a designation that allows power plant use. Future land use plans for Frenchtown Township and Monroe County indicate that utility and industrial use will continue on the Fermi property. General land uses within the Fermi site are shown on Figure 2.4-5.

2.2.1.2 **The Vicinity**

About 95 percent of the land area within the 7.5-mile vicinity of the Fermi site is within Monroe County; the remainder is in Wayne County (Figure 2.1-2). As shown on Figure 2.2-1, land use in the 7.5-mile vicinity around the Fermi site is predominantly agricultural. Approximately 24 percent of the Fermi vicinity is used for agriculture (pasture, hay fields, and cropland). Since land occupies less than half of the vicinity (46 percent land, 54 percent Lake Erie), agricultural uses involve more than half of the land in the vicinity. The developed uses comprise about 14 percent of the vicinity. The areas where developed uses are prevalent are mainly to the southwest of the Fermi site near the city of Monroe and along the Lake Erie shoreline. There is also a greater concentration of developed uses in the portion of southeastern Wayne County that falls within the vicinity. Small areas of forest, wetland, and grassland/herbaceous comprise the remaining approximately eight percent of the 7.5-mile vicinity. The forested and wetland areas make up only a small percentage of the overall land use within the vicinity in contrast to their status as the majority land use on the Fermi site.

Topography in the vicinity is fairly flat, with some lower elevation wetland areas along the Lake Erie shoreline, including the Fermi site. Lake Erie has an elevation of approximately 571 feet, while the area around the Fermi site ranges from approximately 577 to 600 feet (Reference 2.2-2). A topographic map of the Fermi vicinity is provided on Figure 2.4-1.

Residential areas in the Fermi vicinity are expanding, especially in Berlin and Frenchtown Townships. Relatively recent housing developments are present just south of Pointe Aux Peaux Road (the Fermi site southern boundary). There are large residential developments in the planning stages for the area between the two railroad tracks north of Newport Road. The planned development area is about 1 mile long, and new subdivisions are proposed for the entire area. New subdivisions are also planned along Swan Creek Road and along Dixie Highway.

Scattered industrial facilities are present along the Lake Erie shore, mainly west and southwest of the Fermi site along the I-75 corridor and near Monroe. Spartan Steel Coating, National Galvanizing, MAC Steel, and Sylvania Sand are some of the nearest major industries. Commercial development is largely limited to the city of Monroe and the areas along major road corridors like Dixie Highway, Telegraph Road, and I-75. One of the commercial developments in Monroe is the Frenchtown Business Park, located at the intersection of Highways 125 and 50.

Land use plans that could affect the Fermi site and vicinity include the Frenchtown and Berlin Township Master Plans, Monroe County Comprehensive Plan, and planning efforts by the Southeast Michigan Council of Governments (SEMCOG) as part of their mission to assist local governments. According to SEMCOG, both the Frenchtown and Berlin Township Master Plan documents show the area around the Fermi site continuing to be used in a manner consistent with land use at the time of this COL application.

The land within the vicinity of the Fermi site is mainly agricultural, with areas of residential and limited industrial development near Monroe and along the Lake Erie shoreline. Figure 2.2-1 shows the USGS land use and land cover information for the vicinity of the site, which is for the most part agricultural. The nearest population concentration is located in the city of Monroe, which lies about 8 miles southwest of the Fermi site at its nearest point.

Overall land use in the vicinity is comparable to land use in the 50-mile region. The vicinity is approximately 24 percent agricultural versus the 37 percent of the region that is agricultural. These seemingly small percentages of agricultural land use can be accounted for by the fact that the open water of Lake Erie comprises a large portion of both the vicinity and the region.

The land surrounding the Fermi site has several different planned uses according to the Monroe County future land use map (Reference 2.2-9). North of the Fermi site, across Swan Creek, the planned use is mostly residential and agricultural. Also in this area, the USFWS has acquired a parcel called the Brancheau Tract Unit for addition to the DRIWR (Reference 2.2-1). The Stony Point area directly southeast of the Fermi site is also residential. The remainder of the area south of the Fermi site as well as the land abutting its northwest side is designated Rural Reserve, a land use category that includes all incorporated lands not included in other zoning categories. The majority of the land west of the Fermi site is zoned agricultural (Reference 2.2-10). A few additional industrial areas are located about 7 miles southwest in Monroe along the Lake Erie shoreline, such as the Detroit Edison Monroe Power Plant, the Automotive Components Holdings plant, and the Port of Monroe. Monroe County is, for the most part, dedicated to agricultural use (Reference 2.2-10).

No major nonresidential development projects are in progress or anticipated in the vicinity of the Fermi site, although industrial development is anticipated to increase after 2010. Road improvement projects on I-75 and Dixie Highway occurred in 2007 (Reference 2.2-11).

Future land use plans for the area around the Fermi site show prime agricultural and open space as the dominant uses. Draft future land use plans project industrial uses south of Newport and in the I-275/Telegraph Road area.

No zoning issues for townships or counties within the vicinity are expected to affect the Fermi site. According to the Monroe County Planning Director, farmland preservation and conservation will be a new area of focus in the Monroe County Comprehensive Plan update anticipated to be finished in 2008. This drive to preserve farmland in the county will keep additional residential and other development from encroaching more closely on the Fermi site since a large portion of the remaining undeveloped land near Fermi is used for agriculture.

2.2.1.2.1 **Site Accessibility**

The Fermi 3 site is accessible by Lake Erie, road, and rail. The major highways and rail lines in the area are found mainly west of the site, and a number of smaller state and county roads serve the area (Figure 2.1-1 and Figure 2.1-2). Dixie Highway provides access to the Fermi site from I-75. Interstate 75 connects Detroit, Michigan to the north with Toledo, Ohio, to the south and continues across the United States to its terminus in Florida. Interstate 75 is the major transportation route in the vicinity, roughly following the Lake Erie shore through Monroe and Wayne Counties and running within 4.1 miles of the northwest side of the Fermi site at the closest point.

Detroit Edison maintains control of ingress to and egress from the Fermi site through the main gate. There is an auxiliary gate onsite, the Pointe Aux Peaux gate; however, this gate is kept locked at all times and requires a key for entry by authorized Detroit Edison personnel.

A plant emergency or a national crisis could result in closure of I-75 because of its status as a major interstate highway and its proximity to the Fermi site. There are two areas of traffic congestion along two of the nearest exit or evacuation routes to I-75 from Fermi, including the Nadeau Road and I-75 intersection as well as the east side of the Swan Creek Road and I-75 intersection. The Frenchtown Township 2002 Master Plan also states that many of the east-west oriented roads in the township, such as those that would be used to exit the Fermi site, do not span the entire township, but that there is more than enough capacity on north-south roads (Reference 2.2-12). For further discussion of this and other potential egress limitations, refer to the Fermi Evacuation Time Estimate provided in COLA Part 5.

US 24 (Telegraph Road) runs southwest-northeast in the vicinity of the site (5.8 miles northwest), then gradually zigzags southeast through parts of Ohio, Indiana, and Illinois, ending near Palmyra, Illinois. County Highway 125 is a paved, two-lane, secondary road that branches east from US 24 and runs north-south into the center of the city of Monroe, passing within about 4 miles west of Fermi 2. County Highway 125 dead-ends into the east-west County Road 50 in downtown Monroe. Interstate 275 connects Interstate 96 in northern Detroit to Interstate 94 in southern Detroit and ends about 4 miles northwest of Fermi 2.

Toll Road runs north from Fermi Drive (near the main gate) just outside the property boundary. Toll Road is a public county road south of Langton Road; north of Langton Road, it is a private gravel road called Fisher Street with an easement for public use. This road is not heavily used, but provides access to the agricultural parcels just west of the Fermi site. Fermi Drive is also a private road with an easement for public use on the portion west of the site boundary and main security gate. Fermi staff coordinates with the Monroe County Emergency Management Division to provide effective access control for Toll Road, Fermi Drive, and other local roads as needed.

2.2.1.2.2 **Local Communities**

Many townships and villages are present within the 7.5-mile vicinity around the Fermi site in Monroe and Wayne Counties, Michigan, as well as Amherstberg municipality in Essex County, Ontario, Canada.

Estral Beach, Stony Point, Detroit Beach, and Woodland Beach are small towns located along the Lake Erie shore within 5 miles of Fermi. These communities are blended summer resort and permanent residential areas. The nearest of these is Stony Point, about 2 miles south of Fermi. The land within 5 miles of Fermi is primarily agricultural with the exception of these communities and the small Newport-Oldport residential area to the northwest.

Socioeconomic information covering the Fermi vicinity, including population information and traffic conditions, is discussed in Section 2.5.

2.2.1.2.3 **Land Use and Planning**

State laws authorize Michigan townships to provide planning and zoning services in their communities. The majority of townships have a zoning ordinance and/or a master plan; others have planning and zoning provided through county governments (Reference 2.2-13). Frenchtown Township and Berlin Township have their own master plans that apply to the Fermi site and vicinity. The Monroe County Comprehensive Plan also governs planning and zoning for the area.

The 1985 Monroe County Comprehensive Plan (being updated at the time of this COL) includes the retention of agricultural land to serve as buffers between recommended major development corridors. The available land use plan maps and local contacts indicate that the majority of land located east of US 23, US 24, and I-75 in the northeast quadrant of the county will be reserved primarily for agricultural use. The Monroe County Planning Department provided information indicating that there is an increasing emphasis on conservation of agricultural lands in the county to preclude their development for other uses. The new comprehensive plan for Monroe County is likely to place more emphasis on protection and preservation of the county’s agricultural lands.

The development activities planned for the Fermi vicinity include residential subdivisions in Berlin Township, along Swan Creek Road, and along Dixie Highway, as well as construction of a big box store. No new industrial developments are projected for the area by the Monroe County Planning Director since many of the available land parcels are too small to support large industrial developments.

Industries and business parks near the Fermi site include the Frenchtown Business Park, Port of Monroe, Migano Industrial Park (formerly Ternes), MAC Steel, TWB, Spartan Steel, Monroe Recycling, Detroit Stoker, the Automotive Components Holdings (formerly Ford) plant, Advanced

Heat Treatment, National Galvanizing and the Meijer Distribution Center. Businesses with the largest numbers of employees in the area are given in Table 2.5-3. The Automotive Components Holdings plant is anticipated to close in late 2008.

In the southwest corner of the intersection of Newport Road and Telegraph Road about 4 miles northwest of the Fermi site, there is a former Department of Defense (DOD) property. Previously, about 480 acres were owned by the DOD; however, the majority of the site was sold to a private owner in the mid-1980s. A portion of the site is currently owned by the State of Michigan and is used by the Michigan Army National Guard. Plans for future use of this site have not been specified by the DOD.

Land use categories included in the 7.5-mile vicinity are included in Table 2.2-2. Topographic maps of the Fermi site vicinity are included in Section 2.4.

Refer to Section 4.1 and Section 5.1 for comparisons of site and vicinity land use that may be changed by Fermi 3 construction and operation.

2.2.1.2.3.1 **Agricultural Land Use**

The 1985 Monroe County Comprehensive Plan and the draft 2007 version of the plan update are consistent and show the majority of the area around the Fermi site being used for agriculture at the time of this COL application and into the future (Reference 2.2-9).

Lennard Ag Company operates in the Fermi vicinity and is a large potato and soybean agribusiness with 4700 acres split between Southwest and Southeast area operations in Michigan. Its Southeast operation covers the area between Blissfield and Monroe and is about 16 miles west-northwest of the Fermi site (Reference 2.2-14).

According to Michigan Department of Agriculture (MDA) information for Monroe County, there are very few dairy operations in the county. Because of the small number of dairy operations in Monroe County, the MDA, National Agricultural Statistics Service (NASS), and Michigan State University extension agents do not provide specific information on quantities of dairy products produced. No milk animals were identified in a recent land use census for the 5-mile area around the Fermi site. However, these animals are documented in the agricultural district that includes Monroe County (Reference 2.2-15). There are goats and sheep within 5 miles of Fermi, but no information was available about animal numbers or use of these animals for dairy production. Estimates of 2006 milk cow numbers for Monroe and Wayne Counties and District 9 as well as Essex County and Southern Ontario are presented in Table 2.2-3.

The small portion of Wayne County within 10 miles of the Fermi site is predominantly a residential area and has a limited amount of agricultural activity, mostly comprised of small crop growers of field corn, soybeans, hay, and some fresh market vegetables. There are very few dairy farms in this area and relatively little agriculture in Wayne County compared to other counties in the area because of the presence of Detroit and its urbanized expanse (Reference 2.2-15).

2.2.1.2.4 **Viewshed**

There are several areas in the vicinity of the Fermi site that could be considered visually sensitive; these are most likely to be recreation areas and tourist attractions such as Pointe Mouillee State Game Area and Sterling State Park. Existing Fermi 2 structures (cooling towers) are visible from both Pointe Mouillee and Sterling State Park as well as from much of the surrounding area. Certain points within the recreation areas likely have enough forest vegetation to shield views of Fermi from the perspective of an observer on the ground. Fermi can be seen along the shore of Lake Erie and, because it has been an existing facility in the vicinity for more than 20 years, it is likely to be accepted by most observers as part of the expected view in the area.

Section 3.1 provides additional discussion of the potential aesthetic aspects of the Fermi site, and shows projected views of the Fermi site from various vantage points, including the Pointe Mouillee State Game Area.

2.2.1.2.5 **Natural and Recreational Areas**

Natural features in the Fermi vicinity include Swan Creek to the west-northwest, Lake Erie to the east and north, South Lagoon in the southeastern portion of the Fermi site, Quarry Lake in the southwest corner of the Fermi site, the Huron River north at the Wayne-Monroe County boundary, and Stony Creek and the River Raisin to the south near Monroe.

There are several recreational facilities within the vicinity of the Fermi site, including wildlife conservation areas that provide hiking, fishing, and other recreation opportunities. The Fermi site and surrounding area along Lake Erie are part of the USFWS designated DRIWR (Reference 2.2-1). The DRIWR Congressionally approved acquisition boundary, shown on Figure 2.1-1 and Figure 2.1-2, extends along the shore of Lake Erie from the River Raisin at its south extent to the Detroit River at its northern point. Lands for eventual inclusion in the DRIWR are being added as they become available within the acquisition boundary. However, the DRIWR is not open to the public (Reference 2.2-1).

Major recreation areas in the Fermi vicinity are described in Table 2.2-4.

Hunting opportunities are available at several of the above recreation areas as well as many within the 50 mile region. Waterfowl hunting is a popular activity at some spots along the shoreline of Lake Erie. Public hunting areas along the shore are limited to a few locations such as the Pointe Mouillee State Game Area and portions of Lake Erie Metroparks. The most popular type of waterfowl hunting is by boat. Upland game hunting within the authorized DRIWR boundary is limited by local ordinances and the amount of undeveloped lands and public hunting areas. The portion of the DRIWR in southern Monroe County contains the greatest number of private croplands, open fields and woodlots where hunting for deer, wild turkeys, rabbits and other upland game is possible (Reference 2.2-16).

Estimates of the number of people who make use of the beaches along the western Lake Erie shoreline for swimming were not available. There are several public and private beaches along the Lake Erie shoreline of Monroe County and Wayne County, all open for swimming and other forms of water recreation. Lake Erie water quality in the Fermi vicinity and the region has improved greatly since the 1980s. Within the Fermi vicinity, members of the public who live in or stay temporarily in vacation homes along the shore are likely to use the beach areas, especially in the summer months.

Many land trust holdings for conservation were found in the vicinity and the region and are generally held by environmental organizations. There are no land trust holdings in Monroe County, but neighboring counties outside the Fermi vicinity feature various examples of this type of property (Reference 2.2-17). Because of the number and variety of trust lands within the region and the fact that they are not usually major recreation areas, these lands are discussed in general terms in Subsection 2.2.3.

2.2.1.2.6 **Water, Rail, and Air Transportation**

Lake Erie ports and shipping activities have major benefits for the regional economy. The ports along the Lake Erie shoreline in Monroe, Michigan and Ohio serve as destinations for raw materials and distributors of finished goods associated with mining, steelmaking, construction, power generation, and many support industries throughout the world.

Near the Port of Monroe, the navigation channel depth is 21 feet (Reference 2.2-18). The shallow draft near Monroe and the Fermi site requires dredging of a shipping channel so that commodities can be loaded and unloaded to and from large vessels.

Many small marinas and docks line the shore areas of Lake Erie throughout the vicinity. The closest marinas are just north of the Fermi site on the north side of Swan Creek (Swan Boat Club and Swan Yacht Basin at 1.4 miles). Brest Bay Marina is another nearby facility at 2.2 miles southwest of the Fermi site. A comprehensive list of marinas and similar facilities is provided in Subsection 2.5.2.

Lake Erie, which is adjacent to the east side of the Fermi site, provides access to water transportation at the site and in the vicinity. There is a significant amount of barge traffic on Lake Erie near the Fermi site, most of which is in transit to or from the Port of Monroe, the Port of Detroit, or the Port of Toledo. The nearest river port facility is the Port of Monroe, located in the southeast area of the city of Monroe near the mouth of the River Raisin as it flows into Lake Erie. The Port of Monroe is a small facility and Michigan's sole port on Lake Erie. The port offers industrial businesses the resources for transporting bulk raw materials and has immediate access to rail routes and highways. The port is in close proximity to an airport (Reference 2.2-18). This facility is about 7 miles south of the Fermi site at its closest point. Ports in the Fermi vicinity and the cargo transported are further discussed in Subsection 2.5.2.

Four rail lines enter the 7.5-mile area around Fermi, as shown on Figure 2.1-2. The Canadian National line enters the 7.5-mile area approximately 5 miles north of the Fermi site and leaves the vicinity about 6 miles southwest of the site, traveling southwest toward Toledo. This line is a small portion of the nationwide railroad system operated by Canadian National. No plans to expand the current level of rail service in the area are indicated in the Michigan State Transportation Plan (Reference 2.2-19).

A single spur track off the Canadian National main rail line crosses the Fermi site in a west-east direction generally parallel to the route of Fermi Drive. Coming from the north toward the Fermi site, service on the Canadian National main line continues past the plant (about 4 miles west) and south into the rail yards of Toledo, and beyond to Columbus, Dayton, Chicago, Bellevue, and Tiffin (Reference 2.2-20).

Along a parallel path in the same area as the Canadian National line west of Fermi, Norfolk Southern also has two lines that traverse the 7.5 mile radius in the vicinity of Newport (lines are very close together and appear as one line in Figure 2.1-2). There are no spurs off the Norfolk Southern line in the vicinity of Fermi. Rail lines beyond the 7.5 mile radius are described in Subsection 2.2.3.

Further west, about 8 miles west of the Fermi site, is a CSX Transportation rail line running roughly parallel to the Canadian National and Norfolk Southern lines discussed above. This line also runs north through Detroit and south to Toledo, where it branches southwest (Reference 2.2-21).

The Windsor Airport is located about 27 miles northeast of the Fermi site in Ontario, Canada (Reference 2.2-22). Other large airports in the region are farther from the Fermi site and are discussed in Subsection 2.2.3 and Subsection 2.5.2.

2.2.1.2.7 **Pipelines**

Two major natural gas pipelines are present in the vicinity of the Fermi site, traversing the Fermi vicinity in a southwest-northeast direction. The nearest gas-transmission pipeline is a 22-inch diameter Panhandle Eastern Pipeline Company line running roughly southwest-northeast about 10 miles west of Fermi 3, as shown on Figure 2.2-2. There is another Panhandle Eastern line running parallel to the first one about 0.5 mile further west; this line has a 26 inch diameter. The pipelines carry natural gas.

In Monroe County, the main natural gas providers are Michigan Gas Utilities and Michigan Consolidated Gas. The smaller gas lines from these companies that serve homes and businesses are located in the more populated areas and along major road frontages (Reference 2.2-23). Large natural gas pipelines in the vicinity of the Fermi site are located in the far western portion of the 7.5 mile vicinity. They generally run from the Toledo area through Detroit, then branch in east-west directions north of Detroit. Locations of pipelines are shown on Figure 2.2-2 and Figure 2.2-6.

Several petroleum lines are present within the vicinity; all of these lines run in essentially the same corridor about five to 6 miles west of the Fermi site in a southwest-northeast direction roughly parallel to the route of I-75.

2.2.2 **Transmission Corridors and Offsite Areas**

The proposed offsite transmission system for Fermi 3 is described in Section 3.7. In summary, three new 345 kV transmission lines and a separate switchyard are needed to serve Fermi 3. The route for the new lines will span approximately 29.4 miles within an assumed 300-foot right-of-way (ROW) along existing corridors to the Milan Substation. It is assumed that the Milan Substation may be expanded from its current size of 350 by 500 feet to an area approximately 1,000 by 1,000 feet to accommodate the three new transmission lines from Fermi 3.

Additional temporary access corridors are not anticipated for construction of the transmission system and there are no new offsite areas under the control of Detroit Edison that will be required for construction or operation of Fermi 3.

2.2.2.1 **Existing Transmission Routes and Land Use**

The International Transmission Company (ITC*Transmission*) owns and operates the transmission system in Southeastern Michigan. The 345 kV transmission system which provides power to and receives power from Fermi 2 is anticipated to serve Fermi 3.

Electrical power is also provided to the Fermi site via the 120 kV switchyard. This 120 kV system is not directly connected to Fermi 3 and is therefore not discussed. The existing transmission lines serving Fermi 2 and the route proposed to serve Fermi 3 are shown on Figure 2.2-3.

The existing 345 kV transmission corridor on the Fermi site runs from the onsite switchyard west past Doxy Road, then continues west along and just north of Fermi Drive (Figure 2.1-4). There is a small area abutting the west property boundary under the transmission lines that has been restored to native prairie.

The 345 kV infrastructure consists of two double-circuit lines carrying power between Brownstown Substation and Fermi 2. The Brownstown Substation is located north-northwest of the intersection of I-75 and Vreeland Road near Woodhaven, Michigan. From the Fermi site, the 345 kV lines run in a 5-mile corridor to a point just west of I-75 (Figure 2.2-3). The transmission corridor crosses agricultural land outside the west Fermi property boundary up to its intersection with I-75. From this point, the two Fermi-Brownstown double-circuit 345 kV lines run north to the Brownstown Substation for about 12 miles adjacent to and on both sides of I-75. The routes to the Brownstown Substation are characterized by the intersection of agricultural land and the developed land corridor adjacent to I-75.

Land use restrictions within the transmission line easements for lines serving Fermi are governed by agreements between ITC*Transmission* and the property owners along the route. ITC*Transmission* safety guidelines reference the use of agricultural equipment in areas beneath and near transmission lines, and agricultural land use occurs beneath the lines as can be seen on aerial photographs (Reference 2.2-24).

The routes and lengths for the two 345 kV transmission lines that exit the Fermi site are as follows:

1. Fermi-Brownstown #2 345 kV

   Brownstown Substation South - 15.4 miles north of Fermi (Woodhaven, MI)

2. Fermi-Brownstown #3 345 kV

   Brownstown Substation North - 16.2 miles north of Fermi (Woodhaven, MI)

The land use along the existing transmission routes consists mainly of agriculture (cropland and pasture), with some parts of the corridors surrounded by residential, forested, and developed areas. The existing transmission routes and the types of land use along the routes are shown in Table 2.2-5 and on Figure 2.2-3. Figure 2.2-3 shows land use within an approximately 0.5 mile area around each existing route and the proposed Milan transmission route for orientation. The land uses within 0.5 mile of existing and proposed 345 kV transmission corridors are detailed in Table 2.2-6. The existing Fermi-Brownstown 345 kV transmission corridors are maintained at an approximate 150 to 200 foot width range outside of the site.

Land use along the existing transmission line routes roughly corresponds with land use in the region around the Fermi site, which is largely agricultural with some developed areas. Refer to Subsection 2.2.3 for a listing of land uses in the 50-mile region. All of the existing Fermi transmission routes cross roads, and most cross major highways (I-75). None of the routes cross designated or protected natural areas. The routes to the Brownstown Substation cross Swan Creek and the Huron River.

2.2.2.2 **Proposed Transmission System Modifications and Land Use**

Three new transmission lines and a separate switchyard will be needed for Fermi 3 per System Impact Study Report (MISO G867) performed by ITC*Transmission* (Reference 2.2-51). The study indicated the use of new and existing towers, steel poles and/or combinations of these structures will be used in the construction of the new transmission lines to the Milan substation. Without the new transmission lines, the study also indicates that the full power output of Fermi 3 contributes to post contingency overloads on the system, most notably at the points of interconnection on the 345 kV, 230 kV, and 120 kV portions of the system. The study further finds that if Fermi 2 and Fermi 3 have switchyards tied together, unstable conditions may arise. Both 345 kV switchyards will be separate from the onsite 120 kV transmission system.

Onsite

Within the Fermi site, there will be a short length of new transmission corridor needed to transmit power from the Fermi 3 generator to the Fermi 3 switchyard at the intersection of Toll Road and Fermi Drive (refer to Figure 2.1-4). This new transmission corridor will be approximately 170 feet wide and include two sets of towers. The towers will carry both rerouted Fermi 2 transmission lines and new Fermi 3 transmission lines. The new corridor will head west-southwest out of the Fermi 2 switchyard and Fermi 3 power block, turn northwest and cross the canal north of the proposed cooling tower location, then proceed northwest over a Berns Drain area that is a mosaic of phragmites/cattail wetland and along a forested wetland. Near the perimeter fence adjacent to Toll Road, the corridor turns southwest along the fence through woodlot forest, forested wetlands, and thicket until it enters the Fermi 3 switchyard. The switchyard is located in a prairie restoration area.

Onsite 120 kV support for Fermi 2 will be routed underground along the disturbed Fermi Drive corridor.

Offsite

In addition to the Department of Interior “Environmental Criteria for Electric Transmission Systems" and the Federal Power Commission "Guide Lines for the Protection of Natural Historic, Scenic, and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities," when this transmission route to the Milan Substation was originally considered for Fermi 2, the criteria used to select and evaluate the new transmission line route between Fermi and Milan Substation, included the following (Reference 2.2-52):

- Use the shortest route with minimum turns to minimize impact on property owners and property acquisition and construction costs.
- Follow property lines as much as possible to minimize impact on property owners.
- Route through less populated areas and avoid homes and buildings to the extent possible.
- Avoid trees, where practical, and use selective cutting and feathering techniques when wooded areas cannot be avoided to minimize impact on environmental and construction costs.

Several alternate route options for the new transmission line were studied during that previous selection process, and the route option proposed (Fermi to Milan Substation) was that which minimized the line's environmental impact at a reasonable cost.

The proposed route for the three new 345 kV transmission lines from Fermi to the Milan Substation will span approximately 29.4 miles within an assumed 300-foot wide ROW along the entire corridor, with the first 18.6 miles (going west and north from Fermi) installed alongside the 345 kV lines that are already in place (refer to Figure 2.2-3). While ITC*Transmission* has indicated that the lines in this 18.6 mile portion of the route would be created largely by the reconfiguration of conductors on existing towers within the transmission ROW, placement of additional transmission infrastructure may be necessary.

Most of the route for the new transmission lines crosses an area that is agricultural and forested in nature. The majority of the 18.6 mile portion of the route would cross large crop fields, while the construction along the 10.8 mile stretch of ROW heading east near the Milan Substation would run through forests, rural residential areas, and agricultural fields.

It is assumed that the Milan Substation may also be expanded from its current size of 350 by 500 feet to an area approximately 1,000 by 1,000 feet to accommodate the three new transmission lines from Fermi 3. This expansion would encroach into maintained grass and agricultural areas.

The final 10.8 miles of the route approaching the second ITC*Transmission* system interconnection point at the Milan Substation near Milan, Michigan, would be located in a portion of the transmission ROW previously authorized for transmission use, but is largely undeveloped (some transmission tower footings were installed as part of the original Fermi 3 plan) and has been minimally maintained. For the purpose of this land use discussion, the 10.8 mile portion of the proposed route is presumed to be of 300-foot ROW width. To accommodate construction of new transmission towers, steel poles, footings, and conductors along this portion of the corridor, ITC*Transmission* has indicated that acquisition and clearing of additional land adjacent to the existing ROW could be necessary. Methods of transmission line and tower construction will be in accordance with utility industry best practices and ITC*Transmission* construction standards.

Near the transition point where the Fermi-Milan lines running west and north for approximately 12 miles in a corridor shared with other non-Fermi lines meets Fermi-Milan lines continuing west for approximately 10 miles to the Milan Substation (east-northeast of the intersection of Arkona Road and Martinsville Road), the route runs just north of one public recreation land, Crosswinds Marsh Wetlands Interpretive Preserve. This preserve, located in Sumpter Township of Wayne County, Michigan, is an approximately 900 acre parcel of wetlands, prairies, and forests that is open for multiple uses, including birding, hiking, and educational programs. The preserve is roughly bounded by Haggerty Road (east), Oakville-Waltz Road (south), Martinsville Road (west), and Willow Road (north).

The 18.6 mile developed section of the transmission ROW crosses two wetlands and 12 drains or streams, while the 10.8 mile undeveloped section crosses eight wetlands and nine drains or streams, mostly tributaries of Stony Creek.

There are no airports located within 2 miles north or south of the 10.8 mile portion of the Fermi-Milan route. Transmission towers/poles would likely be at a height low enough that no conflicts with airports or flight paths would occur.

Using an assumed 300-foot transmission corridor width for the new 345 kV lines to the Milan Substation, the entire 29.4 mile length of the route has the potential to impact about 1069 acres. Since the first 18.6 miles of the transmission route travels within transmission corridors with towers and lines present, it is likely that the impact area would be smaller along this portion than the area potentially affected by the new construction along the 10.8 mile portion of the transmission route nearest to the Milan Substation which could be approximately 393 acres. It is likely that most of these 393 acres would be impacted due to construction of new transmission lines on new towers and steel poles along the transmission ROW. It has not been determined whether additional areas outside the assumed 300-foot corridor are needed for laydown of equipment. As discussed above, the interconnection studies are performed by ITC*Transmission*, including determining the route for these new transmission lines. As part of this process, Detroit Edison is not involved in the evaluation or decision making for proposed changes to the transmission system or possible design alternatives. Accordingly, Detroit Edison cannot reasonably provide the transmission system design alternatives considered by ITC*Transmission*.

The route to the Milan Substation would begin on the Fermi site at the proposed new Fermi 3 switchyard at the intersection of Toll Road and Fermi Drive. It would follow the existing 4.5 mile common Fermi transmission corridor west across agricultural land uses to I-75. After crossing I-75, the route would continue west in the existing transmission corridor, crossing agricultural and low density residential areas and Old Town Golf Course through northern Monroe. The route crosses Stony Creek Road, Highway 125, and Telegraph Road (Highway 24), then crosses agricultural land and cuts through scattered forest and additional agricultural land before turning north near Steiner Road. From this point, the route continues almost directly north (parallel to and east of Exeter Road) through agricultural cropland with scattered forest and residential areas. It crosses the Panhandle Eastern Pipe Line Company natural gas line in northern Monroe County, then continues across agricultural areas until a point just north of Arkona Road in Wayne County, where it turns west. The 18.6-mile developed portion of this existing transmission ROW continues briefly to the west to a point midway between Haggerty Road and Martinsville Road. Up to this point, the route would pass mostly agricultural areas, with some nearby commercial and scattered industrial facilities present near the Monroe area and just before the route turns west. West of Haggerty Road, use of the 10.8-mile undeveloped portion of the existing ROW would begin as the route runs through rural residential and agricultural areas to the second grid interconnection at the Milan Substation in Washtenaw County.

From its beginning point, the 10.8 mile portion of the route would traverse the following features and land uses, and cross the following roads, from east to west as it runs toward the Milan Substation interconnection:

Haggerty Road to Martinsville Road - forest and undeveloped land.

Martinsville Road to Sumpter Road - mostly forest with some agricultural and rural residential areas.

Sumpter Road to Elwell Road - forest, large parcel of undeveloped land in beginning stages of development (adjacent to the north of ROW).

Elwell Road to Karr Road - agricultural with some forest.

Karr Road to Sherwood Road - forest and agricultural land.

Sherwood Road to Rawsonville Road - forest and agricultural/rural residential.

Rawsonville Road to Bunton Road - agricultural land, forest, rural residential.

Bunton Road to Sikorski Road - forest edges along rural residential/agricultural land.

Sikorski Road to Tuttle Hill Road - forest and few rural residential.

Tuttle Hill Road to Whittaker Road - forest, agricultural, golf course, rural residential.

Whittaker Road to Hitchingham Road - mostly forest, one undeveloped or agricultural portion.

Hitchingham Road to Gooding Road - forest and agricultural lands.

Gooding Road to McCrone Road/Milan Substation - agricultural, Norfolk Southern railroad line crossing, McCrone Road crossing just before Milan Substation interconnection.

The new transmission route would pass through Monroe, southwest Wayne, and southeast Washtenaw Counties. Michigan State land use plans and SEMCOG regional plans do not specifically address compatibility of new transmission system siting with existing land use plans. Although additional land may need to be acquired for the corridor, the new transmission route would have manageable effects on land use in the surrounding areas. These impacts would be lessened somewhat by the use of a ROW that is already authorized and maintained for transmission use. Sumpter Township (Wayne County) and the City of Milan, Milan Township, and York Township (Washtenaw County) have local codes and ordinances that govern essential services such as electric transmission lines; these codes generally hold that essential utility uses in agricultural and rural residential areas are acceptable. Sumpter and Milan Townships allow essential services such as electric transmission lines to be exempted from most ordinances or authorize them on most land uses under the zoning code using a special exception. York Township implements a Stony Creek Watershed Management Plan since the watershed covers much of the township, including much of the new transmission route to the Milan Substation.

Augusta Charter Township in the southeast corner of Washtenaw County has a Master Plan and Zoning Ordinance that allows essential utility uses in existing rights-of-way in agricultural and other rural areas, including those along the proposed route of the new transmission line route to the Milan Substation. The state of Michigan and most local jurisdictions have goals of protecting and preserving farmland, and township maps show local conservation or open space lands near the new transmission route (Reference 2.2-28). Use of the new transmission route along existing and expanded rights-of-way would be consistent with local goals and would prevent greater land use impacts to large areas of valuable farmland and open space that could result from development of an entirely new corridor (Reference 2.2-29 and Reference 2.2-30). Therefore, it is reasonable to conclude that the use of the 10.8-mile undeveloped section of corridor to the Milan Substation would be compliant with local, state, and regional land use plans.

Land use restrictions within the new transmission line easements would be governed by agreements between ITC*Transmission* and the property owners along the proposed route. Any expansions needed to existing ROW along the new transmission route are expected to involve largely temporary changes to existing land uses adjacent to the corridor.

The land uses crossed within 0.5 mile of existing Fermi 345 kV transmission corridors including the proposed route to the Milan Substation are detailed in Table 2.2-6.

2.2.3 **The Region**

The 50-mile region surrounding the Fermi site is dominated by agricultural land use. Outside of the major metropolitan areas of Detroit, Michigan; Toledo, Ohio; and Windsor, Ontario, Canada; most of the area is cropland and pasture.

No Native American tribes are located wholly within the 50-mile region and no Native American land claims have been made in the Fermi 7.5-mile vicinity; therefore, Native American land use plans do not apply to the Fermi region. A very small portion of the Walpole 46 First Nation Reserve northeast of the Fermi site in Ontario, Canada, is just inside the 50-mile region. The Walpole Reserve is a 17,050 acre parcel that extends about 10 miles further northeast outside the 50 mile region (Reference 2.2-25).

The 50-mile region surrounding Fermi is characterized by its proximity to the Great Lakes. The Fermi site falls within the coastal zone of Michigan, which extends along the state's shoreline. Ohio has a similar coastal zone along its Lake Erie shoreline; however, Canada does not have a comparable coastal zone management program for its Great Lakes shoreline areas. Coastal zone boundaries on the land within the 50-mile region are shown on Figure 2.1-1.

2.2.3.1 **Regional Land Use**

Overall land use in the 50-mile region is substantially similar to land use in the 7.5-mile vicinity. The 50-mile region is approximately 37 percent agricultural, whereas the 7.5-mile vicinity agricultural land use is 24 percent. These seemingly small percentages of agricultural land use can be put into perspective by the fact that the open water of Lake Erie comprises a large portion of both the region (28 percent) and the vicinity (54 percent), as shown on Figure 2.2-1 and Figure 2.2-4. As in the vicinity, the agricultural land use comprises just over half of the available land in the region.

Michigan's unique flat geography and proximity to four of the five Great Lakes contribute to its status as the second most agriculturally diverse state in the United States. Michigan's 50,000 farmers grow over 125 crops, contributing to a farm industry that adds over $50 billion to the state's economy (Reference 2.2-26). Development pressures and poor returns on conventional products are forcing many small and mid-sized farms out of the market on a yearly basis; however, agricultural land use continues to dominate the region.

Table 2.2-7 presents land use within the 50-mile region and the portion of the region that each land use comprises.

The states of Michigan and Ohio are each divided into nine districts for reporting agricultural information by the NASS. The 50-mile region includes most of Michigan District 9 with the remainder being a small portion of Jackson County, which is in District 8. The counties included in District 9 are St. Clair, Lapeer, Genesee, Livingston, Oakland, Macomb, Washtenaw, Wayne, Monroe, and Lenawee (Reference 2.2-27). Portions of Ohio Districts 1 and 2 fall within the 50-mile region and include the following counties, respectively: Williams, Fulton, Lucas, Wood, Henry, Defiance, Paulding, Putnam, Hancock, Allen, and Van Wert for District 1 and Ottawa, Sandusky, Erie, Lorain, Huron, Seneca, Wyandot, Crawford, Richland, and Ashland for District 2 (Reference 2.2-28). Ontario, Canada is divided into five regions for reporting by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), with the portion in the 50-mile region falling within Southern Ontario. Southern Ontario includes the following areas: Brant County, Chatham-Kent Division, Elgin County, Essex County, Haldimand-Norfolk Regional Municipality, Hamilton Division, Lambton County, Middlesex County, Niagara Regional Municipality, and Oxford County (Reference 2.2-29).

The major agricultural products and livestock of the region are soybeans, corn, wheat, milk, cattle, and hogs and pigs. Table 2.2-8 provides detailed production by year and averages over 3-year periods for most agricultural products in the 50-mile region. Lenawee County is ranked the second highest among principal counties for corn growing for grain and soybeans, and third highest for wheat, according to 2006 NASS county rankings for Michigan. Monroe County was ranked fifth highest among principal soybean growing counties. None of the Michigan counties in the 50-mile region were listed in the top five principal production counties for livestock or fruits and vegetables (Reference 2.2-30).

2.2.3.1.1 **Agriculture in Michigan**

Dairy farms in the Michigan portion of the region are located in the Carleton, Milan, Adrian, Dundee, and Ann Arbor areas north and mostly west of Fermi. Milk production for the seven county area encompassed by Wayne, Oakland, Macomb, Monroe, Washtenaw, Livingston, and Lenawee Counties was 448,000,000 pounds in 2006. Average annual milk production in the region is estimated at about 25,000 pounds per dairy cow. Some large Confined Animal Feeding Operations (CAFO) type dairies are present in Lenawee County, Michigan, and these types of facilities are also located in the Ohio portion of the 50-mile region.

Fresh market and processed fruits and vegetables comprise a large segment of the agriculture within the 50-mile region. The Eastern Market in Detroit is a major fresh market vegetable distribution location.

Grains grown in the area typically flow toward Toledo. Other significant destinations include ethanol plants in Riga and Marysville, Michigan. At times, significant grain exports head toward Canada to supply biofuels production. When the currency exchange rates are favorable, livestock and grain are exported to Canada to support livestock production operations. A significant amount of meat is processed around Detroit's Eastern Market, and most meat and dairy products are exported out of Michigan. Fruits and vegetables are either sold as commodities to processing companies or through farm markets and roadside stands.

Southeast Michigan is also home to the largest metropolitan area in the state and one of the largest in the nation, with over two million people living in Detroit (Wayne County) and its surrounding suburbs. More than 300,000 people live in cities and villages within Washtenaw County, mostly near Ann Arbor. This population represents the main consumer base for the agricultural counties of Monroe, Lenawee, and other less populated counties in southeast Michigan. Most agricultural products are shipped out of state (Reference 2.2-26).

2.2.3.1.2 **Agriculture in Ohio**

In the Ohio portion of the 50-mile region, urban Lucas County contains the Toledo metropolitan area. It is similar to Wayne County, Michigan in that it is host to a major city in the region and does not have as much agriculture as surrounding counties that are less urbanized. In Lucas County, there are no dairies and very few beef cattle. Crops are grown in greenhouses in the county, and most greenhouse operations raise vegetable starts. Many truck farming products are grown in the area, such as squash, tomatoes, cucumbers, and melons. There are a significant number of farmer's markets in Lucas County. One large poultry facility (two million laying hens) in the county supplies about 10 percent of the egg production for Ohio. Most of the large agricultural producers in the county sell their products to the eastern markets (Chicago, New York, and Philadelphia).

Overall in the area, general crops like corn, soybeans, and wheat are the major agricultural products. Lucas County trades crops with Canada; usually, more crops are imported from Canada than are exported from Lucas County. Cattle are usually shipped to Striker, Ohio, to a collection point, and are then shipped to other locations. Hogs and pigs go to Sandusky County to the Roth packing facility. Produce is exported to Florida, Chicago, and other large metropolitan areas.

Outside of Lucas County, vegetable crops generally move toward the larger cities like Detroit, but not many crops are exported to Canada. Roadside stands and farmer's markets are the primary distribution points for crops in the area.

Sandusky and Ottawa Counties do not have many dairies of large size. There are four dairies with about 100 cows or less each existing in Ottawa County and nine dairies with about 100 cows or less each existing in Sandusky County. There are a few hog farmers in the area. Truck farm production in the counties consists mainly of tomatoes, cabbage, cucumbers, and pickles. Fresh produce can be found at a number of farmer's markets in the area, including large markets in Toledo, Columbus, and Cleveland. A produce auction is also available in the Bloomville area.

Northern Ottawa County, on the peninsula that juts out into Lake Erie, is the location of many fruit farms. Most fruits are generally sold in the bigger cities like Toledo.

2.2.3.1.3 **Agriculture in Southern Ontario**

Outside the Windsor metropolitan area, most of the land in the Canada portion of the region is agricultural.

The province of Ontario has many commercial poultry, hog, dairy, and beef cattle farms. Significant crops include soybeans, corn, mixed grains, forage crops, and wheat and barley. Vegetables also comprise a large share of Ontario's agricultural production. The rich agricultural lands and mild climate of Southern Ontario allow, in addition to the major soybean, corn, and wheat crops grown, for the cultivation of fruits including peaches, plums, and grapes, and specialty crops such as tobacco, ginseng, dry beans, and mushrooms (Reference 2.2-31).

2.2.3.2 **Regional Transportation and Utility Networks**

Transportation infrastructure within the region includes Lake Erie, US 24 and I-75 about 4 miles west of Fermi, and Dixie Highway, which runs about 1.2 miles west of the Fermi 2 reactor. From Monroe, I-75 goes north to Ontario, Canada at its northernmost point and south almost to Miami, Florida at its southern reach (Reference 2.2-32). US 24 (Telegraph Road) runs northeast-southwest in the vicinity of the site, then gradually zigzags southeast through parts of Ohio, Indiana, and Illinois, ending near Palmyra, Illinois. Figure 2.2-5 shows the locations of highways, railroads, and airports in the 50-mile area.

There are many airports in the 50-mile region, the largest of which is the 6700 acre Detroit Metropolitan Wayne County Airport about 19 miles north-northwest of the Fermi site (Reference 2.2-33). The Coleman A. Young International Airport (Detroit City) commuter airport is located about 33 miles north-northeast of the Fermi site (Reference 2.2-34). The other large airport in the United States portion of the region, the Toledo Express Airport in Ohio, is undergoing a four year renovation project (Reference 2.2-35 through Reference 2.2-37). In addition to the aforementioned major passenger airports, Willow Run Airport is located 24 miles northwest of the Fermi site. Willow Run is one of the nation’s largest airports for handling cargo air freight (Reference 2.2-38).

Other than the rail lines in the vicinity of the Fermi site discussed in Subsection 2.2.1, the surrounding region includes a CSX Transportation rail line traveling roughly north-south in the easternmost portion of the region in Lenawee County. Other rail lines in the region travel through the southeast Michigan area in a general southwest-northeast direction. Rail lines traversing the region include Tuscola & Saginaw Bay Railway, which travels northwest to southeast, is crossed by a Norfolk Southern line at Milan, Michigan, and becomes a Norfolk Southern line just south of Dundee, Michigan. At the same point where the line ownership changes, an Indiana & Ohio Rail System track branches off the line to the southwest. To the south-southwest in the Toledo area, the main Canadian National and Norfolk Southern lines branch out into several lines, many owned by Norfolk Southern and a few others by CSX as they branch out from Toledo through Ohio. There is also an Amtrak line that passes through Toledo and connects to Chicago and New York. Toledo is a major national transportation hub, located at the crossroads of four railroads and two transcontinental highways (Reference 2.2-21). A Canadian Pacific rail line loops through the city of Windsor in Essex County, Ontario, Canada, about 27 miles northeast of Fermi. Major transportation infrastructure is shown on Figure 2.2-5.

2.2.3.3 Regional Transmission Lines and Pipelines

There are various voltages of transmission lines, including 345 kV and 120 kV that serve the region. Natural gas pipelines are found throughout the region, and the closest two major natural gas lines exist outside the 7.5-mile vicinity, about 11 miles west of the Fermi site. These pipelines run in a general southwest-northeast direction through Monroe and Wayne Counties and further northeast through Oakland and Macomb Counties, where they later branch off east and west. The major lines running through Monroe County and the general area to the west of the Fermi site pass near Dundee, Maybee, and Carleton along their route toward downtown Detroit and points farther north. Figure 2.2-6 shows major pipelines in the region.

2.2.3.4 Regional Natural and Recreational Areas

In addition to those recreation areas within the 7.5-mile vicinity discussed previously in Subsection 2.2.1, some of the major recreational areas of the 50-mile region include those in Table 2.2-9. There are also many state game areas, wildlife areas, and trust lands in the region, as shown on Figure 2.2-7. The Southeast Michigan Land Conservancy has conservation properties in various counties in southeast Michigan (Reference 2.2-17). Black Swamp Conservancy manages thousands of acres of conservation lands in Ohio. The Nature Conservancy is also active in land preservation efforts, with many parcels in the region in both Michigan and Ohio (Reference 2.2-39). Similar to organizations in the United States, the Ontario Land Trust Alliance and Canada South Land Trust work to preserve lands in Canada through conservation easements (Reference 2.2-40).

2.2.3.5 Regional Planning and Zoning

The main planning and zoning authorities in the 50-mile region are Frenchtown Township, Monroe County, and SEMCOG. Similar to SEMCOG, there is a planning organization called the Toledo Metropolitan Area Council of Governments (TMACOG) that assists in planning for the Toledo, Ohio area.

Most communities in the region have zoning and land use plans that apply to townships and entire counties. Each township controls planning and zoning within its boundaries in coordination with the county. Almost all counties in the region have land use plans and zoning in place. The city of Monroe and other incorporated cities in the region have their own codes and regulations under the county and independent of townships. Villages are governed by township rules. The relationships between various government entities are further explained in Section 2.5.

Monroe County is currently revising its Comprehensive Plan. The plan was updated in the period from 1985 to 1987 and is being updated at the time of this COL application. The updated plan is forecast to be completed in 2008.

The Michigan Association of Planning (MAP) is dedicated to promoting sound community planning that benefits the residents of Michigan through comprehensive community planning that includes opportunities for a variety of lifestyles and housing, employment, commercial activities, and cultural and recreational amenities. MAP provides models and tools that assist community planners with improved development patterns that conserve land and resources, build a vital economy, and provide sustainability for the future (Reference 2.2-41).

None of the planning or zoning activities performed by organizations in the region are anticipated to significantly affect the Fermi 3 site.

2.2.4 References

2.2-1 U.S. Fish and Wildlife Service, Midwest Region, “Detroit River International Wildlife Refuge,” http://www.fws.gov/midwest/detroitriver/, accessed 21 December 2007.

2.2-2 The Detroit Edison Company, Enrico Fermi Atomic Power Plant Unit 2, Applicant’s Environmental Report, Operating License Stage, Volume I, Supplement 4, February 1978.

2.2-3 Michigan Department of Environmental Quality, Office of Geological Survey, “Mineral Rights brochure,” http://www.deq.state.mi.us/documents/deq-ogs-land-oilandgas-mineral-rights.pdf, accessed September 2007.

2.2-4 Earthworks, “Split Estate Information,” http://www.earthworksaction.org/SplitEstate.cfm, accessed 11 March 2008.

2.2-5 U.S. Department of Agriculture, “USDA Compliance Library, Farmland Protection Policy Act, http://www.nrcs.usda.gov/programs/fppa/pdf_files/FPPA_Law.pdf, accessed 23 August 2007.

2.2-6 U.S. Department of Agriculture, Natural Resources Conservation Service, “Web Soil Survey,” version 2.0, http://websoilsurvey.nrcs.usda.gov/app/, accessed 21 November 2007.

2.2-7 Michigan Department of Environmental Quality, “Coastal Management Program Page and Coastal Zone Boundary Maps,” http://www.michigan.gov/deq/0,1607,7-135-3313_3677_3696-11188--,00.html, accessed 26 February 2008.

2.2-8 Federal Historic Preservation Laws, “Coastal Zone Management Act of 1972 (Portions, As Amended),” www.cr.nps.gov/local-law/FHPL_CstlZoneMngmt.pdf, pages 117 through 130, accessed February 2008.

2.2-9 Monroe County Planning Department & Commission, “Future Land Use Map,” Monroe County Comprehensive Plan - 1985 Update, printed May 1987.

2.2-10 James D. Anulewicz Associates, Inc. in conjunction with McKenna Associates, Inc., “Zoning Map (including updates through Amendment Map number 17-05), Frenchtown Township, Monroe County, Michigan,” revision date 19 January 2006.

2.2-11 Michigan Department of Transportation, Road & Bridge Projects pages, “I-75 Project 2, Wayne County,”http://www.michigan.gov/mdot/0,1607,7-151-9621_11008---,00.html http://www.michigan.gov/mdot/0,1607,7-151-9621_11008---,00.html, and “Pavement repairs to begin on I-75, in Monroe County, starting Tuesday night, Oct. 2,” http://www.michigan.gov/mdot/0,1607,7-151-9620_11057-176879--,00.html, accessed 14 March 2008.

2.2-12 James D. Anulewicz Associates, Inc. in conjunction with McKenna Associates, Inc., “Master Plan - Charter Township of Frenchtown, Monroe County, Michigan, 2002,” June 2003, Adopted 26 June 2003.

2.2-13 Michigan Townships.org, Planning and Zoning Information, Services and Programs, “Planning and Zoning,” http://www.michigantownships.org/planzone.asp, page last updated 5 March 2008, accessed 14 March 2008.

2.2-14 Lennard Ag Company, Samaria, Michigan, Current Operations, “Advanced and Efficient Operations,” http://lennardag.com/current-ops.htm, accessed 14 March 2008.

2.2-15 U.S. Department of Agriculture, National Agricultural Statistics Service, “County Livestock Estimates (Monroe County, Wayne County, District 6),” http://www.nass.usda.gov/QuickStats, accessed 3 December 2007.

2.2-16 U.S. Fish and Wildlife Service, “Detroit River International Wildlife Refuge Comprehensive Conservation Plan, Chapter 4,” http://www.fws.gov/midwest/planning/detroitriver/finalCCP/ccp_chapter4.pdf, accessed February 2008.

2.2-17 Southeast Michigan Land Conservancy, “Livingston, Macomb, Monroe, Oakland, Washtenaw, and Wayne County pages,” http://www.smlcland.org/SMLC_properties.php, accessed 19 December 2007.

2.2-18 Port of Monroe, Michigan, “Lake Erie shipping facilities, commercial real estate, and regional economy,” http://www.portofmonroe.com, accessed 13 March 2008, and “Shipping facilities for water transportation, rail, and highway access to the Port of Monroe,” http://www.portofmonroe.com/facil.htm, accessed 17 March 2008.

2.2-19 Michigan Department of Transportation, “Michigan Transportation Plan: Moving Michigan Forward - 2005-2030 State Long-Range Transportation Plan,” (June 2007), http://www.michigan.gov/documents/mdot/MDOT_MI_Transportation_Plan_Final_200346_7.pdf, accessed February 2008.

2.2-20 Toledo Metropolitan Area Council of Governments, Draft *on the Move: 2007-2035 Transportation Plan*, “Chapter IV: Needs Assessment,” http://www.tmacog.org/Transportation/2035/Final%20Draft/2035_Plan_Chapter_4.pdf, accessed February 2008.

2.2-21 Michigan Center for Geographic Information, “Michigan’s Railroad System map,” http://www.michigan.gov/documents/MDOT_Official_Rail_130897_7.pdf, January 2007, accessed 7 February 2008.

2.2-22 Windsor Airport, “Windsor & Detroit: A Unique Combination,” http://www.windsorairport.net/win_det.cfm, accessed 5 March 2008.

2.2-23 Monroe County Planning Department & Commission, “Monroe County Comprehensive Plan - 1985 Update, Public Utilities Component (electric and natural gas utilities information),” printed May 1987.

2.2-24 ITC*Transmission* website, “Safety,” http://www.itctransco.com/app.php?sec=4&id=20, accessed 11 March 2008.

2.2-25 Hilderman Thomas Frank Cram for Poplar River First Nation, “Case Studies - First Nation Involvement in Protected Areas: Management Frameworks, Mechanisms, Structures, Background Working Paper - Poplar River First Nation Land Management Plan,” (27 October 2003), http://www.poplarriverfirstnation.ca/docs/AsatiwisipeAki_caseStudy.pdf, accessed December 2007.

2.2-26 University of Michigan School of Natural Resources and the Environment, “Investigating Opportunities to Strengthen the Local Food System in Southeastern Michigan, Executive Summary, February 2007,” http://www.fsepmichigan.org/reports/Local%20Food%20Systems%20Executive%20Summary.pdf, accessed February 2008.

2.2-27 U.S. Department of Agriculture, National Agricultural Statistics Service, “Charts and Maps, County Maps, State - District and County Boundary Maps,” http://www.nass.usda.gov/Charts_and_Maps/Crops_County/boundary_maps/indexgif.asp, Michigan map, accessed 13 February 2008.

2.2-28 U.S. Department of Agriculture, National Agricultural Statistics Service, “Charts and Maps, County Maps, State - District and County Boundary Maps,” http://www.nass.usda.gov/Charts_and_Maps/Crops_County/boundary_maps/indexgif.asp, Ohio map, accessed 13 February 2008.

2.2-29 Ontario Ministry of Agriculture, Food, and Rural Affairs, "County Statistics, Southern Ontario," http://www.omafra.gov.on.ca/english/stats/county/index.html, accessed 3 December 2007.

2.2-30 U.S. Department of Agriculture, National Agricultural Statistics Service, "County Estimates, (2006), County rankings, selected items," http://www.nass.usda.gov/Statistics_by_State/Michigan/Publications/Annual_Statistical_Bulletin/stats07/countyrank.pdf, accessed February 2008.

2.2-31 Government of Ontario, Canada, "About Ontario, Economy, Agriculture," http://www.gov.on.ca/ont/portal/!ut/p/.cmd/cs/.ce/7_0_A/.s/7_0_252/_s.7_0_A/7_0_252/_l/en?docid=004594, accessed 26 February 2008.

2.2-32 Interstate-Guide.com, "Interstate 75," http://www.interstate-guide.com/i-075.html, accessed 31 March 2008.

2.2-33 Metro Airport, "Press Room: Facts, DTW Facts," http://www.metroairport.com/about/facts.asp, accessed 10 December 2007.

2.2-34 City of Detroit Official website, "Coleman A. Young International Airport," http://www.ci.detroit.mi.us/Departments/Airport/tabid/72/Default.aspx, accessed 11 December 2007.

2.2-35 Airnav.com, "Toledo Express Airport," http://www.airnav.com/airport/KTOL, accessed 30 December 2007.

2.2-36 Toledo-Lucas County Port Authority, "Air Services," http://www.toledoportauthority.org/services/airservices.asp, accessed 26 June 2008.

2.2-37 Goliath Business Knowledge on Demand, "Midwestern Update," http://goliath.ecnext.com/coms2/gi_0199-460161/Midwestern-update-convention-centers.html, accessed 5 February 2008.

2.2-38 Willow Run Airport, "Airport Information," http://www.willowrunairport.com/information/, accessed 10 December 2007.

2.2-39 The Nature Conservancy in Michigan and Ohio, "Places We Protect," http://www.nature.org/wherewework/northamerica/states/michigan/preserves/, and http://www.nature.org/wherewework/northamerica/states/ohio/preserves/, accessed 10 March 2008.

2.2-40 Canada South Land Trust, "Canada South Land Trust - Introducing a New Land Trust for Canada's Carolinian Canada Zone," http://canadasouthlandtrust.org/newsletters/200401/105Introduction, accessed 10 March 2008.

2.2-41 Michigan Association of Planning, “About MAP,” http://planningmi.org/about.asp, accessed 10 March 2008.

2.2-42 U.S. Department of Agriculture, National Agricultural Statistics Service, “Michigan Agricultural Statistics for years 2002 through 2006, Field Crop County Estimates for soy, wheat, corn, oats,” http://www.nass.usda.gov/Statistics_by_State/Michigan/Publications/County_Estimates/index.asp, accessed January through March 2008, and Ontario Ministry of Agriculture, Food, and Rural Affairs, County Statistics, “Number of Cattle, Pigs, and Sheep by County 2006 and Ontario Poultry Production 1998-2006,” http://www.omafra.gov.on.ca/english/stats/livestock/index.html, accessed 3 March 2008.

2.2-43 Michigan Department of Natural Resources, “107 Pointe Mouillee State Game Area,” http://www.dnr.state.mi.us/publications/pdfs/wildlife/viewingguide/slp/107Mouillee/index.htm, accessed 17 March 2008.

2.2-44 Wildernet.com, “Sterling State Park, Michigan,” http://www.wildernet.com/pages/area.cfm?areaID=MISPST&CU_ID=165, accessed 17 March 2008.

2.2-45 Monroe County website, “Heck Park,” http://www.co.monroe.mi.us/monroe/default.aspx?PageId=280, accessed 17 March 2008.

2.2-46 Raisin River Golf Club, http://www.raisinrivergolf.com/, accessed 17 March 2008.

2.2-47 Huron-Clinton Metroparks, “Lake Erie Metropark,” http://www.metroparks.com/parks/pk_lake_erie.php, accessed 17 March 2008.

2.2-48 Monroe County Michigan Tourism Bureau, “Recreation, Monroe Multi-Sports Complex,” http://www.monroeinfo.com/recreation_mmsc.html, accessed 17 March 2008.

2.2-49 Monroe County, “River Raisin Battlefield,” http://co.monroe.mi.us/monroe/default.aspx?PageId=107, accessed 19 December 2007.

2.2-50 U.S. Department of Agriculture, National Agricultural Statistics Service, “Michigan Agricultural Statistics and Ohio Agricultural Statistics for years 2000 through 2006, Field Crop County Estimates for soy, wheat, corn, oats, potatoes, tomatoes and Livestock County Estimates for cattle, milk production, laying hens and poultry, hogs and pigs, and sheep and lambs,” http://www.nass.usda.gov/Statistics_by_State/Michigan/Publications/County_Estimates/index.asp, accessed January through March 2008, and Ontario Ministry of Agriculture, Food, and Rural Affairs, County Statistics, “Number of Cattle, Pigs, and Sheep by County for years 2000 through 2006 and Ontario Poultry Production 1998-2006,” http://www.omafra.gov.on.ca/english/stats/livestock/index.html, accessed 3 March 2008, and Ontario Ministry of Agriculture, Food, and Rural Affairs, County Statistics, “Area and Production, Ontario by County for years 2000 through 2006, statistics for soybeans, winter wheat, spring wheat, grain corn, oats,” http://www.omafra.gov.on.ca/english/stats/crops/index.html, accessed 5 December 2007.

2.2-51 ITC*Transmission*, “System Impact Study Report (MISO G867)”, Generation Interconnection in Monroe County, MI, July 21, 2008.

2.2-52 The Detroit Edison Company, Enrico Fermi Atomic Power Plant Unit 2, Applicant’s Responses to Federal Agency Comments on AEC Draft Environmental Statement, 1 June 1972.

Table 2.2-1 Acreage Associated with Land Uses on Fermi Site

	Area[1] Acres
Total Site	1260
Water	215
Forest	256
Wetland	273
Grassland	168
Other	136
Developed Areas	212

Notes:
1. Acreages given are approximate based on Figure 2.4-5 and Table 2.4-1.

Table 2.2-2 Land Use within the 7.5-Mile Vicinity

USGS Land Use Category	Acreage	Percent of 7.5-Mile Vicinity
Open Water	66,520	52.94
Developed, Open Space	4576	3.64
Developed, Low Intensity	8591	6.84
Developed, Medium Intensity	3802	3.03
Developed, High Intensity	1014	0.81
Barren Land (Rock/Sand/Clay)	1223	0.97
Deciduous Forest	3318	2.64
Evergreen Forest	6.67	0.005
Mixed Forest	23.13	0.02
Shrub/Scrub	95.41	0.08
Grassland/Herbaceous	1209	0.96
Pasture/Hay	6932	5.52
Cultivated Crops	23,465	18.67
Woody Wetlands	3331	2.65
Emergent Herbaceous Wetland	1550	1.23
TOTAL	125,655	100

Table 2.2-3 Livestock Population Estimates for Local Counties and Districts, 2006

	Milk Cows (head)
Monroe County	NR
Wayne County	NR
District 9[1]	24,000
Essex County[2]	910
Southern Ontario[2]	73,172

NR - Not reported

Notes:
1. Michigan Agricultural Statistics District 9 includes St. Clair, Lapeer, Genesee, Livingston, Oakland, Macomb, Washtenaw, Wayne, Lenawee, and Monroe Counties.
2. For Canada, statistics are reported by county and province rather than agricultural statistics districts as they are in the United States. The two most local datasets available for Essex County, Ontario, Canada are presented in this table to provide similar statistics as those presented for the United States.

Source: Reference 2.2-42

Table 2.2-4 Recreation Areas in the Fermi Vicinity

Swan Creek and Swan Boat Club - Residences on the north bank of Swan Creek just west of its inlet from Lake Erie keep private boats along the shore for recreation. This area is about 0.52 mile north of the northern boundary of the Fermi site.
Nearby Recreation Areas - The closest areas to the plant that are used for recreation are along the Lake Erie shore at Stony Point Beach, about 2 miles south, and Estral Beach, 2 miles northeast. These areas are resort communities along the lake. There is reported to be some swimming at these facilities.
Pointe Aux Peaux State Wildlife Area - Directly south of Fermi property boundary west of Stony Beach residential area, this area is estimated to encompass 100 to 200 acres of wetland and offers wildlife watching and hiking opportunities.
Pointe Mouillee State Game Area - 3.1 miles northeast of the Fermi site near the towns of Rockwood and Gibraltar; it is a piece of land that extends into Lake Erie near the Huron River and is reportedly one of the largest fresh water marsh restoration projects in the world. Its approximately 4000 acres consist of wetlands, diked marshes, and river bayous. Pointe Mouillee offers activities such as hiking, public hunting, and waterfowl activities.
William C. Sterling State Park - 4.8 miles south-southwest of Fermi, this 1300 acre lakefront park provides recreational opportunities close to Detroit and features many lagoons and marshes, which are good habitat for a variety of wildlife species. Swimming, boating, fishing, lakefront camping, hiking and biking trails, and wildlife viewing are available at this park. The campground offers 288 modern sites and is open April 15 to November 1.
Captain Norman Heck Park - This 15 acre Monroe County park includes a Vietnam veterans' memorial and is about 5.5 miles southwest of Fermi. The park offers pavilion seating for about 30 adults, trails, a playground, basketball court, Sled Hill, and charcoal operated cooking grills.
Raisin River Golf Club - 5.4 miles southwest, this is Monroe's only 36 hole full service golf facility.
Lake Erie Metropark (Wayne County) - 6.6 miles north-northeast, 1607 acre recreation complex that offers views of Lake Erie along its 3 mile shoreline. The park has excellent bird watching opportunities and an abundance of wildlife and waterfowl. Park features include a wave action swimming pool, an 18 hole golf course, children's play area, a museum and nature center, boat launches, and a marina.
Monroe Multi-Sport Complex - About 7 miles southwest of Fermi in Monroe, this 5 acre recreational facility hosts a wide variety of events. The facility is used for conventions and trade shows, concerts, shows, soccer, flag football, lacrosse, and other field sports, and features two ice rinks and a sports shop.
River Raisin Battlefield - about 7 miles southwest of Fermi, this site is located in Historic Monroe. It is the site of the Battles of Frenchtown, sometimes referred to as the River Raisin Massacre, during the War of 1812. The River Raisin battles and massacre were among the largest military encounters in the War of 1812. More American casualties occurred here than in any other single battle.
Monroe County Historical Museum and Custer Museum - There two facilities in the city of Monroe draw large numbers of visitors each year; both are about 8 miles west-southwest of Fermi.

Source: Reference 2.2-2, Reference 2.2-43 through Reference 2.2-49

Table 2.2-5 Land Use within Existing Transmission Line Corridors

	Transmission Line Routes	
Land Use	Existing 345 kV Route (both lines) to Brownstown (North and South) Substation (miles)[1]	Acreage[2]
Agriculture	4.5	109
Forest	0	0
Developed	11.7	284
Total Miles*	16.2 (North)	393

Notes:
1. Total miles counts the 4.5 mile segment of corridor from Fermi to I-75 that is shared by all lines only one time. The longer Brownstown North corridor mileage is used in this table to represent both 345 kV lines since they share essentially the same route from Fermi to Brownstown Substation.
2. Acreage is based on the nominal 200 foot corridor width.

Table 2.2-6 Land Use Acreages within 0.5 Mile of Fermi Transmission Lines

USGS Land Use Category	Brownstown North (345 kV)	Brownstown South (345 kV)	Milan (proposed 345 kV)
Open Water	1.1	0.4	14.2
Developed, Open Space	35.4	38.9	736.1
Developed, Low Intensity	71.4	68.3	674.1
Developed, Medium Intensity	78.1	35.1	86.7
Developed, High Intensity	5.8	11.3	7.6
Barren Land (Rock/Sand/Clay)	0	0	26.2
Deciduous Forest	16.9	14.5	1434.4
Evergreen Forest	0	1.0	2.2
Mixed Forest	0	9.1	7.1
Shrub/Scrub	0	0	47.6
Grassland/ Herbaceous	19.7	9.1	332.0
Pasture/Hay	18.6	25.4	1441.6
Cultivated Crops	128.4	173.4	4306.9
Woody Wetlands	12.5	16.3	884.0
Emergent Herbaceous Wetland	3.0	4.1	123.4
Total acreage	390.9	406.9	10,124

Table 2.2-7 Land Use within the 50-Mile Region

Land Use	Acres	Percentage of 50-Mile Region
United States		
Open Water	725,910	14.61
Developed, Open Space	346,966	7.00
Developed, Low Intensity	371,809	7.48
Developed, Medium Intensity	264,167	5.32
Developed, High Intensity	106,853	2.15
Barren Land (Rock/Sand/Clay)	10,346	0.21
Deciduous Forest	282,046	5.68
Evergreen Forest	6717	0.14
Mixed Forest	5765	0.12
Shrub/Scrub	3179	0.06
Grassland/Herbaceous	41,308	0.83
Pasture/Hay	219,241	4.41
Cultivated Crops	1,217,689	24.51
Woody Wetlands	128,090	2.58
Emergent Herbaceous Wetland	56,711	1.14
US Total Percentage of Region	3,786,795	76.24
Canada		
Open Water	678,492	13.66
Urban	60,749	1.22
Woodlot	22,173	0.45
Agriculture	413,285	8.32
Wetlands	6826	0.14
Canada Total Percentage of Region	1,181,525	23.76
Combined Total	4,968,320	100

Table 2.2-8 Average Annual Yields for Major Agricultural Products of the Fermi Region[4] (Sheet 1 of 5)

County[1]	All Cattle and Calves (head)	Beef Cattle (head)[2]	Milk Cows (head)	Milk produced (1000 pounds)	Hogs and Pigs (head)[2]	Sheep (head)[2]	Laying Chickens (head)[2]	Wheat (bushels)[5]	Soybeans (bushels)[5]	Oats (bushels)[5]	Corn (bushels)[5]	Potatoes[3] (1000 cwt)	Tomatoes (tons)
Michigan								(1000 bushels)	(1000 bushels)	(1000 bushels)	(1000 bushels)		
Monroe	0 6,000 3 4,800 6 4,200 Av 5,000	0 600 1 600 2 NR 3 NR 6 NA Av 600	0 600 3 NR 6 NR	0 5,600 3 NR 6 NR	0 5,000 3 6,500 5 6,000 Av 5,833	0 1,200 1 1,200 2 1,400 3 1,150 Av 1,238	0 2,800 1 1,700 2 1,300 Av 1,933	0 1,520 3 2,130 6 2,070 Av 1,907	0 4,230 3 2,740 6 3,670 Av 3,547	0 56 3 133 6 67 Av 85	0 8,100 3 10,470 6 9,590 Av 9,387	0 NR 1 270 2 300 Av 285	NA
Wayne	0 700 3 NR 6 NR	0 NR 1 NR 2 NR 3 NR 6 NA	0 NR 3 NR 6 NR	0 NR 3 NR 6 NR	0 NR 3 NR 5 NR	0 NR 1 NR 2 NR 3 NR	0 1,200 1 1,300 2 NR Av 1,250	0 NR 3 35 6 24 Av 30	0 NR 3 125 6 112 Av 119	0 NR 3 NR 6 NR	0 NR 3 325 6 NR	0 NR 1 NR 2 NR	NA
Lenawee	0 19,500 3 23,000 6 27,500 Av 23,333	0 1,500 1 1,300 2 1,500 3 1,200 6 NA Av 1,375	0 8,200 3 10,200 6 9,900 Av 9,430	0 199,000 3 280,000 6 307,000 Av 262,000	0 12,000 3 NR 5 9,000 Av 10,500	0 1,400 1 1,400 2 1,600 3 1,200 Av 1,400	0 NR 1 7,000 2 5,000 Av 6,000	0 2,590 3 3,205 6 2,926 Av 2,907	0 5,040 3 3,760 6 5,340 Av 4,713	0 71 3 120 6 57 Av 83	0 11,800 3 13,990 6 13,800 Av 13,197	0 NR 1 NR 2 NR	NA
Livingston	0 10,000 3 8,200 6 7,800 Av 8,667	0 1,300 1 1,100 2 1,000 3 800 6 NA Av 1,050	0 3,200 3 2,600 6 2,800 Av 2,867	0 67,000 3 66,500 6 66,000 Av 66,500	0 NR 3 900 5 900 Av 900	0 1,100 1 1,200 2 1,200 3 1,850 Av 1,338	0 1,400 1 1,400 2 1,000 Av 1,267	0 540 3 715 6 625 Av 627	0 890 3 580 6 866 Av 779	0 NR 3 NR 6 NR	0 2,600 3 2,660 6 2,320 Av 2,527	0 NR 1 NR 2 NR	NA
Macomb	0 3,500 3 4,000 6 4,100 Av 3,867	0 NR 1 NR 2 NR 3 NR 6 NA	0 NR 3 650 6 600 Av 625	0 10,300 3 8,400 6 9,300 Av 9,333	0 2,800 3 1,700 5 1,200 Av 1,900	0 NR 1 NR 2 NR 3 NR	0 1,100 1 NR 2 NR	0 370 3 305 6 303 Av 326	0 720 3 415 6 932 Av 689	0 NR 3 45 6 NR	0 900 3 825 6 1,620 Av 1,115	0 NR 1 NR 2 NR	NA
Oakland	0 1,800 3 NR 6 NR	0 NR 1 NR 2 NR 3 NR 6 NA	0 NR 3 NR 6 NR	0 NR 3 NR 6 NR	0 NR 3 NR 5 NR	0 800 1 800 2 800 3 900 Av 825	0 1,200 1 NR 2 NR	0 NR 3 80 6 55 Av 68	0 NR 3 75 6 130 Av 103	0 NR 3 NR 6 NR	0 NR 3 235 6 NR	0 NR 1 NR 2 NR	NA

Table 2.2-8 Average Annual Yields for Major Agricultural Products of the Fermi Region[4] (Sheet 2 of 5)

County[1]	All Cattle and Calves (head)	Beef Cattle (head)[2]	Milk Cows (head)	Milk produced (1000 pounds)	Hogs and Pigs (head)[2]	Sheep (head)[2]	Laying Chickens (head)[2]	Wheat (bushels)[5]	Soybeans (bushels)[5]	Oats (bushels)[5]	Corn (bushels)[5]	Potatoes[3] (1000 cwt)	Tomatoes (tons)
Washtenaw	0 17,000 3 14,300 6 13,000 Av 14,767	0 1,000 1 1,000 2 800 3 1,200 6 NA Av 1,000	0 4,200 3 3,200 6 2,900 Av 3,433	0 78,800 3 63,400 6 55,200 Av 65,800	0 4,700 3 4,900 5 5,000 Av 4,867	0 11,600 1 11,000 2 10,500 3 12,500 Av 11,400	0 2,600 1 2,500 2 1,800 Av 2,300	0 980 3 1,000 6 970 Av 983	0 1,830 3 1,240 6 1,950 Av 1,673	0 70 3 76 6 46 Av 64	0 4,850 3 5,030 6 4,970 Av 4,950	0 NR 1 NR 2 NR	NA
Other Counties	0 NR 3 1,500 6 1,800 Av 1,650	0 800 1 700 2 700 3 1,300 6 NA Av 875	0 950 3 700 6 800 Av 817	0 900 3 8,500 6 10,800 Av 6,733	0 600 3 7,500 5 500 Av 2,867	0 700 1 700 2 800 3 1,000 Av 800	0 9,700 1 1,700 2 2,100 Av 4,500	0 120 3 NR 6 NR	0 320 3 NR 6 NR	0 70 3 42 6 55 Av 56	0 700 3 NR 6 290 Av 495	0 NR 1 302 2 400 Av 351	NA
District 90	0 98,000 3 92,000 6 93,000 Av 94,333	0 10,100 1 9,500 2 7,600 3 9,500 6 NA Av 9,175	0 26,000 3 25,000 6 24,000 Av 25,000	0 515,000 3 560,000 6 575,000 Av 550,000	0 35,000 3 27,000 5 28,500 Av 30,200	0 19,400 1 18,800 2 19,000 3 22,500 Av 19,925	0 26,000 1 23,000 2 16,000 Av 21,667	0 8,290 3 10,500 6 9,750 Av 9,513	0 18,300 3 12,000 6 20,200 Av 16,833	0 415 3 670 6 410 Av 498	0 39,700 3 43,900 6 43,600 Av 42,400	0 NR 1 572 2 700 Av 636	NA
Jackson	0 21,000 3 23,000 6 23,000 Av 22,333	0 2,600 1 2,700 2 3,000 3 2,500 6 NA Av 2,700	0 4,300 3 3,700 6 3,900 Av 4,000	0 98,600 3 129,000 6 118,000 Av 115,200	0 3,500 3 NR 5 3,500 Av 3,500	0 4,600 1 4,500 2 5,000 3 7,200 Av 5,325	0 2,200 1 1,000 2 1,000 Av 1,400	0 500 3 690 6 621 Av 604	0 1,630 3 1,110 6 1,830 Av 1,523	0 60 3 70 6 68 Av 66	0 5,650 3 5,720 6 6,520 Av 5,963	0 NR 1 NR 2 NR	NA
Other Counties	0 NR 3 NR 6 NR	0 NR 1 NR 2 NR 3 NR 6 NR	0 NR 3 NR 6 NR	0 NR 3 NR 6 NR	0 NR 3 150,000 5 NR	0 NR 1 NR 2 NR 3 NR	0 1,346,000 1 1,900 2 2,000 Av 449,967	0 NR 3 NR 6 NR	0 NR 3 NR 6 NR	0 69 3 99 6 49 Av 72	0 NR 3 NR 6 NR	0 395 1 710 2 570 Av 558	NA
District 80	0 245,000 3 227,000 6 231,000 Av 234,333	0 22,500 1 20,000 2 17,500 3 19,500 6 NA Av 19,875	0 75,500 3 71,000 6 75,000 Av 73,833	0 1,450,000 3 1,650,000 6 1,720,000 Av 1,607,000	0 230,000 3 225,000 5 225,000 Av 227,000	0 19,600 1 19,400 2 20,000 3 27,000 Av 21,500	0 1,370,000 1 1,545,000 2 1,970,000 Av 1,628,333	0 9,700 3 12,200 6 11,400 Av 11,100	0 25,700 3 19,300 6 30,850 Av 25,283	0 620 3 1,000 6 840 Av 820	0 80,700 3 87,100 6 95,600 Av 87,800	0 2,415 1 2,760 2 2,420 Av 2,532	NA

Table 2.2-8 Average Annual Yields for Major Agricultural Products of the Fermi Region[4] (Sheet 3 of 5)

County[1]	All Cattle and Calves (head)	Beef Cattle (head)[2]	Milk Cows (head)	Milk produced (1000 pounds)	Hogs and Pigs (head)[2]	Sheep (head)[2]	Laying Chickens (head)[2]	Wheat (bushels)[5]	Soybeans (bushels)[5]	Oats (bushels)[5]	Corn (bushels)[5]	Potatoes[3] (1000 cwt)	Tomatoes (tons)
Other Districts	0 NA 3 NA 6 NA	0 NA 1 NA 2 NA 3 NA 6 NA	0 NA 3 NA 6 NA	0 NA 3 NA 6 NA	0 NA 3 NA 5 NA	0 NA 1 NA 2 NA 3 NA	0 NA 1 NA 2 NA	0 NA 3 NA 6 NA	0 120 3 80 6 NR Av 100	0 NA 3 NA 6 NA	0 NA 3 NA 6 NA	0 818 1 1,167 2 1,038 Av 1,008	NA
Ohio													
Fulton	3 19,000 5 19,700 7 20,500 Av 19,733	NA	3 1,400 5 2,400 7 2,900 Av 2,233	3 31,800 5 52,100 6 52,400 Av 45.433	2 61,900 4 51,200 6 57,600 Av 56,900	3 NR 5 NR 7 NR	NA for Ohio since 1980	0 1,498,200 3 1,667,200 6 1,856,400 Av 1,673,933	0 3,568,200 3 3,233,300 6 4,192,700 Av 3,664,733	0 NR 3 NR 6 NR	0 12,875,400 3 14,763,500 6 13,546,000 Av 13,728,300	NA	0 21,060 3 19,890 6 15,560 Av 18,837
Henry	3 5,600 5 5,100 7 5,600 Av 5,433	NA	3 1,100 5 2,000 7 2,700 Av 1,933	3 29,300 5 49,300 6 47,600 Av 42,100	2 12,100 4 7,600 6 9,300 Av 9,667	3 NR 5 NR 7 NR	NA	0 3,459,900 3 2,852,600 6 2,967,800 Av 3,093,433	0 4,044,500 3 3,754,800 6 4,948,100 Av 4,249,133	0 NR 3 NR 6 NR	0 11,637,200 3 12,325,700 6 11,727,900 Av 11,896,933	NA	0 9,460 3 27,690 6 31,020 Av 22,723
Lucas	3 1,600 5 1,100 7 1,000 Av 1,233	NA	3 NR 5 NR 7 NR	3 NR 5 NR 6 NR	2 10,600 4 9,000 6 8,000 Av 9,200	3 NR 5 NR 7 NR	NA	0 667,800 3 587,400 6 484,900 Av 580,033	0 1,386,200 3 1,224,700 6 803,600 Av 1,138,167	0 NR 3 NR 6 NR	0 3,576,500 3 4,511,200 6 3,258,100 Av 3,781,933	NA	0 NR 3 NR 6 NR
Wood	3 5,700 5 4,900 7 5,600 Av 5,400	NA	3 NR 5 1,000 7 1,400 Av 1,200	3 NR 5 20,300 6 26,500 Av 23,400	2 10,200 4 6,000 6 7,400 Av 7,867	3 1,100 5 NR 7 NR	NA	0 4,404,300 3 4,261,600 6 4,141,000 Av 4,268,967	0 5,440,700 3 5,232,400 6 6,157,100 Av 5,610,067	0 NR 3 NR 6 NR	0 13,975,300 3 16,604,300 6 13,382,100 Av 14,653,900	NA	0 34,500 3 14,710 6 15,760 Av 21,657
Other Counties	3 NR 5 NR 7 NR	NA	3 4,300 5 6,700 7 600 Av 3,900	3 130,400 5 164,600 6 10,100 Av 101,700	2 NR 4 NR 6 NR	3 4,100 5 4,100 7 3,700 Av 4,000	NA	0 NR 3 NR 6 NR	0 NR 3 NR 6 NR	0 410,000 3 215,500 6 210,000 Av 278,500	0 NR 3 NR 6 NR	NA	0 4,240 3 6,530 6 5,250 Av 5,340
District 10	3 85,200 5 99,700 7 101,800 Av 95,567	NA	3 17,900 5 27,100 7 36,000 Av 27,000	3 452,400 5 565,100 6 656,200 Av 557,900	2 NR 4 232,200 6 277,900 Av 255,050	3 8,300 5 8,000 7 7,300 Av 7,900	NA	0 27,429,800 3 26,908,900 6 26,227,500 Av 26,855,400	0 41,381,900 3 40,825,200 6 50,583,100 Av 44,263,400		0 105,466,100 3 118,069,400 6 103,636,500 Av 109,057,333	NA	0 113,880 3 133,290 6 124,800 Av 123,990
Erie	3 4,100 5 2,800 7 2,700 Av 3,200	NA	3 NR 5 NR 7 NR	3 NR 5 NR 6 NR	2 4,000 4 2,200 6 2,600 Av 2,933	3 1,300 5 NR 7 NR	NA	0 516,200 3 652,000 6 598,800 Av 589,000	0 1,368,500 3 914,000 6 1,530,400 Av 1,270,967	0 NR 3 NR 6 NR	0 3,799,100 3 4,288,300 6 4,747,000 Av 4,278,133	NA	0 NR 3 NR 6 NR

Table 2.2-8 Average Annual Yields for Major Agricultural Products of the Fermi Region[4] (Sheet 4 of 5)

County[1]	All Cattle and Calves (head)	Beef Cattle (head)[2]	Milk Cows (head)	Milk produced (1000 pounds)	Hogs and Pigs (head)[2]	Sheep (head)[2]	Laying Chickens (head)[2]	Wheat (bushels)[5]	Soybeans (bushels)[5]	Oats (bushels)[5]	Corn (bushels)[5]	Potatoes[3] (1000 cwt)	Tomatoes (tons)
Ottawa	3 1,200 5 1,400 7 1,400 Av 1,333	NA	3 NR 5 NR 7 NR	3 NR 5 NR 6 NR	2 4,300 4 3,100 6 3,400 Av 3,600	3 NR 5 NR 7 NR	NA	0 1,001,400 3 1,252,400 6 1,109,400 Av 1,121,067	0 1,152,400 3 1,865,900 6 1,767,000 Av 1,595,100	0 NR 3 NR 6 NR	0 2,279,600 3 3,252,700 6 2,823,300 Av 2,785,200	NA	0 NR 3 NR 6 8,250
Sandusky	3 6,900 5 7,400 7 6,500 Av 6,933	NA	3 NR 5 NR 7 NR	3 12,700 5 NR 6 NR	2 11,300 4 5,100 6 3,800 Av 6,733	3 1,000 5 NR 7 NR	NA	0 1,626,100 3 1,393,500 6 1,568,500 Av 1,529,367	0 2,724,000 3 2,970,700 6 3,475,000 Av 3,056,567	0 NR 3 NR 6 NR	0 8,770,700 3 10,766,300 6 9,172,400 Av 9,569,800	NA	0 12,090 3 10,480 6 5,600 Av 9,390
Seneca	3 11,800 5 11,700 7 10,700 Av 11,400	NA	3 1,100 5 NR 7 NR	3 NR 5 NR 6 NR	2 33,600 4 31,400 6 33,200 Av 32,733	3 2,800 5 3,000 7 3,300 Av 3,033	NA	0 3,387,700 3 2,845,600 6 2,717,300 Av 2,983,533	0 4,629,300 3 3,857,800 6 5,005,600 Av 4,497,567	0 186,800 3 144,200 6 103,100 Av 144,700	0 11,237,500 3 12,552,200 6 10,866,400 Av 11,552,033	NA	0 NR 3 NR 6 NR
Other Counties	3 NR 5 NR 7 NR	NA	3 1,000 5 2,100 7 2,100 Av 1,733	3 34,800 5 35,400 6 35,600 Av 35,300	2 NR 4 NR 6 NR	3 1,600 5 2,500 7 2,500 Av 2,200	NA	0 NR 3 NR 6 NR	0 NR 3 NR 6 NR	0 258,100 3 153,100 6 215,400 Av 208,867	0 NR 3 NR 6 NR	NA	0 2,400 3 7,940 6 NR Av 5,170
District 20	3 104,500 5 114,700 7 107,000 Av 108,733	NA	3 27,900 5 26,700 7 26,600 Av 27,100	3 469,300 5 457,900 6 465,600 Av 464,267	2 NR 4 191,600 6 223,700 Av 207,650	3 13,800 5 14,500 7 15,000 Av 14,433	NA	0 14,956,400 3 13,889,300 6 12,295,100 Av 13,713,600	0 26,276,600 3 23,935,200 6 29,917,300 Av 26,709,700	0 936,000 3 545,300 6 575,300 Av 685,533	0 66,505,200 3 74,582,100 6 69,376,400 Av 70,154,567	NA	0 14,490 3 18,420 6 13,850 Av 15,587
Other Districts	NA	NA	NA	3 NR 5 NR 6 NR	NA	NA	NA	NA	NA	NA	NA	NA	NA
Canada, Ontario				(kilolitres)			(total poultry - chickens and turkeys)	(winter + spring wheat, 0 is winter only) (1,000 bushels)	(1,000 bushels)	(1,000 bushels)	(1,000 bushels)		
Essex	0 5,470 3 6,550 6 6,015 Av 6,012	0 1,100 3 1,100 6 998 Av 1,066	0 600 3 900 6 910 Av 803	(Essex and Kent) 3 12,503 5 11,259 7 11,331 Av 11,698	0 51,100 3 38,750 6 36,151 Av 42,000	0 980 3 2,850 6 3,811 Av 2,547	NA	0 3,320 3 5,402 6 6,018 Av 4,913	0 6,650 3 5,021 6 7,551 Av 6,407	0 6 3 6 6 41 Av 18	0 7,155 3 7,169 6 5,600 Av 6,641	NA	NA

Table 2.2-8 Average Annual Yields for Major Agricultural Products of the Fermi Region[4] (Sheet 5 of 5)

County[1]	All Cattle and Calves (head)	Beef Cattle (head)[2]	Milk Cows (head)	Milk produced (1000 pounds)	Hogs and Pigs (head)[2]	Sheep (head)[2]	Laying Chickens (head)[2]	Wheat (bushels)[5]	Soybeans (bushels)[5]	Oats (bushels)[5]	Corn (bushels)[5]	Potatoes[3] (1000 cwt)	Tomatoes (tons)
Chatham-Kent	0 6,490 3 15,700 6 12,944 Av 11,711	0 900 3 1,700 6 2,439 Av 1,680	0 700 3 900 6 596 Av 732	(Essex and Kent) 3 12,503 5 11,259 7 11,331 Av 11,698	0 214,700 3 177,600 6 169,793 Av 187,364	0 1,640 3 1,150 6 1,413 Av 1,401	NA	0 5,084 3 9,099 6 9,684 Av 7,956	0 10,780 3 7,288 6 10,594 Av 9,554	0 44 3 112 6 57 Av 71	0 17,125 3 18,576 6 19,940 Av 18,547	NA	NA
Lambton	0 62,270 3 54,050 6 42,989 Av 53,103	0 10,300 3 7,600 6 7,665 Av 8,522	0 5,500 3 4,500 6 4,301 Av 4,767	3 31,698 5 32,893 7 32,276 Av 32,289	0 216,400 3 275,300 6 299,986 Av 263,895	0 7,520 3 8,600 6 5,108 Av 7,076	NA	0 6,560 3 11,005 6 11,360 Av 9,642	0 10,491 3 5,613 6 11,412 Av 9,172	0 70 3 353 6 161 Av 195	0 10,353 3 10,964 6 11,898 Av 11,072	NA	NA
Southern Ontario Region	0 406,780 3 400,050 6 348,937 Av 385,226	0 53,700 3 45,300 6 47,488 Av 48,829	0 79,250 3 83,000 6 73,172 Av 78,474	3 578,824 5 585,322 7 596,168 Av 586,771	0 1,345,500 3 1,454,700 6 1,650,084 Av 1,483,428	0 41,400 3 59,300 6 49,056 Av 49,919	Southern Ontario - NA Total Ontario - 2 210,353,000 4 212,674,000 6 211,224,000 Av 211,417,000	0 27,900 3 46,225 6 50,484 Av 41,536	0 51,348 3 35,348 6 57,211 Av 47,969	0 1,095 3 1,640 6 1,398 Av 1,378	0 89,294 3 99,597 6 110,812 Av 99,901	NA	NA

Notes:

1. Michigan District 80 includes the following counties: Barry, Branch, Calhoun, Clinton, Eaton, Hillsdale, Ingham, Ionia, Jackson, St. Joseph, & Shiawassee.
   Michigan District 90 includes the following counties: St. Clair, Lapeer, Genesee, Livingston, Oakland, Macomb, Wayne, Washtenaw, Lenawee, & Monroe.
   Ohio District 10 includes the following counties: Williams, Fulton, Lucas, Wood, Henry, Defiance, Paulding, Putnam, Hancock, Allen, and Van Wert.
   Ohio District 20 includes the following counties: Ottawa, Sandusky, Erie, Lorain, Huron, Seneca, Wyandot, Crawford, Richland, and Ashland.
   Ontario, Canada Southern Ontario Region includes the following counties: Brant County, Chatham-Kent Division, Elgin County, Essex County, Haldimand-Norfolk Regional Municipality, Hamilton Division, Lambton County, Middlesex County, Niagara Regional Municipality, and Oxford County.
2. After 2003, beef cattle and sheep numbers were no longer reported for Michigan counties in the NASS data due to state budget reductions. Beef cattle and sheep numbers given for Michigan are averages of the numbers reported from years 2000 to 2003. Laying chicken numbers were similarly unreported after 2002, so averages for laying chickens are calculated from years 2000 to 2002. Pig numbers were last reported for Michigan in 2005, so 2005 numbers were used in place of 2006 numbers when averages were calculated.

3 Potato statistics were unreported after 2002, so averages for potatoes are calculated from years 2000 to 2002.

4. Years given for statistics in table are designated by their last digit (0 = 2000, 2 = 2002, 6 = 2006, etc.) Average of the available numbers designated by Av.
5. Wheat, soybeans, oats, and corn for Michigan and Ontario reported in 1,000 bushel quantities; Ohio reported in bushels.

NA - not available (absent from agricultural statistics reports)

NR - not reported (no number given for the county or district)

Source: Reference 2.2-50

Table 2.2-9 Recreation Areas in the Fermi Region (Sheet 1 of 2)

Oakwoods Metropark - 9.6 miles north-northwest
Fort Malden National Historic Site (Canada) - 11.7 miles northeast
Bois Blanc Lighthouse (Canada) - 12 miles northeast
Willow Metropark - 12 miles northwest
East Sister Island National Wildlife Refuge (Canada) - 15 miles east-southeast
West Sister Island National Wildlife Refuge - 16 miles southeast
Erie State Game Area, 16.5 miles southwest
Cedar Point National Wildlife Refuge -18 miles south
Maumee Bay State Park - 20 miles south-southwest
Miller Park - 20 miles southwest
Ojibway Prairie Nature Reserve (Canada) - 22 miles north-northeast
Petersburg State Game Management Area - 22.8 miles west-southwest
Crane Creek State Park - 24 miles south-southeast
Ottawa National Wildlife Refuge - 27 miles southeast
Lake Erie Islands State Park (Catawba, Kelleys [includes Kelleys Island State Park], and South Bass Islands included) - about 30 miles southeast
Perry’s Victory and International Peace Memorial - 31.3 miles southeast
Lighthouse Point (northern Pelee Island, Canada) - 33 miles southeast
Fish Point (southern Pelee Island, Canada) - 34.4 miles southeast
Maybury State Park - 34.6 miles north-northwest
East Harbor State Park - 36 miles southeast
Point Pelee National Park (Canada) - 37 miles east
Marblehead Lighthouse State Park - 40 miles southeast
Oak Openings Preserve Metropark - 41 miles southwest
Two Creeks Conservation Area (Canada) - 42 miles east-northeast
Wheatley Provincial Park (Canada) - 42 miles east-northeast
Island Lake Recreation Area/State Park - 43 miles northwest
Hudson Mills Metropark - 43.2 miles northwest
Kensington Metropark - 43.3 miles north-northwest
Proud Lake Recreation Area - 43.4 miles north-northwest
Maumee State Forest - 44 miles southwest

Table 2.2-9 Recreation Areas in the Fermi Region (Sheet 2 of 2)

Dodge #4 State Park - 45 miles north-northwest
W. J. Hayes State Park - 45 miles west-northwest
Brighton Recreation Area - 46.7 miles northwest
Highland Recreation Area - 47 miles north-northwest
Pinckney Recreation Area - 47 miles northwest
Waterloo Recreation Area - 48 miles west-northwest
Pontiac Lake Recreation Area - 49 miles north-northwest
Mary Jane Thurston State Park - 50 miles southwest
Lake Hudson Recreation Area - about 50 miles west
Cambridge State Historic Park - 50 miles west-northwest
Onsted State Wildlife Management Area - 51 miles west-northwest

Figure 2.2-1 Land Use within the 7.5-Mile Vicinity

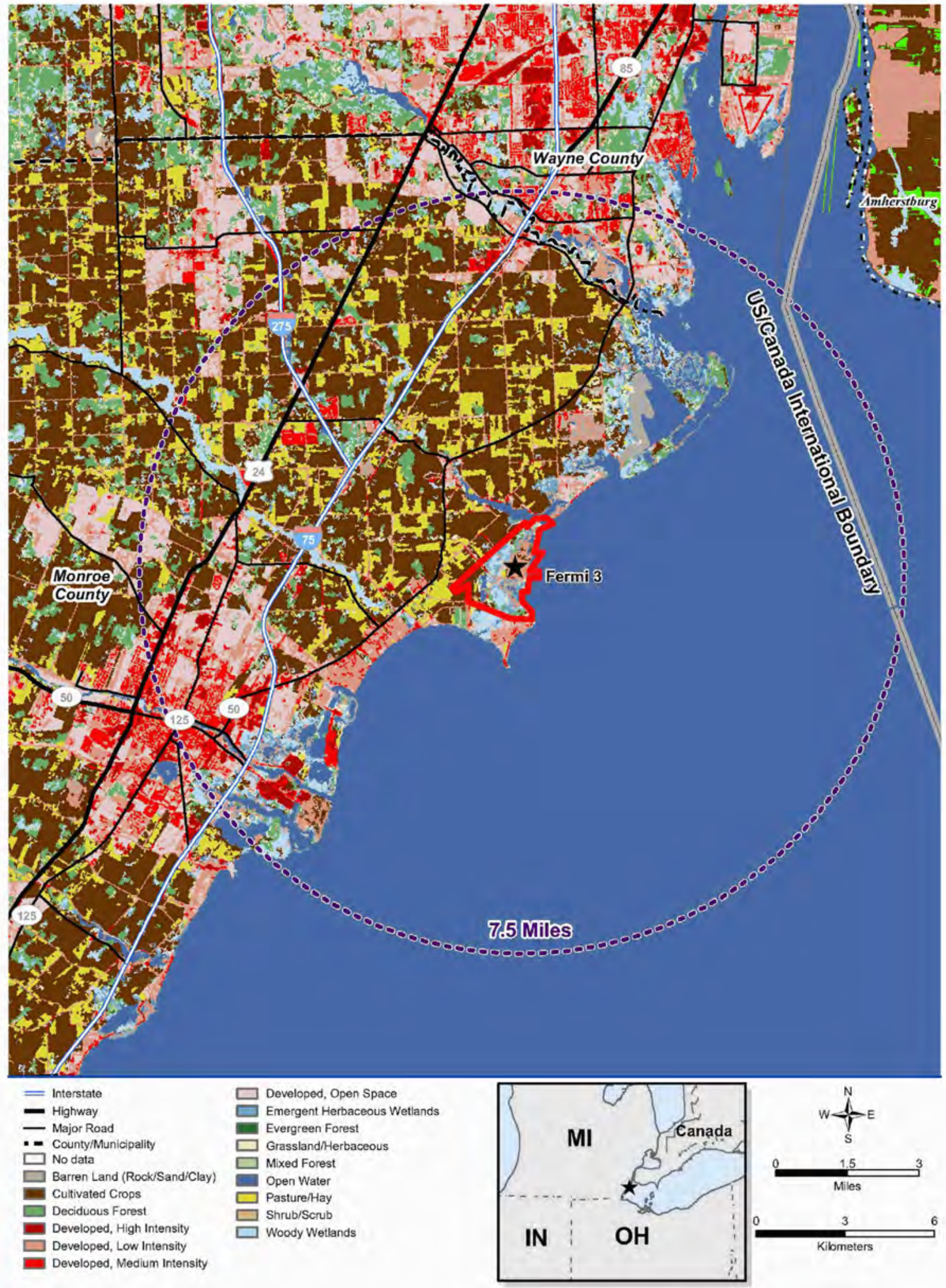


Figure 2.2-2 Utility Infrastructure within the 7.5-Mile Vicinity

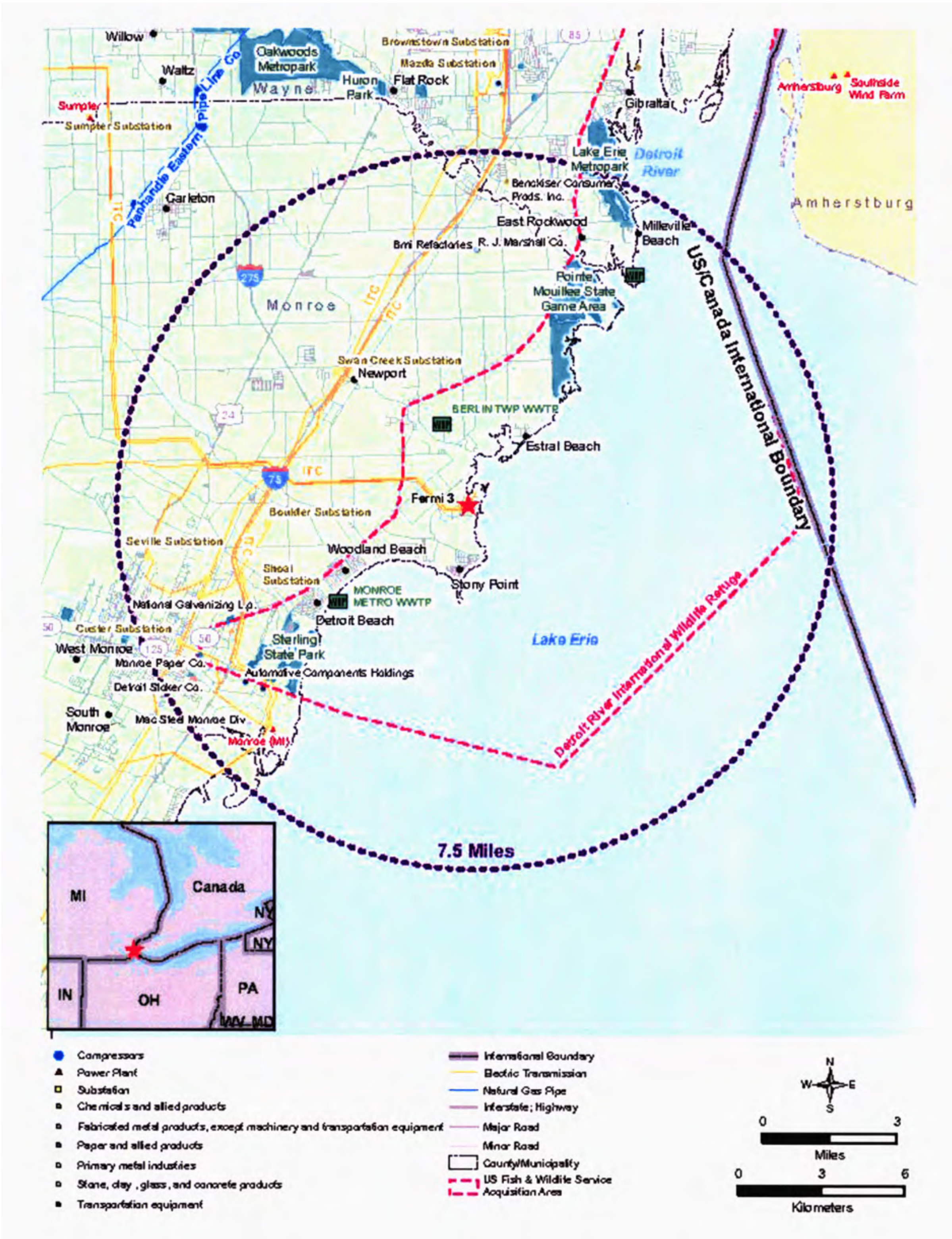


Figure 2.2-3 Land Use in Existing and Proposed Fermi Transmission Corridor Areas (within 0.5 mile)

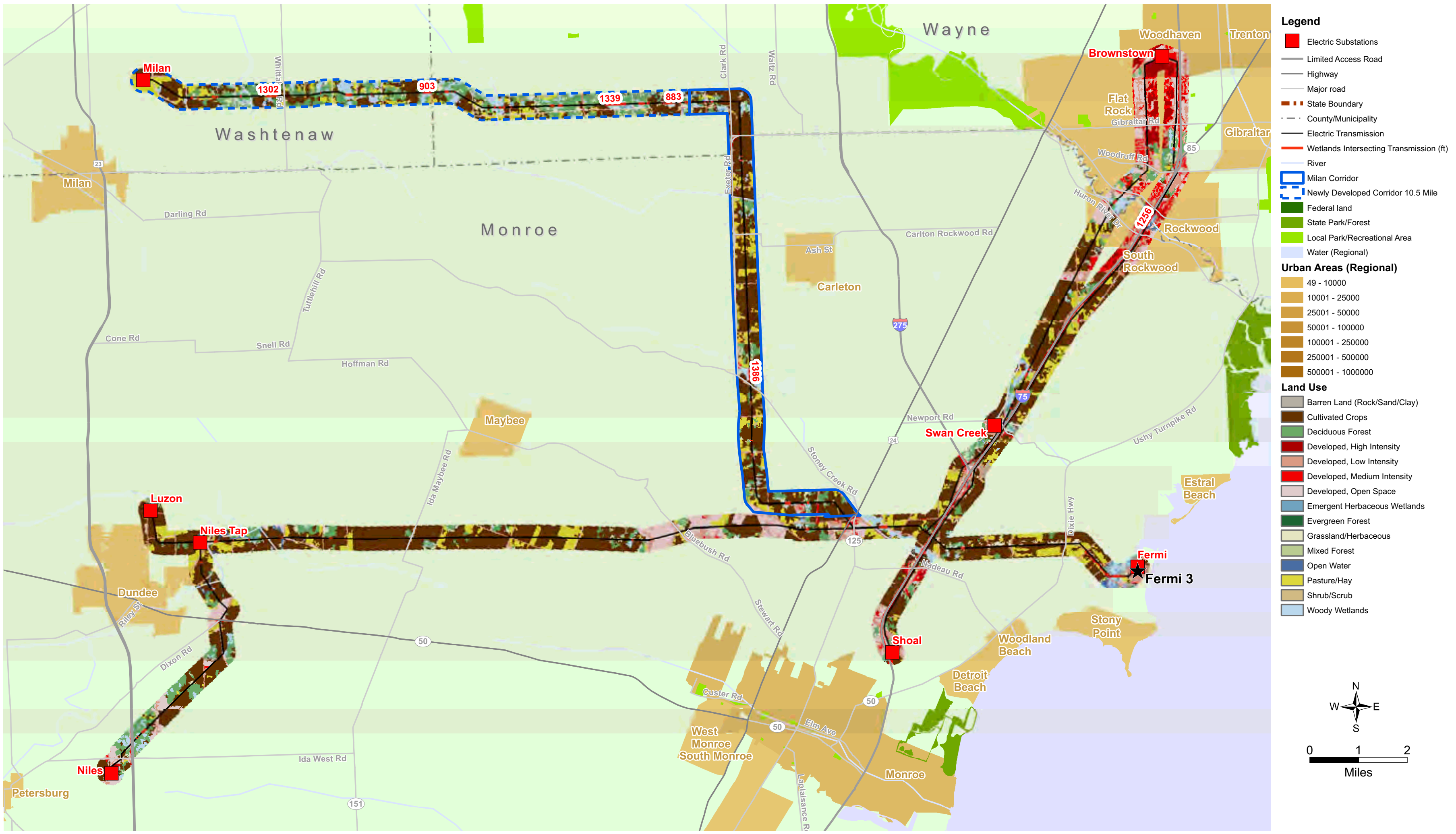


Figure 2.2-4 Land Use within the 50-Mile Region

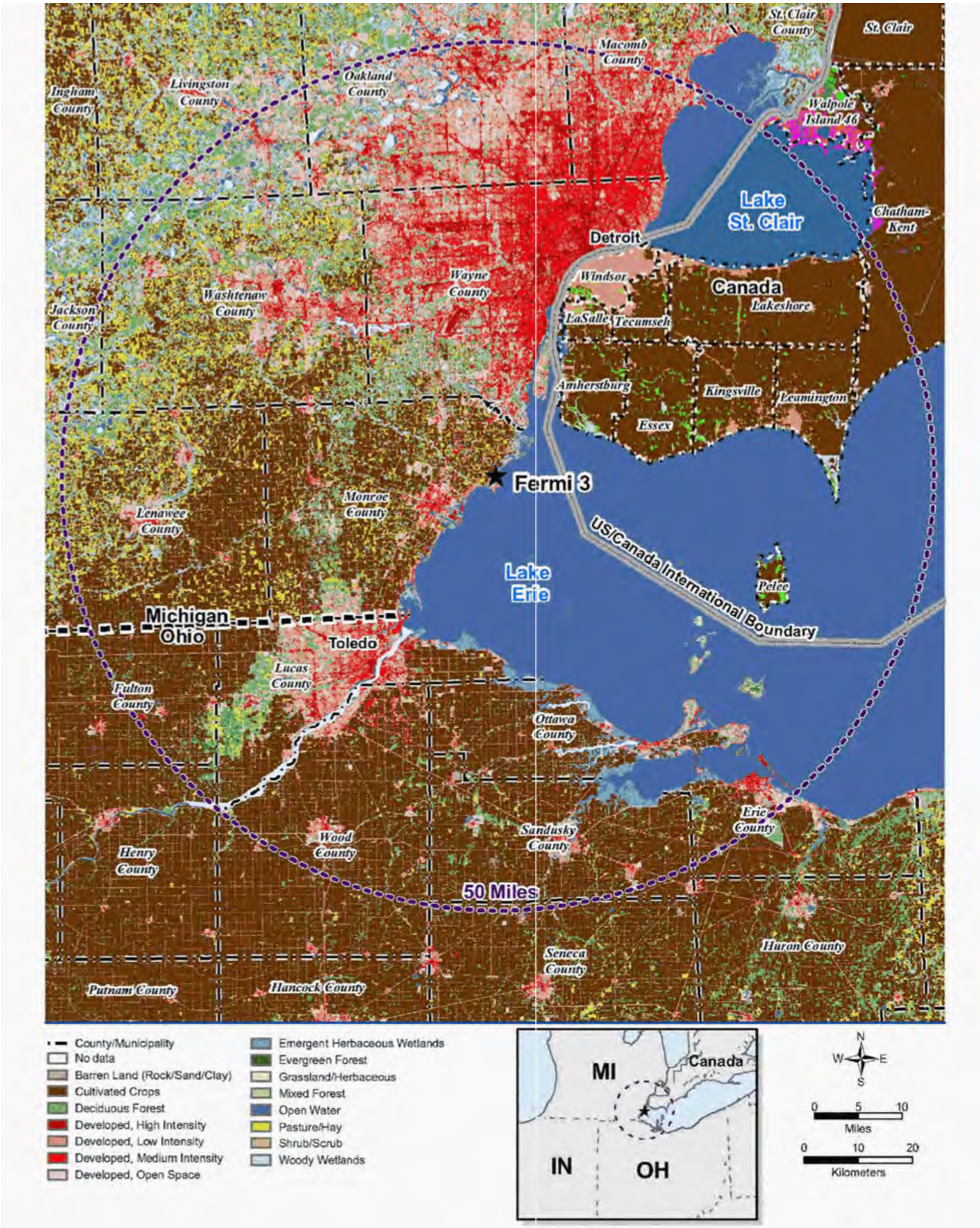


Figure 2.2-5 Transportation Resources within the 50-Mile Region

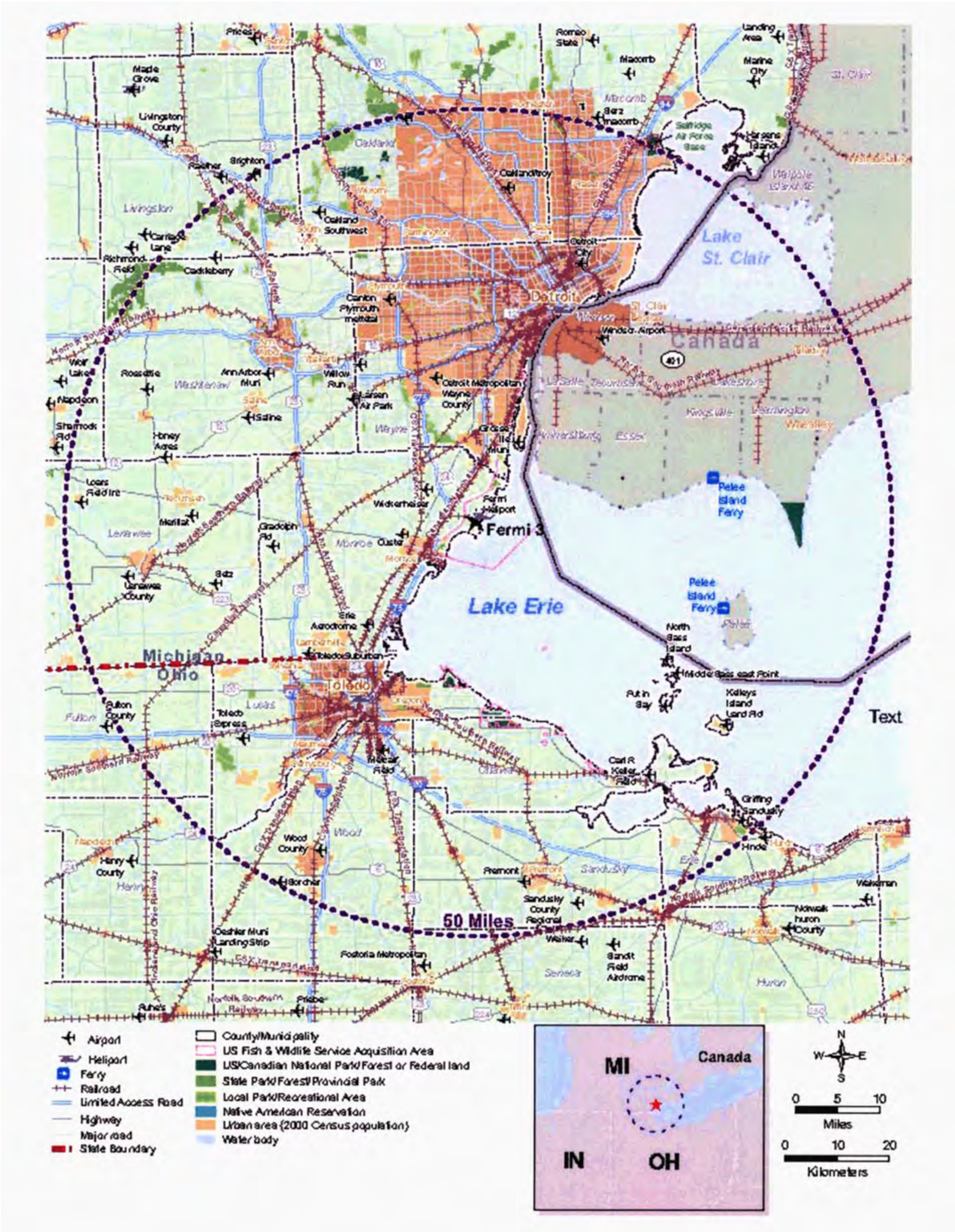


Figure 2.2-6 Utility Infrastructure within the 50-Mile Region

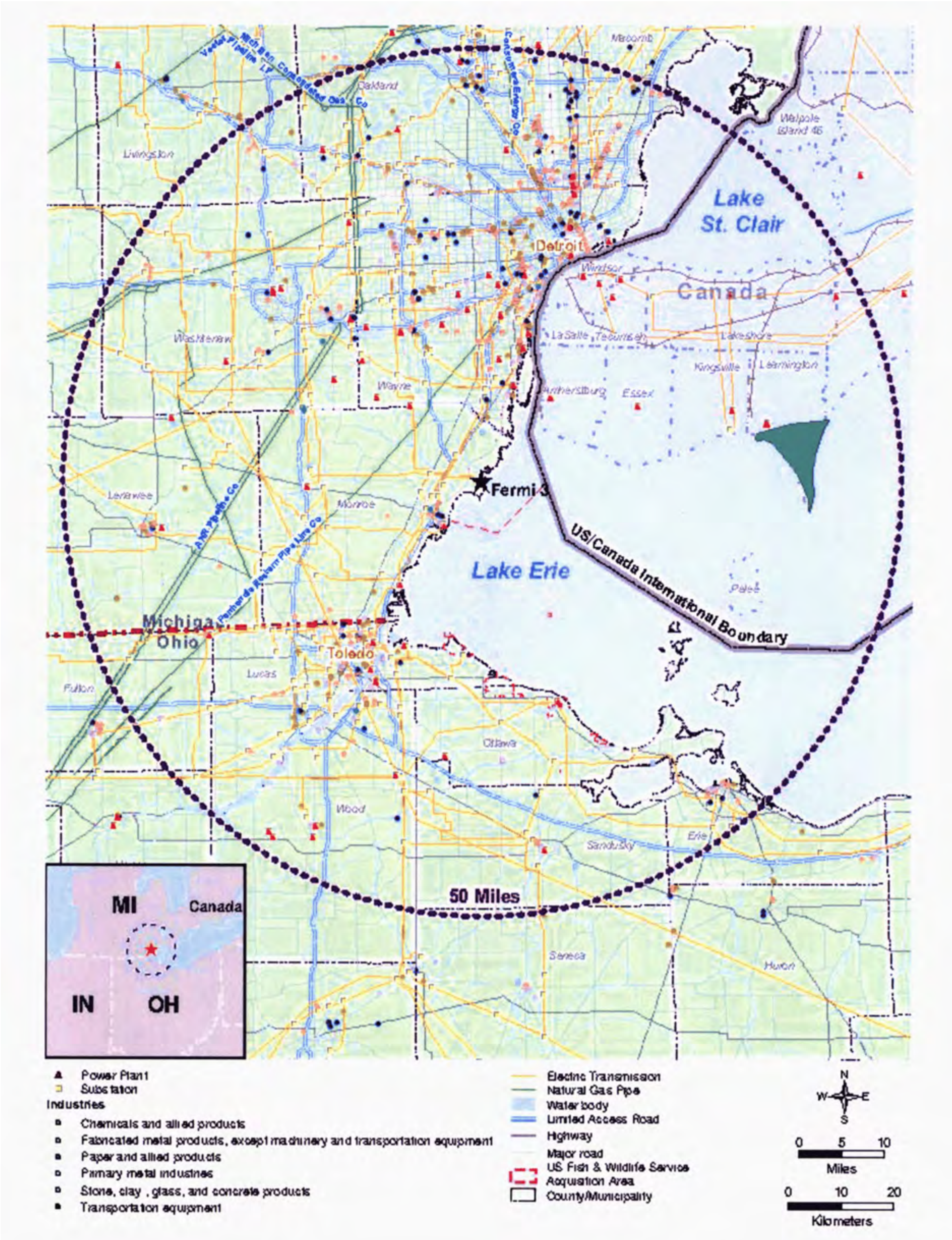
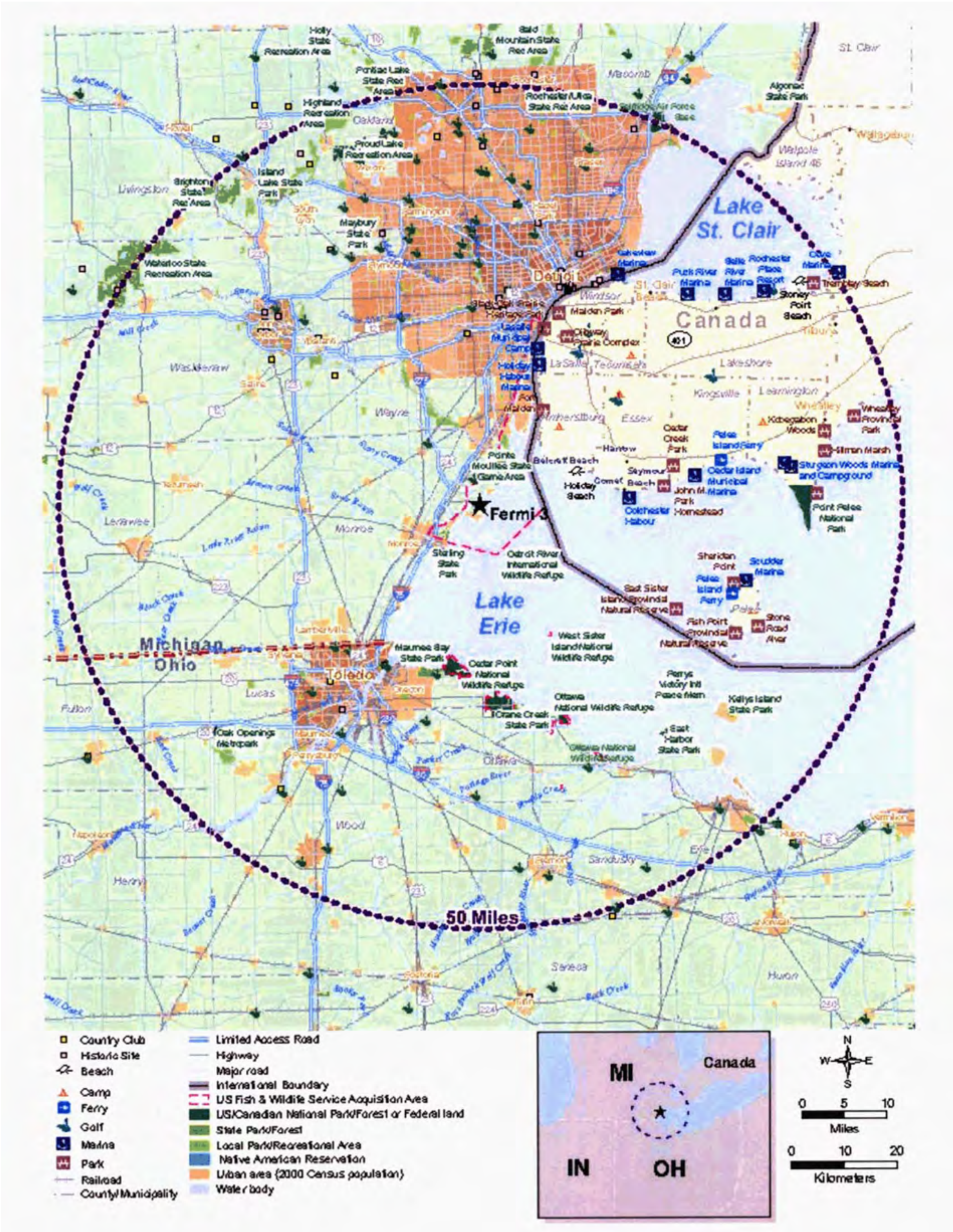


Figure 2.2-7 Natural, Public, and Recreation Areas within the 50-Mile Region



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 302 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 September 1996 through December 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.

Stony Creek

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 2008 wetland investigation report was provided to MDEQ and USACE in the fall of 2008 with a request for review and a jurisdictional determination. Jurisdictional determination letters were provided by the now MDNRE in November 2008 (Reference 2.3-108) and March 2009 (Reference 2.3-109) and by USACE in November 2010 (Reference 2.3-110). The wetland delineation boundaries were updated in response to the jurisdictional determination letters. Additional updates to the wetland delineation were based on site visits and verbal and written feedback from MDNRE and USACE during 2010. The Fermi property has delineated 509 acres of wetlands and 45 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 324 acres followed by forested wetland (PFO, 169 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.

2.3.1.2.1.1.1 **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 2.5.1.2.3.2.3). 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.

<u>June 2007</u>: 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.

September 2007: 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.

December 2007: 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.

<u>December 2007</u>: 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.

<u>March 2008</u>: 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 imported quarry rock fill (P-385 S, MW-387 S, MW-390 S, MW-391 S, P-392 S, and P-396 S). The quarry rock fill is comprised of materials ranging in size from silt-size particles, through sand and gravelsized grains, to boulders greater than one foot in diameter. The slug data for the wells screened in the quarry rock fill indicate an underdamped response (oscillatory pattern), with a small initial displacement (on the order of one to several inches) and very rapid response back to the static water level (one to three seconds). The underdamped, very rapid response in the quarry rock fill 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. Slug tests in formations of high hydraulic conductivity may be affected by mechanisms that are ignored in analytical methods such as Bouwer-Rice and Hvorslev that were developed for tests in less permeable formations with damped responses. The primary mechanism for producing water from storage in a confined aquifer is through compression of the aquifer mineral skeleton or expansion of water due to changes in the pressure field associated with removal of water from the system. However, this behavior is not restricted to confined aquifers only. Any aquifer that is being stressed during the first few seconds to a minute or so produces water through this mechanism, even unconfined aquifers (Prickett 1965, Neuman 1979, Moench 1993, Weight and Sonderegger 2001). The Butler solution method for confined aquifers was selected to evaluate the slug test data for monitoring wells/piezometers screened in the quarry rock fill for the following reasons:

- The Butler method is intended for aquifers with a high hydraulic conductivity.
- The Butler method is intended for aquifers with an underdamped response.
- The Butler method is designed for confined aquifer behavior, which as the previously referenced papers have indicated occurs during the early time period of tests in confined

and unconfined aquifers. For the test performed, the full response occurs in only a few seconds, thereby making the Butler method appropriate to analyze the results.

Calculated hydraulic conductivity values for the overburden ranged from 0.028 to 16.5 ft/day in the glacial/lacustrine 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 4.1×10^{-5} to 2.5×10^{-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):

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

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

$$K = T/b \quad \text{[Eq. 2]}$$

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).

Impacts to wetlands associated with dewatering are addressed in Section 4.2.1.5.

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). Total porosity of rock fill was estimated to be 25%, which is typical of coarse gravel (Reference 2.4-287 and Reference 2.4-288). For the Bass Islands formation, site specific estimates for effective porosity formation were developed based on site measured parameters for hydraulic conductivity and Rock Quality Designation (RQD). The estimates for effective porosity range from 0.1% to 0.8%. For the purposes of this evaluation, a conservative value for effective porosity of 0.1% is used.

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
- Effective porosity is assumed to be 0.1 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 35 ft/day. Based on the minimum hydraulic conductivity estimate, the calculated velocity is 0.2 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 0.37 years to 65 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 0.1 to 17.6 ft/day. Based on this range of velocities, the estimated travel time for the 1476-ft pathway east to Lake Erie ranges from 0.23 years to 40 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) and NEI 08-08A, "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination" (Reference 2.3-107). 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 will 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:
  - The on-site groundwater monitoring program will be developed consistent with NEI 08-08A, "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination" (Reference 2.3-107).
- 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. Detroit Edison performed a confirmatory updated baseline surface water sampling that meets the characteristics described in ESRP 2.3.3 (Reference 2.3-106).

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. Detroit Edison performed confirmatory updated baseline groundwater water sampling that meets the characteristics described in ESRP 2.3.3. And supplements the information described below (Reference 2.3-106).

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.

Lake Erie

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.

<u>Swan Creek</u>

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.

Rouge River

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.

<u>Huron River</u>

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.

2.3.4 **References**

2.3-1 Detroit Edison, “Enrico Fermi Atomic Power Plant Unit 2 – Applicant’s Environmental Report Operating License Stage,” Supplement 3, 1977.

2.3-2 U.S. Environmental Protection Agency, “The Great Lakes: An Environmental Atlas and Resource Book,” Chapter 2, http://www.epa.gov/glnpo/atlas/glat-ch2.html, accessed 13 December 2007.

2.3-3 U.S. Army Corps of Engineers, “Current Regulated Outflows”, http://www.lre.usace.army.mil/greatlakes/hh/outflows/current_regulated_outflows, accessed 13 November 2007.

2.3-4 Great Lakes Information Network, “People in the Great Lakes Region,” http://www.great-lakes.net/envt/flora-fauna/people.html, accessed 8 October 2007.

2.3-5 U.S. Army Corps of Engineers for the Federal Emergency Management Agency, *Great Lakes Open – Coast Flood Levels Phase II*, Revised Report, Detroit, MI, April 1988.

2.3-6 National Geophysical Data Center, “Great Lakes Bathymetry,” http://www.ngdc.noaa.gov/mgg/greatlakes/greatlakes.html, accessed 7 November 2007.

2.3-7 Great Lakes Environmental Research Laboratory, “Lake Erie Physical Data Sets”, http://www.glerl.noaa.gov/ifyle/data/Model/LBRM/runoff.html, accessed 26 June 2008.

2.3-8 Environment Canada and U.S. Environmental Protection Agency, *Lake Erie Management Plan (LaMP)*, updated 2005.

2.3-9 Great Lakes Environmental Research Laboratory, “NOAA Great Lakes Coastal Forecasting System, GLCFS”, http://www.glerl.noaa.gov/res/glcfs/, accessed 4 February 2008.

2.3-10 Environment Canada and U.S. Environmental Protection Agency, *Lake Erie Management Plan (LaMP)*, update 2003, www.binational.net, accessed 13 December 2007.

2.3-11 Environment Canada and U.S. Environmental Protection Agency, “State of the Great Lakes 2005,” published in November 2005, http://binational.net/solec/English/SOLEC%202004/Tagged%20PDFs/SOGL%202005%20Report/English%20Version/Lake%20Sections/Lake%20Erie%20-%20tagged.pdf, accessed 7 November 2007.

2.3-12 U.S. Army Corps of Engineers, Detroit District Corps of Engineers, ”Monthly Bulletin of Lake Levels For The Great Lakes,” December 2006 through November 2007.

2.3-13 Kovacik, T.L., “Information on the Velocity and Flow Pattern of Detroit River Water in Western Lake Erie Revealed by an Accidental Salt Spill”, *The Ohio Journal of Science*, 28 June 1972.

2.3-14 Great Lakes Environmental Research Laboratory, “GLERL Great Lakes Monthly Hydrologic Data,” http://www.glerl.noaa.gov/data/arc/hydro/mnth-hydro.html, accessed 7 November 2007.

2.3-15 U.S. Army Corps of Engineers, “Historic Great Lake Levels,” www.lre.usace.army.mil/greatlakes/hh/greatlakeswaterlevels/historicdata/greatlakeshydrographs, accessed 8 October 2007.

2.3-16 U.S. Army Corps of Engineers, “Long Term Average Min-Max Water Levels,” http://www.lre.usace.army.mil/greatlakes/hh/greatlakeswaterlevels/historicdata/longtermaveragemin-maxwaterlevels, accessed 8 October 2007.

2.3-17 U.S. Geological Survey, “Lake Level Variability and Water Availability in the Great Lakes,” Circular 1311, http://pubs.usgs.gov/circ/2007/1311/pdf/circ1311_web.pdf, accessed 29 November 2007.

2.3-18 Michigan Department of Environmental Quality, Water Management, Water Use Program, “Monroe Water Use 2006”.

2.3-19 National Oceanic & Atmospheric Administration, Tides & Currents, “Great Lakes Water Level Data,” http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=9063090%20Fermi%20Power%20Plant,%20MI&type=Great%20Lakes%20Water%20Level%20Data, accessed 7 November 2007.

2.3-20 National Oceanic & Atmospheric Administration, Tides & Currents, “Great Lakes Water Level Data – Station Selection,” http://tidesandcurrents.noaa.gov/station_retrieve.shtml?type=Great+Lakes+Water+Level+Data, accessed 7 November 2007.

2.3-21 National Oceanic & Atmospheric Administration, Tides & Currents, “Stations Currnets Velocity Nowcast,” http://tidesandcurrents.noaa.gov/ofs/leofs/now_statcur.shtml, accessed 7 November 2007.

2.3-22 U.S. Army Corps of Engineers, “Lake Erie at Fermi Power Plant, MI,” http://www.lre.usace.army.mil/_plugins/Programs/StormRise/pages.cfm?page=Display&cityid=25&lakeid=5, accessed 8 February 2008.

2.3-23 The Greenway Collaborative, Inc., “The Detroit River,” http://www.greenwaycollab.com/images/DET_RIV/DROM.gif, accessed 7 November 2007.

2.3-24 U.S. Nuclear Regulatory Commission, Liquid Radioactive Release Lessons Learned Task Force-Final Report, 1 September 2006.

2.3-25 U.S. Army Corps of Engineers, “Historic Connecting Channel Outflows,” http://www.lre.usace.army.mil/greatlakes/hh/outflows/historic%20connecting%20channel%20outflows/index.cfm, accessed 12 November 2007.

2.3-26 U.S. Department of Interior and U.S. Army Corps of Engineers, *The Ecology of the Coastal Marshes of Western Lake Erie,* Biological Report 85(7.9), February 1987.

2.3-27 Emerson, D.G,. A.V. Vecchia, and A.L. Dahlichigan, Evaluation of Drainage Area Ratio Method Used to Estimate Streamflow for the Red River of the North Basin, North Dakota and Minnesota, U.S. Geological Survey Scientific Investigation Report 2005-5017, http://pubs.usgs.gov/sir/2005/5017/, accessed 17 April 2008.

2.3-28 Michigan Department of Environmental Quality, Land and Water Management Division, Hydrologic Studies Unit, Public Record Data, Plum Brook Gauge 04163500.

2.3-29 Michigan Department of Environmental Quality, Land and Water Management Division, “Flood Discharge Request Record 20070540-1,” 20 December 2007, http://www.deq.state.mi.us/flow/hflow.asp?FileNumber=20070540-1, accessed 3 June 2007.

2.3-30 Michigan Department of Environmental Quality, Land and Water Management Division, Flood Discharge Request Record 20070540-1, 20 December 2007, http://www.deq.state.mi.us/flow/hflow.asp?FileNumber=20070540-2, accessed 3 June 2007.

2.3-31 U.S. Geological Survey, National Water Information System, “Water Quality Samples for Michigan, Annual Water Data Reports,” http://nwis.waterdata.usgs.gov/mi/nwis/qwdata?search_criteria=search_site_no&submitted, accessed 4 October 2007.

2.3-32 Federal Emergency Management Agency, Map Service Center, Flood Map Panel 259 of 510 Monroe County Michigan Effective Date April 20, 2000 map number 26115C0259 D, http://msc.fema.gov, accessed 15 November 2007.

2.3-33 U.S. Environmental Protection Agency, “The Great Lakes: An Environmental Atlas and Resource Book,” http://www.epa.gov/glnpo/atlas/images/big03.gif, accessed 29 November 2007.

2.3-34 Harding, R., *The Mackinac Center Report Groundwater Regulation: An Assessment*, April 2005, http://www.mackinac.org/archives/2005/s2005-01.pdf, accessed 26 July 2008.

2.3-35 Michigan Department of Environmental Quality, “Water Withdrawal Reports, Data, and Graphics,” http://www.michigan.gov/deq/0,1607,7-135-3313_3677_3704-72931--,00.html, accessed 2 October 2007.

2.3-36 U.S. Environmental Protection Agency, “Great Lakes Areas of Concern,” http://www.epa.gov/glnpo/aoc/index.html, accessed 17 October 2007.

2.3-37 U.S. Environmental Protection Agency, “STORET Database, Water Quality Data,” http://iaspub.epa.gov/stormodb/DW_resultcriteria_station, accessed 7 October 2007.

2.3-38 Publications NOAA, Great Lakes Environmental Research Laboratory, “Great Lakes Monthly Hydrologic Data,” GLERL-083, ftp://ftp.glerl.noaa.gov/publications/tech_reports/glerl-083/, accessed 21 April 2008.

2.3-39 Level News Publication, “Great Lakes - St. Lawrence River Water Levels,“ Volume 11, Number 1, 9 January 2003.

2.3-40 The Great Lakes Commission, *Annual Report of Great Lakes Regional Water Use Database Repository Representing 2004 Water Use Data In Gallons*, 13 November 2006, http://www.glc.org/wateruse/database/pdf/2004-gallons.pdf, accessed 14 June 2008.

2.3-41 The Great Lakes Commission, *Annual Report of Great Lakes Regional Water Use Database Repository Representing 2003 Water Use Data in Gallons*, 4 October 2006, http://www.glc.org/wateruse/database/pdf/2003-gallons.pdf, accessed 14 June 2008.

2.3-42 The Great Lakes Commission, *Annual Report of Great Lakes Regional Water Use Database Repository Representing 2002 Water Use Data In Gallons*, 10 August 2005, http://www.glc.org/wateruse/database/pdf/1-beginning-gallons-02.pdf, accessed 14 June 2008.

2.3-43 The Great Lakes Commission, *Annual Report of Great Lakes Regional Water Use Database Repository Representing 2001 Water Use Data In Gallons*, 12 August 2005, http://www.glc.org/wateruse/database/pdf/1-beginning-gallons-01.pdf, accessed 14 June 2008.

2.3-44 The Great Lakes Commission, *Annual Report of Great Lakes Regional Water Use Database Repository Representing 2000 Water Use Data In Gallons*, August 2004, http://www.glc.org/wateruse/database/pdf/1-beginning-gallons-00.pdf, accessed 14 June 2008.

2.3-45 The Great Lakes Commission, *Annual Report of Great Lakes Regional Water Use Database Repository Representing 1999 Water Use Data In Gallons*, August 2004, http://www.glc.org/wateruse/database/pdf/1-beginning-gallons-99.pdf, accessed 14 June 2008.

2.3-46 The Great Lakes Commission and The Water Withdrawl and Use Technical Subcommittee Under Project Element 3 of A Great Lakes Water Resources Decision Support System, *Annual Report of Great Lakes Regional Water Use Database Repository Representing 1998 Water Use Data In Gallons*, July 2002, http://www.glc.org/wateruse/database/pdf/1-beginning-gallons-98.pdf, accessed 14 June 2008.

2.3-47 U.S. Nuclear Regulatory Commission, *Groundwater Contamination (Tritium) at Nuclear Plants*, http://www.nrc.gov/reactors/operating/ops-experience/grndwtr-contam-tritium.html, accessed 29 October 2007.

2.3-48 Cyr, T., River Raisin Public Advisory Council, *The River Raisin Remedial Action Plan Update*, August 2002.

2.3-49 Detroit Edison, “Enrico Fermi Atomic Power Plant Unit 3 – Applicant’s Environmental Report Construction Permit Stage,” January 1967.

2.3-50 U.S. Environmental Protection Agency and Government of Canada, “The Great Lakes: An Environmental Atlas and Resource Book,” Third Edition, (1995), http://www.epa.gov/glnpo/atlas/glat-ch1.html, accessed 3 October 2007.

2.3-51 Groundwater Conservation Advisory Council, Final Report to the Michigan Legislature in Response to Public Act 148 of 2003, 6 February 2006.

2.3-52 The Government of the United States of America and the Government of Canada, Great Lakes Water Quality Agreement of 1978 Protocol Amending the 1978 Agreement Between the United States of America and Canada on Great Lakes Water Quality, Amended 16 October 1993, http://www.epa.gov/glnpo/glwqa/1978/articles.html, accessed 17 October 2007.

2.3-53 Lake LaMP Work Group, *Lake Erie LaMP 2006 Report*, 2006.

2.3-54 Michigan Administrative Code, “Environmental Quality, Water Division, Chapter 323, Water Resources Protection, Part 4, Water Quality Standards, Rule 1100, Designated Uses,” http://cyberregs.com, accessed 2 November 2007.

2.3-55 Michigan Department of Environmental Quality, Surface Water Quality Division, *A Biological Survey of Stony Creek and Amos Palmer Drain, Monroe County, Michigan*, Report Number 151, December 1996.

2.3-56 Michigan Department of Environmental Quality, Surface Water Quality Division, *A Biological Survey of Stony Creek and its Tributaries, Amos Palmer Drain and Ross Drain, Monroe County*, Report Number 087, February 1998.

2.3-57 Michigan Department of Environmental Quality, *Monroe County Groundwater Sampling Results 1983-2003*, 2003.

2.3-58 Michigan Department of Environmental Quality, “National Pollutant Discharge Elimination (NPDES) Permit – Berlin Township Wastewater Treatment Plant, Permit No. MI0020826,” 13 September 2005.

2.3-59 Michigan Department of Environmental Quality, “National Pollutant Discharge Elimination (NPDES) Permit – Detroit Edison Company Fermi 2 Power Plant, Permit No. MI0037028,” 30 September 2005.

2.3-60 Michigan Department of Environmental Quality, “National Pollutant Discharge Elimination (NPDES) Permit Fact Sheet – Detroit Edison Company Fermi 2 Power Plant, Permit No. MI0037028,” 2005, http://www.epa.gov/npdescan/MI0037028FS.pdf, accessed 26 July 2008.

2.3-61 Michigan Department of Environmental Quality, “National Pollutant Discharge Elimination (NPDES) Permit – Detroit Edison Company Monroe Power Plant, Permit No. MI0001848,” 29 September 2005.

2.3-62 Michigan Department of Environmental Quality, “National Pollutant Discharge Elimination (NPDES) Permit Fact Sheet – Detroit Edison Company Monroe Power Plant, Permit No. MI0001848,” 2005, http://www.epa.gov/npdescan/MI0001848FS.pdf, accessed 26 July 2008.

2.3-63 Michigan Department of Environmental Quality, Water Bureau, Water Quality and Pollution Control in Michigan 2006 Sections 303(d), 305(b), and 314 Integrated Report, July 2006.

2.3-64 Michigan Department of Natural Resources, Surface Water Quality Division, *Remedial Action Plan for River Raisin Area of Concern*, 27 October 1987.

2.3-65 Michigan Department of Natural Resources, Surface Water Quality Division, *A Biological Survey of Plum Creek, Sandy Creek and Swan Creek, Monroe and Wayne Counties, June 29-30, 1993,* Report Number 038, April 1994.

2.3-66 Myers, D.N., M.A. Thomas, J.W. Frey, S.J. Rheaume, and D.T. Button, *Water Quality in the Lake Erie-Lake Saint Clair Drainages Michigan, Ohio, Indiana, New York, and Pennsylvania, 1996–98,* U.S. Geological Survey Circular 1203, 2000.

2.3-67 Detroit Edison, 2007 Radioactive Release and Radiological Environmental Monitoring Report, 24 April 2008.

2.3-68 Rouge River Advisory Council, “2004 Rouge River Remedial Action Plan Revision,” 2004.

2.3-69 U.S. Environmental Protection Agency, “Great Lakes Environmental Database, Water Quality Monitoring Data,” http://cleveland.glnpo.net/cfglenda/glendaquery_wq2.cfm, accessed 2 October 2007.

2.3-70 Michigan Department of Environmental Quality, Land and Water Management Division, “Flood Discharge Request Record 20070540-3,” 20 December 2007, http://www.deq.state.mi.us/flow/hflow.asp?FileNumber=20070540-3, accessed 3 June 2008.

2.3-71 Michigan Department of Environmental Quality, Land and Water Management Division, “Low Flow Discharge Request Record 6690,” 8 January 2008, http://www.deq.state.mi.us/flow/lflow.asp?FileNumber=6690, accessed 3 June 2008.

2.3-72 Michigan Department of Environmental Quality, Land and Water Management Division, “Low Flow Discharge Request Record 6691,” 8 January 2008, http://www.deq.state.mi.us/flow/lflow.asp?FileNumber=6691, accessed 3 June 2008.

2.3-73 Michigan Department of Environmental Quality, Land and Water Management Division, “Low Flow Discharge Request Record 6692,” 8 January 2008, http://www.deq.state.mi.us/flow/lflow.asp?FileNumber=6692, accessed 3 June 2008.

2.3-74 Michigan Department of Environmental Quality, Water Management, Water Use Program, “Monroe Water Use 2005”.

2.3-75 Environmental Systems Research Institute (ESRI), ArcGIS Data DVD, Version 9.2, USA and Canada Map Data, 2007

2.3-76 Reeves, H.W., K.V. Wright, and J.R. Nicholas, “Hydrogeology and Simulation of Regional Ground-Water-Level Declines in Monroe County, Michigan,” U.S. Geological Survey Water-Resources Investigations Report 03-4312, 2004.

2.3-77 Detroit Edison, “Fermi Unit 2 Environmental Report,” Supplement 5, January 1979.

2.3-78 Fenneman, N.M., and D.W. Johnson, “Physical Divisions of the United States [Physiography],” U.S. Department of the Interior, Geological Survey, scale 1:7,000,000, 1946, http://water.usgs.gov/GIS/dsdl/physio.e00.gz, accessed 3 December 2007.

2.3-79 U.S. Geological Survey, “Groundwater Atlas of the United States,” Segment 9, Iowa, Michigan, Minnesota, Wisconsin, Hydrologic Investigations Atlas 730-J, Reston, VA, 1992.

2.3-80 Casey, G.D., "Hydrogeologic Framework of the Midwestern Basins and Arches Region in Parts of Indiana, Ohio, Michigan, and Illinois", U.S. Geological Survey Professional paper 1423-B, 1996.

2.3-81 Bugliosi, E.F., "The Midwestern Basins and Arches Regional Aquifer System in Parts of Indiana, Ohio, Michigan, and Illinois; Summary", USGS Professional Paper 1423-A, 1999.

2.3-82 Regional Ground-Water Flow and Geochemistry in the Midwest Basins and Arches Aquifer System in Parts of Indiana, Ohio, Michigan and Illinois," USGS Professional Paper 1423-C, 2000.

2.3-83 U.S. Environmental Protection Agency, “Designated Sole Source Aquifers in EPA Region 5,” http://www.epa.gov/safewater/sourcewater/pubs/qrg_ssamap_reg5.pdf, accessed 20 September 2007.

2.3-84 Bryan Municipal Utilities, City of Bryan, “City Submits Petition for Aquifer Protection,” (22 October 2007), http://www.cityofbryan.net/PR20071022.asp, accessed 16 November 2007.

2.3-85 U.S. Geological Survey, “Estimated Use of Water in the United States in 2000,” USGS Circular 1268, 2005.

2.3-86 U.S. Environmental Protection Agency, “Safe Drinking Water Information System,” database last updated 26 July 2007, http://www.epa.gov/enviro/html/sdwis/sdwis_query.html, accessed 18 September 2007.

2.3-87 U.S. Environmental Protection Agency, “EPA Public Drink Water Systems: Facts and Figures,” 28 April 2006, http://www.epa.gov/safewater/pws/factoids.html, accessed 29 May 2008.

2.3-88 City of Milan, Michigan, “2006 City of Milan Annual Water Quality Report,” http://www.ci.milan.mi.us/public_works/Milan_Water_Quality_Report_2006.pdf, accessed 20 February 2008.

2.3-89 Department of Information Technology, Center for Geographic Information, “Michigan Geographic Data Library,” Michigan Department of Environment Quality, (Well data generated 8 October 2007), http://www.mcgi.state.mi.us/mgdl/, accessed 11 October 2007.

2.3-90 Ohio Department of Natural Resources, “Water Well Log,” Ground Water Mapping and Technical Services, Division of Water, http://www.dnr.state.oh.us/water/maptechs/wellogs/appNEW/custom.aspx, accessed 20 September 2007.

2.3-91 Michigan Department of Environmental Quality, “Thermoelectric Power Generation Water Use Year 2000,” http://www.deq.state.mi.us/documents/deq-wd-wurp-TE2000.pdf, accessed 7 February 2008.

2.3-92 Nicholas, J.R., G.L. Rowe, and J.R. Brannen, “Hydrology, Water Quality, and Effects of Drought in Monroe County, Michigan,” Water-Resources Investigations Report 94-4161, 1996.

2.3-93 U.S. Geological Survey, “National Water Information System - Groundwater Levels for Michigan,” http://nwis.waterdata.usgs.gov/mi/nwis/gwlevels, assessed 17 April 2008.

2.3-94 Weight, W.D., and J.L. Sonderegger, “Manual of Applied Field Hydrogeology,” Slug Testing, Chapter 11, McGraw-Hill, 2001.

2.3-95 HydroSOLVE, Inc., “Aqtesolv for Windows User’s Guide,” Reston, VA, July 24, 2000.

2.3-96 Zumberge, J.H., "Report on Pumping Test Analysis, PRDC Property, Monroe, Michigan,” unpublished, July 25, 1959.

2.3-97 Royle, M., “Standard Operating Procedures for Borehole Packer Testing.”

2.3-98 McDonald, M., and A. Harbaugh, “A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model,” Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6, Chapter A1, 1988.

2.3-99 Harbaugh, A.W., E.R. Banta, M.C. Hill, and M.G. McDonald, “MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Model – User Guide to Modularization Concepts and the Ground-Water Flow Processes,” U.S. Geological Survey Open-File Report 00-92, Reston, Virginia, 2000.

2.3-100 Brigham Young University Environmental Modeling Research Laboratory, “Groundwater Modeling System Tutorials,” Version 6.0, Vols. I, II, and III, October 20, 2005.

2.3-101 Dames & Moore, “Rock Foundation Treatment Residual Heat Removal Complex Fermi II Nuclear Power Plant for the Detroit Edison Company,” July 3, 1974.

2.3-102 Fetter, C.W., “Applied Hydrogeology,” Bell & Howell Co., Columbus, OH, 1980.

2.3-103 Driscoll, F.G., “Groundwater and Wells,” 2nd Edition, Johnson (Well Screen) Division, St. Paul, Minnesota, 1986.

2.3-104 Detroit Edison, “Fermi 2, Offsite Dose Calculation Manual,” Revision 14, 1999.

2.3-105 U.S. Nuclear Regulatory Commission, “Integrated Ground-Water Monitoring Strategy for NRC Licensed Facilities and Sites: Logic, Strategic Approach and Discussion,” Advanced Environmental Solutions LLC for Division of Fuel, Engineering, and Radiological Research, Office of Nuclear Regulatory Research, NUREG/CR-6948, November 2007.

2.3-106 AECOM, “Water Quality Survey, The Detroit Edison Company, Fermi 3 Project, Final Report,” November 2009.

2.3-107 Nuclear Energy Institute, "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination," NEI 08-08A, Revision 0, October 2009.

2.3-108 Michigan Department of Environmental Quality, Wetland Identification Report, Wetland Identification File Number 08-58-0003-W, November 7, 2008.

2.3-109 Michigan Department of Environmental Quality, Wetland Identification Report, Modified Wetland Identification File Number 08-58-0003-WA, March 30, 2009.

2.3-110 U.S. Army Corps of Engineers, Detroit District, Engineering & Technical Services, Regulatory Office, File No. LRE-2008-00443-1, November 9, 2010.

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	246.9	247.3	248.2	248.5	248.6	248.2	248.0	247.4	246.8	246.7	246.7
	1946	1952	1952	1973	1973	1952	1947	1947	1947	1945	1945	1945
Min	242.2	242.1	242.6	242.9	243.1	243.4	243.2	242.8	242.5	242.2	242.0	241.9
	1935	1936	1935	1935	1935	1935	1934	1934	1934	1934	1934	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	183.63	183.61	183.68	183.74	183.76	183.82	183.86	183.86	183.91	183.89	183.81
	1986	1986	1986	1986	1986	1986	1950	1952	1985	1985	1985	1985
Min	182.83	182.76	182.74	182.72	182.76	182.85	182.96	183.02	183.12	183.10	183.01	182.92
	1926	1926	1926	1926	1926	1926	1926	1926	1926	1925	1925	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	177.11	177.12	177.23	177.28	177.33	177.39	177.39	177.38	177.50	177.38	177.26
	1987	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986
Min	175.60	175.59	175.58	175.61	175.74	175.76	175.78	175.77	175.76	175.70	175.65	175.62
	1965	1964	1964	1964	1964	1964	1964	1964	1964	1964	1964	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	175.80	175.80	175.82	175.83	175.92	175.93	175.90	175.84	175.96	175.82	175.80
	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986
Min	173.88	173.89	174.05	174.32	174.42	174.45	174.50	174.41	174.34	174.27	174.18	174.24
	1936	1926	1934	1926	1934	1934	1934	1934	1934	1934	1934	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

Month	Ambient Lake Water Temperature (°F)		Ambient Lake Current Velocity (m/s)	
	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:	19960901
Name:	Fermi Power Plant, MI	End Date:	20071231
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)

	Lake Erie at Fermi Power Plant				
Month	**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

(m^3/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

(m³/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	ER 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 2.3-85
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 2.3-85
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 2.3-85
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 2.3-85
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 2.3-76
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 2.3-85
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 2.3-85
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 2.3-35
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	Coordinates: 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	559.60	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 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)
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	470.70
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	581.2	583.68	579.2	577.2	572.2	571.2	571.2
EFT-1 I	6366.2	5492.6	581.2	583.69	566.7	564.7	559.6	559.7	559.7
EFT-1 D	6366.2	5492.4	581.2	583.69	553.2	550.7	545.7	545.7	545.7
EFT-2 S	6570.55	5734.62	582.4	582.17	580.4	578.4	573.4	572.4	572.4
EFT-2 D	6570.55	5734.62	582.3	581.88	551.3	549.3	544.3	543.8	543.8
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

	Coordinates		June 29, 2007 - November 29, 2007			April 29, 2008 - May 29, 2008		
Surface Water Gauge	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	3/21/08	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	570.19	568.83	569.91	570.83	570.35	570.46	571.39	571.58	571.76	572.62	571.75	571.13
EFT-2 D	Bass Islands	570.67	569.43	570.61	571.08	570.57	570.73	ND	ND	ND	ND	571.90	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	3/21/08	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	572.78	573.24	573.49	573.96	573.61	572.80	572.19	571.96	571.80	571.55	571.92	572.22
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	569.00	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
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

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	3/21/08	4/28/08	5/28/08
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	576.80	577.50	577.75	577.32	576.62	575.71	576.25	575.95	575.68	575.82	575.54	576.07
EFT-2 S	Overburden	577.93	577.66	577.51	577.14	576.62	576.12	575.36	575.27	574.80	574.87	574.49	576.60
GS-1 A	Surface Water	572.05	571.75	571.76	570.86	570.65	570.46	ND	ND	ND	ND	ND	ND
GS-2 A	Surface Water	571.94	571.60	571.56	570.84	570.44	570.38	ND	ND	ND	ND	ND	ND
GS-3 A	Surface Water	571.99	571.75	571.75	571.29	ND	571.13	ND	ND	ND	ND	ND	ND
GS-4 A	Surface Water	572.02	571.69	ND	570.82	570.57	570.42	ND	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

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

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

Total Report – All Facilities

	Withdrawls				Diversions		Consumptive
Category	**GLSW**	**OSW**	**GW**	**TOTAL**	**Intrabasin**	**Interbasin**	**Use**
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 Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
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 Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
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: See Table 2.3-20

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

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

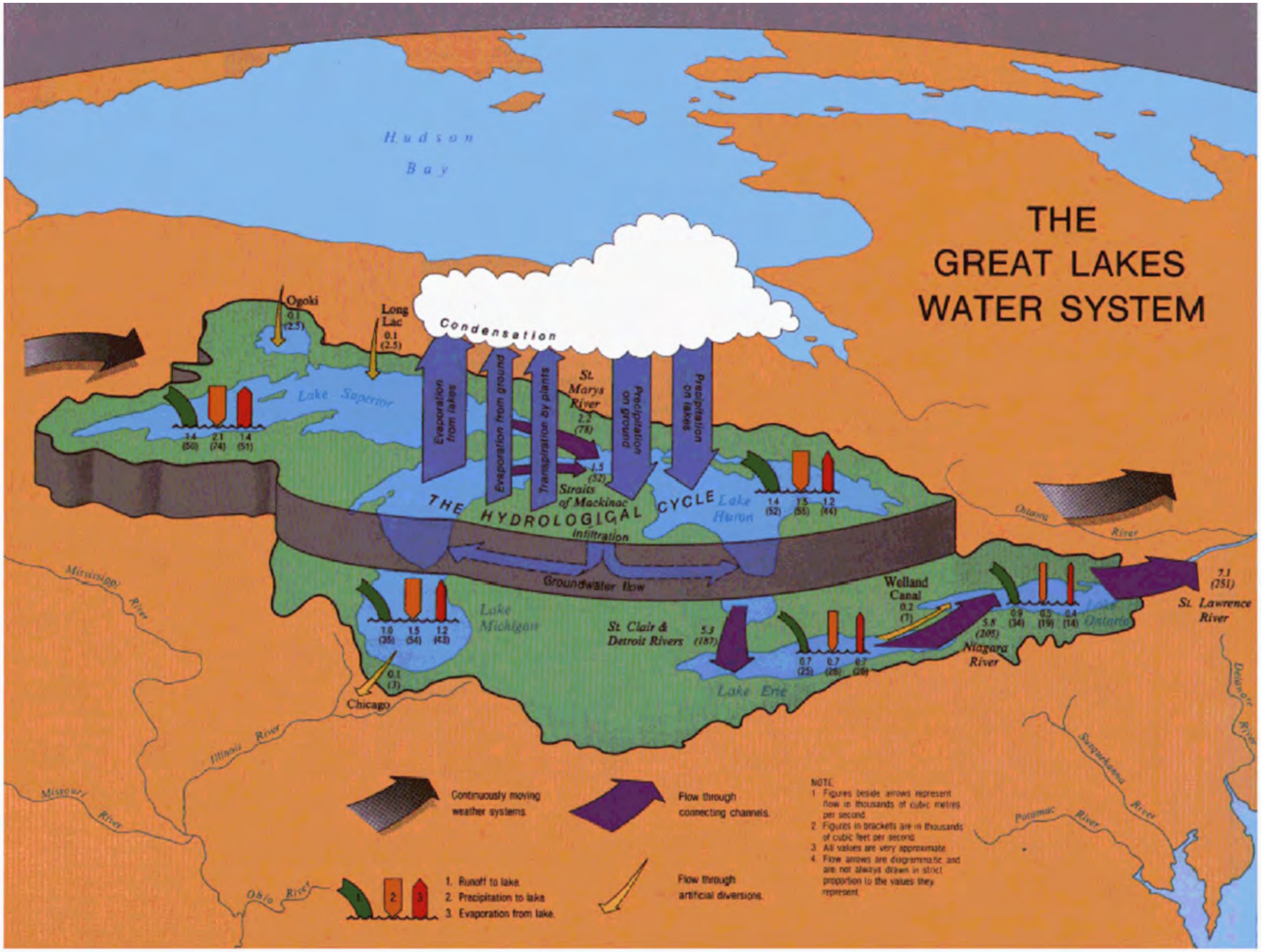
Table 2.3-68 Parameters Sampled at Fermi Intake in October 2003 (Sheet 4 of 4)

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

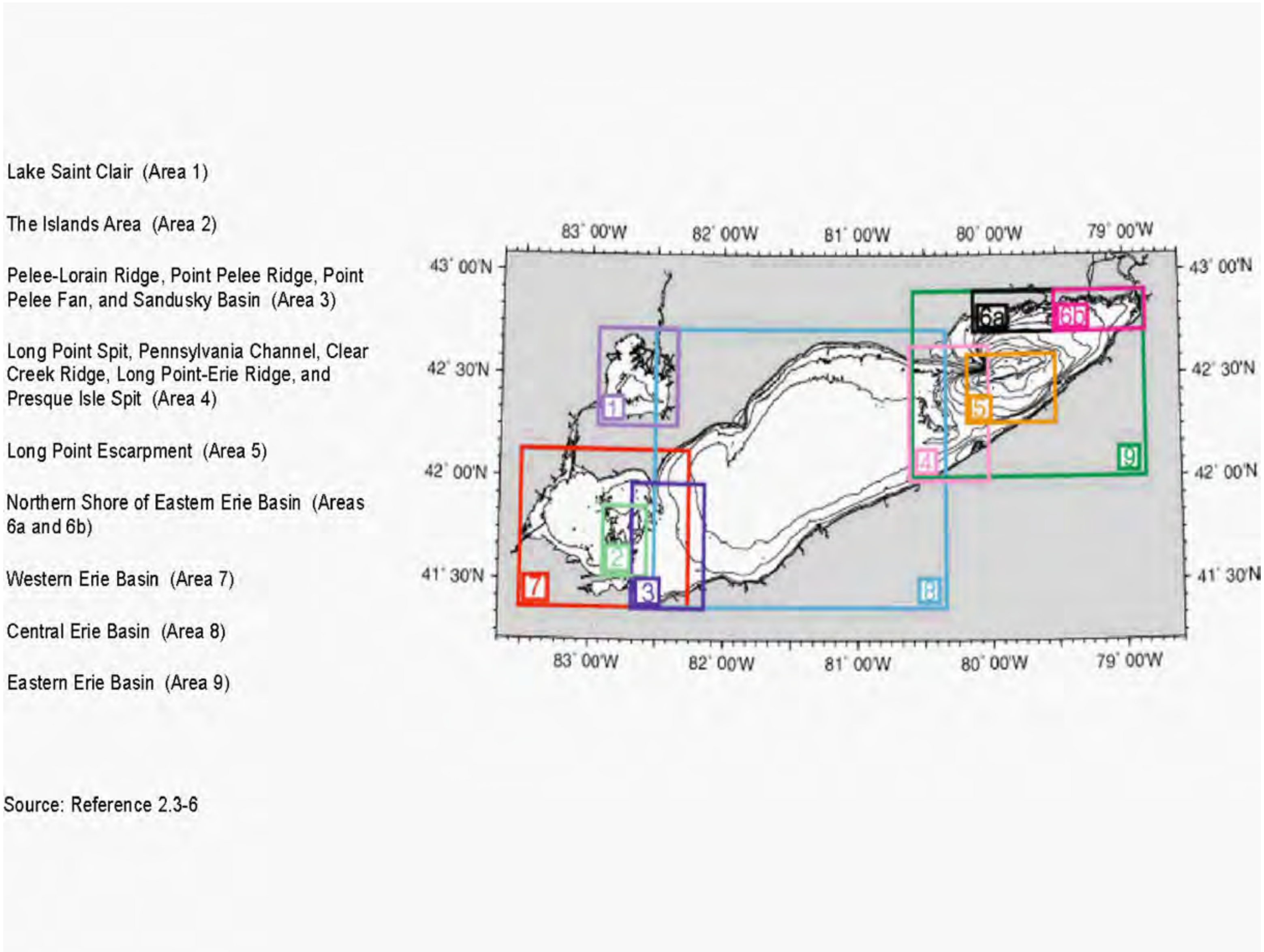
Source: Reference 2.3-17

Figure 2.3-2 Great Lakes Water System



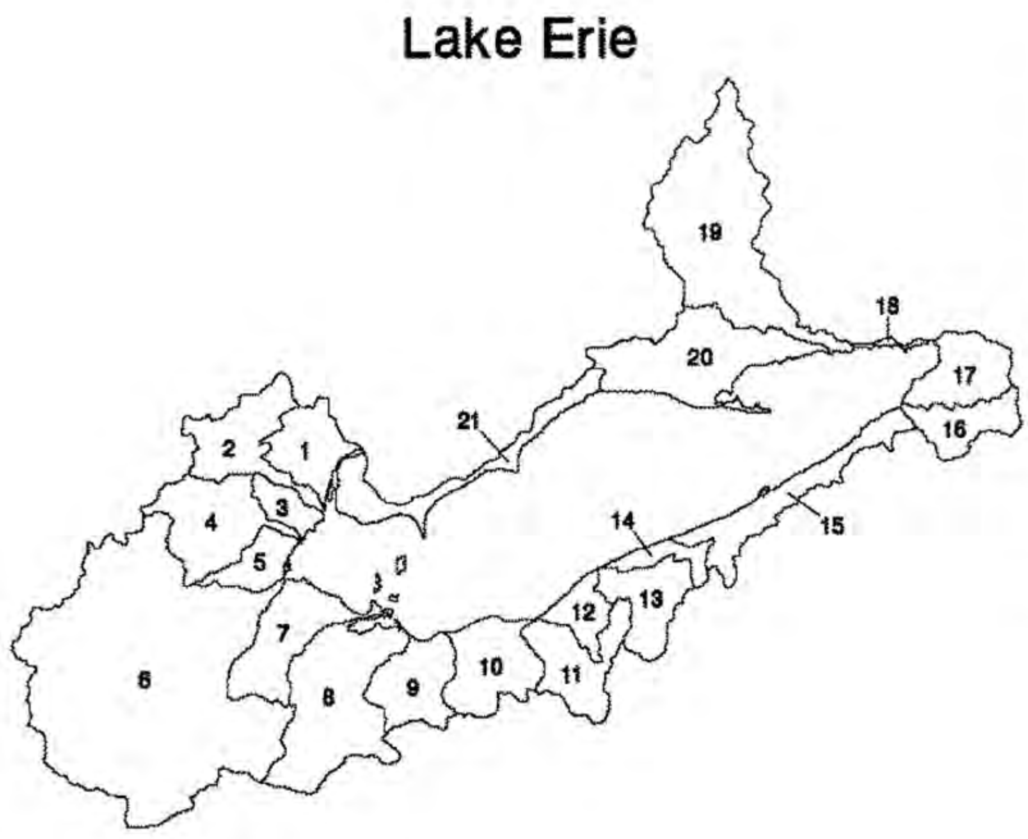
Source: Reference 2.3-2

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

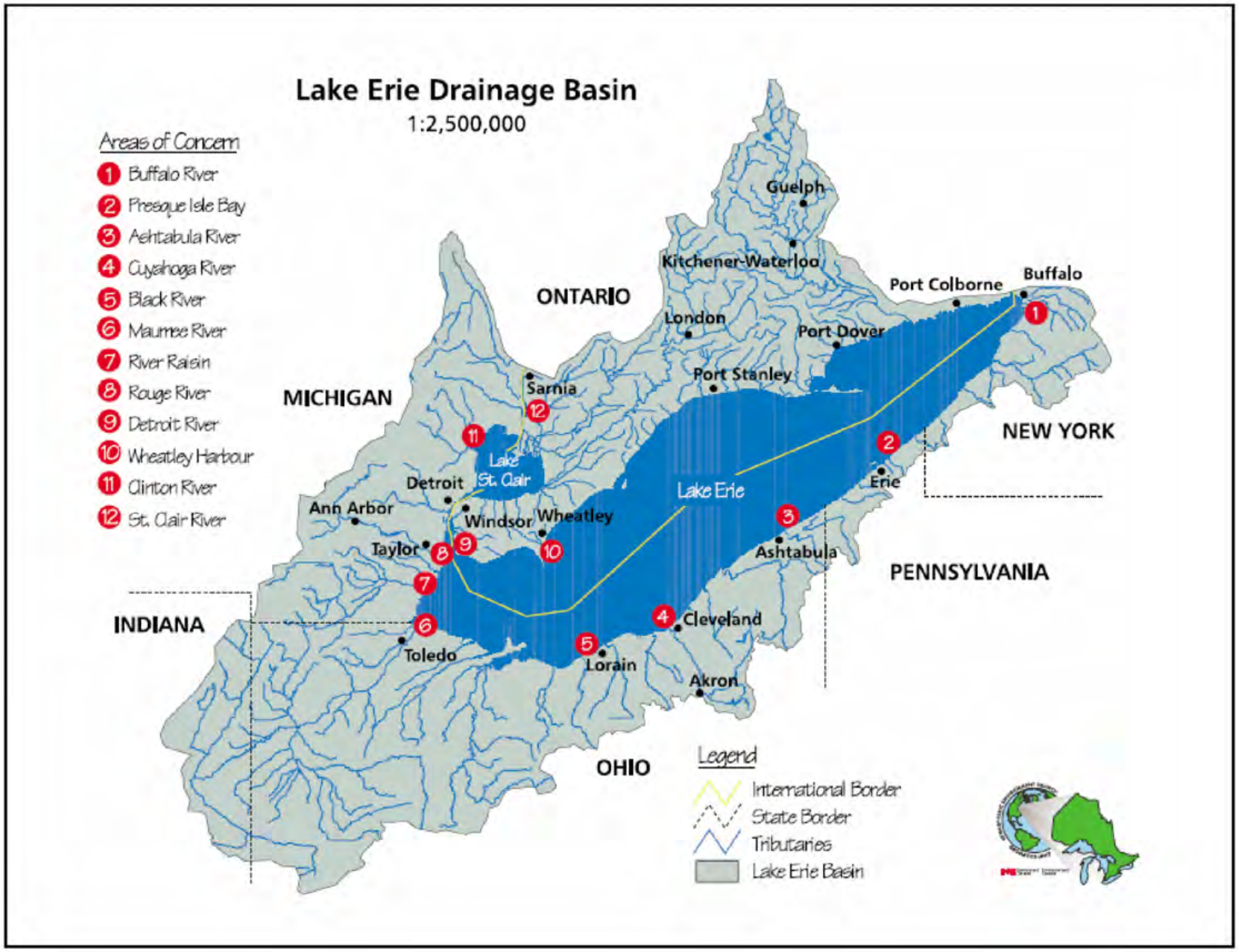


Lake Erie Subbasin Area for use in Large Basin Runoff Model
Digital Areas in square meters

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

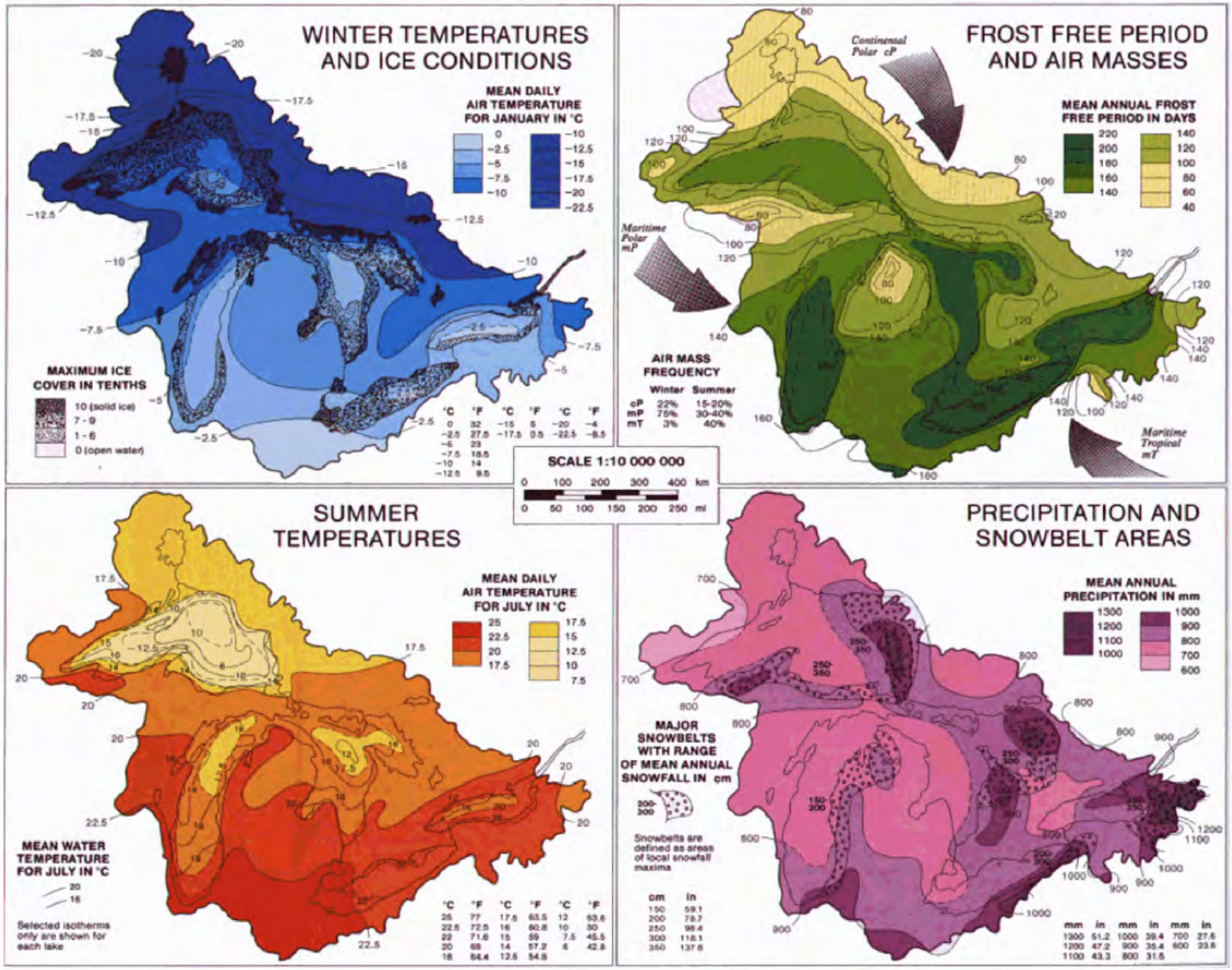
Source: Reference 2.3-7

Figure 2.3-5 Major Tributaries of Lake Erie



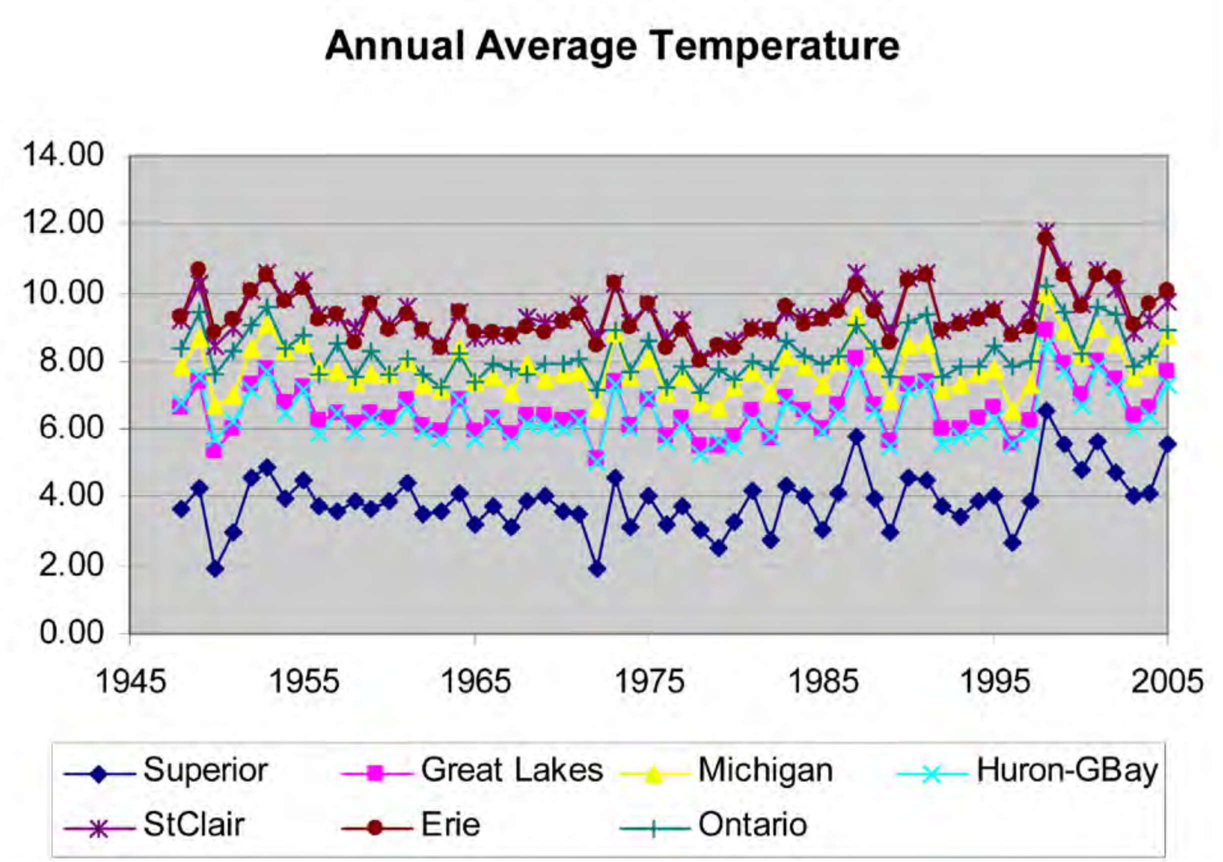
Source: Reference 2.3-10

Figure 2.3-6 Climate Variations in the Great Lakes Region



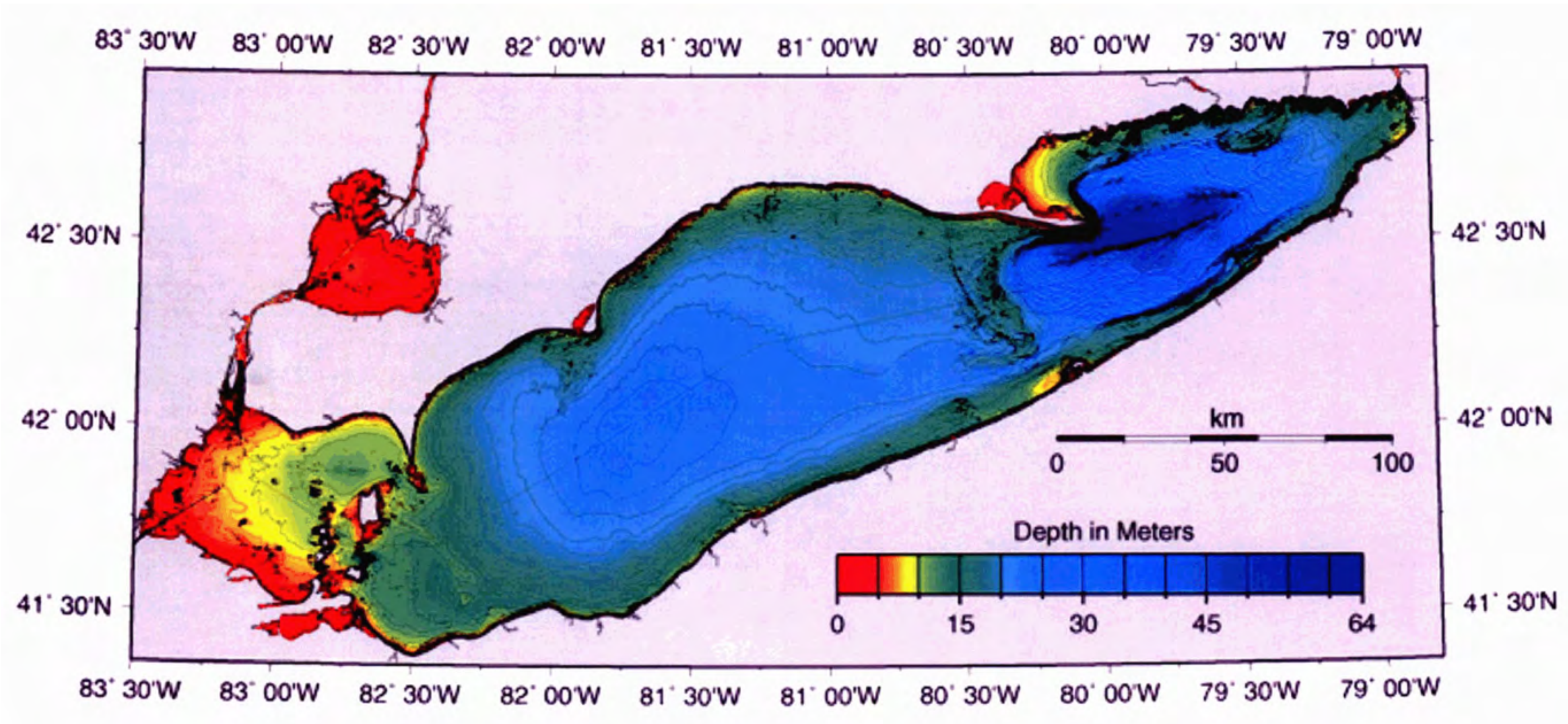
Source: Reference 2.3-33

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



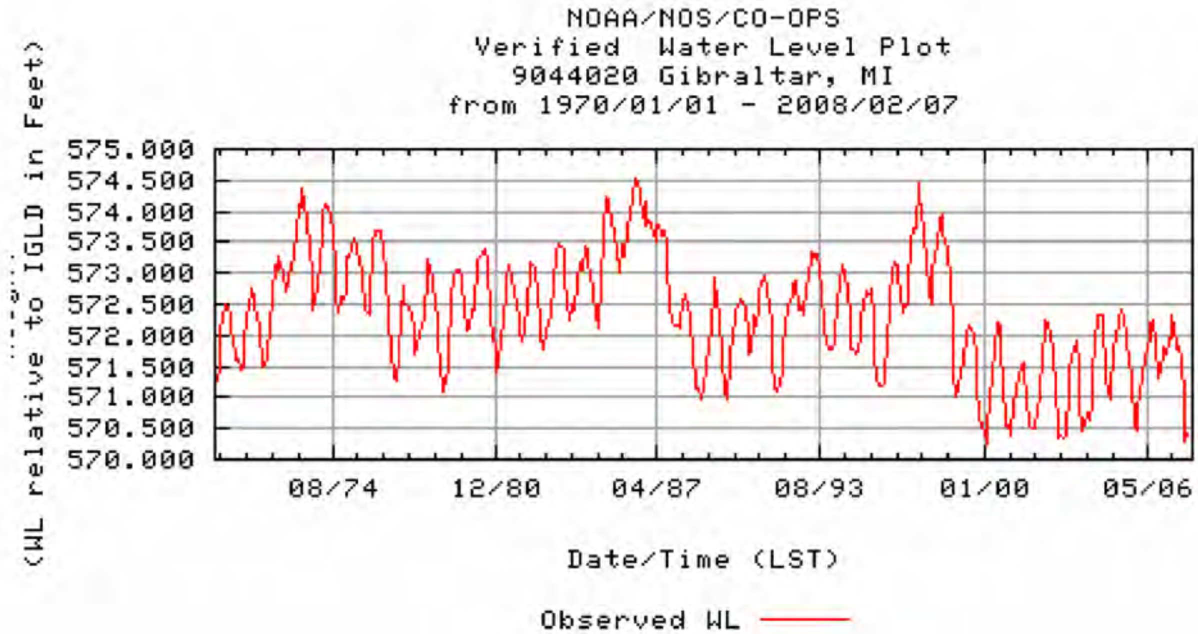
Source: Reference 2.3-7

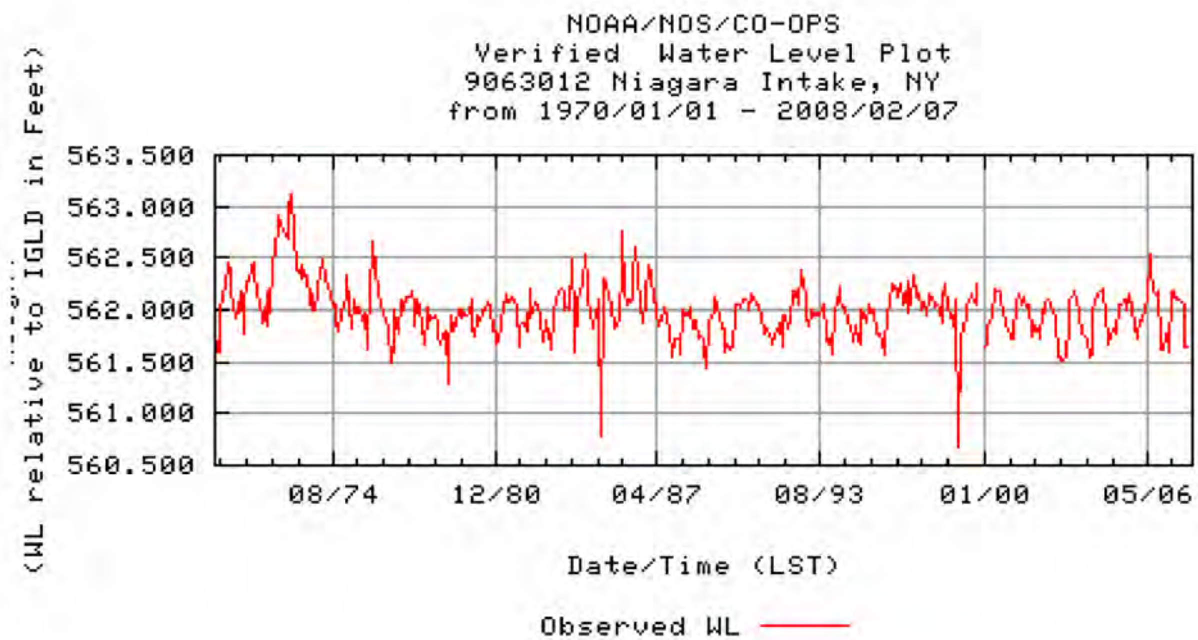
Figure 2.3-8 Bathymetry of Lake Erie and Lake Saint Clair



Source: Reference 2.3-11

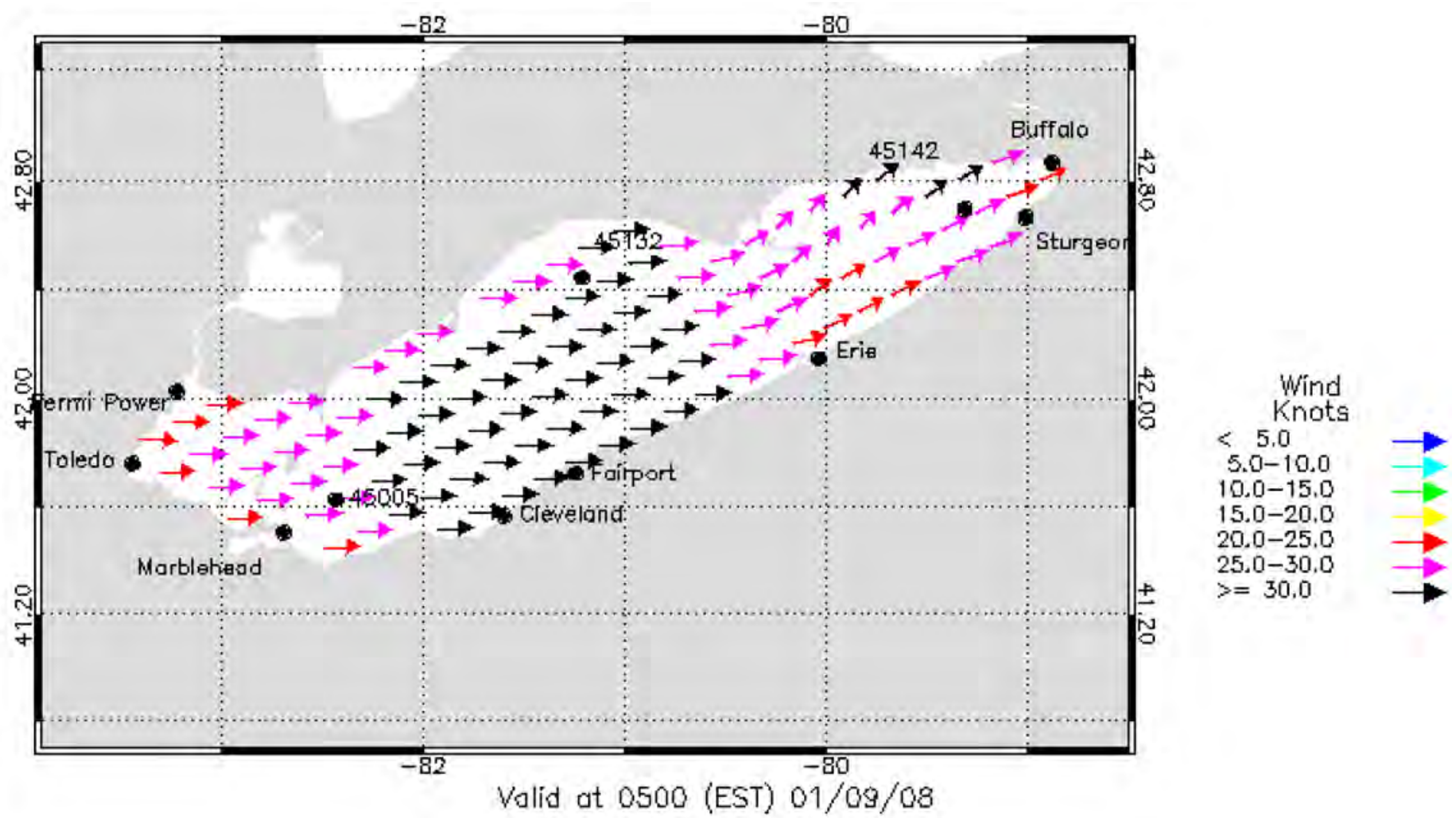
Figure 2.3-9 Historical Inflow and Outflow Water Level Elevations for Lake Erie (IGLD 85)





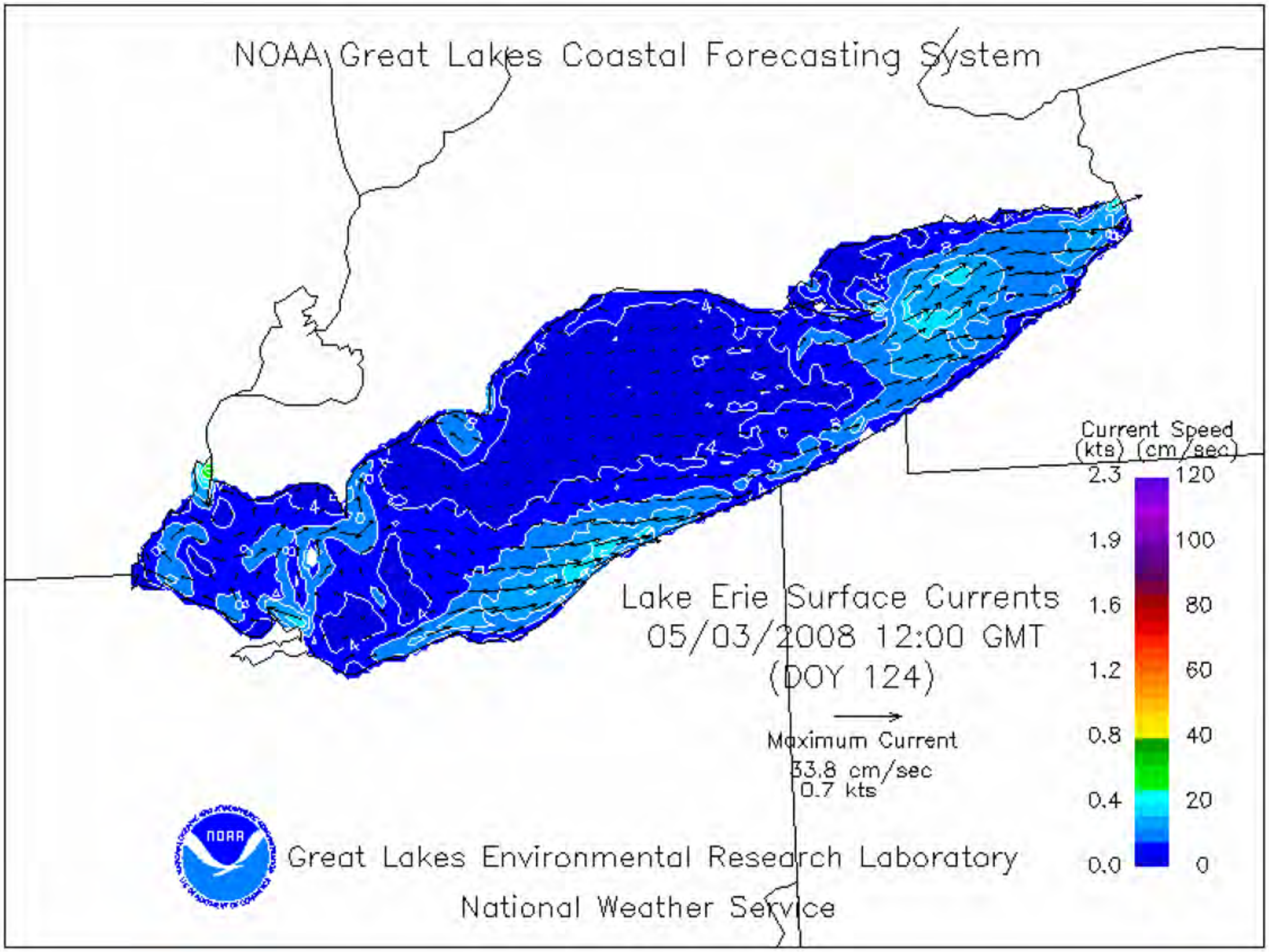
Source: Reference 2.3-20

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

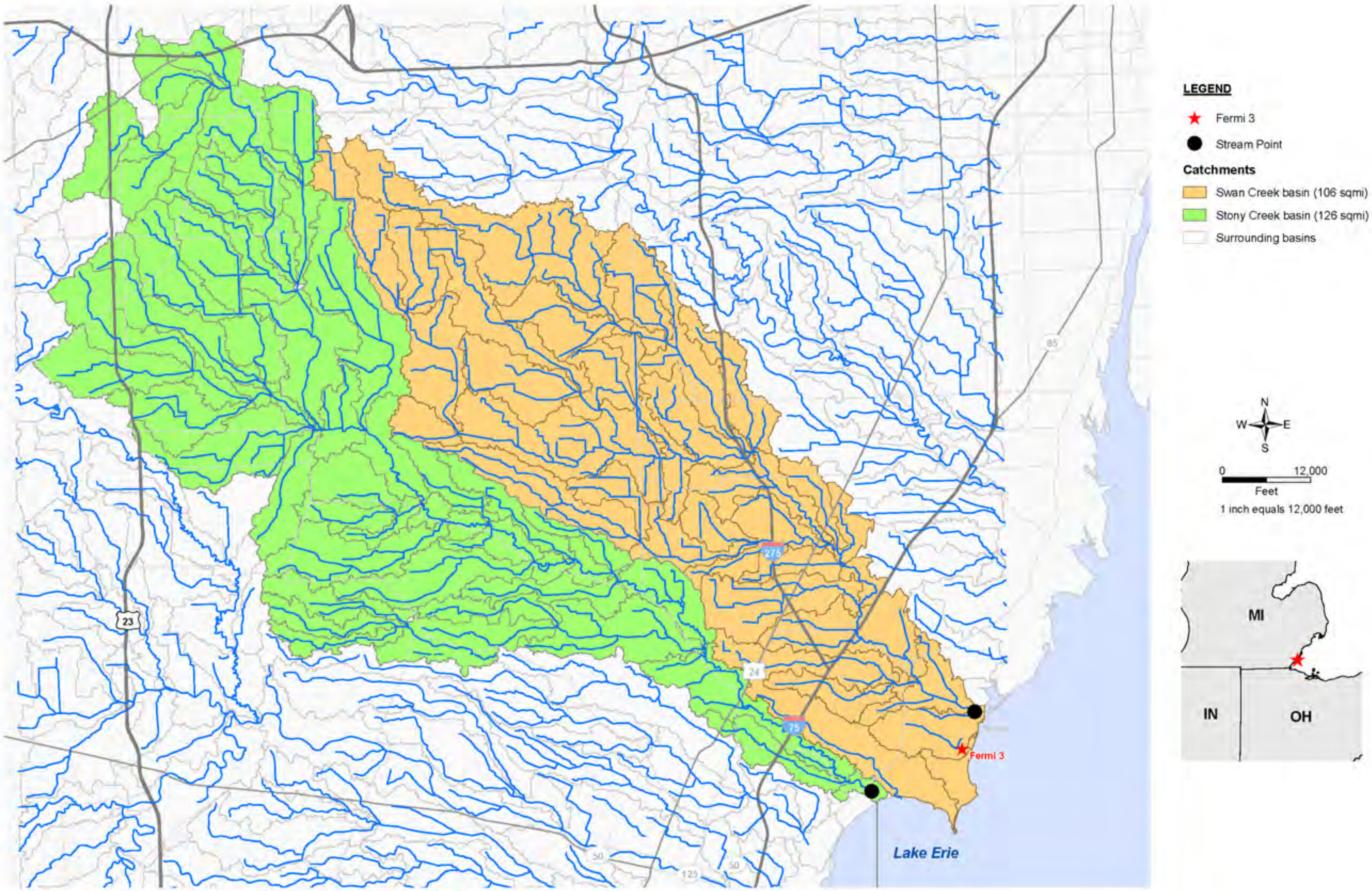


Source: Reference 2.3-9

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

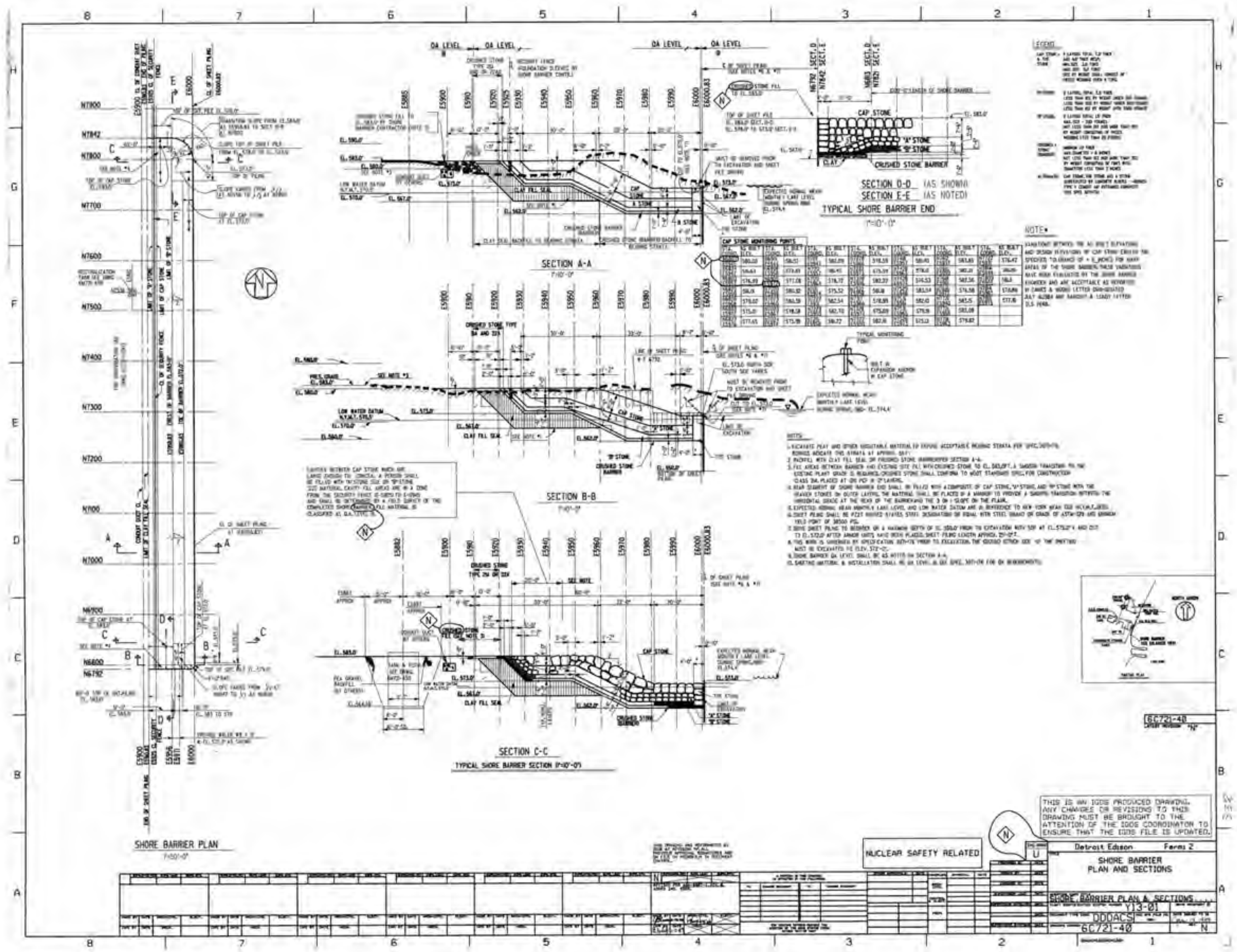
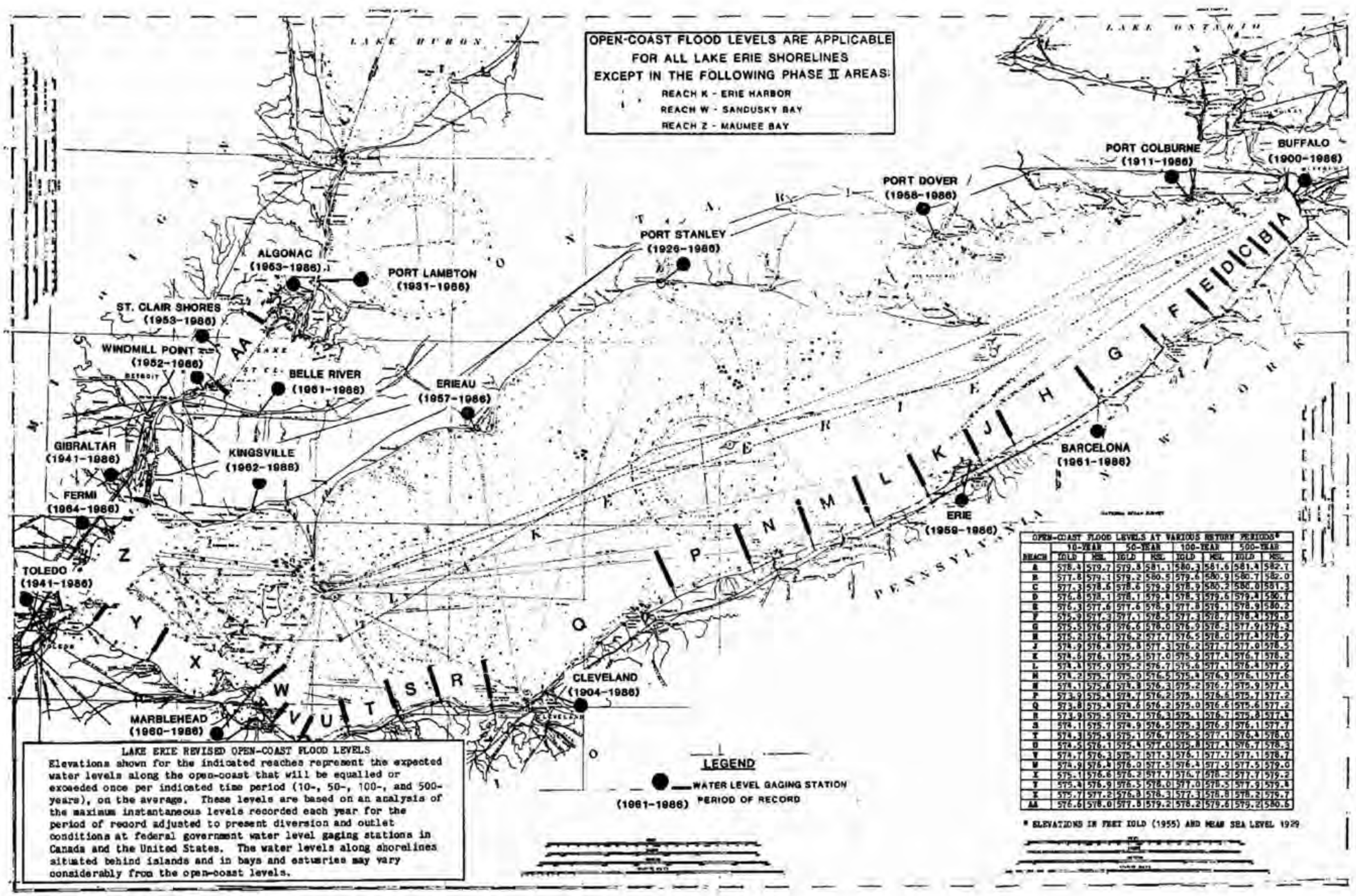


Figure 2.3-15 FEMA Flood Insurance Rate Map



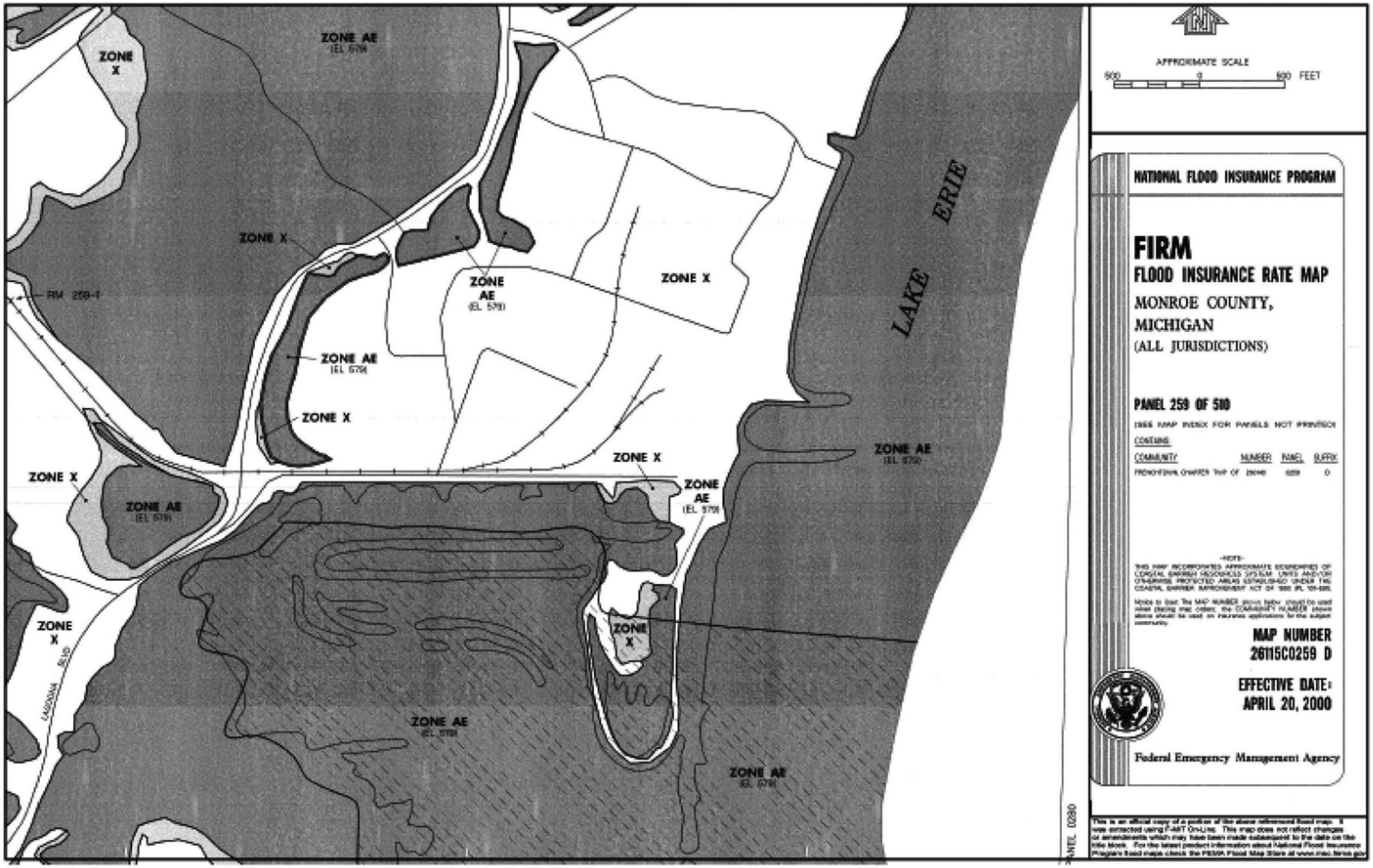
OPEN-COAST FLOOD LEVELS AT VARIOUS RETURN PERIODS*

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 ‘

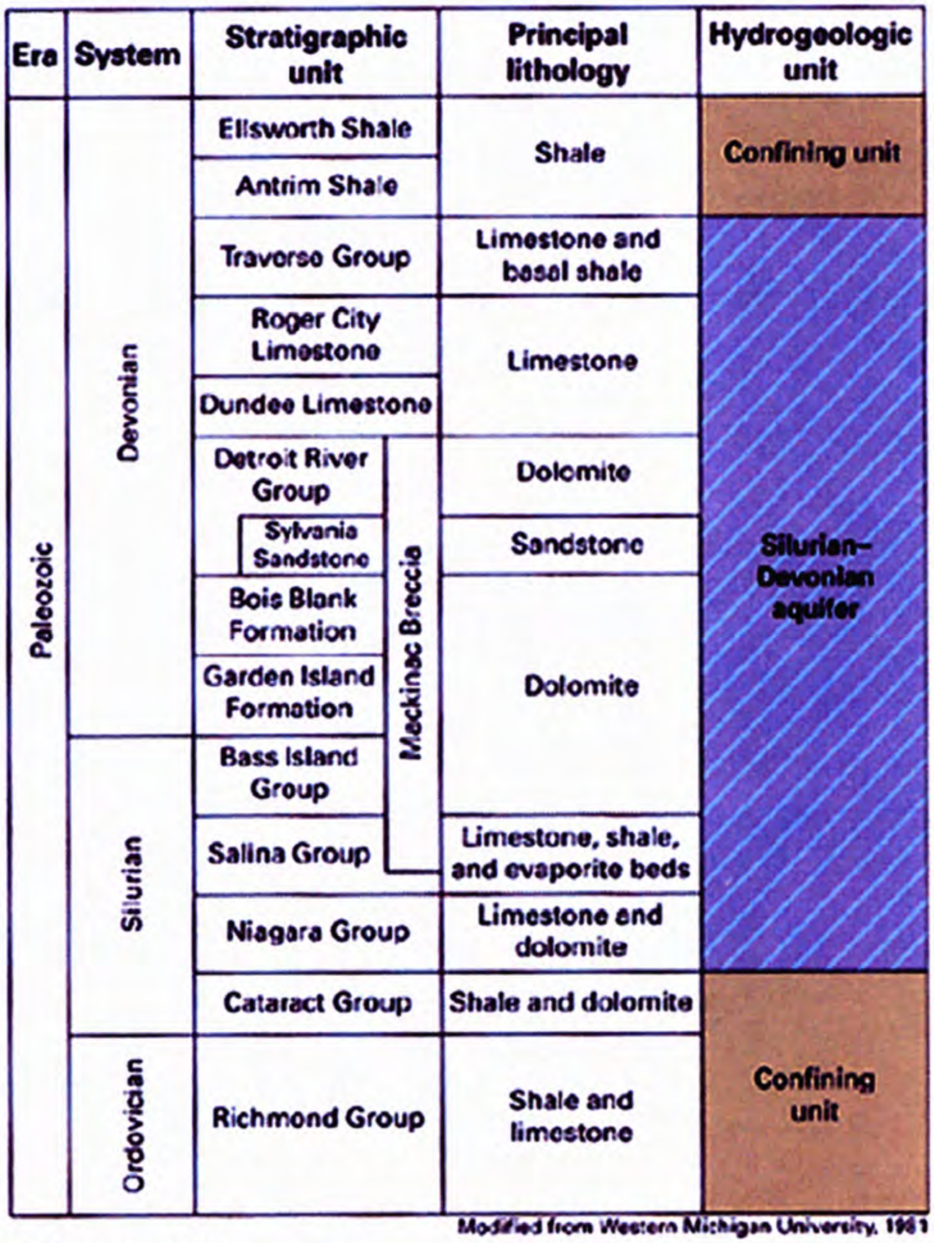
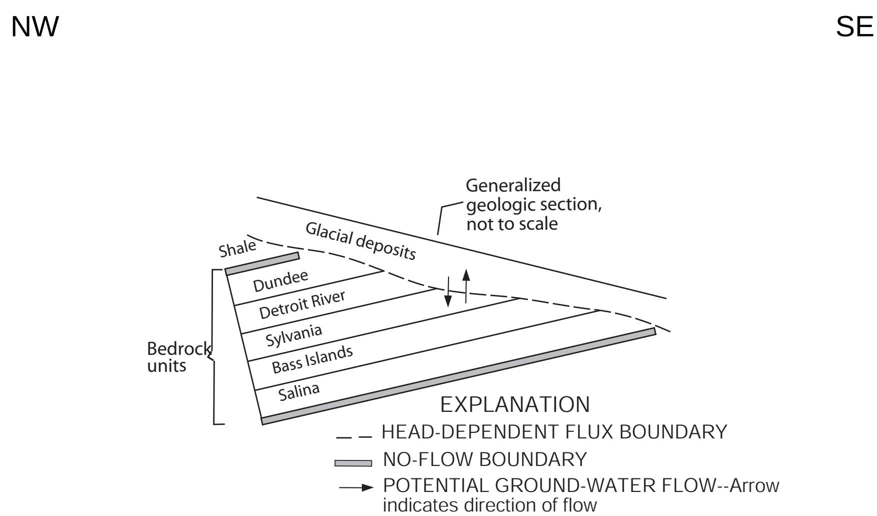


Figure 76. *The Silurian-Devonian aquifer in Michigan consists primarily of dolomite and limestone with interbedded sandstone, shale, and evaporite beds. The Mackinac Breccia results from collapse of Devonian rocks after dissolution of some of the underlying Silurian evaporite beds.*

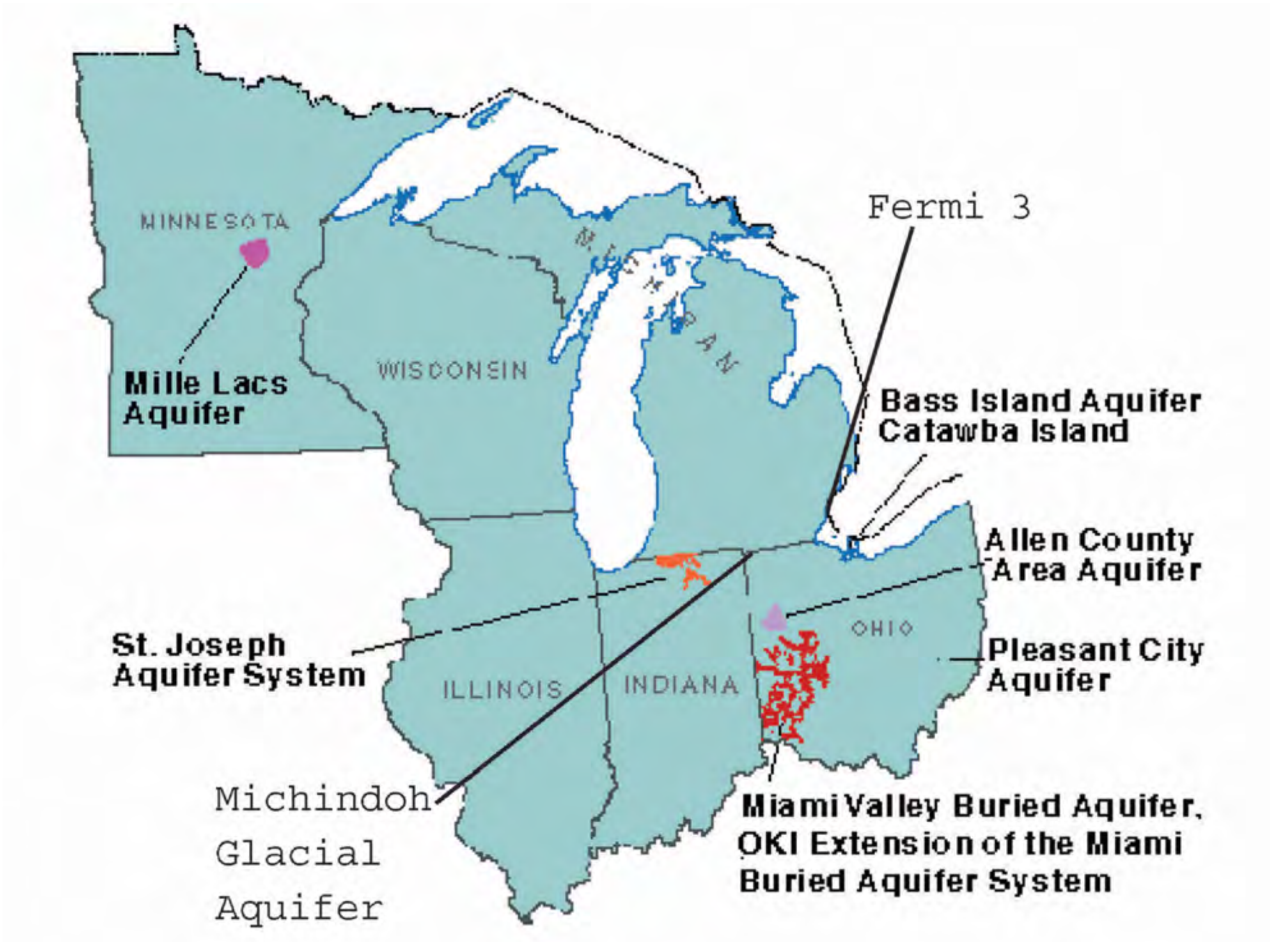
Source: Reference 2.3-4

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



Source: Reference 2.3-1

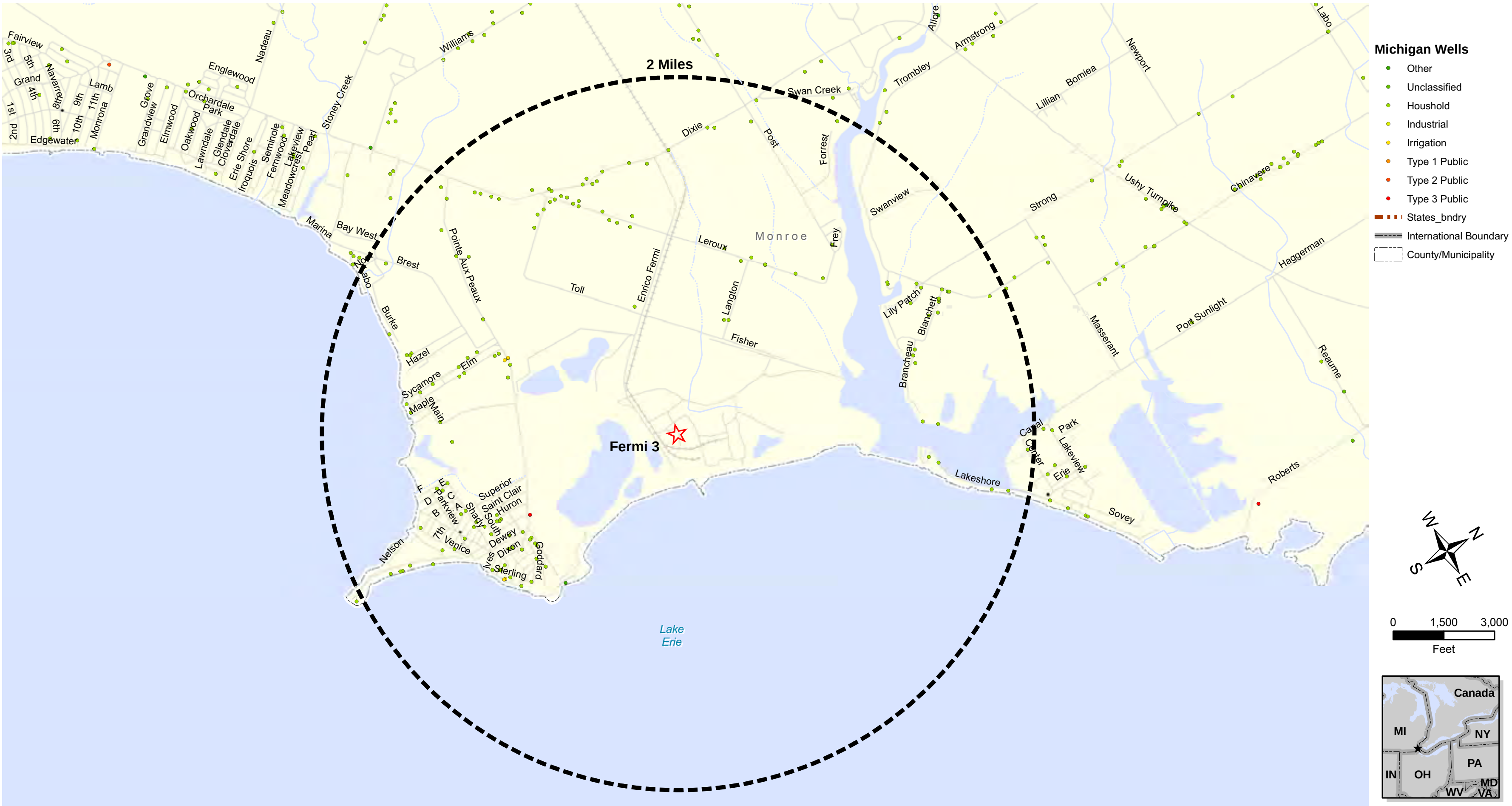
Figure 2.3-20 Sole Source Aquifers



Source: Reference 2.3-8 and Reference 2.3-9

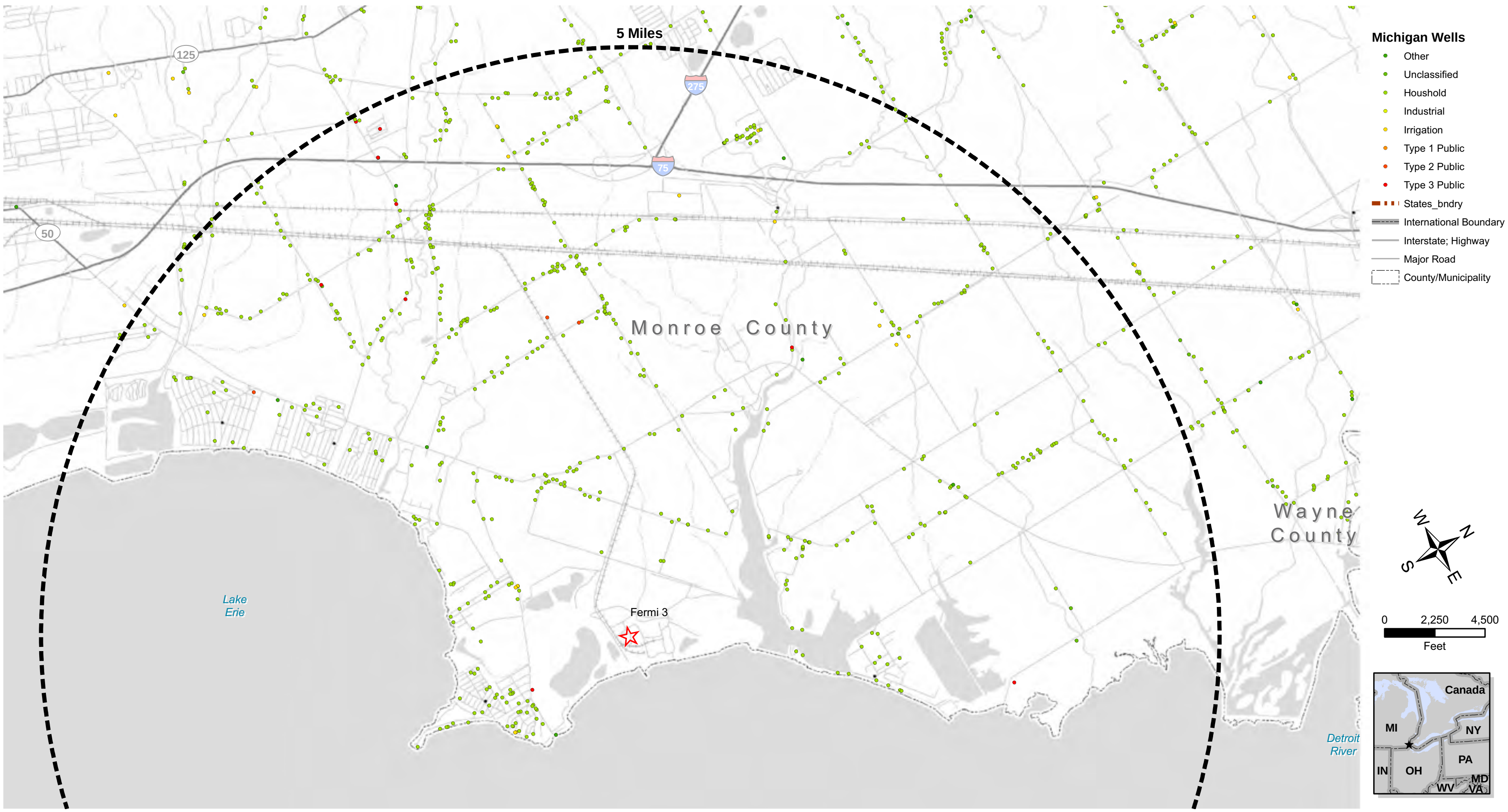
Figure 2.3-21 Quarries of Monroe County, Michigan

Figure 2.3-22 All Wells Within 2 Miles



Source: Reference 2.3-14

Figure 2.3-23 All Wells Within 5 Miles

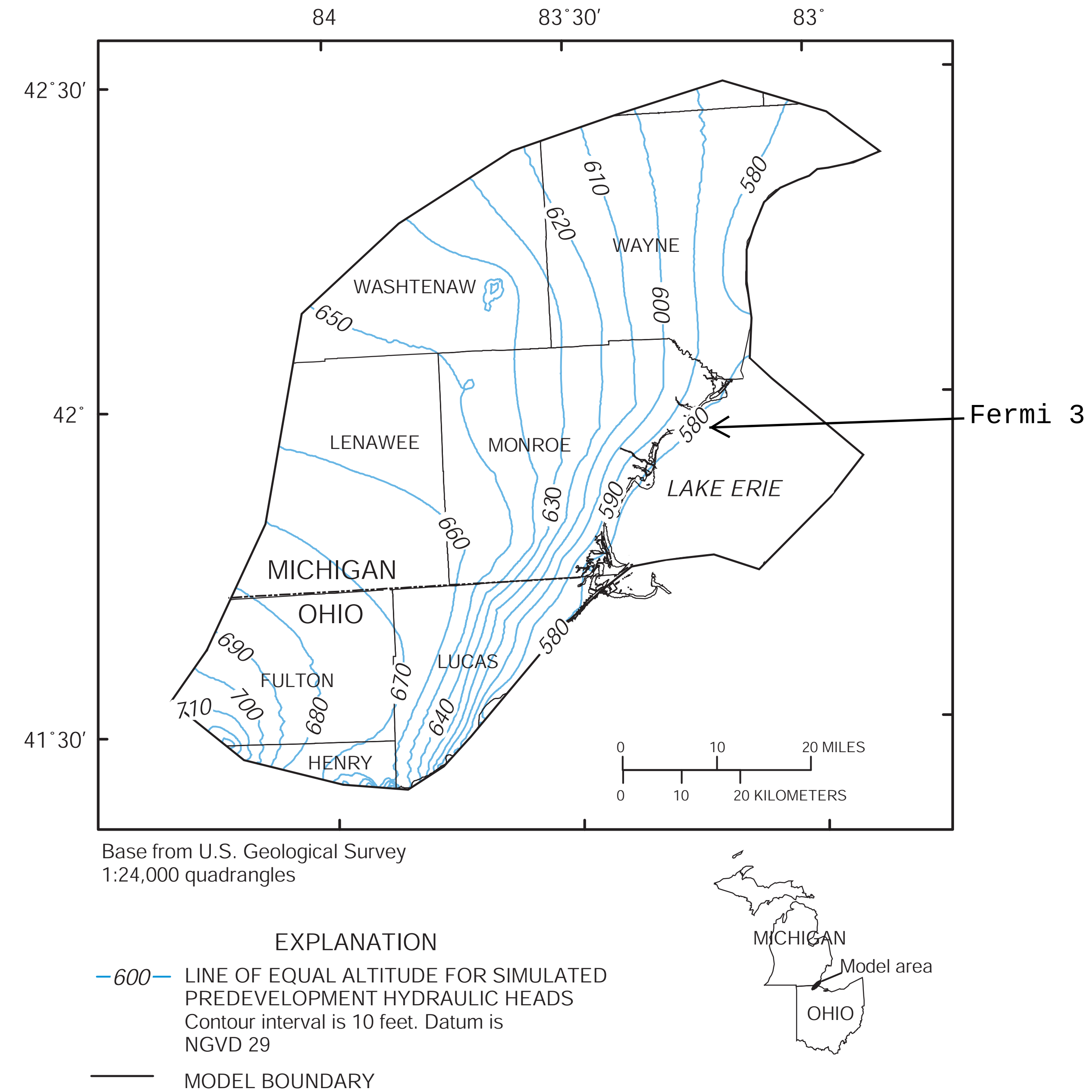


Source: Reference 2.3-14

Figure 2.3-24 All Wells Within 25 Miles

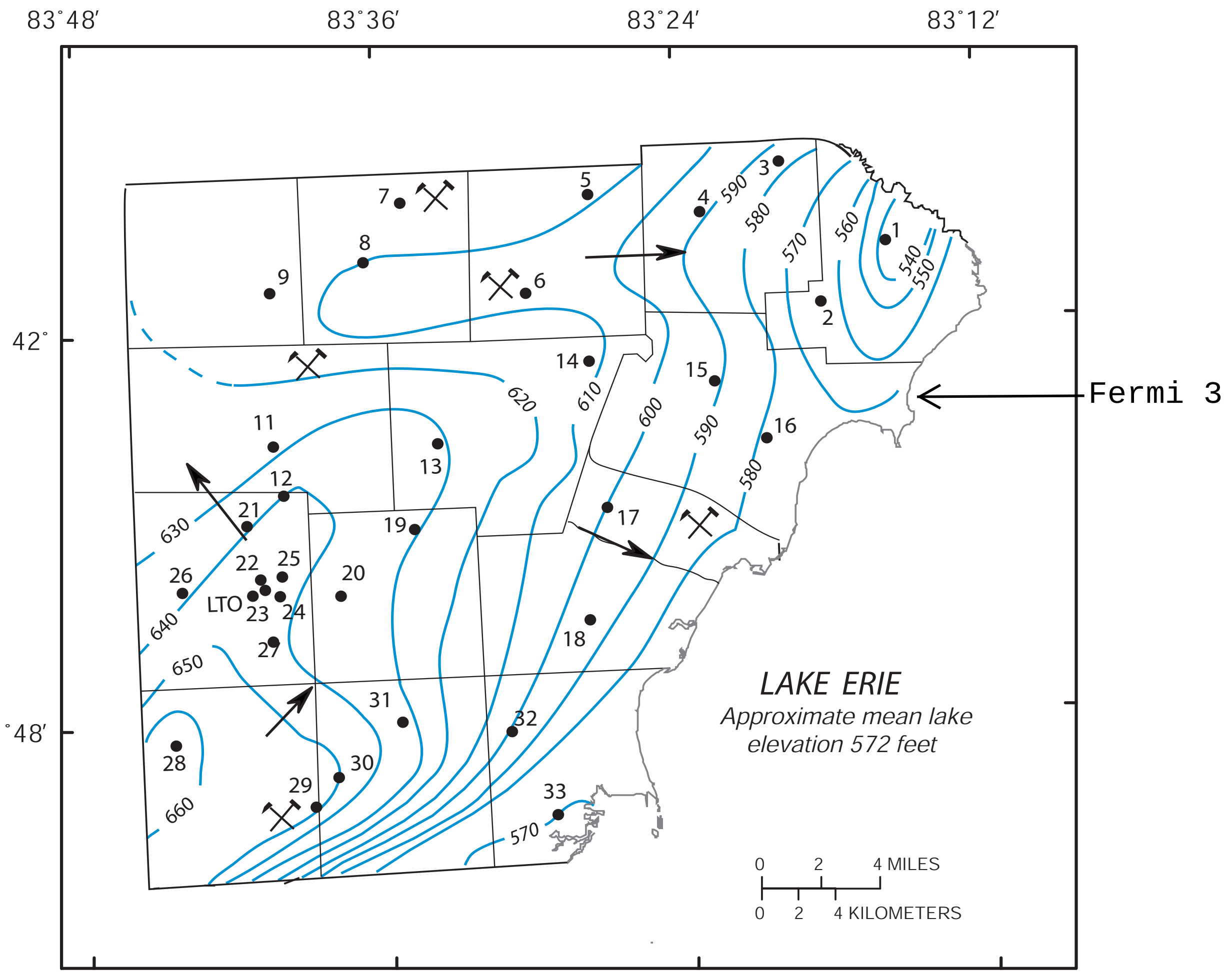
Source: Reference 2.3-14 and Reference 2.3-15

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



Base from U.S. Geological Survey
1:24,000 quadrangles

EXPLANATION

660 — POTENTIOMETRIC CONTOUR--Shows altitude of water level, January, 1993. Dashed where approximately located. Contour interval 10 feet. Datum is sea level

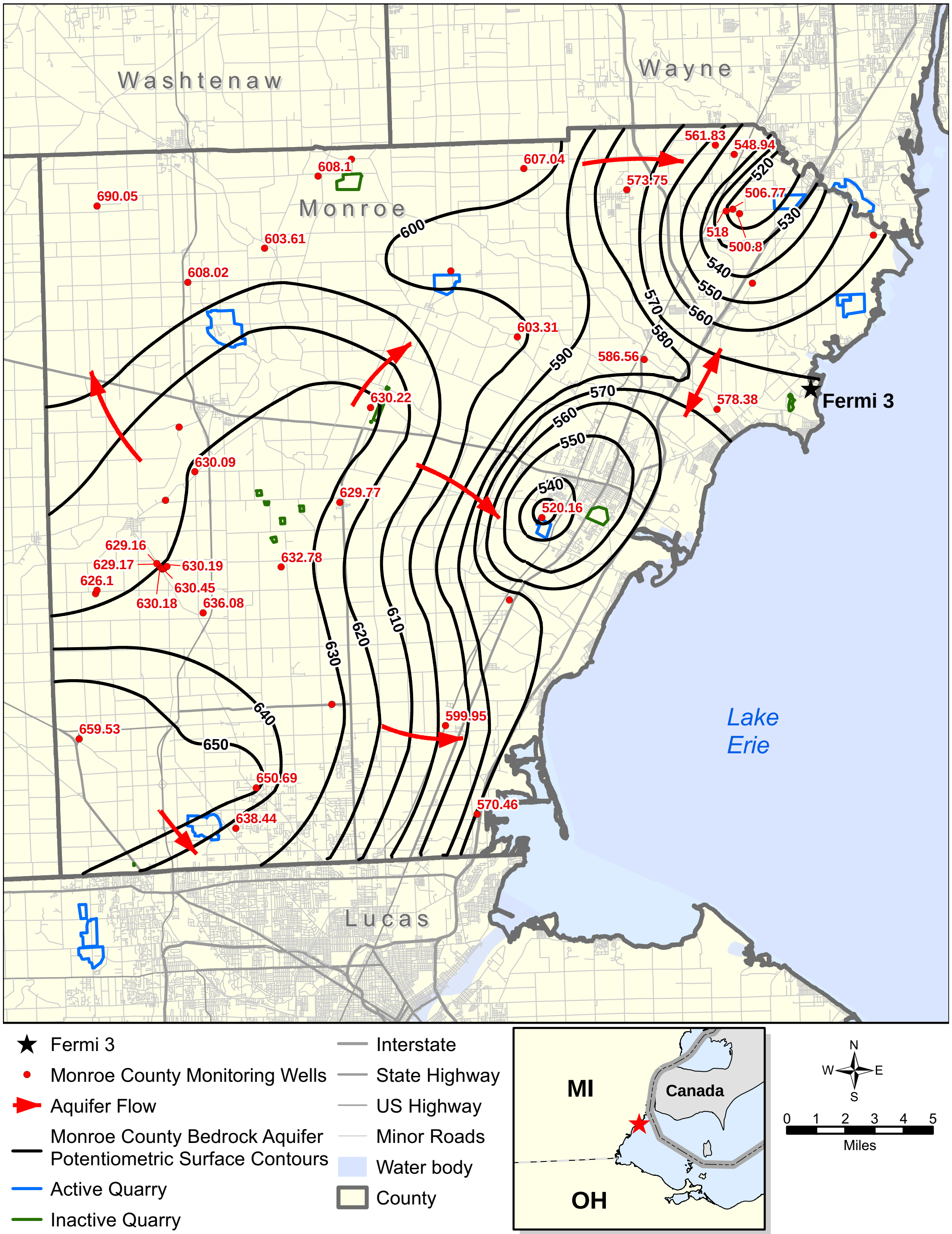
GROUND-WATER FLOW--Arrow indicates direction of ground-water flow if the aqufier was isotropic and homogeneous with respect to transmissivity

● 28 WELL AND IDENTIFIER--Prefix the letter G to number

QUARRY--Active in 1992

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

NOAA Fermi Power Plant Gauge Station
Detroit Edison Monitoring Wells
Fermi 3 COLA Monitoring Wells
Fermi 3 COLA Piezometers
Fermi 3 Cola Gauge Stations
Groundwater Flow Direction
Shallow Groundwater Elevations (ft)
Streets
Site Features
Estimated Dike Locations/Configurations
Surface Water

N W E S

0 450 900
Feet

Datum: North American Vertical Datum 1988

Note: ND = No data

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

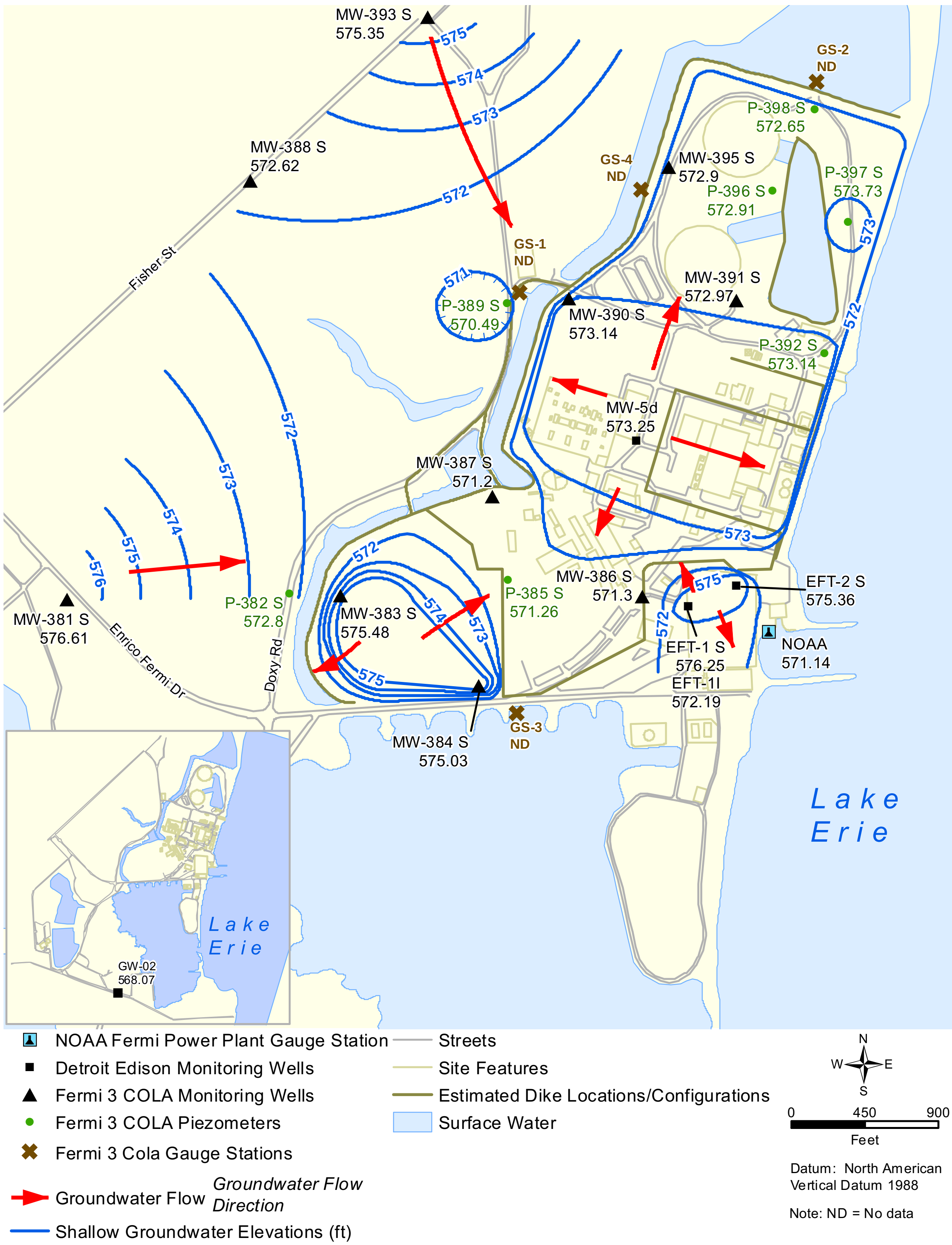


Figure 2.3-31 Overburden Water Table Map 03/21/2008

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

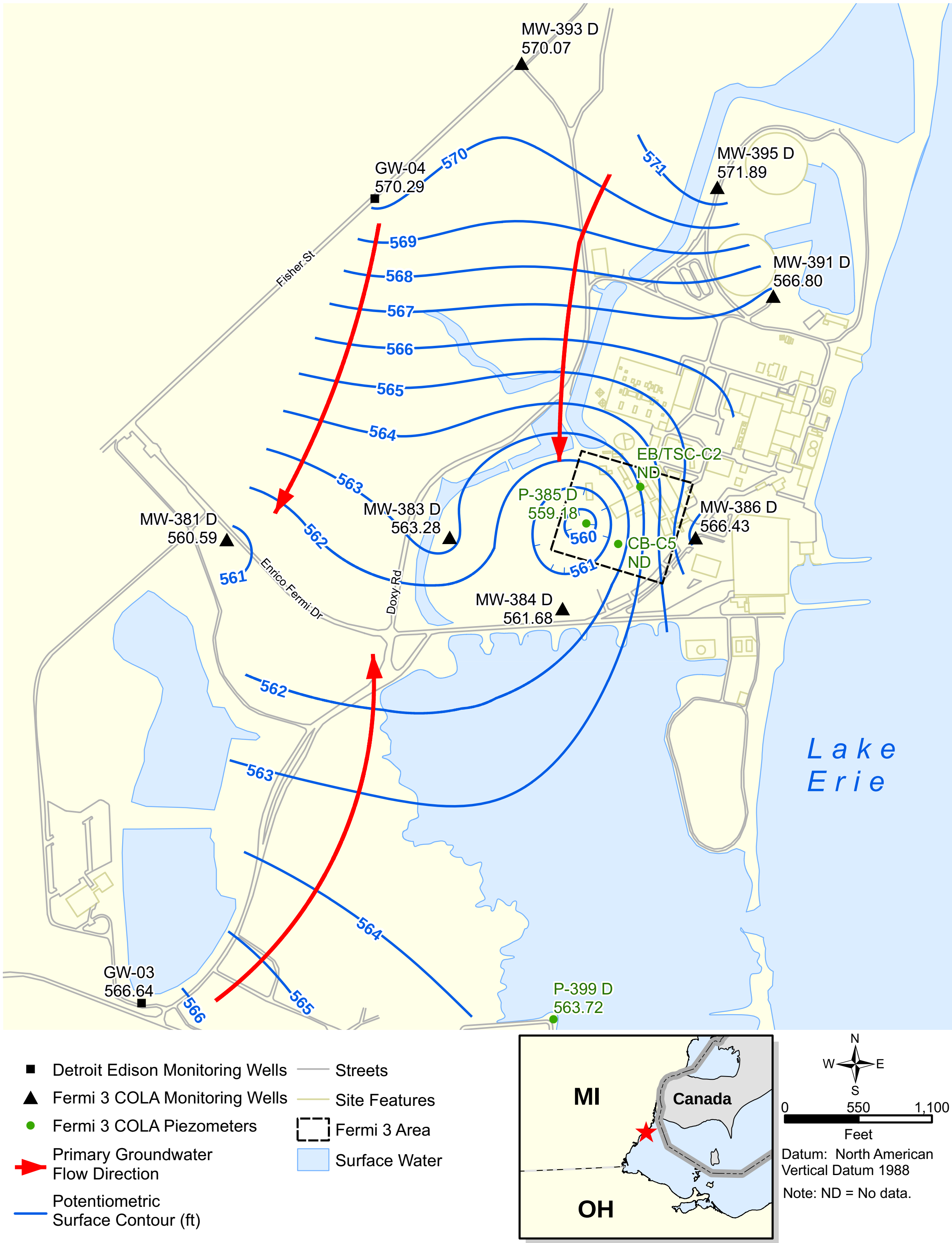


Figure 2.3-33 Bass Islands Aquifer Potentiometric Surface Map 09/28/2007-09/29/2007

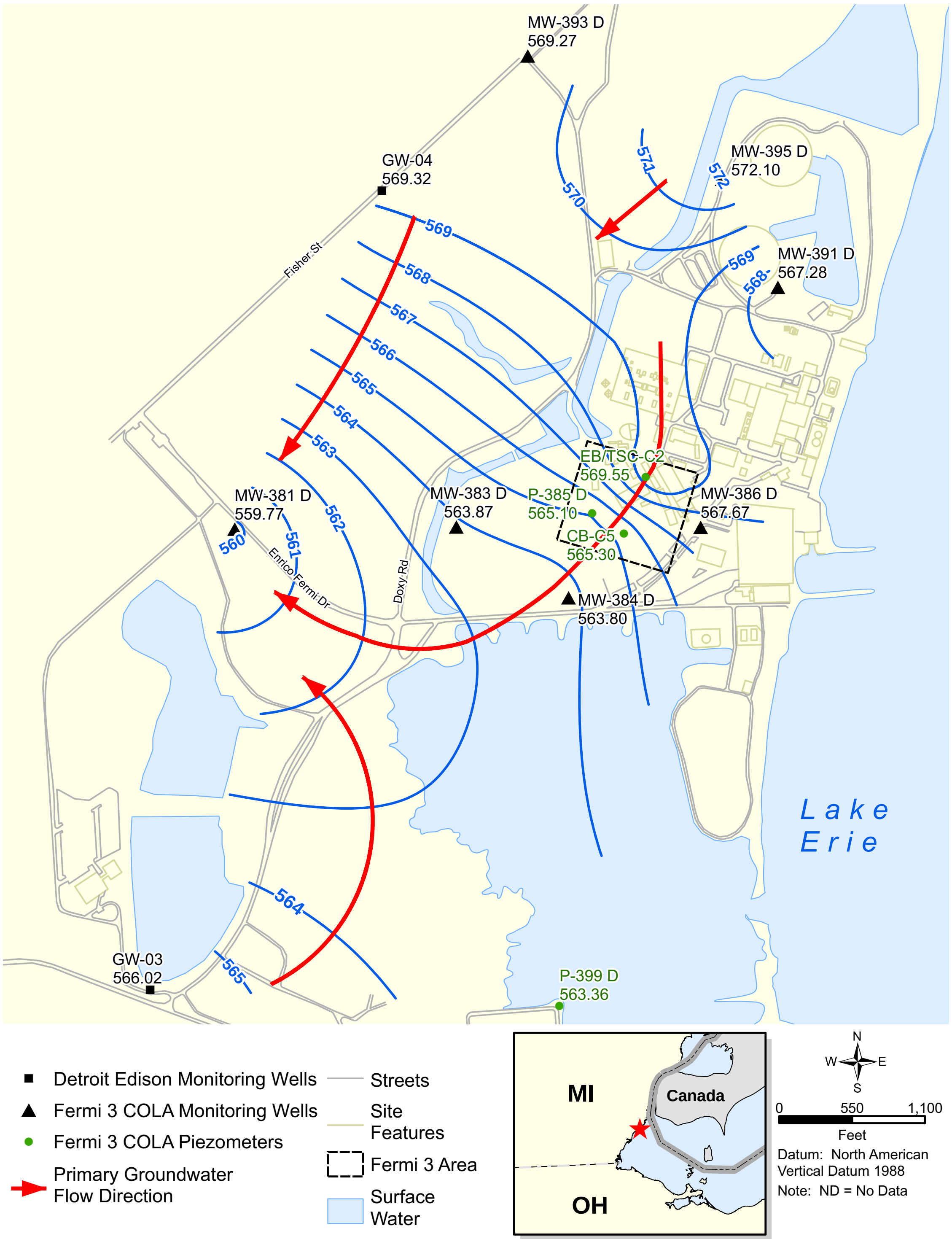


Figure 2.3-34 Bass Islands Aquifer Potentiometric Surface Map 12/29/2007

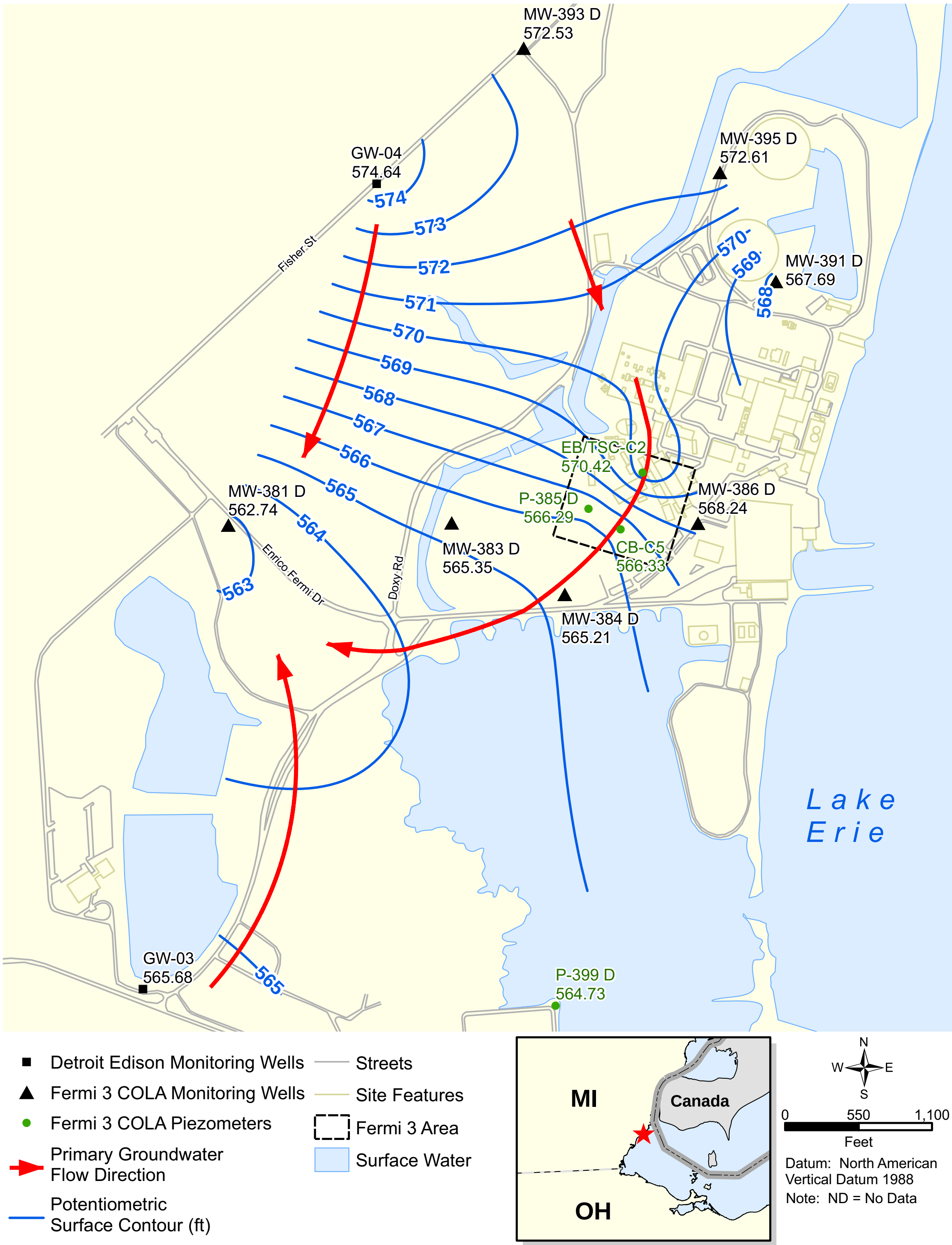


Figure 2.3-35 Bass Islands Aquifer Potentiometric Surface Map 03/29/2008

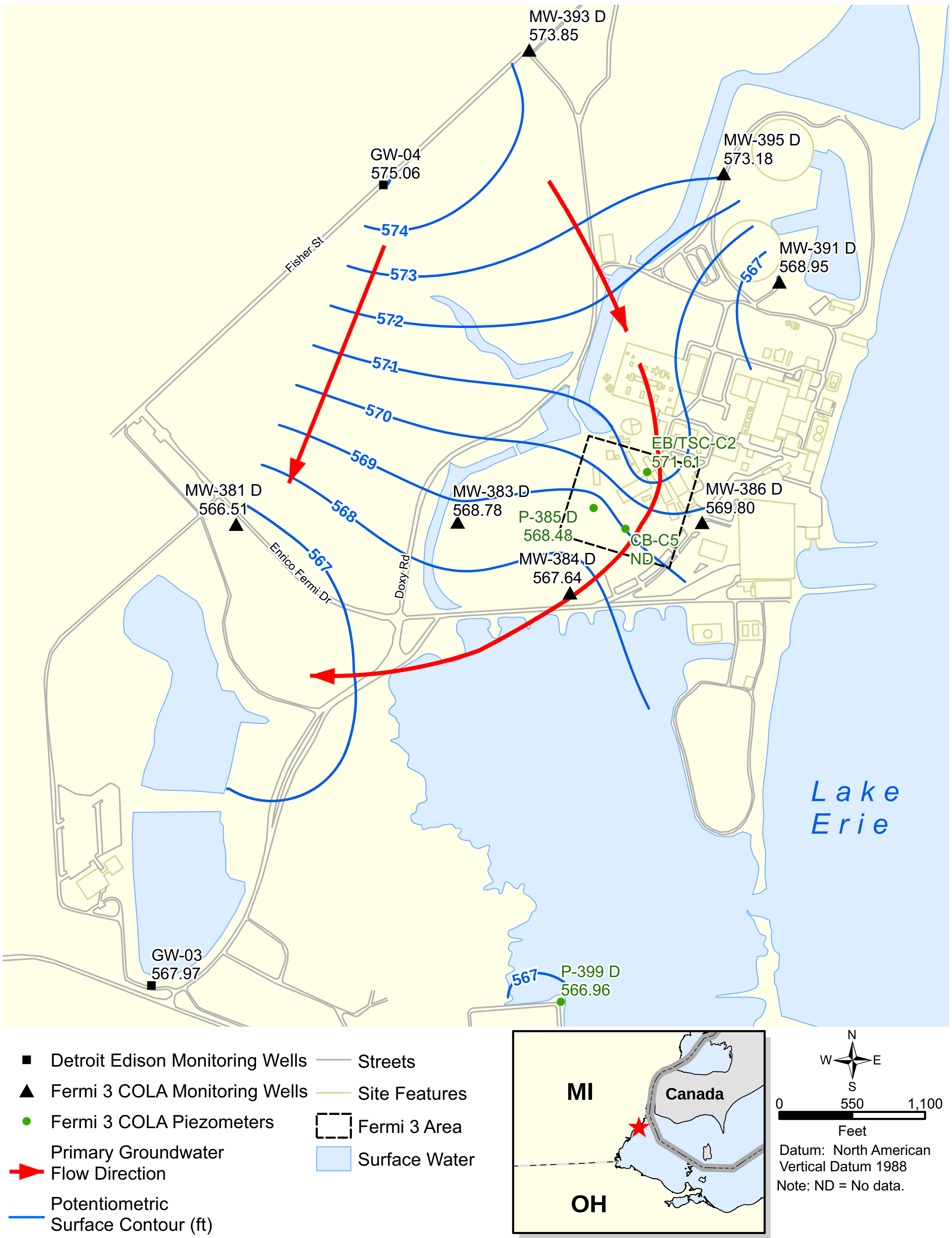


Figure 2.3-36 Fermi 3 Paired Hydrographs

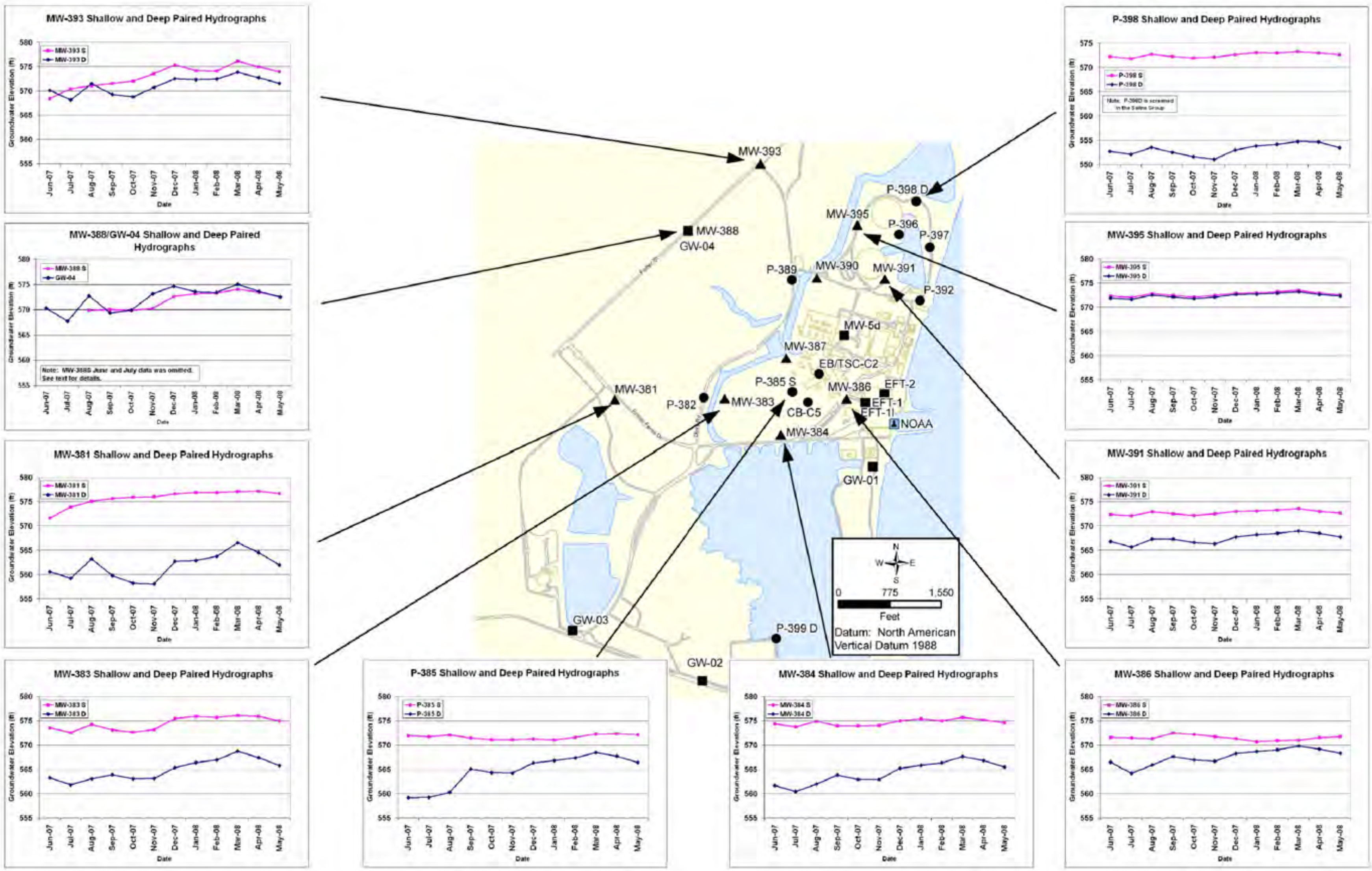
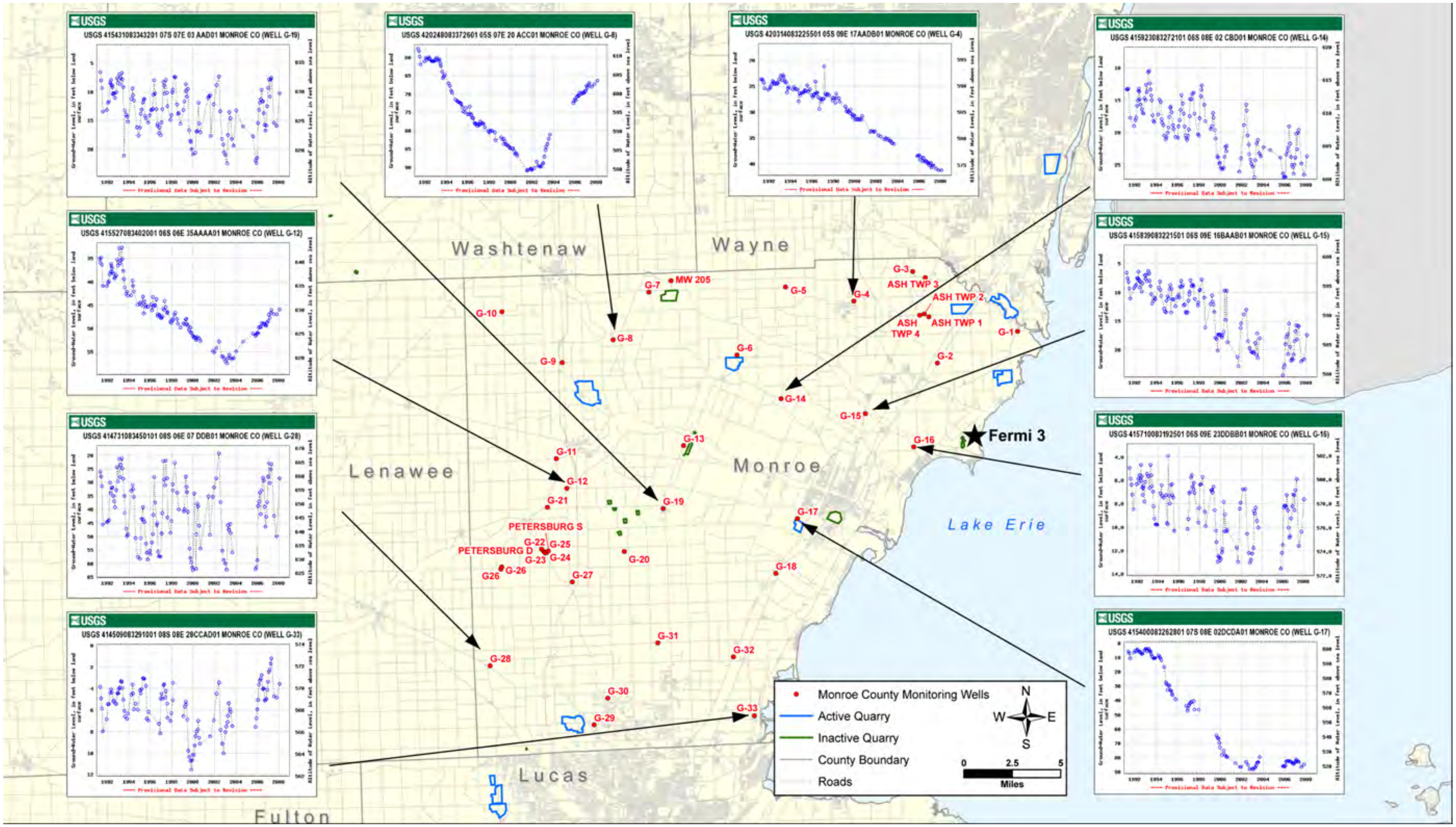


Figure 2.3-37 Monroe County Water Level Hydrographs



Source: Reference 2.3-18

Figure 2.3-38 Fermi 3 Overburden Hydraulic Conductivity

Figure 2.3-39 Fermi 3 Bedrock Hydraulic Conductivity

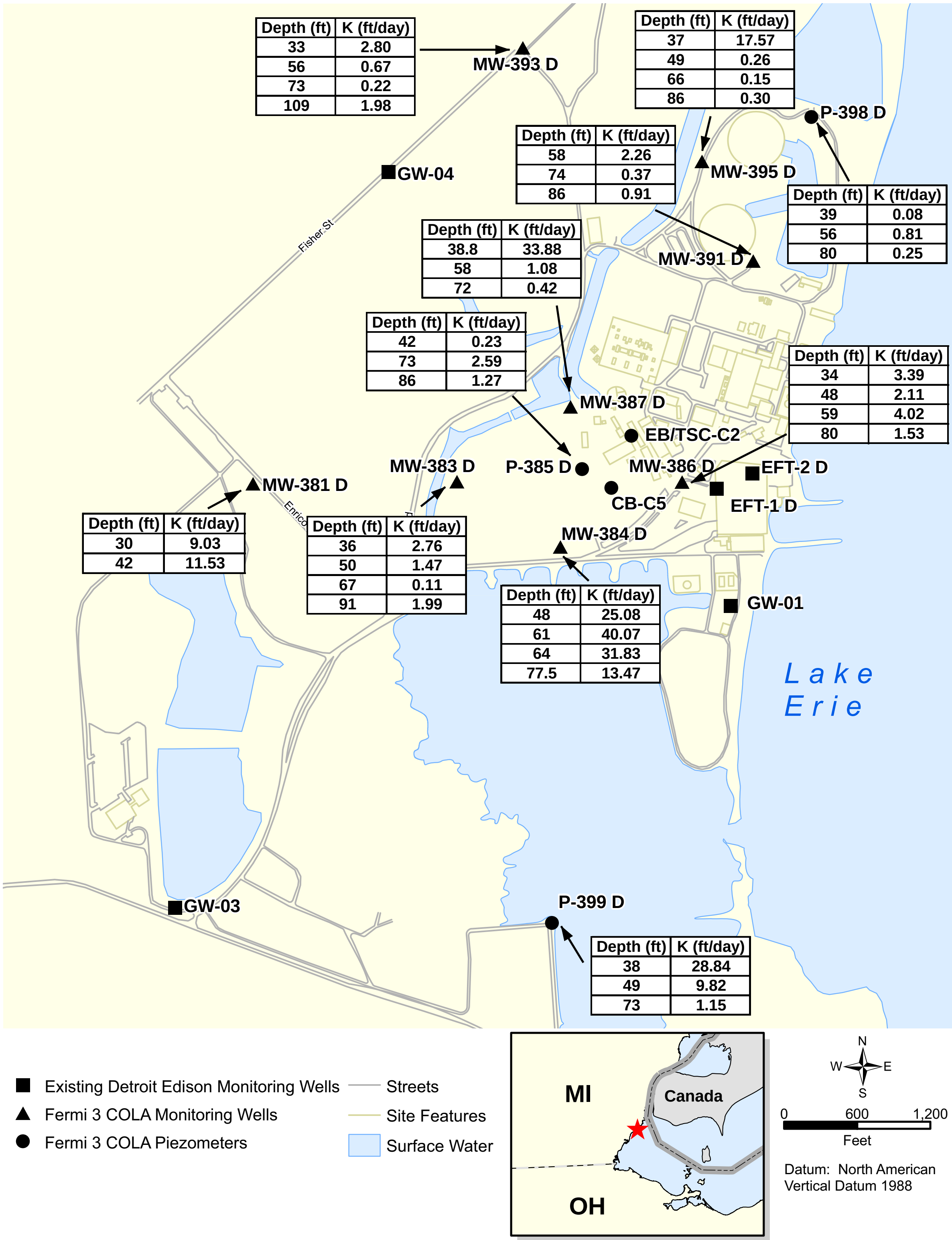


Figure 2.3-40 Groundwater Model Grid Refinement

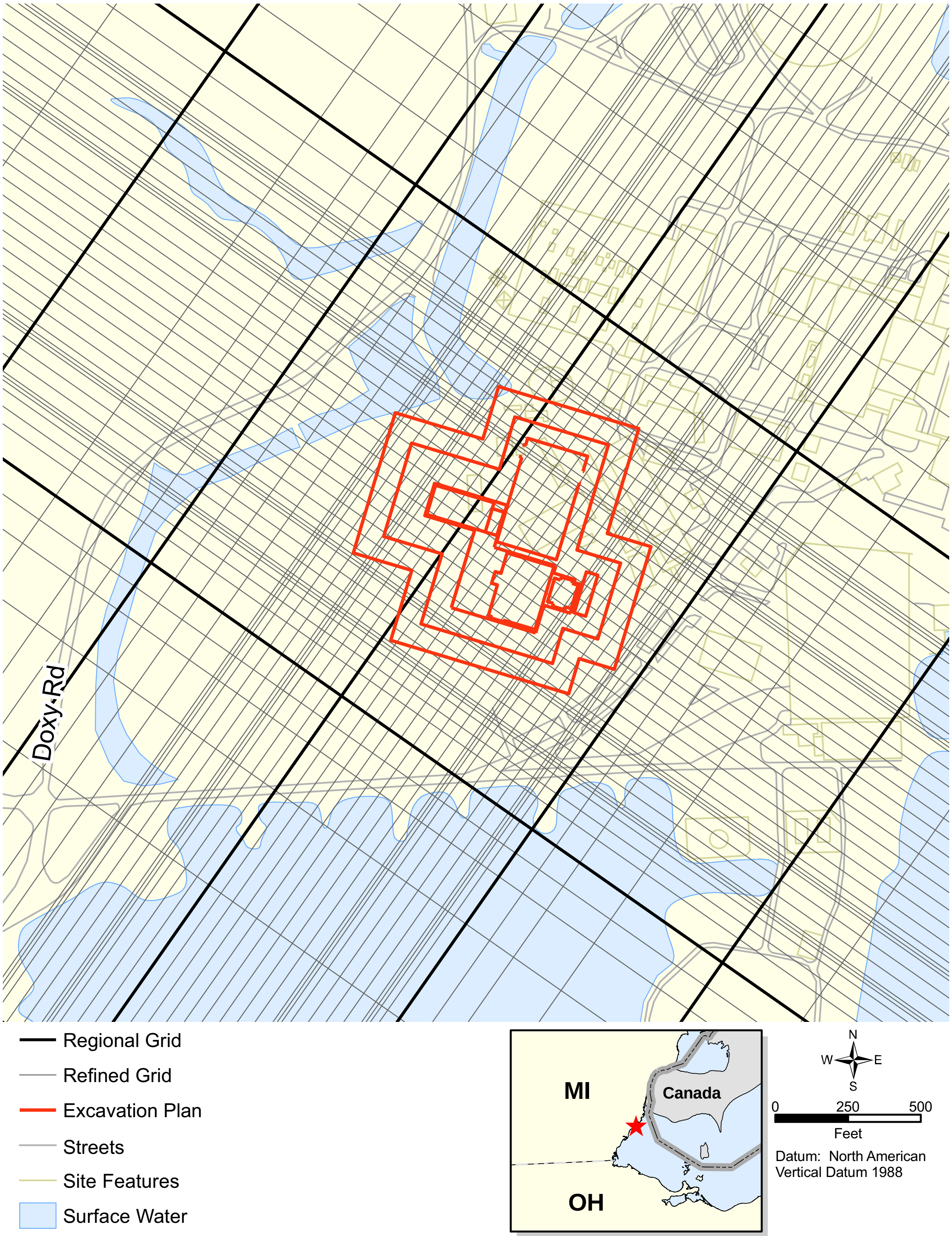


Figure 2.3-41 Dewatering Bass Islands Group: Drawdown Contours - Reinforced Diaphragm Concrete Wall With Grouted Base Combination

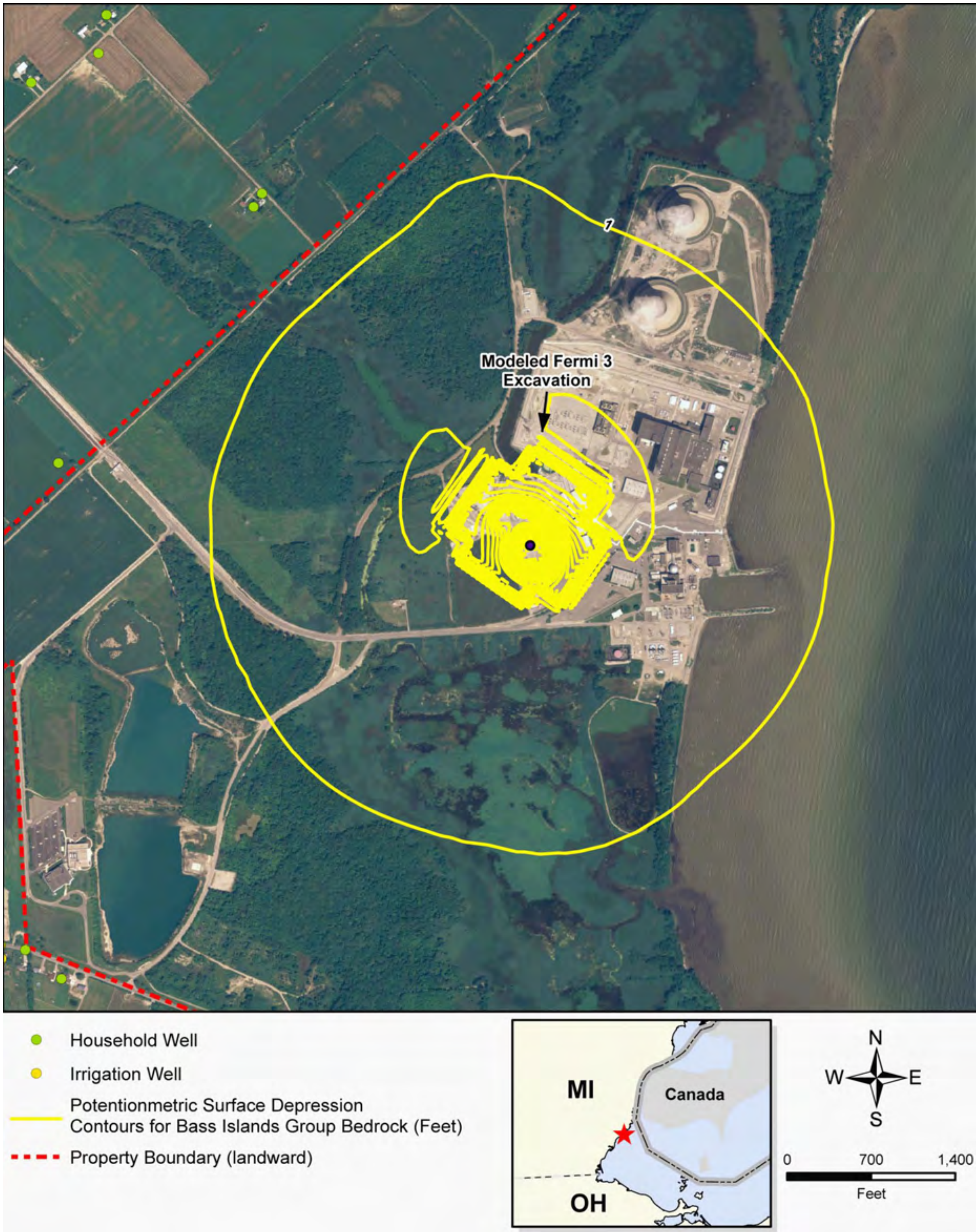


Figure 2.3-42 Dewatering Bass Islands Group: Drawdown Contours – Grout Curtain/Freeze Wall Combination with a Grouted Base

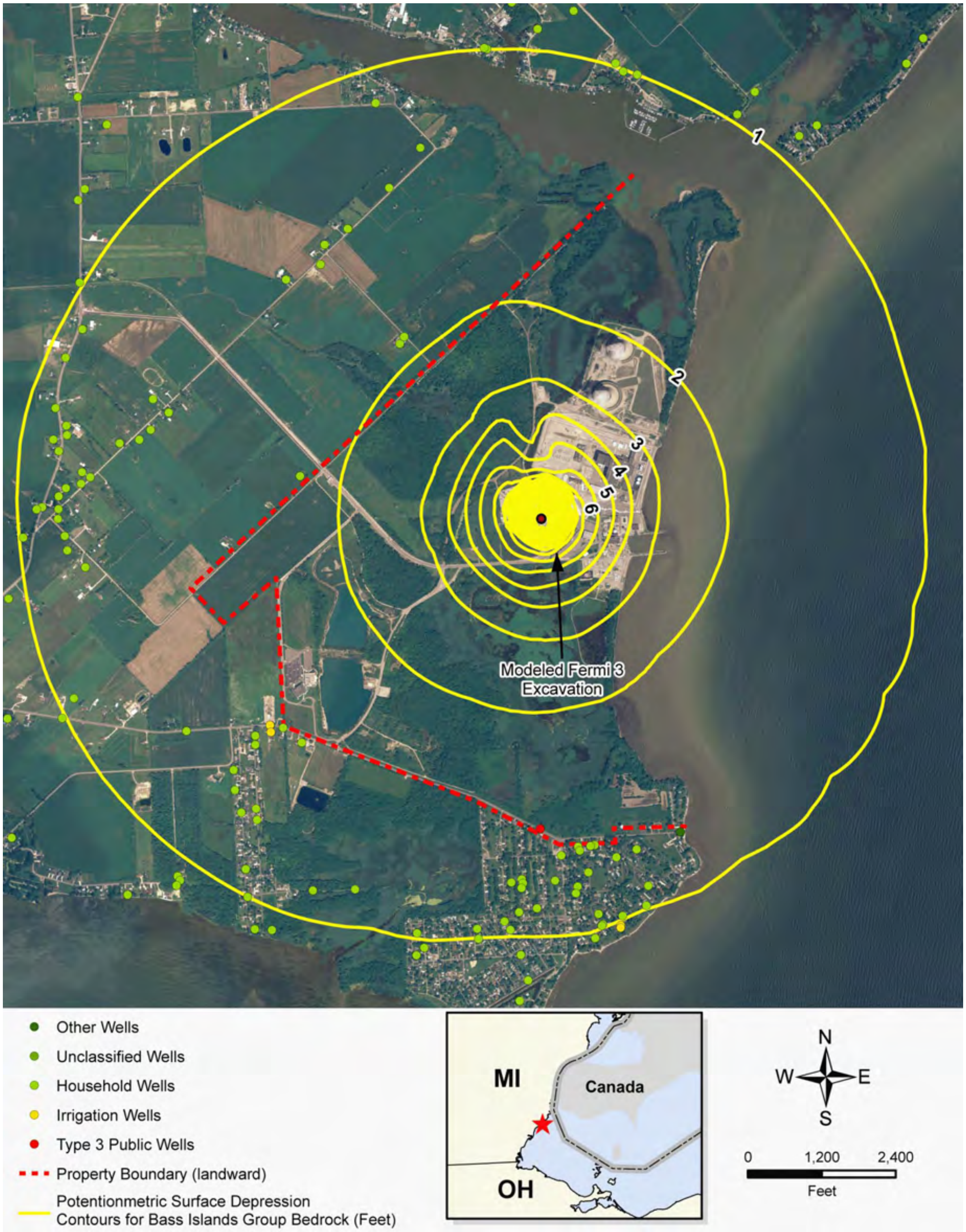


Figure 2.3-43 Effective Monitoring Intervals For Bedrock Wells At The Fermi Site

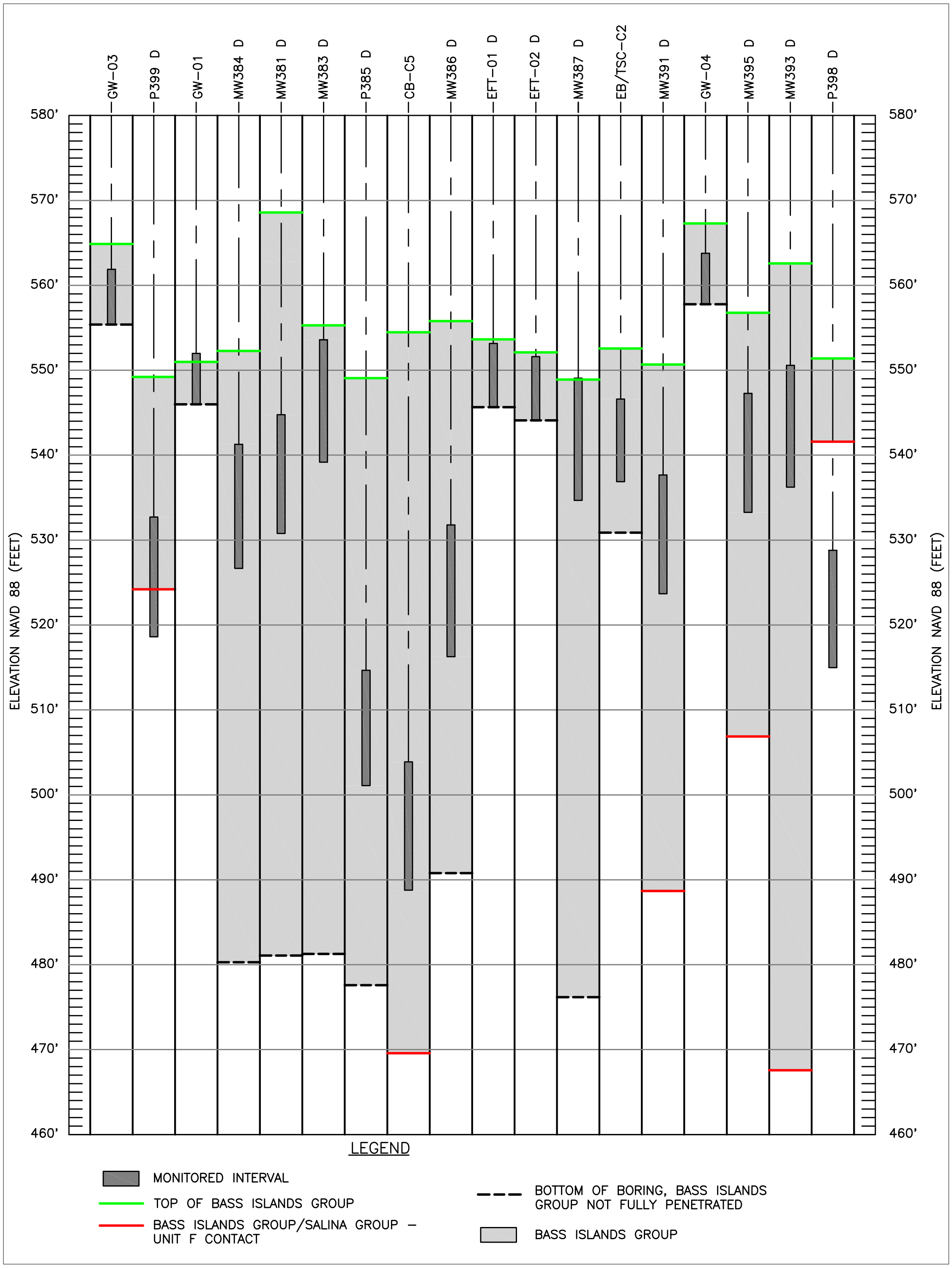
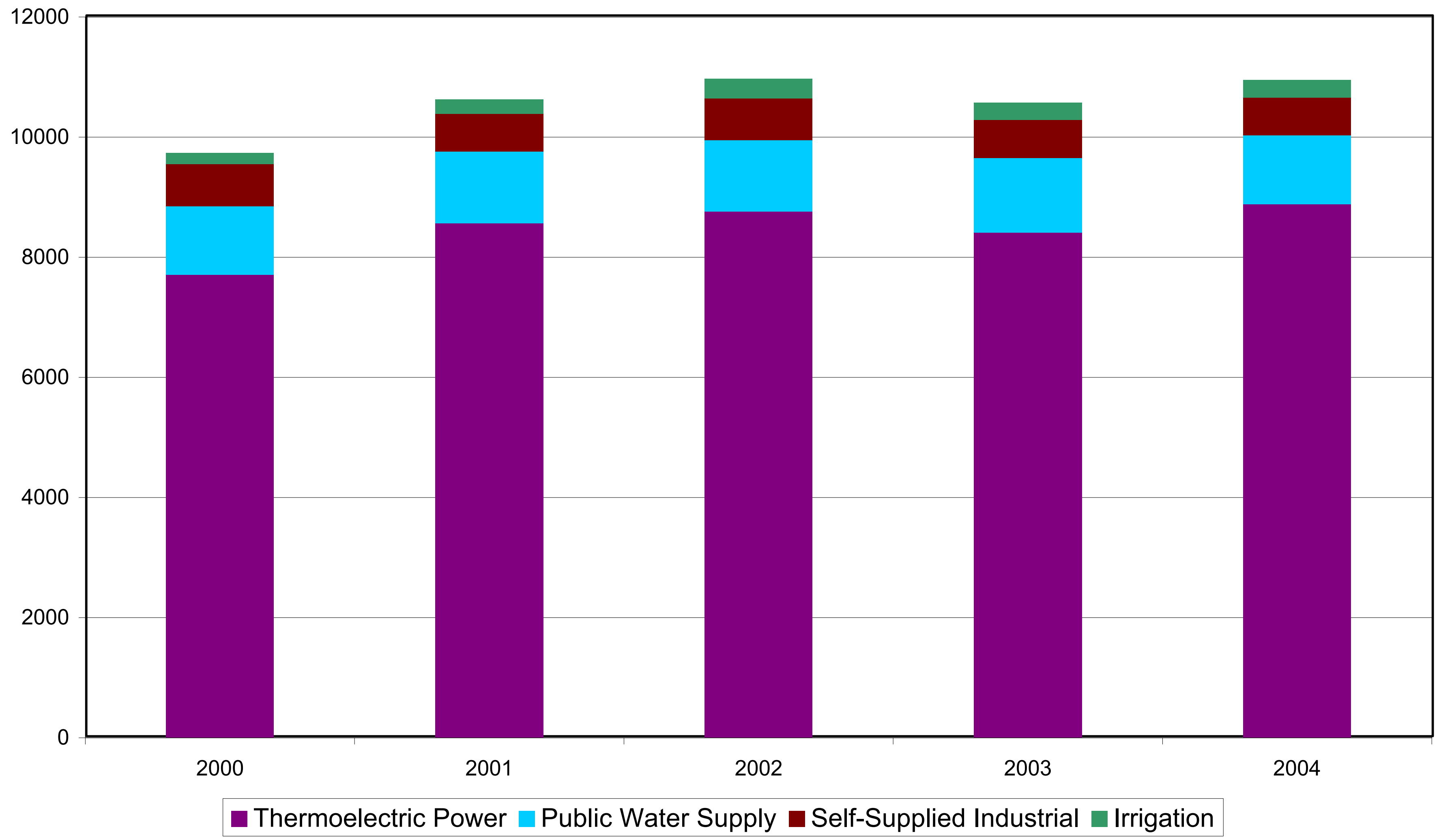
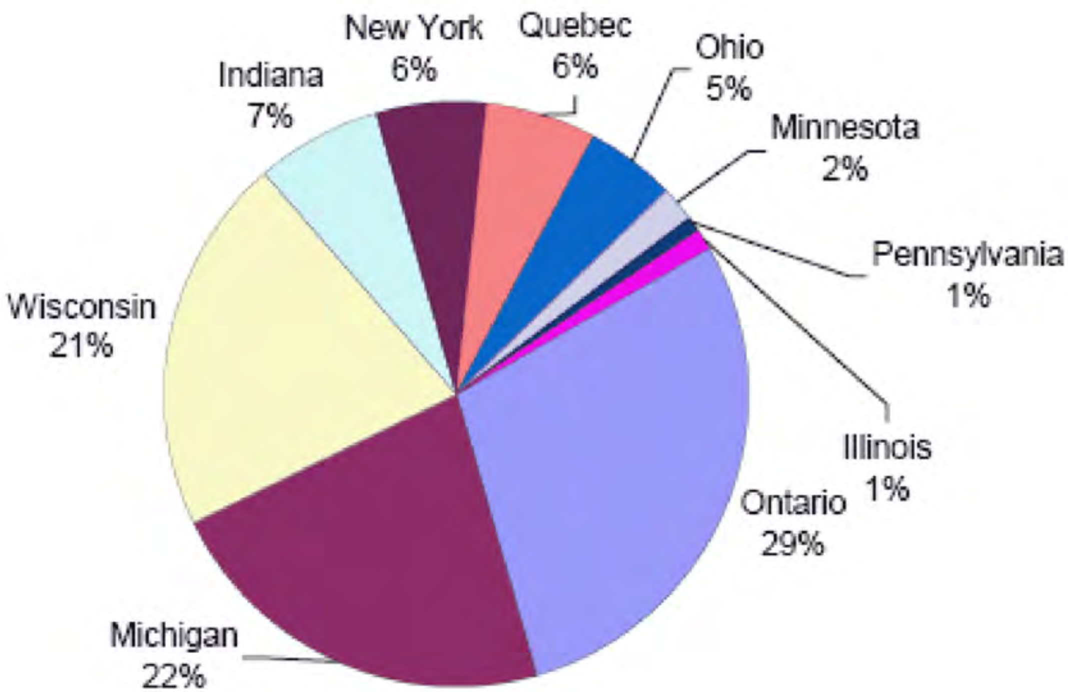


Figure 2.3-44 Total Water Withdrawals by Sector in Michigan (MGD) 2000-2004



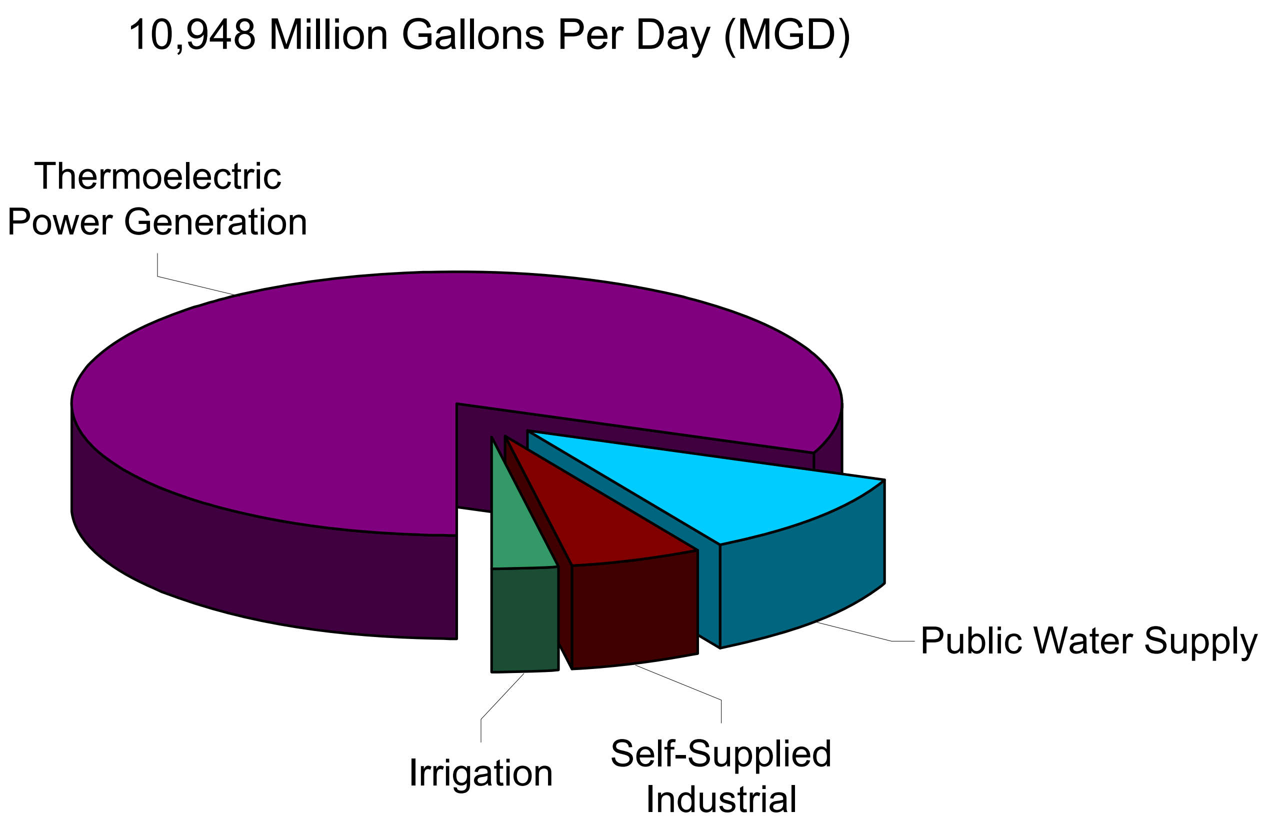
Source: Reference 2.3-35

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

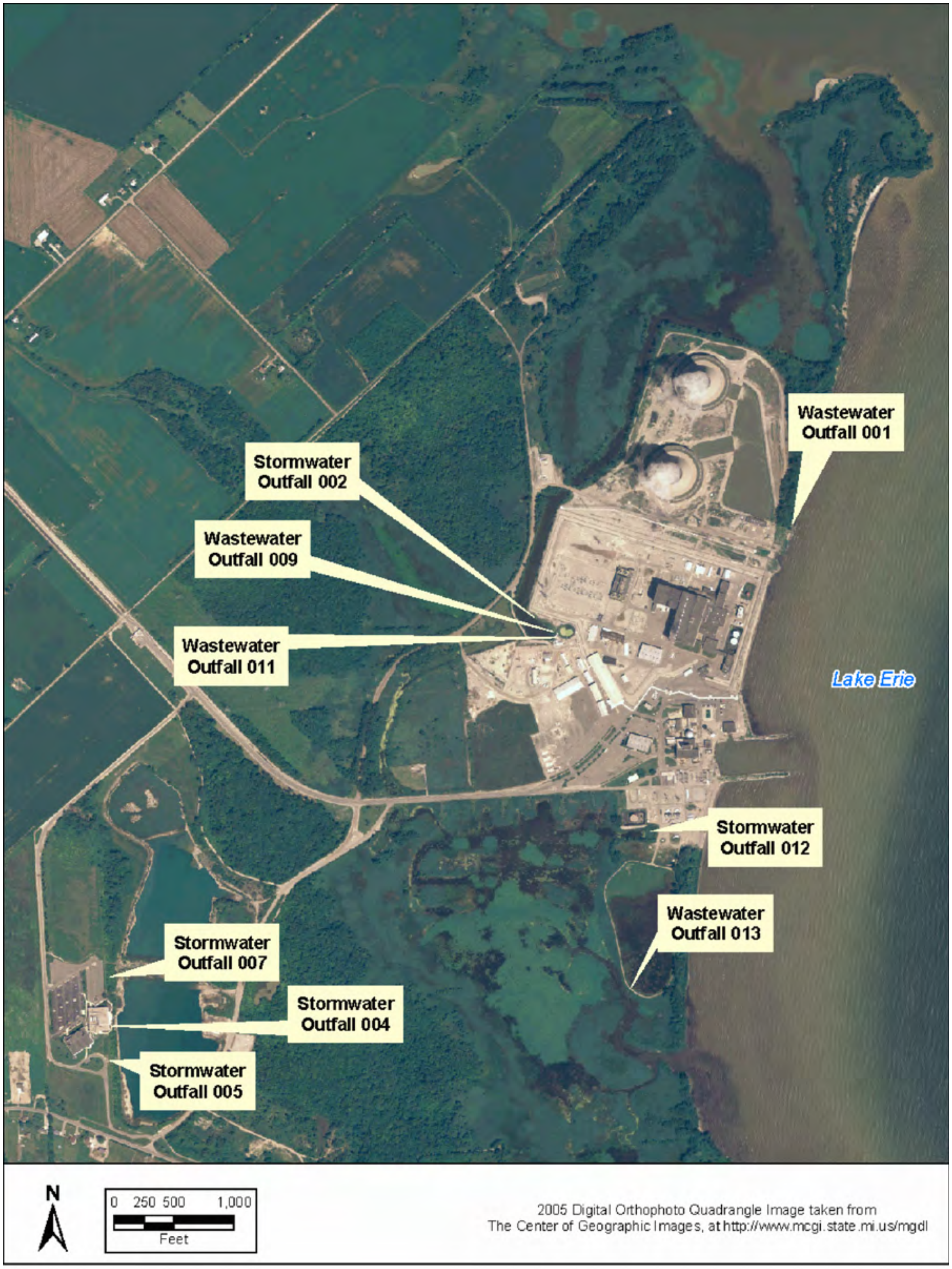


Figure 2.3-48 Surface-Water Resources in the Vicinity of the Fermi Site

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

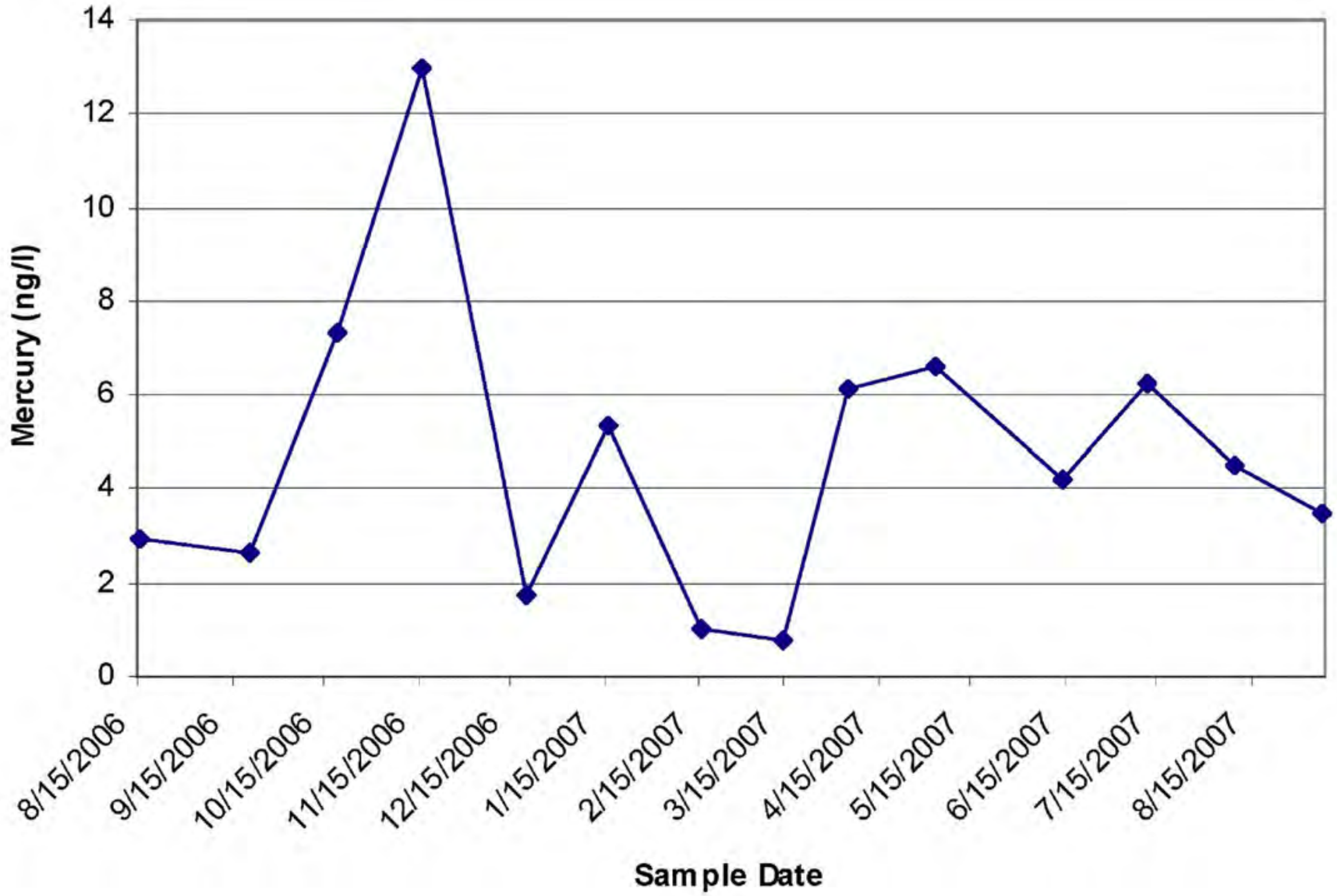
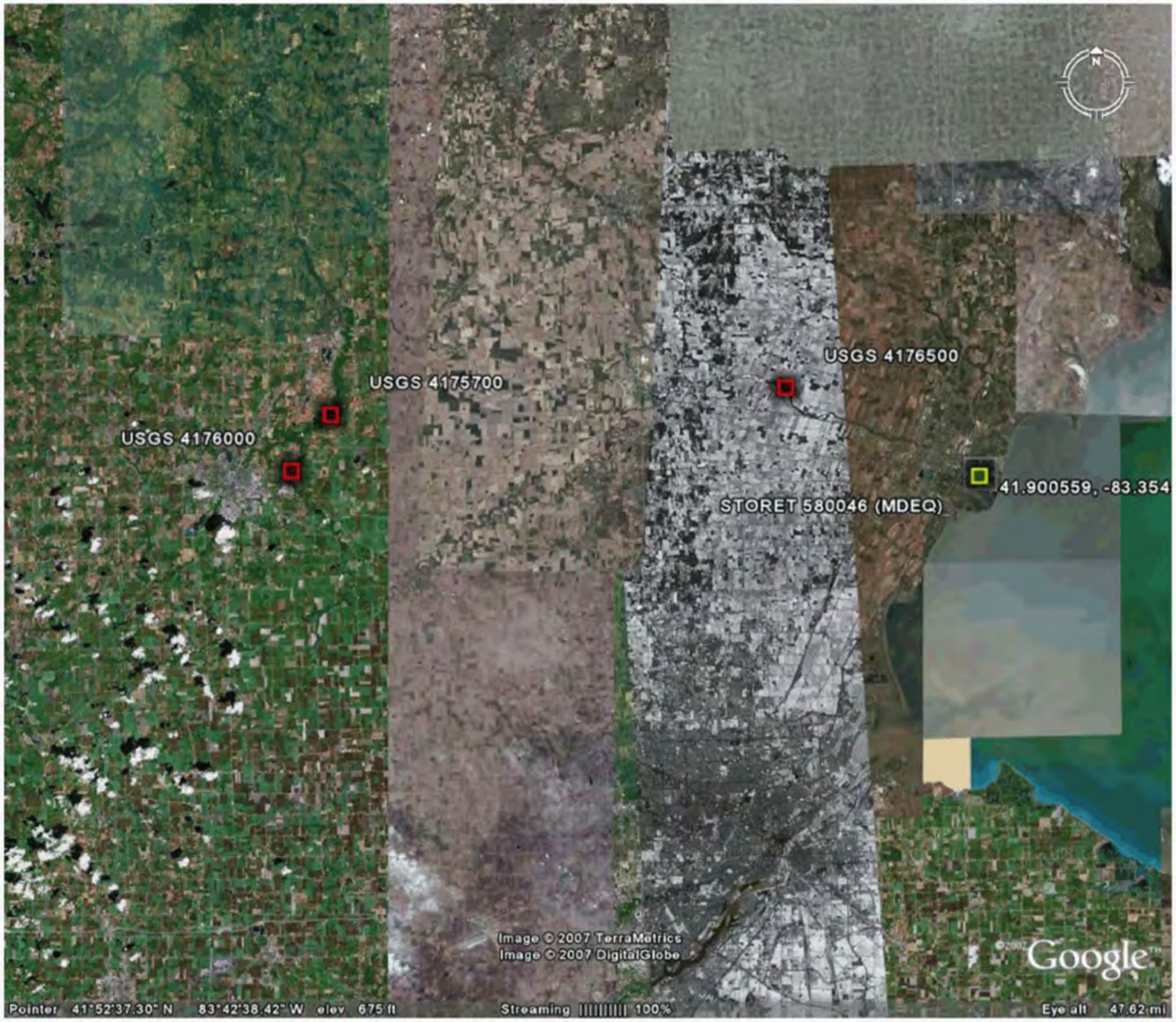


Figure 2.3-51 Swan Creek and Stony Creek USGS Sampling Stations

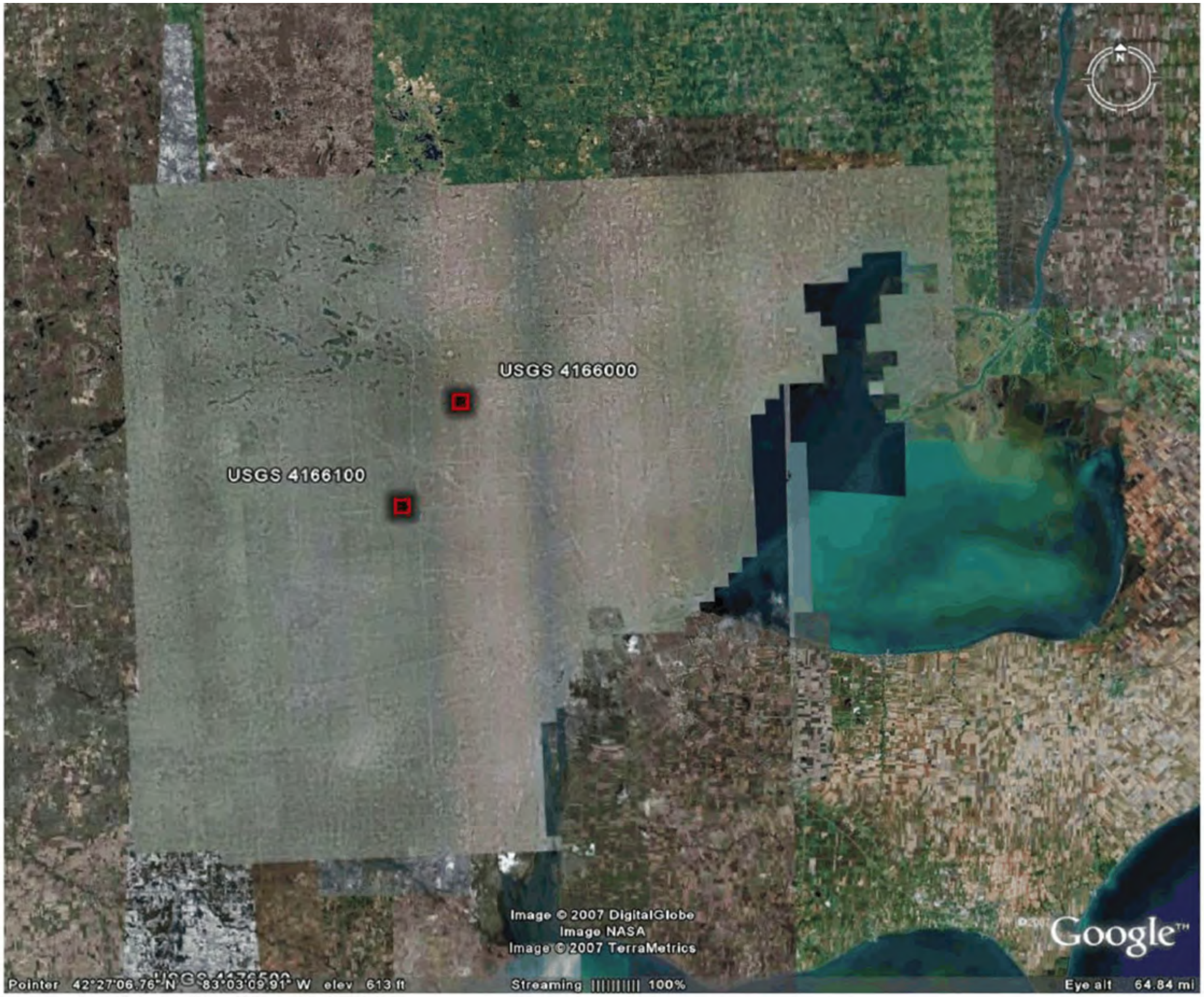
Approximate scale: 1" = 3.5 miles

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



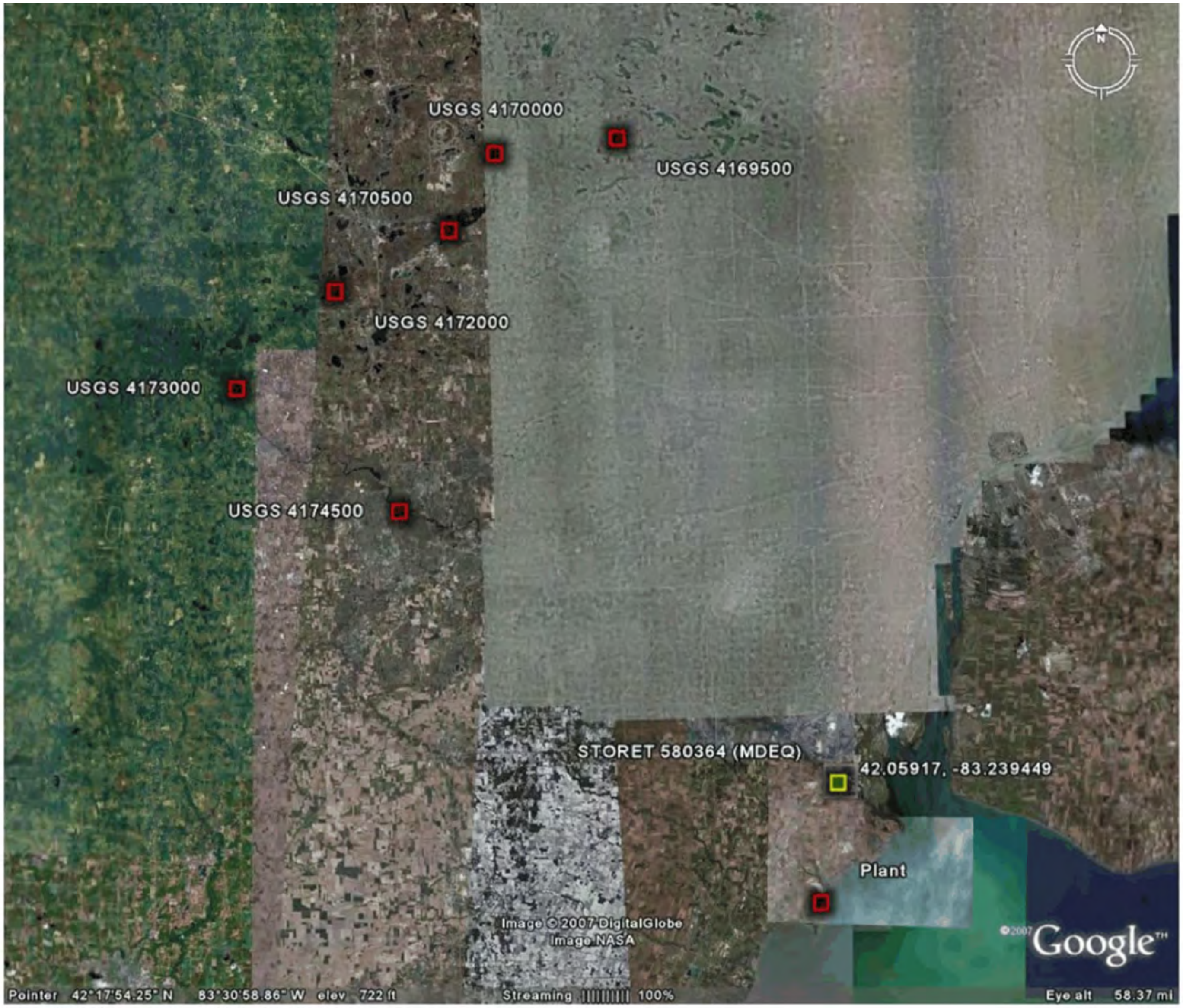
Approximate scale: 1” = 8.5 miles

Figure 2.3-53 Rouge River USGS Sampling Stations



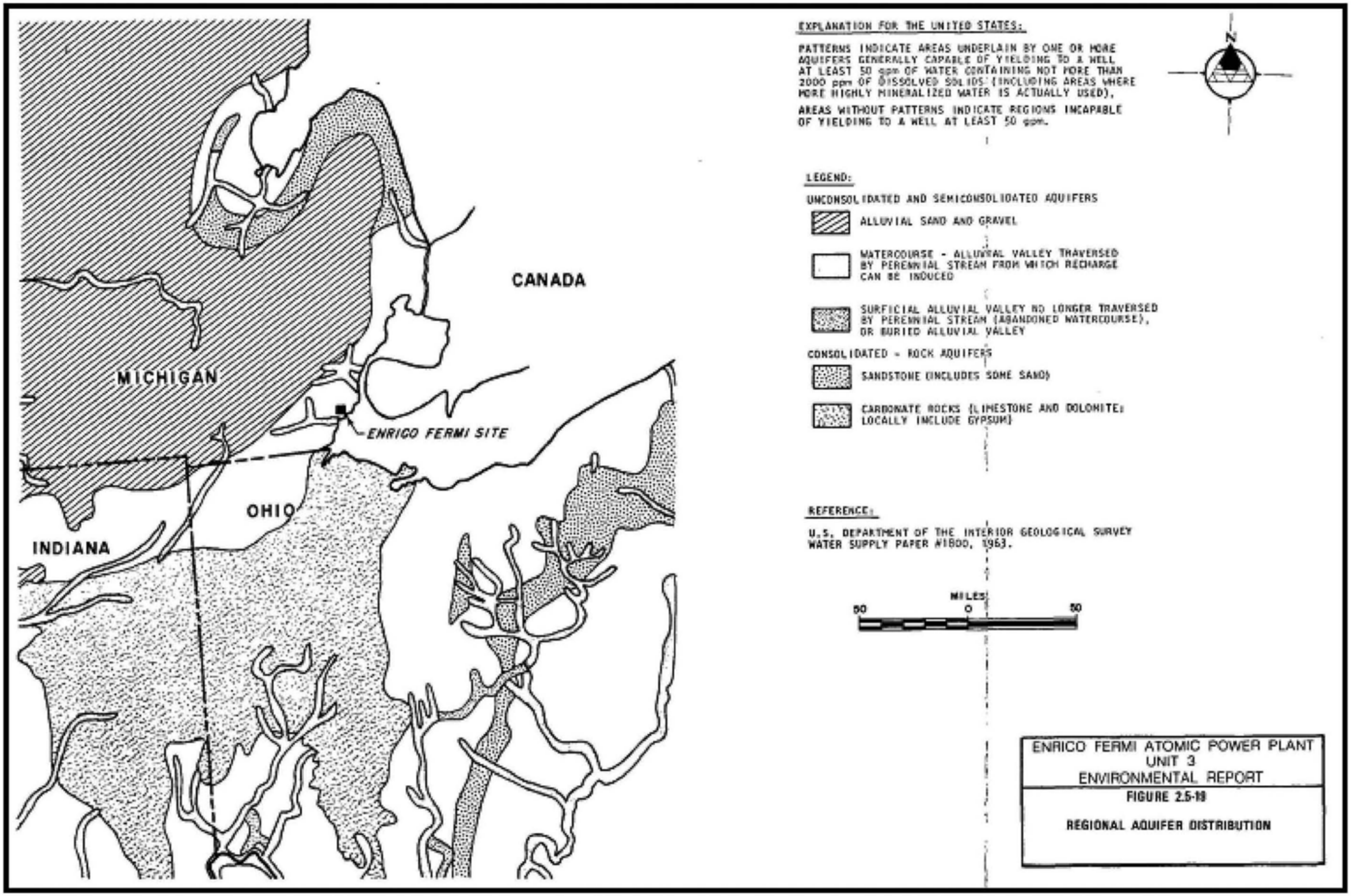
Approximate scale: 1" = 11 miles

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



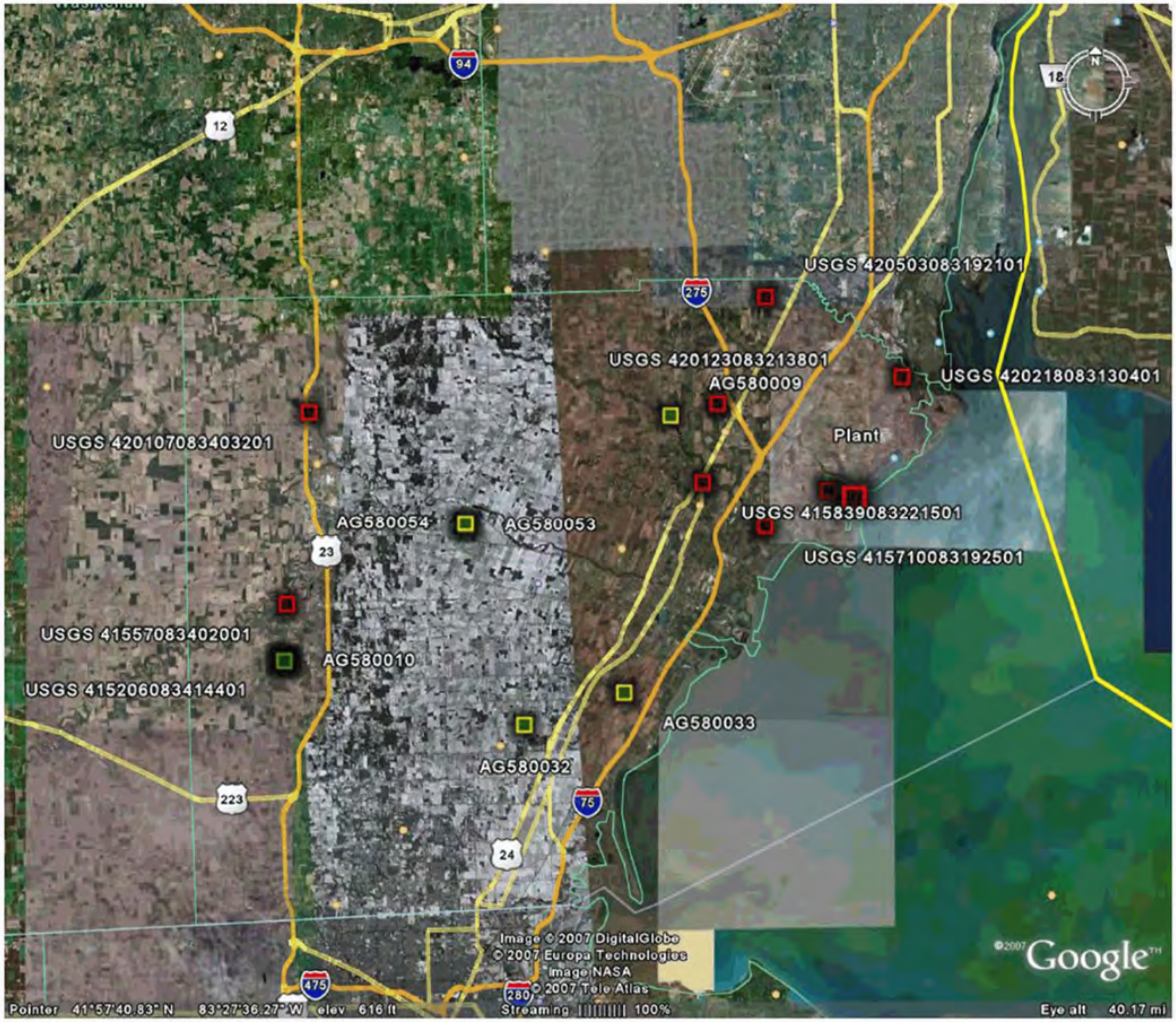
Approximate scale: 1” = 11 miles

Figure 2.3-55 Regional Aquifer Distribution



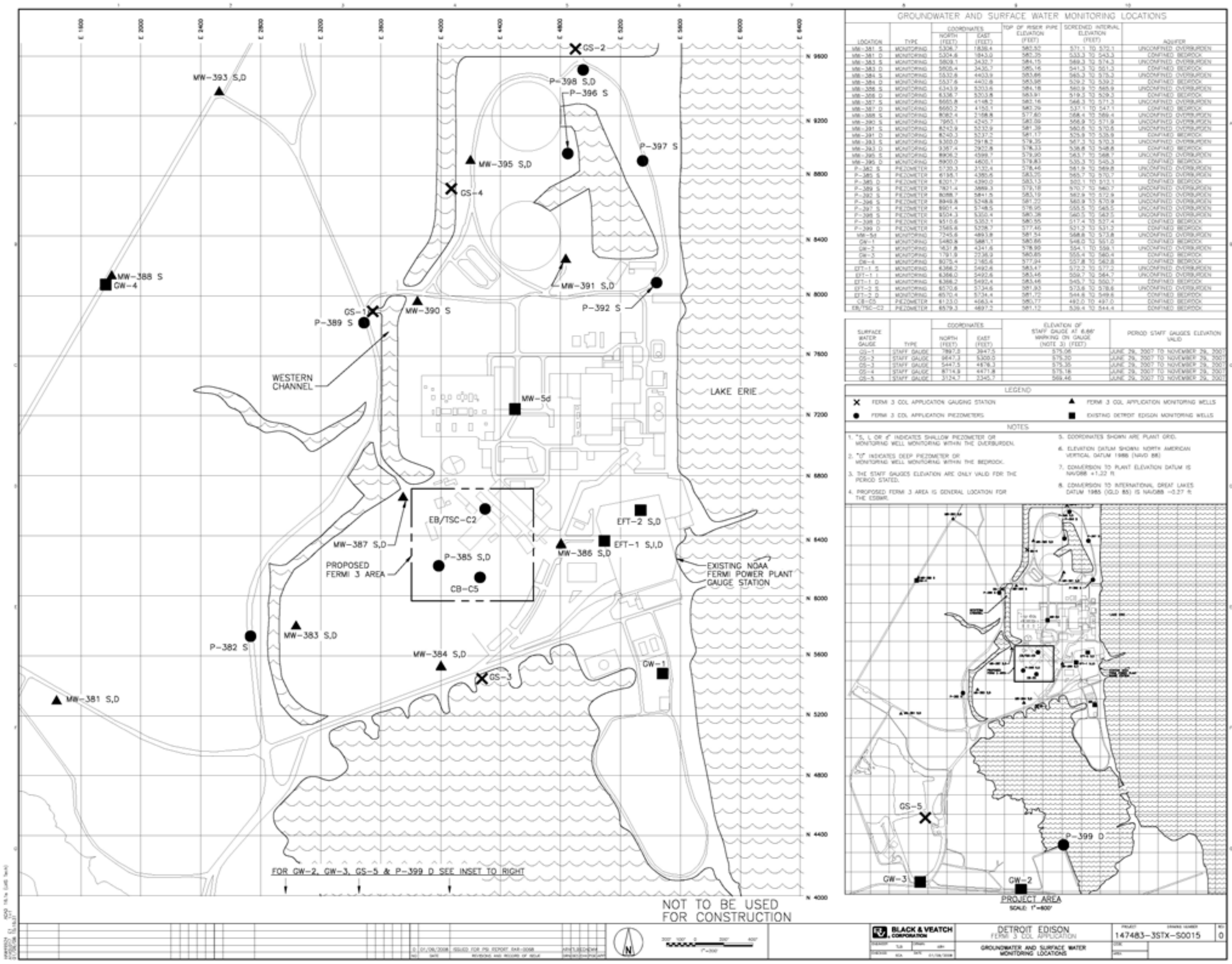
Source: Reference 2.3-49

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)



2.4 Ecology

The purpose of this section is to describe the terrestrial and aquatic environment and biota of the site and vicinity, transmission corridors, and offsite areas to provide a baseline from which to judge the construction and operational impacts on these areas. Subsection 2.4.1 and Subsection 2.4.2 identify and describe the terrestrial and aquatic species composition, spatial and temporal distribution, abundance, and other structural and functional attributes of biotic assembleges that could be impacted by Fermi 3. Important terrestrial and aquatic natural resources are identified, as well as wildlife sanctuaries, preserves, and other natural areas that are potentially affected.

2.4.1 Terrestrial Ecology

The Fermi 3 project is located on the shore of Lake Erie at the west end of the Lake Erie Basin in the Southern Lower Peninsula Ecoregion (SLPE) (Reference 2.4-1). West of the Fermi site is primarily agricultural land (row crops) with scattered rural residences. The general land use in the vicinity of the Fermi site is illustrated in Figure 2.1-1. To the south the area is equally divided between residential properties and a narrow lagoon off Lake Erie that is surrounded by brushy forest. The general area of interest around the existing Fermi 2 is illustrated in Figure 2.4-1.

The SLPE includes approximately the southern half of the Lower Peninsula of Michigan. The eastern portion of the region where the project is located has a prevalence of flat plains, the Lake Erie basin, that eventually give way to the main body of Lake Erie. The region is underlain by Paleozoic bedrock and was completely glaciated during the late Wisconsin Period, some 18,000 to 20,000 years ago (Reference 2.4-2). Today this type of broad lacustrine plain is found around most areas of the Great Lakes and typically extends several to many miles inland (Reference 2.4-1). Nearly all of Monroe County lies on this plain, making the landward extent of the plain in the project vicinity about 25 miles.

Reconnaissance surveys to the Fermi site and vicinity were made between November 2006 and May 2008. Detailed terrestrial surveys were conducted at the site from 2008 through 2009. The purpose of these investigations was to observe and assess existing conditions of the ecological resources, including vegetation and wildlife. Several previous wildlife and plant studies have been made on the property. NUS Corporation examined the site between 1973 and 1974 (Reference 2.4-3). In 2000 the Detroit Edison Fermi 2 Plant Wildlife Habitat Team in cooperation with the Wildlife Habitat Council prepared a Wildlilfe Management Plan, which included updated wildlife occurrence lists for the site. The Wildlife Management Plan was re-certified in 2002 and again updated the wildlife occurrence lists. Information from these studies is included and considered in the present study. As indicated above, Detroit Edison performed a confirmatory updated terrestrial ecological survey of the site that provides a year’s worth of seasonal sampling data to reflect variations in terrestrial populations (Reference 2.4-95 and Reference 2.4-96).

A topographic map of the Fermi area showing the property boundaries is provided in Figure 2.4-2. Figure 2.4-3 is an aerial photograph of the Fermi area taken in 1981 during the construction of Fermi 2. Figure 2.4-4 is an aerial photograph taken in 2005 that is representative of current existing conditions. The most notable difference in the two photographs is the much higher water conditions in the lagoons in 1981 compared to 2005 and the difference in cover types present due to Fermi 2 construction activities in 1981.

2.4.1.1 **Terrestrial Communities**

Following are brief discussions of the floral and faunal components found at the Fermi site. The vicinity surrounding Fermi consists of similar habitats but is dominated by Lake Erie (about 50 percent), urban areas, rural residences, and agricultural lands.

2.4.1.1.1 **Vegetation on Site and Vicinity**

The flora at the Fermi site was studied during site reconnaissance between 2006 and 2008 and again in a detailed survey between 2008 and 2009 (Reference 2.4-95). Using current aerial photography of the Fermi property, plant community boundaries were drawn on a provisional basis. The property was then divided into a gridwork of approximately 1,000 feet square parcels. Pedestrian surveys were then made of all areas of the site, using the grid system to effectively examine the habitats on and areas of the property. The surveys were conducted during the spring, summer and fall seasons to account for the variation in flowering time for different plant species. Field inspection of the structure and species composition of these areas was used to refine the boundaries of the plant communities present. Within each terrestrial community identified, point to point transects were examined to determine cover type and dominant species. At least two transects were examined in each habitat area of significant size. For example, if five separated areas of the property were identified as the same habitat, at least two transects were examined in each of these tracts, assuming each tract was large enough to accommodate a 100 meter or longer transect. Random sampling of plants was done within all communities identified to more thoroughly examine microhabitats and better understand the species diversity present. The outcome of the field studies was used to refine the boundaries of the plant communities present and provide an understanding of the character of these communities as they exist on the Fermi property. The discussion that follows is based on the findings of these studies.

The 1260 acre Fermi site is composed of approximately 16.8 percent developed areas and 5.1 percent cropland. Terrestrial habitats account for approximately 61 percent of the property. The remaining approximately 17 percent are water bodies, e.g. Quarry Lake and the main body of Lake Erie that lies east and north of the site. Figure 2.4-5 illustrates the extent and location of the habitats identified and the developed areas on the Fermi site. Table 2.4-1 provides an accounting of the acres present of each habitat. Plant community descriptions (Table 2.4-1 and Figure 2.4-5) are defined biologically, which may differ from the regulatory definitions used in the wetlands delineation (Figure 2.4-19).

Studies of the flora at Fermi between 2006 and 2008 identified 216 plant species present. This should be considered a conservative number of species since in some instances specimens could not be identified beyond the genus. Table 2.4-2 provides a list of plant species observed during reconnaissance visits or reported as occurring. Plant identifications and nomenclature primarily follow that used in the *Michigan Flora* (Reference 2.4-4). Common names primarily follow those found in the *National List of Plant Species that Occur in Wetlands: North Central (Region 3)* (Reference 2.4-5 and Reference 2.4-95).

Early accounts of the Fermi site indicate that as recently as 1961, most of the site was in cultivation or had been otherwise disturbed. The NUS study (Reference 2.4-3) describes nearly all of the habitats on site as being in relatively early stages of succession. For example, most woodlots present in 1973 and 1974, which remain intact today, were nearly all once cleared land at one time. Over time these areas became revegetated by tree species representative of the area as well as some non-native species. But while the tree flora is mostly representative of other areas of southern Michigan, the ground cover remains diminished, presumably due to the lack of an adequate seed bank for ground cover species and probably alterations to soils conditions (fill material, mixing due to scrapping, shading, etc.). The terrestrial habitats present on the Fermi site today are described in the following paragraphs and the distribution of these is illustrated in Figure 2.4-5. The communities are categorized according to the 2006 Michigan Department of Natural Resources Terrestrial Systems for the Lower Peninsula (Reference 2.4-1) with minor modifications.

Grassland: Row Crops (GRC) (brown areas in Figure 2.4-5)

Grassland: Row Crop (GRC) areas are agricultural fields that are planted with a single species (usually corn or soybeans) and harvested annually. Approximately 64 acres or 5.1 percent of the property is completely GRC.

Grassland: Idle/Old Field/Planted (GOF) (orange areas in Figure 2.4-5)

Grassland: Idle/old fields/planted (GOF) are communities of opportunistic plants that take over ground that had once been cleared for agriculture or other purposes. In some cases, these areas are initially planted with a cover grass, usually perennial brome or fescue when the area is to remain idle permanently or for the long term. The GOF communities at the Fermi site are dominated by smooth brome (*Bromus inermis*), but contain a good mix of opportunistic (weedy and invasive) native and introduced species, such as Canada thistle (*Cirsium arvense*), Canada goldenrod (*Solidago canadensis*), and flattop-fragrant goldenrod (*Euthamia graminifolia*). Invasive shrubs, such as multiflora rose (*Rosa multiflora*) and blackberry (*Rubus* spp.), may also be present but are not dominant. This is a disturbed community and offers limited value to wildlife, although it provides shelter to small mammals, birds, and reptiles and has some forage value. Approximately 75 acres or 6.0 percent of the site is GOF.

Grassland: Right-of-way (GRW) (yellow areas in Figure 2.4-5)

Grassland: Rights-of-way (GRW) are linear features associated with roadways, railways, power lines, pipelines, etc. At Fermi approximately 29 acres or 2.3 percent of the property is right-of-way, including less than one percent along roadways. An existing power line right-of-way accounts for the majority of this classification. The power line right-of-way is periodically mowed to keep the area free of trees for reasons of safety in relation to line clearance issues. About one-half of the area is a prairie creation area while the remainder is unmanaged. The prairie was planted in 2003 by Detroit Edison with the assistance of a North American Wetland Conservation Act grant managed by Ducks Unlimited and the Natural Resources Conservation Service (NRCS). The area is dominated by big bluestem (*Andropogon gerardii*) and Indiangrass (*Sorghastrum avenaceum*). Broomsedge (*Andropogon virginicus*) is an undesirable and invasive grass that is relatively common in the area and is even abundant in some localities. Other undesirable plants are also present, including purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), teasel (*Dipsacus sylvestris*), and all non-native species. Surveys of the area between 2005 and 2008, including species identified prior to the preparation of this document, listed approximately 110 plant species as occurring in this area. To date, management has consisted of periodic mowing of most of the site to discourage the growth of woody species.

In the lowest portions of the GRW, large grasses like the bluestem and Indiangrass become less dominant. Where broomsedge has not overtaken the ground cover, composition tends to be somewhat representative of a perennial, herbaceous wetland. Grass-like bulrushes (*Scirpus* spp.), rushes (*Juncus* spp.), and sedges (*Carex* spp.) are present in some areas, as are broadleaf forbs, such as common boneset (*Eupatorium perfoliatum*) and southern blue flag (*Iris virginica*). An unmanaged portion of the right-of-way is dominated by broomsedge in the driest areas and with cattails (*Typha* spp.) in the lowest areas. The variation in hydrologic conditions across this area has encouraged the growth of a substantial variety of forbs representative of native and introduced species.

The GRW is a previously disturbed area that presently provides some limited value to wildlife in the form of diverse foraging and shelter for small mammals, birds, and reptiles and perhaps some grazing for larger mammals.

Shrubland (SHB) (red areas in Figure 2.4-5)

Shrubland (SHB) communities at the Fermi site are upland areas with relatively dry soils that are dominated by deciduous shrubs. Approximately 113 acres or 9.0 percent of the site is SHB. On the Fermi property, all shrublands are located in areas that were filled or otherwise severely disturbed by construction activities for Fermi 1 and 2, with the possible exception of SHB in the extreme southeastern corner of the property. Shrub species, like dogwood (*Cornus* spp.), common buckthorn (*Rhamnus cathcartica*), mulltiflora rose (*Rosa multiflora*), and blackberries (*Rubus* spp.), dominate the site. Saplings of trees in the area are also common, such as honey locust (*Gleditsia triacanthos*), cottonwood (*Populus deltoides*), and green ash (*Fraxinus pennsylvanica*). Despite the cover of shrubs and saplings there generally is substantial ground cover in the form of grasses and coarse forbs are common. Since these areas have been previously disturbed, it is not surprising to find that many of the species present are introduced or native increasers (i.e., plants native to the area but tending to be opportunistic in where they grow). Examples include smooth brome (*Bromus inermis*), prickly lettuce (*Lactuca serriola*), Canada goldenrod (*Solidago canadensis*), and Missouri ironweed (*Vernonia missurica*). Wildlife use in the SHB would include cover, nesting sites, and bedding areas but is expected to be limited for foraging due to lack of appropriate plant species.

Thicket (TKT) (light orange areas in Figure 2.4-5)

Areas identified as Thicket (TKT) on the Fermi property are generally located in areas between wetlands and upland. Approximately 23 acres or 1.8 percent of the site is designated TKT. These areas are densely populated with small trees, such as hawthorn (*Crataegus* spp.), and box elder (*Acer negundo*). Shrubs are also common, including European privet (*Ligustrum vulgare*), dogwoods (*Cornus* spp.). Saplings of eastern cottonwood *(Populus deltoides*), peach-leaved willow (*Salix amygdaloides*), and green ash are also prevalent and poison ivy (*Toxicodendron radicans*) is abundant. Ground cover is sparse to lacking except in a few open areas. The low quality species composition present suggests that the area was disturbed in the past. A comparison of the 1981 (Figure 2.4-3) and 2005 (Figure 2.4-4) aerial photographs of the site illustrates the change that has occurred from shrub/grassland habitat to thicket. Regarding wildlife, the TKT area is probably most beneficial to small mammals and birds for shelter and foraging, since large mammals would find it difficult to move through the dense brush.

Forest: Coastal Shoreline (FCS) (dark green hatched areas in Figure 2.4-5)

The Forest: Coastal Shoreline (FCS) community occurs in a narrow, interrupted band along the east side of the property adjacent to the main body of Lake Erie. The area includes about 47 acres of land or 3.7 percent of the property. The area is dominated by large cottonwoods (*Populus deltoides*) and peach-leaved willow (*Salix amygdaloides*), some as much as two feet or more in diameter. Box elder (*Acer negundo*) and green ash (*Fraxinus pennsylvanica*) are also scattered in the area. Shrub growth varies from dense to sparse depending on lake exposure and the extent of high water ponding that occurs. Ground cover is sparse in heavily shaded areas and on the edges includes dense stands of reed canarygrass (*Phalaris arundinacea*). Forbs include primarily species capable of withstanding fluctuations in moisture availability and generally sandy soil conditions, such as stinging nettle (*Urtica dioica*). In this area it is also common to discover unexpected native and introduced species that have likely been dispersed here from other areas via the waters of Lake Erie. Examples include jimson-weed (*Datura strumonium*) and clammy-weed (*Polanisia dodecandra*). Overall, the FCS at Fermi is a dynamic community composed of opportunistic, early succession species. Wildlife value of the area is primarily limited to birds roosting or nesting in the trees.

Forest: Lowland Hardwood (FLH) (dark green areas in Figure 2.4-5)

The Forest: Lowland Hardwood (FLH) community represents the most mature habitat on the Fermi property. The FLH accounts for about 92 acres or 7.3 percent of the site located in areas immediately northeast of Quarry Lake and the south-central portion of the site along the west side of the south lagoon. Like the FCS, cottonwood (*Populus deltoides*) and peach-leaved willow (*Salix amygdaloides*) are present but oaks (*Quercus* spp.), American basswood (*Tilia americana*), and hickory (*Carya* spp.) are well represented. Overall, the habitat is drier and more stable than that found in the FCS and the topsoil is organic to even clayey rather than sandy. The largest trees are found in the area northeast of Quarry Lake where numerous specimens can be found in the range of 18 to 26 inches in diameter. In the south-central area, scattered trees reach this size but most are less than 14 inches in diameter. Larger specimens appear to have been logged out of the area years ago, as evidenced by scattered old stumps. Shrubs are widely scattered in the FLH, so it is generally easy to move about the habitat. Ground cover is overall sparse, but consists of a variety of woodland species, such as woodland bluegrass (*Poa sylvestris*), scattered sedges (*Carex* spp.), enchanter's nightshade (*Circaea lutetiana*), false spikenard (*Smilacina racemosa*), and Virginia stickseed (*Hackelia virginiana*). Poison ivy (*Toxicodendron radicans*) is common as are grape vines

(*Vitis* spp.). The habitat provides substantial cover, shelter and foraging for a variety of wildlife in the area, as evidenced by tracks, nests, and scat observed in the area.

Forest: Woodlot (FWL) (light green areas in Figure 2.4-5)

The Forest: Woodlot (FWL) community is found in the east-central and northwestern portions of the Fermi property and account for about 117 acres or 9.3 percent of the site. The FWL developed over fill material from Fermi 1 and 2 construction or on land otherwise heavily disturbed by Fermi 1 and 2 activities. The canopy is well developed and is composed of Cottonwood (*Populus deltoides*), box elder (*Acer negundo*), and green ash (*Fraxinus pennsylvanica*). Introduced species, such as the tree-of-heaven (*Ailanthus altissimus*) can also be observed. The understory is composed of saplings of the same species, dense in some areas and less dense in other places. Vines of poison ivy (*Toxicodendron radicans*), grape (*Vitis* spp.) and trumpet creeper sometimes form localized thickets. Introduced European privet (*Ligustrum vulgare*) and common buckthorn (*Rhamnus cathcartica*) are relatively common. The ground cover is overall sparse and composed entirely of native and non-native invasive or otherwise undesirable species. Some of the more common herbaceous species include burdock (*Arctium minus*), heal-all (*Prunella vulgaris*), and garlic mustard (*Alliaria petiolata*). The value of FWL to wildlife is limited to nesting areas and den areas and sheltered resting areas. Few native species in the community are provided adequate foraging opportunities because of the dominance by non-native species.

Coastal Emergent Wetland (CEW) (light blue and blue hatched areas in Figure 2.4-5)

The Coastal Emergent Wetland (CEW) is the largest plant community represented on site, covering about 273 acres or 21.7 percent of the site. The area is divided between a north and south lagoon and an unnamed drainage corridor entering the site from the west. From the most recent study, it is estimated that 238 acres is vegetated and 35 acres is open water. The extent of aquatic vegetation present fluctuates annually depending on water conditions in Lake Erie. High water years result in more open water and less in low water years. The 1981 aerial photograph in Figure 2.4-3 illustrates relatively high water conditions, while the 2005 photograph in Figure 2.4-4 shows a marked increase in vegetation in the lagoons during low water periods. At the present time the lagoon is dominated by dense and extensive stands of common reed (*Phragmites australis*) and cattail (*Typha* spp.). The introduced and undesirable purple loosestrife (*Lythrum salicaria*) is present throughout most of the area. The west-side drainage corridor has virtually no open water because of these plant communities. Because these stands are so dense, they provide minimal habitat for wildlife, especially waterfowl. In the south lagoon, and to a lesser extent in the north lagoon, are large stands of American lotus (*Nelumbo lutea*), which is a state listed threatened species. The status of the lotus is discussed in detail in Subsection 2.4.1.2. Most of the lagoon is quite shallow. The south lagoon has fill deposits scattered throughout. Wading birds utilize the shallow water areas for foraging. A few songbirds use the cattails and reeds for nesting.

Developed Areas (DA) (white areas in Figure 2.4-5)

Developed areas (DA) include buildings, parking areas, equipment storage areas, roadways, maintained lawns, and similar areas. Approximately 212 acres or 16.8 percent of the site is developed. Plant species present are those planted for ornamental value or undesirable weeds. Wildlife value is very low because of poor plant species diversity, poor cover and exposure to frequent disturbance.

Lakes, Ponds and Rivers (LPR) (dark blue areas in Figure 2.4-5)

Lakes, Ponds and Rivers (LPR) account for 44 acres or 3.5 percent of the site. These water bodies include an unnamed stream draining east across the central portion of the site and Quarry Lake, an abandoned rock quarry from Fermi 1 construction. No significant plant communities as discussed here are present, except for noting that cut-leaf water-milfoil (*Myriophyllum pinnatum*), a noxious plant native to Europe, has been observed in the waters. These waters are discussed further in Subsection 2.4.2.

Lake Erie (main body)

The main body of Lake Erie lies north and east of the project. Lake Erie accounts for about 171 acres or 13.6 percent of the site. These aquatic areas are addressed in Subsection 2.4.2.

2.4.1.1.2 **Wildlife on the Site and Vicinity**

Habitat diversity in an area generally contributes directly to the diversity of wildlife present in the same area. The more diverse the habitat, the greater the number of wildlife species that can be supported. The Fermi site and vicinity provide primarily a rural agricultural setting with small parcels of disturbed grassland, forest, and wetland habitats scattered throughout the area. The majority of the Fermi site proper is occupied by disturbed forest, lagoons, thickets, and developed areas. The site was extensively surveyed for wildlife in 1973 and 1974 by NUS Corporation (Reference 2.4-3). Wildlife observations were made during site reconnaissance between late 2006 and mid 2008 and during a detailed wildlife survey from mid-2008 until 2009 (Reference 2.4-96) to evaluate the diversity of species potentially present. The following discussions are based on the finding of these studies.

Mammals

The 1973-74 NUS study (Reference 2.4-3) listed 17 species of mammals directly or indirectly observed. The 2000 Wildlife Management Plan listed 41 species as potentially occurring on the property; 14 species were observed, 3 of which were newly observed. In 2002, Wildlife Habitat Program Re-certification document listed one additional newly observed mammal, bringing the total number of mammals observed on the property to 21. Field studies were made for the Fermi 3 work from late 2006 to mid 2008. Mammals were recorded on the basis of direct observation, tracks, and scat, anytime while on the property, but the most intense study periods occurred concurrently with the flora studies described in Subsection 2.4.1.1.1. During the 2007-2008 studies, 13 of the 21 species listed for the site were observed. Table 2.4-3 provides a composite list of mammals observed at the site.

The area surrounding the existing units is a mosaic of developed land, mowed grass, woodlots and second generation forest that do not appear to provide significant travel corridors as might be found along watercourses or entry/exit locations for desirable foraging or resting habitats. The Fermi property is surrounded by high chain-link fence in terrestrial areas, which is expected to inhibit larger mammals from access to the site. Because the property is fenced, wildlife corridors in the truest sense are not present on the property. However, the Lake Erie waterfront and north lagoon areas may provide access via water. White-tailed deer, for instance, are frequently seen on the site. The varied habitats around the site, however, are well suited to small mammals, although the diminished quality of most of the communities discussed provides less than ideal foraging opportunities. None of the wildlife species observed or reported at the site is unusual for the region.

Birds

Birds in the Fermi region include year-round residents, seasonal residents and transients (birds stopping briefly during migration). A large percentage of the species occurring in Michigan are migratory, and because Fermi lies on the western shore of Lake Erie, it lies within the Atlantic flyway which is one of several major migratory flyways in North America. Avian surveys conducted at the Fermi site between 1973 and 1974 by NUS Corporation (Reference 2.4-3) listed about 150 species of birds occurring on the site. Although the 2000 Wildlife Management Plan provided a list of 287 species potentially occurring in the Fermi vicinity, only 150 were noted as observed on the Fermi property, the same 150 noted in the 1973-74 NUS study. The list of 287 species was derived from surveys conducted at the Ottawa National Wildlife Refuges located along Lake Erie about 30 miles southeast of Fermi near Oak Harbor, Ohio. In 2002, the Wildlife Habitat Program Re-certification added 6 new species to the list of species provided in the 2002 Wildlife Management Plan. According to the Michigan Natural Feature Inventory, the potential number of resident and transient birds in the region is much higher depending on the reporting resource group (Reference 2.4-6). In 2002, an April bird survey by the Detroit Edison Wildlife Habitat Team at Fermi counted 293 individuals and 31 species. Five (5) species accounted for 50% of the birds counted: common grackle, red-winged blackbird, herring gull, brown-headed cowbird, and northern pintail. The 2007 National Audubon Society Christmas Bird Count for Monroe, Michigan, covered a 15 mile diameter area centered on Monroe and was conducted between December 15, 2007 and January 4, 2008. The northeast edge of the study area lies less than 3.5 miles from the Fermi property. The count recorded 27,609 individuals and 71 species. 71% of the individuals recorded were one of 7 species: European starling (18%), ring-billed gull (15%), Canada goose (11%), common merganser (9%), rock pigeon (7%), herring gull (7%), and house sparrow (4%).

Fermi 3 avian studies were conducted between late-2006 and mid-2008. Point surveys were conducted early and late in the day in different areas across the Fermi property that were representative of the variety of habitats present. The sampling periods included seasonal variation, such as spring and fall migration periods. These surveys confirm that the avian fauna at Fermi, especially songbirds and certain water bird, remains diverse, but that a small number of common species make up a large percent of individuals present. The most common species observed were the European starling, Canada goose, gulls, and red-winged blackbirds. Table 2.4-4 provides a list of the birds that have been recorded at Fermi and notes those species recently observed. The following are brief discussions of different bird guilds at Fermi.

Forest, Shrub and Grassland Community Birds

These birds nest in trees, shrubs or grasses and include year-round and seasonal residents. Examples include the American robin (*Turdus migratorius*), blue jay (*Cyanocitta cristata*), brown thrasher (*Toxostoma rufum*) and Eastern meadowlark (*Sturnella magna*). During the spring and fall, large flocks of European starlings pass through the area. Open areas, such as the transmission line prairie and grass/shrub habitats are used by many of the species present to forage for seeds, insects or other forms of food.

Water Dependent Birds

Approximately 38 percent of the observed bird species fall into this classification. These birds are mostly found in association with the shoreline area of Lake Erie and areas designated as Coastal Emergent Wetlands in Figure 2.4-5, since they require surface water to complete at least part of their life cycle. Great blue herons (*Ardea herodias*), great egrets (*Casmerodius albus*), and American common mergansers (*Mergus merganser americanus*). American coots and mallards can be readily observed foraging in the shallow open water areas of the lagoons. Red-winged and yellow-headed blackbirds (*Ageliaus phoeniceus* and *Xanthocephalus xanthocephalus*) nest in the tall cattail and reeds. The red-winged blackbird normally accounts for a large percentage of the birds observed on the Fermi property. Many more birds were typically observed in the lagoons than along the shore of Lake Erie, where the most common sighting is that of gulls.

Birds of Prey

Birds of prey were not frequently observed on the Fermi site but the most common sightings were that of the turkey vulture (*Cathartes aura*) and red-tailed hawk (*Buteo jamaicensis)*. In 1973 a single peregrine falcon (*Falco peregrinus*) and a single osprey (*Pandion haliaetrus*) were observed over the lagoon (Reference 2.4-3). No peregrine falcons were observed in recent studies, but several ospreys were observed at the site. No evidence of nesting on the property was encountered.

The bald eagle (*Haliaeetus leucocephalus*) occurs in the area. In the fourth quarter of 2007 three nests were observed on the property, two are north and one is south of Fermi 2 in the large trees of the coastal shoreline forest (FCS) adjacent to Lake Erie. Eagles may be more common during the winter months around the plant where the warmer cooling water keeps some areas ice free. Additional discussion regarding legislated protection of this species is found in Subsection 2.4.1.2.2.1. By May 2008, only the two nests north of Fermi 2 remained, as the southernmost nest had been destroyed by winter storms. Only one of the remaining nests was occupied.

Upland Game Birds

The mourning dove (*Zenaida macroura)* is the only upland game bird observed on the Fermi property. Wild turkey (*Meleagris gallopavo*) may be in the area but none were observed directly or indirectly (tracks, feathers, etc.) during site evaluations between 2006 and 2008.

Reptiles and Amphibians

The lagoons, other wetlands areas and adjacent habitats provide a significant amount of potential habitat for amphibians and reptiles on the Fermi property. Direct and indirect observations of a diversity of these species, however, have been infrequent both in recent studies and past studies. The 2000 Wildlife Management Plan listed 18 species of amphibians whose geographical ranges include the Fermi site, but only 3 species were observed. The same report did not list any reptiles. The 2002 wildlife habitat Re-certification document listed 3 additional amphibians and 3 reptiles. No intense surveys were made for the Fermi 3 project but observations were recorded during the course of other studies conducted for terrestrial resources. During the 2007-08 study period 2 amphibians were observed and 6 reptiles. Table 2.4-5 provides a list of species observed and others that potentially occur in the area based on past studies (Reference 2.4-3).

2.4.1.2 **Important Terrestrial Species and Habitats**

NUREG-1555 defines “important species” as: 1) species listed or proposed for listing as threatened, endangered, candidate, or species of special concern in 50 CFR 17.11 and 50 CFR 17.12, by the USFWS, or the state in which the project is located; 2) commercially or recreationally valuable species: 3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; 4) species critical to the structural and function of local terrestrial ecosystems; or 5) species that could serve as biological indicators of effects on local terrestrial ecosystems. From the above definition, only element 1) is applicable to the species found on the Fermi site and vicinity. “Important habitat” is defined by the NRC in NUREG-1555 as wildlife sanctuaries, refuges, or preserves, wetland, floodplains and areas identified as critical habitat by the USFWS. The terrestrial species and habitats deemed important by these definitions are addressed in the sections that follow. Subsection 4.3.1 describes the construction impacts on the terrestrial ecosystem and potential needs for preventative measures.

The following discussion reflects the results of the detailed wildlife survey conducted in 2008 and 2009 (Reference 2.4-96) and other information sources as cited.

2.4.1.2.1 **Federal Protected Species**

The USFWS was consulted concerning the occurrence or potential occurrence of species on or in the vicinity of the Fermi property that are protected under the Endangered Species Act of 1973 (ESA) (Reference 2.4-7). The USFWS stated that the project occurs within the potential range of some federally listed species, but that the USFWS had no records of occurrence nor was there any designated critical habitat in the area. The USFWS further stated that because of the types of habitat present at Fermi, no further action is required under ESA. The USFWS did state that if more than six months pass before the project is initiated, then the USFWS should again be contacted to ensure there have been no changes from the regulatory perspective. Detroit Edison will continue consultations with the USFWS per their recommendations.

A broad range of bird species, over 800 total, are protected by the Migratory Bird Treaty Act of 1918 (MBTA) (Reference 2.4-8). The statute makes it unlawful to pursue, hunt, take, capture, kill or sell birds listed and grants protection to any bird parts including feathers, eggs and nests. Detroit

Edison is remaining in contact with the USFWS to keep abreast of future changes in the regulatory environment regarding compliance with the MBTA. Based on avian surveys conducted during the 2006-2008 reconnaissance visits, the bald eagle appears to be the only migratory species of note that has been observed to date on the Fermi property, or in the site vicinity. The Indiana bat is also of interest, as it has been sited within the Fermi region.

Bald Eagle

The USFWS de-listed the bald eagle (*Haliaeetus leucocephalus*) as federally threatened under the Endangered Species Act, effective August 8, 2007 (Reference 2.4-9). However, the species continues to receive federal protection under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act (Reference 2.4-10), which prohibits the take, transport, sale, barter, trade, import and export, and possession of eagles, making it illegal for anyone to collect eagles and eagle parts, nests, or eggs without an USFWS permit.

Two nests were observed on the Fermi property in May 2008. Both nests are located north of Fermi 2 in the large trees of the forested coastline immediately adjacent to Lake Erie. Biologists from the USFWS usually check the nests in late winter for young. If present, the young are banded and blood samples taken. One of the nests was occupied in May 2008. As long as there is open water where they can forage, the bald eagle typically will remain in the region throughout the year (Reference 2.4-6). Protection of the bald eagle is discussed in more detail in Subsection 2.4.1.2.2.1.

Bald eagles are found throughout the United States. Their breeding range extends from Alaska and Newfoundland south to Baja California and Florida, although many areas in the interior of the continent have few, if any nesting pairs. Nests are usually constructed near seacoasts, lakes or large rivers to be near their most common food supply: fish. Although they are quite capable of catching their own, sometimes even wading in shallow water to stalk fish like herons, they have often been seen stealing fish from other birds such as osprey. When fish are not available, such as in winter, eagles will also feed on waterfowl, small mammals (up to rabbit-size) and carrion (even road-kill). During Michigan winters, bald eagles are seen throughout the state. They nest mainly in the Upper Peninsula and the northern portion of the Lower Peninsula. Bald eagles reach maturity at four to five years of age. The beginning of the breeding season, from mid-February to mid-March, consists of the establishment of a territory, nest building and mating displays. The nest is usually located in the tallest tree in the area, often a white pine or dead snag. From late March to early April, one to four eggs are laid. Both male and female bald eagles participate in the incubation and the feeding of the chicks that hatch around seven weeks later. In about three months, by late summer, the fledglings are ready for flight. When it is time to move for the winter, the young birds are abandoned by their parents. A 1999 survey in Michigan found 343 nests that produced 321 young. The productivity was calculated as 96 percent, i.e., young per nest with known outcomes. (Reference 2.4-82)

Indiana Bat

The Indiana bat (*Myotis sodalist*) is a federal endangered species. The species has not been observed on the Fermi property, nor has it been reported from Monroe County, Michigan, according to the Michigan Natural Features Inventory (MNFI) (Reference 2.4-46). However, MNFI records do indicate that the Indiana bat has been observed in counties to the north and west of Monroe County. The bat is distributed from the Ozarks of Oklahoma east to Tennessee and northern Florida, and north to Vermont, northern Indiana and southern Michigan. The Indiana bat spends the winter hibernating in limestone caves (hibernacula) to the south of Michigan. From late spring to early fall, bats returning to Michigan typically roost in forested areas under the loose bark of large trees or in hollow snags. They leave their roosts to forage for insects from a half hour to one hour before dark in or near forested areas. (Reference 2.4-81). The Indiana bat is discussed further in Subsection 2.4.1.2.2.1.

2.4.1.2.2 State-Listed Protected Species

The MDNR and the Michigan Natural Features Inventory (Reference 2.4-6) was consulted regarding the presence of known or potential occurrences of state-listed threatened and endangered animals and plants in and around the project area. Eight terrestrial species were identified by MDNR as occurring or potentially present. Organisms listed by MDNR as “species of special concern” are not protected under state endangered species legislation. Terrestrial species listed by MDNR are discussed below.

2.4.1.2.2.1 Animals

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is a state threatened species, although as of March 24, 2008, Michigan is moving toward removing the bald eagle from the state list of threatened and endangered species. As long as the bald eagle remains protected under Michigan law, MDNR offers the following recommendations:

> To avoid disturbing nesting bald eagles, we recommend the following if an active bald eagle nest tree is within 400 meters (1/4 mile) of the project area: 1) avoid land altering activities during the critical nesting period from January 1 to June 1 in the Lower Peninsula and January 10 to June 10 in the Upper Peninsula, 2) retain the nest tree as long as the tree is healthy and not a safety concern, and 3) maintain a forested buffer (preferred) or natural buffer as wide as possible around the nest tree. Ideally, the buffer would protect the existing nest tree and provide for alternative or replacement nest trees. If the nest tree will be disturbed, an Endangered Species Permit may be needed from the Michigan Department of Natural Resources.
>
> Each nest within a breeding area is protected by three zones that become less restrictive to human activity as the distance from the nest increases. The first zone, or Primary Zone, is defined as 330 feet (5 chains) around the nest. All land use activities, including human entry, motorized access, and low-level aircraft operations, should be prohibited during the most critical period described above. Exceptions are actions necessary to protect or improve the nest site, eagle researchers, or management by qualified individuals.

The Secondary Zone extends 660 feet (10 chains) from the nest (additional 330 feet from the Primary Zone). Land-use activities that result in significant changes in the landscape such as clear cutting, land clearing, or major construction should be prohibited during the most critical period described above. Actions such as thinning tree stands, maintenance of existing improvements, human entry, low-level aircraft operations, and construction of trails, are permitted but not during the most critical period. Exceptions are the same as above.

The Tertiary Zone extends 1/4 mile (or 20 chains) from the nest, but may extend up to 1/2 mile (40 chains) if topography and vegetation permit a direct line of sight from the nest to potential activities at that distance. The configuration of this zone therefore, may be variable. Many activities are permissible in this zone with some exceptions during the most critical period. Please contact the U.S. Fish and Wildlife Division, East Lansing Field Office at (517) 351-2555 for activities that are permissible in this zone, if your project is 1/4 to 1/2 mile from a known nest.

MDNR further noted that following Michigan de-listing, MDNR guidelines for bald eagle management would follow those provided by the USFWS *National Bald Eagle Management Guidelines* (Reference 2.4-11).

Indiana Bat

The Indiana bat (*Myotis sodalist*) is state endangered. The species is only found in Michigan during late spring to early fall when it would roost in forested areas beneath loose bark of large trees or in hollow snags. During the winter these bats migrate south to hibernate in caves in the Ohio Valley or more southern areas. Although portions of the Fermi site are forested, large trees with loose bark that would provide roosting habitat for the Indiana bat are not common. As such, suitable habitat for the Indiana bat at Fermi is scarce. MDNR expressed no concern for the species during consultations, and according to MNFI, there are no reported occurrences of the Indiana bat for Monroe County. Accordingly, this species is not being considered in Chapter 4 and Chapter 5 for Fermi 3 construction or operational impacts.

Barn Owl

The barn owl (*Tyto alba*) is state endangered. The barn owl is a distinctive species that uses a wide array of natural community types, including agricultural lands and buildings. These resident birds may be found year-round if prey species are abundant. Although reported in the region in the early 1980s (Reference 2.4-6), there appear to be no recent reports of occurrence and no observations were made during project related studies. The project would have no effect on the continued existence of the barn owl in the region, since neither prey species nor nesting/roosting habitat would be adversely affected. Accordingly, no further consideration is being given to this species as being potentially affected by Fermi 3.

Common Tern

The common tern (*Sterna hirundo*) is state threatened. The species prefers nesting on islands to avoid terrestrial predators but may be observed using gravelly shores and bars (Reference 2.4-6).

This small bird has been observed in Monroe County (Reference 2.4-6) but none were observed during site studies and there have been no recent observances reported. There is no known reason to believe that the project would adversely affect the continued existence of the common tern in the project region. Accordingly, no further consideration is being given to this species as being potentially affected by Fermi 3.

Eastern Fox Snake

The Eastern fox snake (*Pantherophis gloydi*) is state threatened. Primarily an open wetland species, this snake inhabits emergent wetlands along Great Lakes shorelines and associated drainages where cattails (*Typha* spp.) are common. Little is known about the life history of the Eastern fox snake. They are typically active from mid-April to late October, usually throughout the day except during periods of intense heat. Breeding probably occurs annually beginning at two to four years of age with mating occurring in June or early July. The eggs are deposited in rotten stumps, mammal burrows, soft soil or mats of decaying vegetation. Eastern fox snakes eat small rodents and amphibians, insects and earthworms. (Reference 2.4-12)

In 2007, nine occurrences were reported in Monroe County (Reference 2.4-8). The snake was sighted two times on the Fermi property in June 2008.

2.4.1.2.2.2 **Plants**

American Lotus

The American lotus (*Nelumbo lutea*) is state threatened. Healthy populations of American lotus are found in scattered areas of southern Michigan. The species is distributed from New England to Florida and west to Michigan and Texas. It occurs in shallow water, usually in marshes, quiet backwaters, and near-shore areas of large rivers and lakes. The large perennial plant grows from thick tubers and flowers in mid summer. American lotus is abundant in the south and north lagoons on the project site.

Arrowhead

The arrowhead (*Sagittaria montevidensis*) is state threatened. The species is primarily distributed sporadically along the Mississippi River drainage, but is reported in other areas of the eastern United States. Southeastern Michigan populations represent a northern limit of distribution for the species (Reference 2.4-4 and Reference 2.4-6). This perennial grows in wet to shallowly inundated mud flats and banks, lagoons, and estuaries. It flowers in mid to late summer and sets fruit by fall. This wetland species was not observed on the Fermi property during the recent field survey, but has been observed in Monroe County as recently as 2001 (Reference 2.4-6).

Franks Sedge

Frank's sedge (*Carex frankii*) was listed in the MDNR report as state threatened (Reference 2.4-5). Consultation with MDNR Endangered Species Permitting group revealed that the correct classification for Frank's sedge is 'special concern' species. Special concern species have no legislated state protection. It was delisted in 2009 because it is more common than originally thought. The species was observed in the GRW transmission line prairie in 2005, but there is no specimen documentation by which the occurrence can be verified. It was not observed during a separate 2007 study, or in observations associated with this Environmental Report including the detailed terrestrial surveys from mid-2008 to 2009 (Reference 2.4-95 and Reference 2.4-96). Accordingly, no further consideration is being given to this species as being potentially affected by Fermi 3.

2.4.1.2.3 **Habitats**

No areas of the Fermi property are designated as critical habitat for listed wildlife species. Other important habitats present on the property are discussed below.

<u>Wetlands</u>

In 1984, Michigan received authorization from the Federal government to administer Section 404 of the Federal Clean Water Act in most areas of the state. A state-administered 404 program must be consistent with the requirements of the Federal Clean Water Act and associated regulations set forth in the Section 404(b)(1) guidelines. Unlike other states where applicants must submit wetland permit applications to both the U.S. Army Corps of Engineers (USACE) and a state agency, applicants in Michigan generally submit only one wetland permit application to the MDEQ to obtain the necessary authorizations from both the MDEQ and the USACE.

In 1979, the Michigan legislature passed the Geomare-Anderson Wetlands Protection Act, 1979 PA 203, which is now Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. The MDEQ has adopted administrative rules which provide clarification and guidance on interpreting Part 303. Some wetlands in coastal areas are given further protection under Part 323, Shorelands Protection and Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. This includes the Fermi site since the lagoons are connected to one of the Great Lakes, Lake Erie (Reference 2.4-13). Standard USACE guidelines with minor modifications are used for the delineation of wetlands in Michigan (Reference 2.4-14).

State and Federal authorities overlap in a coastal situation such as that at Fermi, according to Section 10 of the Federal Rivers and Harbors Act. Activities in these waters require a joint permit application, which minimizes time and effort for applicants. In accordance with the Clean Water Act, Section 404(g), USACE retains Federal jurisdiction over traditionally navigable waters. This jurisdiction includes the Great Lakes, connecting channels, other waters connected to the Great Lakes where navigational conditions are maintained, and wetlands directly adjacent to these waters.

In June 2008, a field delineation and assessment of wetlands on the Fermi property was completed. Flagging of wetland boundaries and data collection along the boundaries were performed between May 16, 2008 and June 13, 2008. The boundaries were delineated in accordance with procedures outlined in the USACE 1987 Wetland Delineation Manual (Reference 2.4-14). The boundaries between each type of wetland were identified and flagged to facilitate a functions and values assessment. The delineated wetlands were surveyed and acreage was calculated for each wetland. Data was collected on wetland vegetation, and on primary and secondary indicators of hydrology and soils. Wetlands delineated on the Fermi property were evaluated using USACE–recommended methodology (Reference 2.4-93), supplemented with vegetation community measurements for species richness, diversity and cover and wildlife observations. Thirteen functions and values typically considered by regulatory and conservation agencies when evaluating wetlands are used as part of the New England Method. These include: groundwater recharge/discharge, floodflow alteration, fish habitat, sediment/toxicant retention, nutrient removal, production export, sediment/shoreline stabilization, wildlife habitat, recreation, educational/scientific value, uniqueness/heritage, visual quality/aesthetics and endangered species habitat.

The 2008 wetland investigation report was provided to MDEQ and USACE in the fall of 2008 with a request for review and a jurisdictional determination. Jurisdictional determination letters were provided by the now MDNRE in November 2008 (Reference 2.4-98) and March 2009 (Reference 2.4-99) and by USACE in November 2010 (Reference 2.4-100). The wetland delineation boundaries were updated in response to the jurisdictional determination letters. Additional updates to the wetland delineation were based on site visits and verbal and written feedback from MDNRE and USACE during 2010. Forty wetland units covering 509 acres of wetlands and 45 acres of open water were delineated on the Fermi property (Figure 2.4-19). Areas within the delineation boundary did not include open water areas in Lake Erie. The primary wetland type on the Fermi property is palustrine emergent marsh (PEM) comprising 324 acres followed by palustrine forested (PFO, 169 acres) and palustrine scrub-shrub (PSS, 16 acres).

Wetlands dominated by woody vegetation having a basal area larger than 3” diameter at breast height (dbh) were classified as PFO. Some herbaceous and woody vegetation with <3” dbh may be present, but contribute less than 50% combined of the basal area. Dominant vegetation in the PFO wetlands include silver maple (*Acer saccharinum*), shellbark hickory (*Carya laciniosa*), swamp white oak (*Quercus bicolor*), American elm (*Ulmus americana*), and eastern cottonwood (*Populus deltoides*). The shrub layer in PFO wetlands was dominated by American elm saplings, silky dogwood (*Cornus amomum*), and green ash (*Fraxinus pennsylvanica*) saplings. Herbaceous vegetation was sparse during delineation. Common species included black raspberry (*Rubus* spp.), mayapple (*Podophyllum peltatum*), reed canary grass (*Phalaris arundinacea*), poison ivy (*Toxicodendron radicans*), and Virginia creeper (*Parthenocissus quinquefolia*). Due to the intermittent hydrology of these PFO wetlands, a significant proportion of herbaceous species were plants that favor upland areas. Soils are hydric and saturated with pockets of standing water throughout the PFO wetlands. Approximately 169 acres of wetland were delineated as PFO including: B, D, F, G, I, L, O, P, S, T, V, X, Y, BB, GG, and KK (Figure 2.4-19).

Wetlands dominated by woody vegetation smaller than 3” dbh but greater than 3.2’ in height were classified as PSS. PSS wetlands may have some woody plants >3” dbh or some herbaceous vegetation that, combined, contribute less than 50% of ground cover. Common shrub species in PSS wetlands include silky dogwood, green ash, and Hawthorn (*Crataegus* spp.). PSS wetlands on the Site were largely early successional woody communities located on the fringes of PFO and upland or PFO and PEM wetland habitats. Approximately 16 acres of wetland were delineated as PSS including: E, K, Q, HH, and JJ (Figure 2.4-19).

PEM wetlands are characterized by greater than 50% of the ground surface covered by herbaceous vegetation, or woody vegetation less than 3.2' tall. PEM wetlands were dominated by reed canary grass, common reed (*Phragmites australis*), sedge species (*Carex* spp.), narrow-leaf cattail (*Typha angustifolia*), water lily (*Nymphaea* spp.), and coontail (*Ceratophyllum demersum*). Approximately 324 acres of wetlands were delineated as PEM and include: A, C, J, M, N, R, W, Z, AA, CC, DD, EE, FF, II, WW, XX, YY, ZZ, the south canal, and fringes around open waters H and U (Figure 2.4-19). Wetlands delineated as PEM span a range of periodically inundated wet meadows to deep water marsh systems. Due to the well-developed stands of invasive plants including common reed and reed canary grass, vegetation diversity was relatively low in PEM wetlands. There is significant build up of plant duff in PEM wetlands primarily from large, persistent stands of common reed.

Open water habitat is characterized by inundation to a depth greater than 4 feet with no emergent vegetation present. Several open water habitats are located within the delineation boundary. Some open water habitats were delineated with an aerial photograph. Most open water habitats are not flagged and do not have data points within their boundaries. There are approximately 45 acres of open water habitat (not including open water areas in Lake Erie) within the site property(Figure 2.4-19).

With the exception of a few wetlands isolated by berms or roads, the majority of wetland communities at the Fermi property are hydrologically connected and thus, for the purposes of the functions-values assessment, considered one wetland system. A functions-values assessment was completed for woody (PFO and PSS) and non-woody (PEM) wetland communities to provide distinctions in functions and values where necessary to complete an overall assessment for the wetland system at the Fermi property. The principal functions of the wetland system include floodflow alteration, sediment/toxicant retention, nutrient removal and fish and wildlife habitat. Additional functions and values this wetland system is suitable to provide, though not considered principal functions, are production export, sediment/shoreline stabilization, uniqueness/heritage and endangered species habitat. The wetland system was not considered well suited for groundwater recharge/discharge, recreation, educational/scientific value, or visual quality/aesthetics.

Floodflow alteration, sediment/toxicant retention and nutrient removal: The Fermi property's wetland complex is large relative to the watershed, relatively flat with storage potential and contains hydric soils and dense vegetation suitable to absorb and slow water flow. The wetland system is highly suitable to reduce flood damage by retaining and gradually releasing floodwater following precipitation events. Fermi 2, including cooling towers and control centers, is located downstream and in the floodplain of the wetland system. In the event of a large storm that results in floodflow from the watershed and excess water backing in from Lake Erie, the wetland system could slow and detain floodwaters for gradual release. The wetland system is highly suitable for trapping sediments, toxicants and pathogens as well as nutrient retention. There are potential sources of excess sediment, toxins, and nutrients upstream in the agriculturally dominated watershed. The Clean Water Act status for the Monroe County portion of the Ottawa-Stony watershed cites excessive nutrient levels as a documented impairment in waterbodies (Reference 2.4-94). There is opportunity for sediment trapping and nutrient uptake in diffuse, slow moving and deepwater areas of the Fermi property wetlands that are edged or interspersed with dense herbaceous and woody vegetation.

Fish and wildlife habitat: The deepwater PEM of the Fermi wetland system is suitable to support fish habitat. There is an abundance of cover objects, the wetland is large and part of a larger, persistent, contiguous watercourse with slow velocity. The wetlands have sufficient size and depth to retain open water areas during the winter. Direct observation of fish species were observed in the wetland. The diverse wetland communities present across the entire wetland system provide suitable habitat for a significant number of wildlife species. While there has been notable direct and indirect disturbance in all wetlands observed, there remains significant abundance and diversity in habitat cover to support wildlife. With the exception of the buildings and roadways associated with the nuclear plant, the landscape is largely undeveloped with relatively large parcels of vegetated wetlands and uplands. The majority of the wetlands evaluated are connected hydrologically in spite of fragmentation by multiple roadways. The wetland system presents an interspersion of open water areas with dense emergent vegetation grading into shrub dominated and tree dominated communities. Some portions of the wetlands have a high degree of diversity in vegetation structure and species. The Clean Water Act Status Report for the Monroe County portion of the Ottawa-Stony watershed cites loss of aquatic life benefits as the most common impairment of waterbodies in the watershed (Reference 2.4-94).

Detroit River International Wildlife Refuge (DRIWR)

Detroit Edison entered into a cooperative agreement with the USFWS on September 25, 2003, placing portions of the Fermi property into the DRIWR (Reference 2.4-15). Lands on the Fermi property constitute the DRIWR Lagoona Beach Unit and the extent of these is illustrated in Figure 2.4-6. The general public does not have access to this land without the permission of the USFWS and Detroit Edison, since all areas are within the outer fenced area of the facility. The agreement can be cancelled by either party at any time.

Transmission Line Corridor Prairie Planting

The USFWS, ITC*Transmission*, and Detroit Edison cooperatively funded the restoration and planting of a 29 acre prairie area in the on-site transmission corridor along the north side of the existing facility approach road. The restoration was begun in 2005 and completed in 2006. The area is described earlier in Subsection 2.4.1.1 as Grassland: Right-of-Way community and illustrated in Figure 2.4-5. Surveys of the restoration area were conducted in 2005 and 2007 to determine the plant species present in 2005 and 2007.

2.4.1.3 **Habitat Importance**

Forest, shrub, grass and wetland communities on the Fermi property provide habitat to a variety of wildlife. However, there are no unique attributes of the Fermi site and vicinity as habitats to the important species described in Subsection 2.4.1.2, as compared with the habitats of these species across their entire range.

2.4.1.4 **Disease Vectors and Pests**

No unusual disease vectors or pest species were listed for the site and none were identified by federal or state agencies. Mosquitoes and ticks are in the area that could be carriers of West Nile disease and Lyme disease, respectively.

The emerald ash borer (EAB) (*Agrilus planipennis*), is an exotic beetle discovered in southeastern Michigan near Detroit in the summer of 2002. It probably arrived in the United States on solid wood packing material carried in cargo ships or airplanes originating in its native Asia. Because ash trees (*Fraxinus* spp.) in North America have no immunity to the insect, EAB has the potential to wipe out more than 700 million ash trees in Michigan. Since 2002, it has killed more than 10 million ash trees in southeastern Michigan alone. State and federal agencies in Michigan, and researchers in Michigan universities, are working to stop EAB from spreading. This includes the initiation of quarantines to stop the movement of infested ash wood and wood products, research to understand the pest's life cycle and what methods and strategies can control or eradicate it, and development of educational and informational materials to help communities detect and deal with EAB infestations. Michigan now requires that any re-forestation efforts exclude ash from species planted. (Reference 2.4-16)

Dutch elm disease first entered Michigan about 1950. This disease probably accounts for the lack of large specimens on the site and the remains of old, fallen specimens (Reference 2.4-3).

2.4.1.5 **Wildlife Travel Areas**

The entire land portion of the study area is surrounded by an eight-foot tall chain-linked fence topped in most places with barbed wire. As such, wildlife movement to and from the site is severely restricted for larger mammals. Entry by way of water routes through the lagoons or from Lake Erie are the only available option for larger wildlife. Onsite wildlife can move freely around woodlots and shrub areas but roadways and transmission corridors fragment the area and may create barriers for some species.

The site lies within the Atlantic Flyway for migrating birds. Woodlots provide forested resting areas. For water birds, the lagoons, wetlands, and lakes provide resting and foraging areas.

2.4.1.6 **Existing Natural and Man-Made Ecological Effects**

While portions of the Fermi site consist of a mosaic of forest, shrub and grassland, the area is fragmented by roads and other development (e.g., the shooting range). Portions of the site, described in Subsection 2.4.1.1, were once cleared and or covered by fill materials. Some of the forested areas, such as those along the southern edge of the property, have experienced logging in the past. The south lagoon contains large deposits of dredged and other fill materials. These activities have degraded the habitat value of essentially all the plant communities on the property. While there is no adequate quantitative data available with which to compare today’s conditions, this disturbance suggests a diminished habitat for wildlife. With regard to certain wildlife, the area is completely fenced, which restricts movement and habitat use.

The existing hyperbolic cooling towers (approximately 400 feet tall) may have a small impact on avian wildlife in the area. Avian collisions are not monitored by Detroit Edison, but deceased birds are occasionally found around the towers. Typically only a few birds are observed at any one time, but on one occasion in September 1973, 15 dead birds were found (with as many as 50 potentially killed) at the Fermi 2 south cooling tower. More recently, 45 dead birds were found at the Fermi 2 south cooling tower; occuring during a one-week period during October 2007.

Noise can be a deterrent to wildlife when it is abrupt and irregular. However, most wildlife tends to adapt to constant noise and this appears to be the case at Fermi. For example, song birds, wading birds, and waterfowl were always observed in the north lagoon immediately west of the cooling towers, an area which has one of the highest outdoor noise levels on the site. In addition, it is not unusual to observe groups of turkey vultures soaring above the cooling towers.

2.4.1.7 **Ongoing Ecological and Biological Studies**

Other than the terrestrial site reconnaissance conducted in 2007 and 2008, and the detailed terrestrial surveys conducted in 2008 and 2009, no formal monitoring of the terrestrial environment has been conducted on the Fermi site since the construction of Fermi 2. The only recent study is that of the Detroit Edison/NAWCA transmission right-of-way prairie planting that was surveyed for plant species occurrences in 2005 and 2007.

2.4.1.8 **Regulatory Consultation**

The USFWS and MDNR were consulted for information on known occurrences of federal and state listed protected species and habitats. The identification and discussion of important species above was based in part on the information provided by these consultations.

2.4.1.9 **Transmission Corridors and Offsite Areas**

The offsite 345 kV transmission system and associated corridors are exclusively owned and operated by ITC*Transmission*. The Applicant has no control over the design of the transmission system. Accordingly, the terrestrial ecology that interfaces with the offsite transmission corridors is based on publicly available information, and reasonable expectations of the configurations that ITC*Transmission* would likely follow based on standard industry practice. However, the information described in this subsection does not imply commitments made by ITC*Transmission* or Detroit Edison, unless specifically noted. The discussion within this subsection pertains only to the offsite transmission corridor.

The offsite transmission system will consist of three 345 kV lines running from the Fermi site north, then west to the Milan Substation, located approximately 1.5 miles northwest of Milan, a distance of about 29.4 miles. The route is located in portions of Monroe, Wayne and Washtenaw counties and is illustrated in Figure 2.2-3. The three 345 kV lines for Fermi 3 will run in a common corridor, with transmission lines for Fermi 2, to a point just east of I-75. From the intersection of this Fermi site corridor and I-75, the three Fermi-Milan lines will run west and north for approximately 12 miles in a corridor shared with other non-Fermi lines within an assumed 300-foot wide right-of way (ROW) in which the vegetation has been managed to exclude tall woody vegetation. In this section of the route, reconfiguration of existing conductors would allow for the use of existing transmission infrastructure to create the new lines. In Wayne County, where Arkona Road and Haggerty Road intersect, all non-Fermi lines turn north and continue on to their respective destinations and the three Fermi-Milan lines will continue west for approximately 10.8 miles to the Milan Substation. To accommodate the new transmission lines, it is assumed the Milan Substation may be expanded from its current size of 350 by 500 feet to an area approximately 1,000 by 1,000 feet, utilizing maintained grassed areas and cropland.

2.4.1.9.1 **Vegetation**

Major vegetation types occurring in and adjacent to the transmission corridor are illustrated in Figure 2.2-3. The plant communities found in and along the corridor are similar to those described in Subsection 2.4.1.1.1. Table 2.4-17 provides an accounting of the area of each land use/vegetation type found within the corridor, using a 300-foot width.

The eatern section of the corridor is dominated by cropland, including the areas beneath the existing transmission lines. Non-cropland areas are generally pasture, open developed space and emergent wetlands. No forested areas are present within the corridor in this section as normal maintenance includes the removal of large woody species. The corridor passes only a few small forested areas. Emergent wetlands and other waters crossed by the existing lines are generally narrow. None of the existing towers are located in wetlands, with the exception of one set of towers at Stony Creek (north of Stony Creek Road), where the crossing is in excess of 1,300 feet, one set of towers is located in the wetland. Further discussion of wetlands is found in Subsection 2.4.1.9.4.

The western section of the transmission corridor is dominated by a mosaic of pastures, forest, shrubs or scrub, cultivated, and developed land. Corridor maintenance in this section is minimal, since no towers or lines are present. Wetlands are present and three are in excess of 900 feet in length, where it is expected a tower may need to be placed.

The Milan Substation site is located entirely in an area of cropland and planted grassland.

2.4.1.9.2 **Wildlife**

The diversity of wildlife found along the new transmission route is expected to be similar to that found on and in the vicinity of the Fermi property as described in Subsection 2.4.1.1.2, since the habitats in and along the ROW are representative of the areas on the Fermi property. The exception is the lack of lake shore habitat along the ROW, that is present at Fermi. Certain birds in particular, such as the bald eagle, are less likely to be found along the new transmission route than they are on the Fermi property because of the proximity of Fermi to the coastline of Lake Erie.

2.4.1.9.3 **Important Species**

Important species potentially occurring along the new transmission route are the same as those described in Subsection 2.4.1.2. Based on information obtained from the USFWS and MDNR, there are currently no reported occurrences of Michigan or Federal important species or designated critical habitat along the route.

2.4.1.9.4 **Important Habitats**

NUREG-1555 defines 'important habitats' as including wildlife sanctuaries, refuges or preserves, wetlands, floodplains, and areas identified as critical habitat for protected species identified by the USFWS. With the exception of wetlands, none of these features are known to occur within the assumed 300-foot ROW of the transmission corridor or immediately adjacent to the ROW.

The new transmission route crosses about 30 wetlands or other waters that may be regulated by the USACE and MDEQ, according to USFWS National Wetland Inventory mapping (Reference 2.4-48). The western 10.8-mile section of the route crosses 8 wetlands and 9 drains or narrow streams (Figure 2.4-18). The majority of the wetlands are 100 to 400 feet long but 3 wetlands are much longer at 1,302 feet, 903 feet, and 1,339 feet (Figure 2.2-3). Since the upper limit of spans between transmission structures is typically 900 feet, it is anticipated that construction of this undeveloped section of corridor will require the placement of one tower or pole within each of these wetlands. The wetlands present include woody and emergent herbaceous community types.

The 18.6-mile eastern section of the route crosses 2 wetlands and 12 narrow drains or small streams. The existing lines span all of these wetlands, with the exception of a 1,386 long wetland crossing at Stony Creek, where one set of towers is currently located.

2.4.1.9.5 **Existing Stresses**

The 18.6-mile eastern section of the ROW is located in a region dominated by crop and pasture land, or other land uses resulting from development. This coupled with ROW maintenance including the removal of undesirable vegetation by mechanical means and herbicides imposes a substantial level of existing stress on the existing terrestrial resources. In the western portion of the ROW, these stresses appear to be less intense. Although large woody vegetation is not allowed to grow in the ROW that is owned by ITC*Transmission*, privately held adjacent areas may be impacted by construction as these areas do support woody vegetation. Other areas of this ROW section support herbaceous plant communities, however, rural residences are common and cropland is scattered throughout the section.

Disease vectors and pests are the same as those discussed in Subsection 2.4.1.4

2.4.1.9.6 **Regulatory Consultation**

The USFWS and MDNR were consulted for information on known occurrences of federal and state listed protected species on the Fermi property and in the project vicinity for a radius of 7.5 miles around the facility. Although no regulatory contact has occurred for the more western portion of the transmission route, Federal and State web sites have been consulted. As the transmission system design is formalized, it is expected that agency contacts will be initiated by ITC*Transmission* to ensure the protection of terrestrial resources.

2.4.2 **Aquatic Ecology**

The Fermi site is located within a coastal wetland ecosystem near Newport (Frenchtown Township) in Monroe County, Michigan. The Fermi site consists of 1260 acres of developed and undeveloped land on the shoreline of the western basin of Lake Erie between Swan Creek and Stony Creek (see Figure 2.4-7 and Figure 2.4-8). Approximately 656 acres of this land is designated as a portion of the DRIWR. Coastal wetlands are common to areas surrounding the Great Lakes. Great Lakes coastal wetland systems contain morphological components of both riverine and lacustrine systems, and can be described as “freshwater estuaries.” Such freshwater estuaries are formed at river mouths drowned by the postglacial rise in lake level, and are influenced by both the lake level and riverine inflows (Reference 2.4-17).

Aquatic habitats onsite and in the vicinity of the Fermi site with the potential to be impacted by the construction and operation of Fermi 3 include:

- Man-made circulating water reservoir, canals, and drainage ditches,
- Quarry lakes and other waters and wetlands within the DRIWR,
- Lake Erie and its associated bays,
- Swan Creek, and
- Stony Creek.

Surface-water drainage at the Fermi site is influenced by Swan Creek, Lake Erie, and the waters associated with the surrounding DRIWR including the coastal wetlands and lowlands (Reference 2.4-77 and Reference 2.4-78). Section 2.3 provides a more detailed discussion of the hydrology, water use, and water quality of onsite water bodies.

The following provides a discussion of the primary aquatic habitats associated with the Fermi site. Information presented in the following sections is supported by current and historic site information, area specific literature, and both academic and industry-generated data summaries of the relative aquatic populations. In addition to using existing data sources, Detroit Edison performed a confirmatory updated aquatic ecological survey of the site that provides a year’s worth of seasonal sampling data to reflect variations in aquatic populations (Reference 2.4-97).

2.4.2.1 **Key Data Source Review**

A number of state agencies, federal agencies, and universities were contacted or otherwise utilized in the review of the data currently available for assessing the aquatic ecology of the area. Each entity and a brief description of its relevance to the proposed project are listed below:

- Michigan Department of Environmental Quality (MDEQ) – The MDEQ oversees implementation of environmental quality regulations. The MDEQ includes state and federal government resource managers as well as advisory boards in Michigan. The MDEQ issues annual environmental reports on water and air quality and pollution prevention (Reference 2.4-26).
- Michigan Department of Natural Resources (MDNR) – The MDNR is responsible for the stewardship of Michigan’s natural resources and management of outdoor recreational programs. The MDNR promotes diverse recreational outdoor opportunities, wildlife and

fisheries management, forest management, state lands and minerals, state parks and recreation areas, and conservation, and law enforcement (Reference 2.4-27).

- Ohio Department of Natural Resources (ODNR) – The ODNR Division of Wildlife contains two Lake Erie Fisheries Units that assess and manage fish populations and fisheries in Lake Erie's Western and Central basins and their tributary streams. Using research vessels, these units monitor the food web and the spread of exotic species in the lake, as well as the abundance, growth, age, diet, and health of fish populations (Reference 2.4-28).
- United States Environmental Protection Agency (EPA) – The EPA manages implementation of federal laws to protect the environment. The EPA focuses on many aspects of the environment including air, water, soils, compliance, research, and control (Reference 2.4-34).
- United States Fish and Wildlife Service (USFWS) –The USFWS enforces federal wildlife laws, protects endangered species, restores significant fisheries, and helps foreign governments with international conservation efforts, while providing public education and promoting environmental stewardship (Reference 2.4-75).
- Universities in the area of western Lake Erie – The University of Michigan, Michigan State University and the University of Toledo employ many professors and research associates with intimate knowledge of the aquatic ecology of western Lake Erie and its tributary waters in Michigan and Ohio. Select faculty members of each university also serve as directors or members of other organizations such as Michigan Sea Grant, the Institute of Fisheries Research for MDNR, and the Lake Erie Center.

2.4.2.2 **Aquatic Communities**

The aquatic communities located on the Fermi site as well as in the vicinity contribute to a healthy ecosystem. These habitats include lakes, creeks, drainages, canals, as well as coastal wetlands. These aquatic habitats are discussed in greater detail in the following sections.

2.4.2.2.1 **Onsite Principal Aquatic Habitats**

The following are onsite aquatic habitats located within the Fermi site:

- Circulating water reservoir (heat dissipation system);
- Overflow and Discharge Canals;
- Drainage ditches:
- Quarry lakes; and
- Waters within the DRIWR

An important aquatic habitat is defined in NUREG-1555 as wildlife sanctuaries, refuges, or preserves; habitats identified by State and Federal agencies as unique, rare, or of priority for protection if they may be adversely affected by plant or transmission line construction or operation. Wetlands, floodplain, or other resources specifically protected by Federal regulations or Executive order, or by State regulations. Land areas identified as "critical habitat" for species listed as threatened and endangered by the USFWS. The only important aquatic habitat identified is the DRIWR.

Circulating Water Reservoir (cooling water pond, circulation pond)

The circulating water reservoir, a component of the heat dissipation system associated with the operation of Fermi 2, provides the cooling water for the circulating water system. The circulating water reservoir is located east of the Fermi 2 cooling towers on the northern portion of the Fermi site. The man-made reservoir is approximately 20 feet in depth and is clay lined. The circulating water reservoir is chemically treated to inhibit excessive growth of vegetation and production of aquatic organisms; however, some benthic species and aquatic vegetation do occur in the reservoir.

Overflow and Discharge Canals

One clay-lined canal, approximately 5 to 10 feet in depth and 70 feet in width, originates in the central portion of the Fermi site and extends north where it flows into Swan Creek. This canal is termed the overflow canal. The overflow canal was previously utilized as a cooling water discharge/overflow canal for operation of Fermi 1, but was taken out of use when Fermi 1 was temporarily shut down in the mid-1960s. Currently, the Fermi site utilizes the canal as Outfall 009. The outfall and discharge points of the Fermi site are further discussed in Subsection 2.3.3. A second canal (discharge canal), approximately 5 to 10 feet in depth and 70 feet in width, originates in the central portion of the Fermi site and extends south where it flows into the South Lagoon. This canal serves as a drain path for the western wetlands area. Between the two canals is a stagnant waterbody.

Drainage Ditches

Several ditches located throughout the Fermi site drain surface-water runoff to Swan Creek and the adjacent wetlands. The drainage ditches are regularly maintained and equipped with concrete culverts to divert runoff from the surface roads. The ditches are not ideal to support any significant aquatic species.

Quarry Lakes

The Quarry Lakes are located in the southwestern portion of the Fermi site. The two lakes are approximately 50 feet deep. The Quarry Lakes were created when water filled the abandoned rock quarries which were used for site development and construction of Fermi 2 (Reference 2.4-79). Although the Quarry Lakes are currently not utilized for any recreational or commercial use, they have been used in the past for scuba diving and recreational fishing by plant personnel.

Waters within the DRIWR

The DRIWR is a conservation area along the western basin of Lake Erie and along the Detroit River. The boundaries of the refuge are segmented into eleven units which include coastal wetlands, marshes, islands, shoals, and waterfront lands along approximately 48 miles of the western Lake Erie shoreline (Figure 2.4-7).

The Lagoona Beach Unit of the DRIWR surrounds the Fermi site on the northern, western, and southern borders of the Fermi site. Detroit Edison and the USFWS signed a cooperative agreement in 2003. The Lagoona Beach Unit includes approximately 656 acres of land and is divided into four sections, DRIWR-1 through DRIWR-4 shown on Figure 2.4-7. DRIWR-1, located in the north-northeast portion of the Fermi site, contains approximately 162 acres of land and consists primarily of coastal wetlands and palustrine systems, including freshwater emergent wetlands and lake areas that are semi-permanently flooded. DRIWR-2, located in the northwest portion of the Fermi site, includes approximately 161 acres of coastal wetlands, upland forests, wet meadows, and coastal prairies, with palustrine scrub-shrub systems consisting of broad-leaved deciduous vegetation. The area is seasonally inundated. DRIWR-3, the southwest section, encompasses approximately 22 acres of upland forest and palustrine forested land with broad-leaved deciduous vegetation. The area is seasonally inundated and/or partially drained at various times during the year. DRIWR-4 is located in the south-southeast portion of the Fermi site. This section includes approximately 311 acres of coastal wetland and upland forest comprised of palustrine forested seasonally inundated areas, as well as seasonally flooded palustrine emergent areas (Reference 2.4-48, Reference 2.4-73, and Reference 2.4-74).

Wetland habitats along the shoreline of Lake Erie are essential to aquatic species because of the spawning and feeding grounds they can provide as well as the ideal habitat they provide for hydrophytic vegetation (Reference 2.4-42). Factors known to influence the distribution of aquatic species within the DRIWR on the Fermi site include water quality and plant operations. Water quality on the Fermi site is further discussed in Subsection 2.3.3. Aquatic plant species observed during a September 2007 site visit included American lotus, floating duckweed, and the common reed. A fisheries survey of coastal marshes within the DRIWR documented species composition and richness comparable to other Lake Erie coastal habitats. Aquatic communities of the DRIWR are described in further detail in Subsection 2.4.2.2.1.2.

American lotus was observed during the site visit in areas associated with the DRIWR and Swan Creek. American lotus is a hydrophilic plant listed as a threatened species in the State of Michigan. Because its roots require soil, the American lotus is being treated as a terrestrial species and addressed in detail in Subsection 2.4.1.

2.4.2.2.1.1 **Principal Aquatic Species in Circulating Water Reservoir, Overflow and Discharge Canals, and Drainage Ditches**

Aquatic species that occur in the circulating water reservoir, overflow and discharge canals, and drainage ditches on the Fermi site are expected to be representative of typical Great Lakes coastal ecosystems and species. Aquatic vegetation including the common reed (*Phragmites australis*) were observed fringing the banks of the overflow and discharge canals during a September 2007 site visit. Despite the lack of other aquatic species observed in the overflow and discharge canals, the potential exists for aquatic species present in Swan Creek and the South Lagoon to also inhabit the canals due to the hydrological connectivity of the water bodies. The onsite drainage ditches are not expected to serve as habitat for aquatic species as they only carry surface runoff water during rainfall events and are routinely maintained.

An “important” aquatic species is defined in NUREG-1555 as listed threatened or endangered species or species of concern (State and/or Federal); proposed for listing as threatened or endangered species, or is a candidate for listing in the most current list of such species as published by the *Federal Register*; a commercially or recreationally valuable species; species that are essential to the maintenance and survival of species that are rare and commercially or recreationally valuable; species that are critical to the structure and function of the local aquatic ecosystem; and species that may serve as biological indicators to monitor the effects of the facilities on the aquatic environment. In summary, there are no known important aquatic species within the circulating water reservoir, overflow and discharge canals, and drainage ditches.

2.4.2.2.1.2 **Principal Aquatic Species in Quarry Lakes and Waters of the Lagoona Beach Unit of the DRIWR**

The Quarry Lakes support a small variety of aquatic species common to the Great Lakes coastal marsh. Historical recreational fishing catch was not recorded, but carp (*Cyprinidae* spp.) and sunfish (*Centrarchidae* spp.) species are known to occur within the lakes. In addition to fish, common reeds (*Phragmites australis*) and panic grasses (*Panicum* spp.) were among the species of aquatic vegetation observed along the banks during the September 2007 site visit. Both migratory and non-migratory birds are known to utilize the quarry lakes habitat as well.

A fisheries survey of coastal marshes within the DRIWR was conducted in September of 2005 as a joint venture by the MDNR and USFWS to document fish communities associated with Michigan waters of Lake Erie and to inventory the fisheries resources of the refuge. This survey utilized electrofishing and seining to sample four marsh complexes within the refuge, one of which was the Swan Creek Estuary/Lagoona Beach Unit located in the area of the Fermi site. A total of 38 species of fish from 13 families were collected at this sampling site. Species most well represented in the catch included gizzard shad (*Dorosoma cepedianum*), bluntnose minnow (*Pimephales notatus*), mimic shiner (*Notropis volucellus*), bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), goldfish (*Carassius auratus*), and largemouth bass (*Micropterus salmoides*).

A general habitat survey conducted by the Wildlife Habitat Council (WHC) in July of 2000 identified 21 species of wildlife and 28 species of plants (Table 2.4-6). No important aquatic species were identified during the habitat survey.

Aquatic plant species observed during the September 2007 site visit include duckweed (*Lemna* spp.) and common reed (*Phragmites australis*). These species provide a significant amount of spatial coverage for most of the DRIWR within the Fermi site.

In summary, there are no known important aquatic species in the Quarry Lakes and waters within the Lagoona Beach unit of the DRIWR.

2.4.2.2.2 **Principal Aquatic Habitats in the Vicinity of the Fermi Site**

The following provides a list and detail of aquatic habitats in the vicinity of the Fermi site:

- Lake Erie western basin

- Swan Creek
- Stony Creek

None of the above aquatic habitats are characterized as important aquatic habitats per the criteria of NUREG-1555.

Lake Erie

Lake Erie is one of the five lakes included in the Great Lakes system and is the smallest of the group in volume (116 cubic miles). Measuring 241 miles across and 57 miles from north to south, Lake Erie's surface area is nearly 10,000 square miles, with 871 miles of shoreline. The average depth of Lake Erie is approximately 62 feet (210 feet at its maximum depth) (Reference 2.4-38).

Lake Erie is divided into three basins; the eastern basin, the central basin, and the western basin. Because the Fermi site is located on the shoreline of the western basin, this portion of Lake Erie is of the greatest concern. The western basin receives 95 percent of the drainage water entering Lake Erie, including five major river drainages (Maumee River, River Raisin, Rouge River, Huron River, and Detroit River) as well as numerous streams that discharge directly into the western basin. Depth generally increases from west to east in Lake Erie. The western basin is the shallowest basin in the lake, averaging approximately 24 feet in depth. Soil deposits beneath the west end of the lake consist primarily of sand, with intermittent layers of gravel and clay (Reference 2.4-77, Reference 2.4-78, and Reference 2.4-79). While thermal stratification is a frequent and persistent problem during summer months for the central basin, stratification events occur less frequently in the western basin, although the waters have been shown to exhibit diel patterns of afternoon stratification followed by mixing at night.

Water levels in Lake Erie fluctuate in response to seasonal precipitation variations. The most significant lake level variations are observed at the western and eastern basins of the lake. During prolonged high southwesterly winds, Lake Erie is subject to surges when water from the western basin is pushed to the eastern basin resulting in surges greater than 7 feet. Lake Erie also experiences seiches in response to such surges. A seiche is a periodic oscillation of water level set in motion by an atmospheric disturbance passing over the lake. Major shifts in winds, a significant front, or high or low pressure weather systems can initiate a seiche event. Seiche events can cause flooding in low-lying areas of the eastern basin and cause already shallow bay areas of the western basin to become emergent sand flats (Reference 2.4-24).

The drainage basin of Lake Erie includes portions of Indiana, Michigan, Ohio, Pennsylvania, New York and Ontario and is the most densely populated of the five lake basins. The fertile soils associated with the Lake Erie watershed support intense agricultural production throughout the entire drainage basin. This greater urbanization and agricultural development, as well as its smaller volume, make the Lake Erie system more susceptible to external ecological stressors than the other Great Lakes. This became apparent in the latter half of last century after decades of cultural eutrophication and toxic contamination caused severe degradation of the system. By the 1980s, positive recovery of Lake Erie's water quality was observed due to implementation of remediation plans through the National Pollutant Discharge Elimination System (NPDES). In addition to pollution abatement programs, colonization of Lake Erie by invasive zebra mussels (Driessena polymorpha) has helped return the lake to more mesotrophic conditions.

The overall health of the Lake Erie western basin is determined by observing indicator organisms. The resurgence of the mayfly is discussed in Subsection 2.4.2.5. The recent documentation of lake sturgeon and spawning lake whitefish in the Detroit River (located approximately ten miles northeast of the Fermi site) and the observation of birds of prey are also indicators that the overall health of Lake Erie is favorable, and has improved over the last 10 years. However, some sources state that the presence of toxic algal blooms, hypoxic zones, and contaminated sediments is going to prolong the recovery period of Lake Erie, especially in the central and eastern basins. Improvement measures currently being evaluated include remediating contaminated hot spots, reducing greenhouse gases, preventing the introduction of invasive aquatic species, and protecting high quality habitats (Reference 2.4-68).

Conditions in Lake Erie have been improving. Hexagenia spp. mayfly nymphs returned to sediments of western Lake Erie in 1992 to 1993 after an absence of 40 years. Their recovery was aided by pollution-abatement programs combined with the invasion of exotic zebra mussels in 1986 that changed the trophic status of nearshore waters of the Great Lakes (Reference 2.4-32). Further information discussing the mayfly is available in Appendix 2A.

Swan Creek

Swan Creek is located approximately half a mile north of the Fermi site. It originates approximately 12 miles to the northwest of the Fermi site as small streams and then flows south and east where it enters Lake Erie. Land use adjacent to the Swan Creek drainage includes small residential communities and agricultural development.

The benthic habitat associated with Swan Creek consists of sandy sediment interspersed with small pockets of gravel and flat stone. Swan Creek is a shallow waterway (averaging three feet in depth) that is mainly used for recreation, with residential developments and recreational parks bordering the majority of its banks.

The shoreline of Swan Creek, near the Fermi site, is heavily vegetated with aquatic plants such as cattails (*Typha latifolia*) and common reed (*Phragmites australis*). The common reed is an invasive aquatic plant species, and is further discussed in Subsection 2.4.2.6.

Stony Creek

Stony Creek is located approximately 2.6 miles southwest of the Fermi site, and drains directly into the western basin of Lake Erie. Stony Creek is approximately 35 miles long, and is supported by many more miles of smaller tributaries which comprise the Stony Creek Watershed and the larger Ottawa-Stony Creek Watershed. The creek bed is mostly comprised of rock, and the banks are heavily forested or adjacent to agricultural and residential development.

The Ottawa-Stony Creek Watershed includes a land area of approximately 114,000 acres, is approximately 32 miles long, and is approximately 8 miles wide at its widest point. The upper portion of the watershed is well developed and utilized by residential, commercial, and industrial sectors. The lower portion of the watershed has been developed mainly for agricultural use, although some residential areas have been developed as well (Reference 2.4-25 and Reference 2.4-44).

Some biological data have been collected from Stony Creek and its many tributaries. The Stony Creek Watershed Project has performed studies focusing on water quality, nutrients, and indicator species. The majority of the data from these studies were not collected near the Fermi site; however, these data were reviewed and are further discussed in Subsection 2.4.2.2.2.3.

2.4.2.2.2.1 **Principal Aquatic Species in Lake Erie**

Plankton

Plankton are small plants or animals that float, drift, or weakly swim in the water column of any body of water. Studies of zooplankton and phytoplankton communities (the animal and plant components of plankton, respectively) of the western basin of Lake Erie extend back to the late nineteenth and early twentieth centuries.

Because they respond quickly to changes in nutrient input to Lake Erie, phytoplankton and zooplankton are important indicators of change in nutrient pollution (Reference 2.4-32). The Planktonic Index of Biotic Integrity (P-IBI) was developed to measure the biological health and diversity of Lake Eire. This indicator is based on the abundance of plankton, which in turn indicates the lake's productivity. Because of the importance of plankton to the Lake Erie ecosystem, recent studies have focused on the phytoplankton biomass abundance associated with seasonal variations, depth, and overall health of Lake Erie.

Phytoplankton studies conducted in the 1980s and the 1990s in nearshore waters of the western basin have demonstrated that plankton biomass fluctuates seasonally, with highest overall general phytoplankton densities occurring in the spring (Figure 2.4-9). The species documented in greatest abundance were diatoms (*Bacillariophyceae* spp.) and green algae (*Chlorophyceae* spp.). These species both exhibited peak abundance in the summer and fall months. A total of 53 taxa were identified (Table 2.4-7). Phytoplankton density varies spatially throughout the western basin, with increased phytoplankton abundance along the entire southern shore and decreased abundance offshore and throughout deeper waters (Figure 2.4-10). Phytoplankton tend to favor shallower water conditions due to increased light available in the shallow water column.

Seasonal zooplankton sampling has been conducted near the Davis Besse Power Station, located 25 miles south of the Fermi site on the western basin. Oblique tows identified 43 different species of zooplankton, with rotifers being the dominant species (Table 2.4-8). Vertical tow data collected in the mid- to late-1980s identified 118 zooplankton species and 53 genera, with rotifers dominating the biomass (Figure 2.4-11).

Two species of zooplankton, the spiny water flea (*Bythotrephes* spp.) and the fishhook water flea (*Cercopagis pengoi*), are considered invasive species throughout Lake Erie, and are further discussed in Subsection 2.4.2.6.

Benthic Invertebrates

Benthic species inhabit the bottom of aquatic environments and serve as valuable indicators of the surrounding ecosystem. Benthic species include epifauna, which live on the surface, and infauna, which burrow into seafloor sediment. Benthic epifauna include species such as mussels, scallops, snails, crabs, and crayfish. Examples of infauna include clams and many species of worms (Reference 2.4-17).

Many studies have been conducted focusing on benthic organisms and communities. Benthic communities are important to the lake's ecosystem for several reasons. They serve as food sources for many aquatic species, are significant indicators of water quality, aid in protection of the shoreline, and provide spawning and nursery grounds for many aquatic species.

Populations of benthic invertebrates south of the mouth of the Detroit River are lowest in nearshore areas, likely due to lack of appropriate habitat. Benthic data collected in studies conducted in the late 1970s in the western basin of Lake Erie identified 25 taxa (Table 2.4-9), with annelids dominating the samples (Figure 2.4-12). Benthic trawl data collected in 2006, taken near the southern shore of the western basin, identified 11 taxa, with mussels (*Dreissena* spp.) comprising the largest portion of the sample (Figure 2.4-13).

A 1998 benthos survey was conducted by the EPA's Great Lakes National Program Office (GLNPO) for western Lake Erie. Sediment composition at the sampling sites was dominated by silt, with smaller components of clay and fine sand. Major benthic groups represented from sampling were aquatic worms (*Oligocheata* spp.), midges (*Chironomidae* spp.), and freshwater bivalves (*Sphaeriidae* spp.) (Reference 2.4-33).

Lake Erie was one of the first water bodies to be colonized by invasive zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena rostriformis bugensis)* in the late 1980s. The zebra mussels have caused extensive economic and environmental impacts to Lake Erie as well as many other freshwater systems in the U.S. Many power plants, including Fermi 2, have implemented control programs specifically to address the zebra mussel. Native mussel species have also been affected by the decrease of natural habitat and food sources due to the introduction of the zebra mussel (Reference 2.4-40 and Reference 2.4-76). These species are considered invasive nuisance species and are further discussed in Subsection 2.4.2.6.

Fish

The improving overall health of Lake Erie has been contributing to a healthy fish population, including the presence of important sport and commercial fish species such as walleye and yellow perch, as well as an increased abundance of common species such as bluegill and white perch. Extensive research has been conducted on the Lake Erie fishery, focusing on seasonal abundance and distribution. Impingement rate data from Fermi 2 and Davis-Besse power stations have also been recorded.

Ichthyoplankton entrainment data collected from western Lake Erie identified 19 taxa, and 1 unidentified taxa, comprising 12 families of bony fish (Osteoichthyes spp.) (Table 2.4-10). Dominant families identified in the ichthyoplankton entrainment samples included drums (Sciaenidae spp.), herrings (Clupeidae spp.), minnows (Cyprinidae spp.), and perch (Percidae spp.). Ichthyoplankton collection data identified the emerald shiner (*Notropis atherinoides*) as the most abundant species (during the spring and summer months) in southwestern Lake Erie followed by yellow perch (*Perca flavescens*) and gizzard shad (*Dorosoma cepedianum*). Larval abundance of walleye (*Sander vitreus*), an important recreational fish, increased during the late 1970s. This increase could be due to several factors including increase in adult fish population and improvement in water quality.

Impingement data collected from Davis Besse Power Plant south of the Fermi site indicated that the dominant species impinged was the goldfish (*Cassius auratus*), representing approximately 50 percent of fish documented in impingement samples. Additional impingement data collected from the Bayshore Power Station on Lake Erie, south of the Fermi site, identified 52 species (Table 2.4-11).

Impingement data collected in 1991-1992 from the Fermi 2 Power Plant indicated that the dominant species impinged was the gizzard shad at 71.5 percent of the estimated annual total abundance. White perch was the second most abundant species impinged at 6.8 percent of the annual total. Third, fourth, and fifth species ranked by abundance included the rock bass, freshwater drum, and emerald shiner (Table 2.4-16). The estimated annual impingement at the Fermi 2 Power Plant is 13,699 fish, with a total estimated biomass of 329.7 kgs.

Based on entrainment sampling conducted from October 1991 to September 1992 at the Fermi 2 Power Plant, the annual ichthyoplankton entrainment was estimated to be 2,955,693 (2,883,326 larvae and 72,367 eggs). The most abundant larval fish taxa were Cyrinidae (22.9 percent), *Morone* spp. (20.0 percent), gizzard shad (19.5 percent) Clupeidae (8.8 percent) and white perch (6.2 percent). The most abundant fish egg taxa were Cyprinidae (42.1 percent) and Percidae (22.4 percent).

More detailed species-specific information including spawning areas, nursery grounds, food habits, feeding areas, wintering areas, and migration routes is available in Appendix 2A.

2.4.2.2.2.2 **Principal Aquatic Species in Swan Creek**

Extensive benthic research has not been conducted on Swan Creek; however, some general species surveys have been conducted to determine general fish species abundance. The most common species collected included sunfishes (Centrarchidae spp.) and carps and minnows (Cyprinidae spp.).

A fisheries survey of the Swan Creek estuary was conducted in September of 2005 as a joint venture by the MDNR and USFWS. This survey utilized electrofishing and seining to sample nine sites along Swan Creek ranging from approximately 0.5 to 2.5 miles from the Fermi site. A total of 38 species of fish from 13 families were collected at these sampling sites. Species most well represented in the catch included gizzard shad, bluntnose minnow, mimic shiner (*Notropis volucellus*), bluegill, pumpkinseed, goldfish, and largemouth bass. (Reference 2.4-83)

Swan Creek is a popular recreational water body. Recreational fisheries data, further discussed in Subsection 2.4.2.3, listed several species common to Michigan as frequent catches in Swan Creek, including the northern pike (*Esox lucius*), largemouth bass, and the bluegill.

2.4.2.2.2.3 **Principal Aquatic Species in Stony Creek**

Benthic Invertebrates

A macroinvertebrate survey was conducted in 2004 at several sampling sites along Stony Creek to assess the quality of the water body. The nearest sampling site was located approximately 2.5 miles south-southwest of the Fermi site. Various hydrological parameters were collected in addition to the macroinvertebrate samples. Results from the survey indicated an increase in the number of insect families with respect to previous studies of Stony Creek. There was also an observed increase in mayflies (*Ephemeroptera* spp.), stoneflies (*Plecoptera* spp.), and caddisflies (*Trichoptera* spp.), three sensitive orders of insects that comprise the “EPT index,” a measure of water quality. A higher number of taxa from each of these orders generally indicate higher water quality. The downstream sites (located nearest to the Fermi site) had a higher EPT index than the upstream survey sites. This may indicate a higher overall health of portions of Stony Creek nearest to the Fermi site (Reference 2.4-70).

In 1995 and 1997, species survey data were collected from six stations located along Stony Creek, approximately 10 miles southwest of the Fermi site (Reference 2.4-90 and Reference 2.4-91). Survey data indicated that the most dominant species included isopods and chironomids. Nearly all sample sites lacked taxa diversity and density in groups including EPT species.

Fish

The native fish assemblage of the Ottawa-Stony Creek Watershed is documented to have been historically comprised of 72 species of fish. Only 63 of these species are currently noted in this watershed (Table 2.4-13). Additionally, the benthic invertebrate studies discussed above also collected quantitative fish samples, with twenty three species identified (Table 2.4-12).

2.4.2.3 **Commercial and Recreational Fisheries**

Lake Erie

Commercial Fisheries

Lake Erie supports one of the largest freshwater commercial fisheries in the world, with the majority of commercial fishing based on the Canadian border. Commercial landings are dominated by yellow perch and walleye, as well as the rainbow smelt (*Osmerus mordax*) and white bass (*Morone chrysops*).

Commercial harvest in the Michigan waters of Lake Erie for 2006 included 12 species of fish comprising a total of 664,870 pounds, with an estimated value of $254,992 (Figure 2.4-14). Total catch was dominated by three species: the common carp (57 percent), buffalo (*Ictiobus* spp.) (13 percent), and goldfish (10 percent) accounting for about 80 percent of the total catch by weight.

Other species harvested include channel catfish (*Ictalurus punctatus*), gizzard shad, and lake whitefish (*Coregonus clupeaformis*). This commercial harvesting utilized shoreline seining and small-mesh trap net fishing gear. Michigan fishing harvest in 2006 was approximately 67 percent higher than the mean for the past ten years. However, harvests have been highly variable during this period, ranging from a high of 721,580 pounds to a low of 85,720 pounds (Reference 2.4-72).

Commercial harvest in the Ohio waters of Lake Erie for 2006 included more than 15 species of fish which comprised a total of 3.9 million pounds with an estimated market value of $3.4 million (Figure 2.4-15). Ohio's catch is dominated by five species which comprise approximately 76 percent of the total catch by weight, including the yellow perch, white perch, white bass, freshwater drum (*Aplodinotus grunniens*), and channel catfish. Other important species include the common carp, buffalo, and quillback (*Carpiodes cyprinus*). Gears utilized in Ohio's commercial fishery included trap nets, seines, and trotlines. Ohio's commercial fishing harvest in 2006 was slightly below the mean for the past ten years, and harvests have been fairly steady during this period (Reference 2.4-84).

Recreational Fisheries

Lake Erie is the warmest and most biologically productive of the Great Lakes, producing more fish each year for human consumption than the other four Great Lakes combined. The western basin of Lake Erie is known as the "Walleye Capital of the World," producing more walleye per acre than any other lake globally. Important recreational species include both native and non-native species such as the common carp and the white perch, as well as the rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*).

The non-charter sport harvest of the Michigan waters of Lake Erie for 2006 was estimated at 521,240 fish from onsite creel surveys. Walleye harvest rates were the highest recorded since 1998, while yellow perch harvest rates were their lowest since 1994. Charter-boat anglers harvested 45,701 fish from Lake Erie in 2006. Walleye (73 percent) and yellow perch (26 percent) accounted for 99 percent of the harvest. (See Figure 2.4-16) (Reference 2.4-72).

Non-charter sport boat harvest surveys of the Ohio waters of Lake Erie for 2006 was estimated at 7,262,541 fish. Ohio walleye harvest was the highest recorded since the late 1990s, increasing 255 percent from 2005 to 2006, while yellow perch harvest decreased slightly from 2005 to 2006. Shoreline creel surveys have not yet been tabulated for 2006 as of August 2007. Ohio charter-boat anglers harvested 587,580 fish from Lake Erie in 2006. Walleye (60 percent) and yellow perch (37 percent) accounted for nearly 98 percent of the harvest. The walleye harvest rate increased to the highest level since 1977, and the yellow perch harvest rate increased 19 percent from 2005.

Sport fish landings are managed utilizing state-implemented fishing regulations like the harvest quota system. In the 1990s, walleye fisheries throughout Lake Erie were affected by reduced spawning and resulted in a lower adult abundance. Harvest quotas and fishing regulations became more restrictive because of this reduced adult population. This resulted in a rebound of the adult walleye population and less restrictive current fishing regulations for the walleye.

Regulations such as the catch-and-immediate-release (CIR) season manage the entire state of Michigan bass fishing stocks.

Swan Creek

There are no recognized commercial fisheries operations in Swan Creek; however, this system does support a strong recreational fishery for common game fishes including northern pike, largemouth bass, and bluegill. Portions of the creek located near recreational areas such as public parks receive increased fishing pressure.

Other Waters

There are no recognized commercial or recreational fisheries within the boundaries of Stony Creek, the DRIWR, or other water bodies located at the Fermi site.

Table 2.4-14 provides a list of species and the watershed within the vicinity of the Fermi site in which they are most likely to be encountered. Specific life history information on each of the species listed in the table can be found in Appendix 2A. Life histories presented provide detailed information on any critical life-support requirements such as reproduction, spawning areas, nursery grounds, food habits, feeding areas, wintering areas, and migration routes.

Based on the experience of the effects of Fermi 2 on these species, no adverse effects are anticipated for Fermi 3.

2.4.2.4 **Threatened and Endangered Aquatic Organisms**

The following threatened and endangered (T&E) species discussion focuses on Federal or State listed species in Michigan, Ohio, and Ontario with the potential to be affected by construction and/or operational activities at the Fermi site. Threatened and endangered species lists prepared by the USFWS (federal level), the MDNR (state level), and the Government of Canada were reviewed and those species with potential to be adversely impacted are addressed below. Academic and industry-generated literature was also reviewed for documented and expected T&E species occurrences in the western basin of Lake Erie and other aquatic habitats within and near the Fermi site.

Table 2.4-15 identifies the state and federally listed threatened and endangered species located within a 50-mile radius of the Fermi site. Detailed life history information on each of the species listed in this chart can be found in Appendix 2B. Life histories presented provide detailed information on any critical life-support requirements such as spawning areas, nursery grounds, food habits, feeding areas, wintering areas and migration routes as well as abundance and distribution.

2.4.2.5 **Aquatic Indicator Organisms**

One of the best assessments of water body integrity is the examination of its biological inhabitants. Since biological communities incorporate and reflect the quality of their surroundings, the presence or absence of certain types of organisms can be utilized as an ecological indicator of fluctuating environmental conditions.

Mayflies

Mayflies are thought of as an ecological keystone species[1] and their presence is believed to be an important environmental indicator of mesotrophic (moderately productive) conditions which may have the potential to be affected by changes in the aquatic ecosystem.

Mayflies may be used to measure the restoration success of any adverse impacts that construction or operation may have on the onsite or area water bodies, and to get an idea of the overall water quality in Lake Erie's western basin, because enough data are being collected to establish a reliable set of biological reference points. In 2003, a three-year running average of mayfly nymphs per square meter was equal to a rating of "excellent" under the EPA biological reference point scoring system. The rating for the mayfly species between 1996 and 2004 in Lake Erie ranged from good to excellent, but the mayfly population in portions of the western basin exhibited large variation and appeared threatened in some years, possibly as a result of fluctuating dissolved oxygen concentrations.

Mayfly nymphs prefer to live in areas with softer sediments, which often harbor higher concentrations of pollutants in contaminated regions. These species do well in shallow, productive lakes with soft, organically rich sediment.

Burrowing mayfly populations (*Hexagenia* spp.) on western Lake Erie were extirpated during the 1940s and 1950s. Municipal and industrial pollution associated with urbanization greatly decreased the likelihood of mayfly reoccurrence. Absent for some 40 years, pollution-abatement programs, focusing on the lake's water quality, have facilitated the return of mayflies to western Lake Erie.

Mayfly nymph density in western Lake Erie has been designated by the State of the Lake Ecosystem Conference (SOLEC) as an important water quality indicator. Mayfly density will be used to report to the International Joint Commission and the public on progress made in restoring the chemical, physical, and biological integrity of the Great Lakes, as called for in the Canada-U.S. Great Lakes Water Quality Agreement. (Reference 2.4-32).

2.4.2.6 Nuisance and Invasive Species

Aquatic nuisance species have the capability to cause large scale ecological and economical problems when they have been introduced into a system that does not have the proper natural controls to keep them in check such as pathogens, predators and parasites. When such species are introduced into new habitats, the lack of natural controls may cause the populations to grow at or near maximum exponential rates. If a nuisance species becomes established, it may disrupt the existing ecosystem balance. As a nuisance species proliferates, it may prey upon, out-compete, or cause disease in the existing inhabitants. Nuisance species common near the Fermi site are discussed below.

1. Keystone Species - refers to species whose presence and role within an ecosystem has a disproportionate effect on other organisms within the system.

Zebra mussel-*Dreissena polymorpha*

Zebra mussels are considered a nuisance species throughout all of the Great Lakes Region and are known to inhabit the western basin of Lake Erie, near the Fermi site. Zebra mussels have been reported in Swan Creek, Stony Creek and the Detroit River as well. Originally found primarily in Russia, the mussel was transported to the Great Lakes Region by transatlantic freighter in 1988. Since that time, it has spread to over 100 lakes and several major river systems including the Mississippi River.

Zebra mussels are very successful invaders because they live and feed in many different aquatic habitats, breed prolifically, and have both a planktonic larval stage and an attached adult stage. Adult zebra mussels inhabit all types of living and non-living things from boats, docks, piers, water intake pipes, plants and even slow moving animals. They can also attach to each other, creating dense blankets of mussels up to one foot thick. In 1989, the town of Monroe lost its water supply for three days when large amounts of zebra mussels clogged the city's water intake pipeline. The USFWS estimates the economic impact of zebra mussels to be in the billions of dollars (over the next 10 years) in the Great Lakes Region alone (Reference 2.4-76).

Quagga mussel-*Dreissena bugensis*

The quagga mussel is a nuisance species native to the Ukraine, and is believed to have been introduced to the U.S. through the ballast water discharge of transatlantic shipping vessels. It is well-established in Lake Erie, has been reported in the Lake Erie mouths of Swan and Stony Creeks (near the Fermi site), and is most likely present in parts of the Detroit River as well. Very similar to the zebra mussel, the quagga mussel inhabits all types of living and non-living things including intake pipes and structures causing problems for operation and maintenance of these structures. Another threat posed by the quagga mussel lies in its filtration of the water. By filtering phytoplankton and suspended matter from the water column, the quagga mussel eliminates the biggest zooplankton food source; thus, impacting the entire food chain. By clarifying the water, the species augments the natural success of aquatic vegetation, and in turn, alters the entire lake ecosystem (Reference 2.4-18).

Other Species

Other nuisance species that may occur near the Fermi site include the spiny water flea, the fish hook flea, the round goby, the sea lamprey; and the aquatic plant species, common reed. These species are further discussed in Appendix 2A. The biggest threat of the sea lamprey includes disruption of the food chain and aquatic ecosystem.

2.4.2.7 **Important Habitats**

Areas within the DRIWR have been allocated as important habitats due to the habitat available for aquatic wildlife or other species requiring an aquatic environment. The Lagoona Beach Unit of the DRIWR is located north, west, and south of the Fermi site (see Figure 2.4-7). Habitat associated with the refuge includes wetlands, coastal uplands and lowlands, and woodland forests. The refuge habitat is more thoroughly discussed in Subsection 2.4.2.2.1.

2.4.2.8 **Environmental Stresses**

The onsite aquatic habitats are subject to a variety of historical and current environmental stresses, both man-induced and natural. Man-induced stresses can include many aspects of habitat conversion, consumptive biological resource use, pollution, and modification of natural processes including increased sediment deposits caused by deforestation and dredging of streambeds and drainages. Natural stresses include biological interactions and additional natural processes including drying out and inundation of onsite areas and scouring of the shoreline.

Man-induced stresses onsite have included farming and agricultural activities in the past, and operation of Fermi 1 and 2. Catastrophic natural environmental stresses may include massive infestations, epidemics, drought, or significant weather storms and/or climatic changes. Other natural stresses include the presence of invasive species including zebra mussels and Phragmites. Invasive species are further discussed in Subsection 2.4.2.6. There have been no recorded environmental catastrophes on or near the Fermi site.

2.4.2.9 **Transmission Corridors**

The offsite 345 kV transmission system and associated corridors are exclusively owned and operated by ITC*Transmission*. The Applicant has no control over the design of the transmission system. Accordingly, the aquatic ecology that interfaces with the offsite transmission corridors is based on publicly available information, and reasonable expectations of the configurations that ITC*Transmission* would likely follow based on standard industry practice. However, the information described in this subsection does not imply commitments made by ITC*Transmission* or Detroit Edison, unless specifically noted. The discussion within this subsection pertains only to the offsite transmission corridor.

The offsite transmission system will consist of 345 kV lines running from Fermi west to the Milan Substation, located approximately 1.5 miles northwest of Milan, a distance of about 29.4 miles. The route is located in portions of Monroe, Wayne and Washtenaw counties and is illustrated in Figure 2.2-3. The three 345 kV lines for Fermi 3 will run in a common corridor, with transmission lines for Fermi 2, to a point just east of I-75. From the intersection of this Fermi site corridor and I-75, the three Fermi-Milan lines will run west and north for approximately 12 miles in a corridor shared with other non-Fermi lines within an assumed 300-foot wide right-of way (ROW) in which the vegetation has been managed to exclude tall woody vegetation. In this section of the route, reconfiguration of existing conductors would allow for the use of existing infrastructure to create the new lines. In the area where Arkona Road and Haggerty Road intersect, the non-Fermi lines turn north and continue on to their respective destinations and the three Fermi-Milan lines will continue west for approximately 10.8 miles to the Milan substation. This western 10.8 miles of the corridor is undeveloped; no lines or towers are present, and where vegetation is present the maintenance has been minimal, except to keep tall woody vegetation removed. New transmission system infrastructure will be needed along this western section of the transmission corridor within the assumed 300-foot wide ROW. To accommodate the new transmission lines, it is assumed that the Milan Substation may also be expanded from its current size of 350 by 500 feet to an area approximately 1,000 by 1,000 feet, utilizing maintained grassed areas and cropland where no there is no aquatic habitat.

2.4.2.9.1 Aquatic Communities and Principal Aquatic Species

Aquatic communities within or adjacent to the new transmission route include several small streams and numerous small drainage ditches. The route does not cross any lakes, ponds, or reservoirs. Stoney Creek, which is located in the developed eastern portion of the route, is the largest stream crossed by the transmission route and is discussed in Subsection 2.4.2.2.2. Wetlands are associated with some of the drainages (Figure 2.4-7) and are discussed in Subsection 2.3.1.1.4.

Due to the small size of the streams and ditches present along the transmission path, information regarding principal aquatic species is not readily available. It is presumed that species diversity is similar to that described for Stoney Creek in Subsection 2.4.2.2.2.3, if not less diverse due to a lack of water in these smaller, and often intermittent, surface features. There are no commercial and recreational fisheries present within the assumed 300-foot ROW due to the small size of the drainages present.

2.4.2.9.2 Important Species

Important species, including threatened and endangered species, potentially occurring along the new transmission route are the same as those described in Subsection 2.4.2.4. Based on information from the USFWS and MDNR, there are currently no reported occurrences of Michigan or Federal important species.

2.4.2.9.3 Important Habitats

Important habitats associated with the new transmission route include wetlands and small areas of lowland forest that are identified in Figure 2.2-3. No wildlife areas or refuges are crossed by the route. There are no areas along the corridor that are designated as critical habitats, based on information obtained from the USFWS and MDNR. Wetlands associated with the transmission corridors are discussed in Subsection 2.3.1.1.4.

2.4.2.9.4 Environmental Stresses

The aquatic habitats along the new transmission route are subject to a variety of historical and current environmental stresses, both man-induced and natural. Man-induced stresses can include many aspects of habitat conversion, consumptive biological resource use, pollution, and modification of natural processes. Agricultural and residential land use (described in Subsection 2.2.2) are the primary contributors to man-induced stresses along the corridor. Natural stresses include biological interactions and additional natural processes, such as habitats drying out or scouring from flooding. Environmental stresses are discussed further in Subsection 4.3.2.

2.4.2.9.5 Regulatory Consultation

The USFWS and NDNR were consulted for information on known occurrences of Federal and State listed protected species on the Fermi property and in the project vicinity for a radius of 7.5 miles around the facility. Although no regulatory contact has occurred for the more western portion of the transmission route, Federal and State web sites have been consulted. As the transmission system design is formalized, agency contacts are expected to be initiated by ITC*Transmission* to ensure the protection of aquatic resources in the region.

2.4.3 References

2.4-1 Michigan Department Natural Resources, Michigan's Wildlife Action Plan, "Southern Lower Peninsula," http://www.michigan.gov/dnr/0,1607,7-153-10370_30909_31053-153463--,00.html, accessed 4 October 2007.

2.4-2 Porter, S.C., Late-Quaternary Environments of the United States: *The Late Pleistocene*, Page xi, University of Minnesota Press, Minneapolis, MN, 1983.

2.4-3 Ecological Sciences Department, Cyrus Wm. Rice Division, *1973-74 Annual Report of the Terrestrial Ecological Studies at the Fermi Site*, NUS Corporation, 1974.

2.4-4 Voss, E.G. (1972-96), *Michigan Flora*, Part I Gymnosperms and Monocots (1972), Part II Dicots (Saururaceae-Cornaceae) (1985), Part III Dicots Concluded (1996). Cranbrook Institute of Science and University of Michigan Herbarium.

2.4-5 Reed, Jr., P.B., *National List of Plant Species That Occur in Wetlands: North Central (Region 3)*, U.S. Fish and Wildlife Service Biological Report 88(26.3), 108 pages, 1988.

2.4-6 Michigan Natural Features Inventory, Rare Species Explorer, http://web4.msue.msu.edu/mnfi/explorer/index.cfm, accessed 25 January 2008.

2.4-7 Endangered Species Act of 1973, 16 U.S.C. §§ 1531-1544.

2.4-8 Migratory Bird Treaty Act, 16 U.S.C. §§ 703-712 http://laws.fws.gov/lawsdigest/migtrea.html, accessed 24 March 2008.

2.4-9 50 CFR 17, "Endangered and Threatened Wildlife and Plants; Removing the Bald Eagle in the Lower 48 States From the List of Endangered and Threatened Wildlife," 9 July 2007, http://www.fws.gov/migratorybirds/issues/BaldEagle/baldeaglefinaldelisting.pdf, accessed 24 March 2008.

2.4-10 Bald and Golden Eagle Protection Act, 16 USC 668a-d, http://www.animallaw.info/statutes/stus16usc668.htm, accessed 24 March 2008.

2.4-11 U.S. Fish and Wildlife Service, *National Bald Eagle Management Guidelines*, May 2007, http://www.fws.gov/migratorybirds/baldeagle.htm, accessed 24 March 2008.

2.4-12 Michigan Natural Features Inventory 2004, *Elaphe vulpine gloydi* Conant, Eastern Fox Snake, Michigan State University Board of Trustees, Michigan State University Extension.

2.4-13 Michigan Department of Environmental Quality, *Michigan's Wetland Law - Complete Administrative Rules*, 1988, http://michiganwetlands.org/citguide/AppendixE.pdf, accessed 24 March 2008.

2.4-14 U.S. Army Corps of Engineer Waterways Experiment Station, Environmental Laboratory, *Corps of Engineers Wetlands Delineation Manual*, Technical Report Y-87-1, Vicksburg, MS, 1987.

2.4-15 Detroit Edison and U.S. Fish and Wildlife Service, *Detroit International Wildlife Refuge*, 2003

2.4-16 Michigan Department of Agriculture, “Emerald Ash Bore Information”, http://www.michigan.gov/mda/0,1607,7-125-1568_2390_18298---,00.htm, accessed 24 January 2008.

2.4-17 Albert, D.A. Michigan Natural Features Inventory, Lansing, MI. Natural Community Abstract for Great Lakes Marsh. 11 pp., November 2004.

2.4-18 Benson, A.J., M.M. Richerson, and E. Maynard, USGS Nonindigenous Aquatic Species Database, Gainesville, FL. Dreissena rostriformis bugensis, 25 January 2007, http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=95, accessed 15 October 2007.

2.4-19 Carman, S.M., Michigan Natural Features Inventory, Lansing, MI. “Special Animal Abstract for Opsopoeodus emiliae (Pugnose minnow),” 2 pp., 2001, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11343, accessed 8 August 2007.

2.4-20 Carman, S.M., Michigan Natural Features Inventory, Lansing, MI. “Special Animal Abstract for Percina shumardi (River darter),” 3 pp., 2001, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11410, accessed 8 August 2007.

2.4-21 Carman, S.M., Michigan Natural Features Inventory, Lansing, MI. “Special Animal Abstract for Notropis photogenis (Silver shiner),” 3 pp., 2001, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11323, accessed 8 August 2007.

2.4-22 Carman, S.M., Michigan Natural Features Inventory, Lansing, MI. “Special Animal Abstract for Erimyzon oblongus (Creek chubsucker),” 2 pp., 2001, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11349, accessed 8 August 2007.

2.4-23 Carman, S.M. and R.R. Goforth, Michigan Natural Features Inventory, Lansing, MI. “Special Animal Abstract for Percina copelandi (Channel darter),” 2 pp., 2000, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11408, accessed 8 August 2007.

2.4-24 Clark, G., Coastal Natural Hazards University of Wisconsin Sea Grant Institute, Seiches and Storm Surges, 2004, www.seagrant.wisc.edu/coastalhazards/default.aspx?tabid=426, accessed 5 December 2007.

2.4-25 Clinton River Watershed Council, “Stony Creek Subwatershed Management,” http://www.crwc.org/programs/watershedmgmt/scnonpoint/scnonpointhome.html, accessed 28 January 2008.

2.4-26 Michigan Department of Environmental Quality, “History of the DEQ,” http://www.michigan.gov/deq/0,1607,7-135-3306-13142--,00.html, accessed 15 December 2007.

2.4-27 Michigan Department of Natural Resources, “The Department of Natural Resources…,” http://www.michigan.gov/dnr/0,1607,7-153-10366-30397--,00.html, accessed 23 April 2008.

2.4-28 Ohio Department of Natural Resources, ”About ODNR,” www.dnr.state.oh.us/tabid/10748/default.aspx, accessed 28 January 2008

2.4-29 Derosier, A. L., Michigan Natural Features Inventory, Lansing, MI. “Special Animal Abstract for Macrhybopsis storeriana (Silver chub),” 2 pp., 2004, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11341, accessed 28 January 2008.

2.4-30 Derosier, A. L., Michigan Natural Features Inventory, Lansing, MI. “Special Animal Abstract for Ammocrypta pellucida (Eastern sand darter),” 3 pp., 2004, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11397, accessed 28 January 2008.

2.4-31 Derosier, A. L., Michigan Natural Features Inventory, Lansing, MI. “Special Animal Abstract for Sander Canadensis (Sauger),” 3 pp., 2004, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11411, accessed 28 January 2008.

2.4-32 U.S. Environmental Protection Agency, Large Lakes and Rivers Forcasting Research Branch, “Detroit River-Western Lake Erie Basin Indicator Project,” http://www.epa.gov/med/grosseile_site/indicators/mayflies.html, accessed 15 October 2007.

2.4-33 U.S. Environmental Protection Agency, “Great Lakes National Program Office (GLNPO)”, http://www.epa.gov/glnpo/monitoring/indicators/benthic98/index.htm, accessed 23 April 2008.

2.4-34 U. S. Environmental Protection Agency, About EPA, “Who We Are,” www.epa.gov/epahome/aboutepa.htm#whoweare, accessed 5 December 2007.

2.4-35 Goforth, R.R. Michigan Natural Features Inventory, Lansing, MI. “Special Animal Abstract for Acipenser fulvescens (Lake sturgeon),” 4pp., 2000, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11270, accessed 28 January 2008.

2.4-36 Government of Canada-Fisheries and Oceans Canada, Aquatic Species at Risk, “Aurora Trout,” March 2004, http://www.dfo-mpo.gc.ca/species-especes/species/species_auroraTrout_e.asp, accessed 13 March 2008.

2.4-37 Government of Canada-Fisheries and Oceans Canada, Aquatic Species at Risk, “Eastern Pondmussel… a Species at Risk in Ontario,” http://www.dfo-mpo.gc.ca/species-especes/species/factsheet/factsheet_easternpondmussel_e.asp, accessed 13 March 2008.

2.4-38 Great Lakes Information Network, Lake Erie, “Overview,” http://www.great-lakes.net/lakes/erie.html#overview, accessed 28 January 2008.

2.4-39 Great Lakes Fishery Commission, Sea Lamprey Control, “Sea Lamprey: A Great Lakes Invader,” http://www.glfc.org/lampcon.php, accessed 28 January 2008.

2.4-40 Gulf of Maine Aquarium, “Zebra Mussels,” http://www.gma.org/surfing/human/zebra.html, accessed 28 January 2008.

2.4-41 Invasive Plants.net, “Phragmities: Common Reed, Basic Information,” www.invasiveplants.net/phragmites, accessed 15 October 2007.

2.4-42 Kellys Island Birds and Natural History, “Lake Erie Coastal Wetland Significant Features,” 31 July 2006, http://www.kelleysislandnature.com/lake_erie_water_snake/wetlands.htm, accessed 28 January 2008.

2.4-43 Lindgren, J. and I. A. Grigorovich, I.A., Minnesota DNR, University of Windsor, *Aquatic Invasive Species: Spiny and Fishhook Water Fleas*, December 2005, http://www.in.gov/dnr/files/spiny_and_fishhook_water_flea.pdf, accessed 18 March 2008.

2.4-44 Clinton River Watershed Council, “Stony Creek Watershed Management Plan,” (23 September 2005), http://www.crwc.org/programs/watershedmgmt/scnonpoint/scnonpointhome.html, accessed 13 December 2007.

2.4-45 Michigan Department of Natural Resources, Michigan’s Wildlife Action Plan SGCN Status & Species-Specific Issues, “Mussels,” 27 June 2005, http://www.michigandnr.com/publications/pdfs/HuntingWildlifeHabitat/WCS/SGCN/Ligumia_recta.pdf, accessed 15 October 2007.

2.4-46 Michigan Natural Features Inventory, Rare Species Explorer, “Northern Madtom (Noturus stigmosus)”, http://web4.msue.msu.edu/mnfi/explorer, accessed 13 March 2008.

2.4-47 Mulcrone, R. S., "Obliquaria reflexa," University of Michigan Museum of Zoology, Animal Diversity Web, 2006, http://animaldiversity.ummz.umich.edu/site/accounts/information/Obliquaria_reflexa.html, accessed 12 March 2008.

2.4-48 U.S. Fish & Wildlife Service, Wetlands Online Mapper, http://wetlandsfws.er.usgs.gov/wtlnds/launch.html, accessed 15 October 2007.

2.4-49 NatureServe Encyclopedia, NatureServe Explorer: An online encyclopedia of life [web application], Version 7.0. NatureServe, Arlington, Virginia, http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-50 NatureServe Encylopedia, “Blacknose shiner (Notropis heterolepis),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-51 NatureServe Encylopedia, “Black sandshell (Ligumia recta),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-52 NatureServe Encyclopedia, “Fawns foot (Truncilla donaciformis),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-53 NatureServe Encyclopedia, “Greater redhorse (Moxostoma valenciennesi),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-54 NatureServe Encyclopedia, “Kidney shell (Ptychobranchus fasciolaris),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-55 NatureServe Encyclopedia, “Lake chubsucker (Erimyzon sucetta),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-56 NatureServe Encyclopedia, “Longnose sucker (Catostomus catostomus),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-57 NatureServe Encyclopedia, “Mudpuppy mussel (Simpsonaisa ambigua),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-58 NatureServe Encyclopedia, “Pocketbook (Lampsilis ovata),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-59 NatureServe Encyclopedia, “Pondhorn (Uniomerus tetralasmus),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-60 NatureServe Encyclopedia, “Pugnose shiner (Notropis anogenus),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-61 NatureServe Encyclopedia, “Rayed bean (Villsoa fabalis),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-62 NatureServe Encyclopedia, “Round pigtoe (Pleurobema sintoxia),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-63 NatureServe Encyclopedia, “Shortnose cisco (Ammocrypta pellucida),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-64 NatureServe Encyclopedia, “Spotted gar (Lepisosteus oculatus),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-65 NatureServe Encyclopedia, “Threehorn wartyback (Obliquaria reflexa),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-66 NatureServe Encyclopedia, “Western banded killifish (Fundulus diaphanous menoma),” http://www.natureserve.org/explorer, accessed 12 March 2008.

2.4-67 National Oceanic and Atomospheric Administration, Coastal Services Center, Benthic Habitat Mapping, “What is Benthic Habitat?,” 24 July 2007, www.csc.noaa.gov/benthic/start/what.htm, accessed 11 December 2007.

2.4-68 Michigan Sea Grant, Upwellings Online Edition, “Indicators Reflect Health of Detroit River, Western Lake Erie,” December 2006, http://www.miseagrant.umich.edu/upwellings/issues/06dec/health-detroit-river.html, accessed 5 December 2007.

2.4-69 Stagliano, D.M., Natural Features Inventory, Lansing, MI, “Special Animal Abstract for Phoxinus erythrogaster (Southern redbelly dace),” 3pp., 2001, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11330, accessed 28 January 2008.

2.4-70 Stony Creek Watershed, Huron River Watershed Council, *Report on Stony Creek Watershed Sampling*, July 2004.

2.4-71 Swart, S.L., Michigan Natural Features Inventory, Lansing, MI, “Special Animal Abstract for Noturus miurus (Brindled Madtom),” 2pp., 2005, http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11366, accessed 28 January 2008.

2.4-72 Thomas, Michael, Haas, Robert. Lake St. Clair Fisheries Research Station, “Status of the Fisheries in Michigan Waters of Lake Erie and Lake St. Clair, 2006,” March 22, 2007.

2.4-73 U.S. Fish and Wildlife Service, Fish & Wildlife Journal, “Detroit River International Wildlife Refuge and International Wildlife Refuge Alliance Issue Annual Progress Report, 31 July 2006, http://www.fws.gov/arsnew/regmap.cfm?arskey=19280, accessed 15 October 2007.

2.4-74 U.S. Fish and Wildlife Service, Detriot River International Wildlife Refuage, “Background”, http://www.fws.gov/Midwest/DetroitRiver/documents/brochureAug23.pdf, accessed 5 December 2007.

2.4-75 U.S. Fish and Wildlife Service, About the U.S. Fish and Wildlife Service, “History and Statutory Authority”, 29 June 2007, www.fws.gov/help/about_us.html, accessed 5 December 2007.

2.4-76 U.S. Geological Surgey, Great Lakes Science Center, “Zebra Mussel,“ http://www.glsc.usgs.gov/main.php?content=research_invasive_zebramussel&title=Invasive%20Invertebrates0&menu=research_invasive_invertebrates, accessed 15 October 2007.

2.4-77 Detroit Edison, “Fermi Power Plant No. 1 Study Report on Cooling Water Intake,” Chapter 2-4, July 1976.

2.4-78 Detroit Edison, “Fermi Atomic Power Plant Unit 3-Applicants Environmental Report Construction Permit Stage,” Vol. 1-3, Section 2.7, January 1967.

2.4-79 Detroit Edison, “Fermi Atomic Power Plant Unit 2-Applicants Environmental Report Operating License Stage,” Vol. 1-3, August 1977.

2.4-80 Lawler, Matusky, & Skelly Engineers, Fish Entrainment and Impingement Study (October 1991-September 1992), February 1993, Fermi Power Plant.

2.4-81 Newell, T. L., “Myotis sodalist” University of Michigan Museum of Zoology, Animal Diversity Web, 2008, http://animaldiversity.ummz.umich.edu/site/accounts/information/Myotis_sodalis.html, accessed 6 June 2008.

2.4-82 Michigan Department of Natural Resources, Wildlife & Habitat, “Bald Eagle (*Haliaeetus leucocephalus*),” http://www.michigan.gov/dnr/0,1607,7-153-10370_12145_12202-32581--,00.html, accessed 1 May 2008.

2.4-83 Francis, J. and J. Boase. (2007), Michigan Department of Natural Resources and U.S. Fish and Wildlife Service, A Fisheries Survey of Selected Lake Erie Coastal Marshes in Michigan, 2005.

2.4-84 Ohio Department of Natural Resources Division of Wildlife and Lake Erie Fisherier Unit, *Ohio’s Lake Erie Fisheries 2006*,. March 2007, http://www.dnr.state.oh.us/Portals/9/pdf/estatus2006[1].pdf, accessed 19 June 2008.

2.4-85 Reutter, J.M. and J.W. Fletcher, *Phytoplankton and zooplankton densities from Lake Erie near the Davis-Besse nuclear power station during 1978*, Clear Technical Report No. 106, 25 pp.,The Ohio State University, Columbus, OH, 1979.

2.4-86 Makarewicz, J. C., “A Lakewide Comparison of Zooplankton Biomass and Its Species Composition in Lake Erie, 1983-1987,” *Journal of Great Lakes Research*, 19.2, 1993.

2.4-87 Reutter, J.M., *Benthic Macroinvertebrate populations in Lake Erie near the Davis-Besse nuclear power station during 1978*, Clear Technical Report No. 107, 9 pp., The Ohio State University, Columbus, OH, 1979

2.4-88 Reutter J.M., C.E. Herdendorf, and G.W. Sturm, *Impingement and Entrainment Studies at the Bay Shore Power Station, Toledo Edison Company*, Clear Technical Report No. 78b, The Ohio State University Center for Lake Erie Area Research, Columbus, OH, 1978.

2.4-89 Reutter, J.M., C.E. Herdendorf, G.W. Sturm. *Impingement and Entrainment Studies at the Acme Power Station, Toledo Edison Company*, Clear Technical Report No. 78A, The Ohio State University Center for Lake Erie Area Research, Columbus, OH, June 1978.

2.4-90 Michigan Department of Environmental Quality, Surface Water Quality Division, *A Biological Survey of Stony Creek and Amos Palmer Drain, Monroe County, Michigan*, Report Number 151, December 1996.

2.4-91 Michigan Department of Environmental Quality, Surface Water Quality Division, *A Biological Survey of Stony Creek and its Tributaries, Amos Palmer Drain and Ross Drain, Monroe County*, Report Number 087, February 1998.

2.4-92 Makaerwiczl, J.C. et al, “Phytoplankton composition and biomass in the offshore waters of Lake Erie: Pre- and post- Dreissena introduction,1983-1993,”. *Journal of Great Lakes Research* 25.1, 1999.

2.4-93 U.S. Army Corps of Engineers, *The Highway Methodology Workbook Supplement: Wetland Functions and Values: A Descriptive Approach*, 1999.

2.4-94 U.S. Environmental Protection Agency, “Ottawa-Stony Watershed,” http://cfpub.epa.gov/surf/huc.cfm?huc_code=04100001, accessed 4 August 2008.

2.4-95 Black & Veatch Corporation, Fermi 3 Terrestrial Vegetation Survey Final Report, Prepared for The Detroit Edison, November 2009.

2.4-96 Black & Veatch Corporation, Fermi 3 Terrestrial Wildlife Survey Final Report, Prepared for The Detroit Edison, November 2009.

2.4-97 AECOM, “Aquatic Ecology Characterization Report, Detroit Edison Fermi 3 Project, Final Report,” November 2009.

2.4-98 Michigan Department of Environmental Quality, Wetland Identification Report, Wetland Identification File Number 08-58-0003-W, November 7, 2008.

2.4-99 Michigan Department of Environmental Quality, Wetland Identification Report, Modified Wetland Identification File Number 08-58-0003-WA, March 30, 2009.

2.4-100 U.S. Army Corps of Engineers, Detroit District, Engineering & Technical Services, Regulatory Office, File No. LRE-2008-00443-1, November 9, 2010.

Table 2.4-1 Approximate Acres per Plant Community Present on the Fermi Site

Habitat[1]	Acres	% of Site
Coastal Emergent Wetland (CEW) Open Water	35	2.8
Coastal Emergent Wetland (CEW) Vegetated	238	18.9
Grassland: Right-of-Way (GRW)	29	2.3
Grassland: Idle/Old Field/Planted (GOF)	75	6.0
Grassland: Row Crop (GRC)	64	5.1
Shrubland (SHB)	113	9.0
Thicket (TKT)	23	1.8
Forest: Coastal Shoreline (FCS)	47	3.7
Forest: Lowland Hardwood (FLH)	92	7.3
Forest: Woodlot (FWL)	117	9.3
Developed Areas (DA)	212	16.8
Lakes, Ponds, Rivers (LPR)	44	3.5
Lake Erie (main body)	171	13.6
Totals	1260	100

1. Habitats are based on Michigan's Wildlife Action Plan, Michigan Department of Natural Resources (Reference 2.4-1).

Table 2.4-2 Plant Species Listed for the Fermi Site (Sheet 1 of 10)

Scientific Name[1]	Common Name[2]	Wetland Status[2]	Habitat[3]									
			CEW	GRW	GOF	GRC	SHB	TKT	FCS	FLH	FWL	DA
Abuitilon theophrasti	Velvet Leaf	FACU-		x	x	x	x					
Acalypha virginica	Three-seeded Mercury	FACU		x						x		
Acer negundo	Box Elder	FACW-	x		x		x	x	x	x	x	
Acer saccharinum	Silver Maple	FACW			x		x		x	x		
Acer saccharum	Sugar Maple	FACU								x		
Agrimonia pubescens	Soft Agrimony	UPL		x								
Agrimonia striata	Woodland Groovebur	FAC-								x		
Agropyron repens	Quackgrass	FACU			x			x	x			
Ailanthus altissimus	Tree-of-Heaven	UPL					x	x			x	x
Alisma plantago-aquatica	Broad-leaf Water Plantain	OBL	x									
Alliaria petiolata	Garlic Mustard	FAC								x	x	
Amaranthus albus	White Pigweed	FACU			x	x	x					
Ambrosia artemiisifolia	Annual Ragweed	FACU		x	x	x	x		x			x
Ambrosia psilostachya	Naked-Spike Ragweed	FAC-			x							x
Andropogon gerardii	Big Bluestem	FACU-		x								x
Andropogon virginicus	Broomsedge	FAC-		x	x							
Anemone canadensis	Canada Anemone	FACW		x								
Anemone cylindrica	Thimbleweed	UPL		x								
Apocynum cannabinum	Prairie Dogbane	FAC		x	x	x	x					
Arctium minus	Burdock	UPL			x				x		x	
Asclepias incarnata	Swamp Milkweed	OBL	x	x								
Asclepias syriaca	Common Milkweed	UPL		x	x							
Aster lateriflorus	Side-flowering Aster	FACW-		x								
Aster pilosus	Heath Aster	FACU+		x	x				x			
Barbarea vulgaris	Yellow Mustard	FAC				x						

Table 2.4-2 Plant Species Listed for the Fermi Site (Sheet 2 of 10)

Scientific Name[1]	Common Name[2]	Wetland Status[2]	Habitat[3]									
			CEW	GRW	GOF	GRC	SHB	TKT	FCS	FLH	FWL	DA
Bidens sp.	Beggars-tick		x									
Boehmeria cylindrica	Bog Nettle	OBL		x						x		x
Bromus inermis	Smooth Brome	UPL		x	x		x		x			
Bromus japonicus	Japanese Brome	FACU		x	x	x						x
Bromus tectorum	Cheat	UPL				x						
Campsis radicans	Trumpet Creeper	FAC					x	x				
Carex blanda	Sedge	OBL		x								
Carex cristatella	Crested Sedge	FACW+		x								
Carex frankii	Frank's Sedge	OBL		x								
Carex grayi	Gray's Sedge	FACW-		x								
Carex hirtifolia	Sedge	UPL		x								
Carex stipata	Sedge	OBL		x								
Carex vulpinoidea	Fox Sedge	OBL	x	x								
Carex sp.	Sedge	unknown								x		
Carya glabra	Pignut Hickory	FACU										
Carya ovata	Shagbark Hickory	FACU								x		
Celtis occidentalis	Common Hackberry	FAC-									x	
Cenchrus longispinus	Sandbur	UPL		x	x				x			
Centaurea maculosa	Knapweed	UPL			x							x
Ceratophyllum demersum	Common Hornwort	OBL	x									
Chenopodium album	Lamb's Quarters	FAC		x								
Cichorium intybus	Cichory	NL		x	x							
Cinna arundinacea	Wood Reedgrass	FACW	x							x		
Circaea lutetiana	Enchanter's Nightshade	FACU	x	x					x	x		x
Cirsium arvense	Canada Thistle	FACU	x	x	x	x	x	x	x			

Table 2.4-2 Plant Species Listed for the Fermi Site (Sheet 3 of 10)

Scientific Name[1]	Common Name[2]	Wetland Status[2]	Habitat[3]									
			CEW	GRW	GOF	GRC	SHB	TKT	FCS	FLH	FWL	DA
Cirsium discolor	Thistle	NL										
Cirsium muticum	Swamp Thistle	OBL	x	x					x			
Cirsium vulgare	Bull Thistle	FACU-		x	x		x					x
Conyza canadensis	Canada Horseweed	FAC-		x	x	x	x		x			x
Coreopsis lanceolata	Sand Coreopsis	FACU		x								
Cornus amomum	Silky Dogwood	FACW+	x						x	x		
Cornus drummondii	Rough-leaf Dogwood	FAC		x	x		x					
Cornus foemina	Stiff Dogwood	FACW-					x					
Crataegus cf. mollis	Downy Hawthorne	FACW-						x				
Cyperus esculentus	Chufa	FACW	x						x			
Cyperus rivularis	Shining Flatsedge	FACW+	x						x			
Dactylis glomerata	Orchard Grass	FACU	x		x		x		x		x	
Datura strumonium	Jimson-weed	UPL							x			
Daucus carota	Queen Ann’s Lace	UPL		x	x	x			x			
Dianthus armeria	Deptford Pink	UPL		x								
Digitaria ischaemum	Smooth Crabgrass	FACU			x							x
Digitaria sanguinalis	Hairy Crabgrass	FACU										x
Dipsacus fullonum	Teasel	UPL		x	x		x					
Diervilla lonicera	Bush Honeysuckle	NL								x		
Echinacea purpurea	Purple Coneflower	UPL		x								
Echinochloa crusgalli	Barnyard Grass	FACW	x	x					x			
Echinochloa muricata	Rough Barnyard Grass	OBL	x									
Elaeagnus umbellata	Autumn Olive	FACU		x			x	x			x	
Elymus canadensis	Canada Wild Rye	FAC-	x	x	x		x	x				
Elymus virginicus	Virginia Wild Rye	FACW-	x	x	x			x				

Table 2.4-2 Plant Species Listed for the Fermi Site (Sheet 4 of 10)

Scientific Name[1]	Common Name[2]	Wetland Status[2]	Habitat[3]									
			CEW	GRW	GOF	GRC	SHB	TKT	FCS	FLH	FWL	DA
Equisetum arvense	Field Horsetail	FAC	x						x			
Eragrostis pectinata	Purple Lovegrass	FAC			x							
Eragrostis spectabilis	Purple Lovegrass	UPL		x								
Erechtites hieracifolia	American Burn	FACU	x									
Erigeron annuus	Annual Fleabane	FAC-		x								
Erigeron strigosus	Prairie Fleabane	FAC-			x							
Eupatorium perfoliatum	Common Boneset	FACU		x								
Eupatroium serotinum	Late-flowering Thorough-wort	FAC+								x	x	
Euphorbia nutans	Eyebane Broomspurge	FACU				x						
Euphorbia maculata	Spotted Broomspurge	FACU-			x	x						
Euthamia graminifolia	Flattop-Fragrant Goldenrod	FACW-		x								
Festuca arundinacea	Kentucky Fescue	FACU+			x							
Fragaria virginiana	Wild Strawberry	FAC-		x	x							
Fraxinus americana	White Ash	FACU		x								
Fraxinus pennsylvanica	Green Ash	FACW		x	x		x	x	x	x	x	
Galium aparine	Catchweed Bedstraw	FACU					x	x	x		x	
Geranium maculatum	Wild Geranium	FACU		x	x							
Geum canadense	White Avens	FAC		x			x	x			x	
Geum rivale	Purple Avens	OBL		x								
Gleditsia triacanthos	Honey Locust	FAC			x		x	x				
Glyceria striata	Fowl Manna Grass	OBL	x	x								
Hackelia virginiana	Virginia Stickseed	FAC-								x		
Helenium autumnale	Sneezeweed	FACW+		x								
Hibiscus moscheutos	Swamp Mallow	OBL	x									
Hordeum jubatum	Foxtail	FAC+				x						x

Table 2.4-2 Plant Species Listed for the Fermi Site (Sheet 5 of 10)

Scientific Name[1]	Common Name[2]	Wetland Status[2]	Habitat[3]									
			CEW	GRW	GOF	GRC	SHB	TKT	FCS	FLH	FWL	DA
Humulus lupulus	Common Hops	FACU						x		x		
Hydrocharis morus-ranae	European frog-bit	OBL	x									
Hypericum perforatum	Common St. John's-wort	UPL		x	x							
Hypericum punctatum	Spotted St. John's-wort	FAC+	x									
Impatiens capensis	Spotted Touch-me-not	FACW								x	x	
Iris virginica	Southern Blue Flag	OBL		x								
Juncus gerardii	Black-grass	OBL	x									
Juncus dudleyi	Dudley's Rush	NL		x					x			
Juncus marginatus	Grass-leaf Rush	OBL	x									
Juncus tenuis	Path Rush	FAC	x									
Kochia scoparia	Mexican Summer-cypress	FACU-			x	x						x
Kuhnia eupatorioides	False Boneset	NL		x			x					
Lactuca serriola	Prickly Lettuce	FAC			x	x						
Leersia oryzoides	Cut Grass	FACW	x							x		
Lemna sp.	Duckweed	OBL	x									
Lepidium perfoliatum	Pepper-grass	NL			x	x						
Lepidium virginicum	Pepper-grass	NL				x			x			x
Liatris spicata	Marsh Blazing Star	FAC		x								
Ligustrum vulgare	European Privet	FAC-						x		x	x	
Lobelia siphilitica	Great Blue Lobelia	FACW+		x								
Lotus corniculatus	Bird's-foot Trefoil	FAC-		x								
Lycopus americanus	Common Water Horehound	OBL	x	x								
Lysimachia ciliata	Fringed Loosestrife	FACW		x								
Lysimachia nummularia	Creeping Jennie	FACW+	x	x						x		
Lythrum alatum	Winged Loosestrife	OBL	x	x								

Table 2.4-2 Plant Species Listed for the Fermi Site (Sheet 6 of 10)

Scientific Name[1]	Common Name[2]	Wetland Status[2]	Habitat[3]									
			CEW	GRW	GOF	GRC	SHB	TKT	FCS	FLH	FWL	DA
Lythrum salicaria	Purple Loosestrife	OBL	x	x					x			
Malus coronaria	Wild Crab	UPL				x	x	x				
Medicago lupulina	Black Medic	FAC-			x	x						
Medicago sativa	Alfalfa	NL		x								
Melilotus alba	White Sweet Clover	FACU		x	x	x						x
Melilotus officinalis	Yellow Sweet Clover	FACU			x	x			x			x
Mentha arvensis	Wild Mint	FACW		x					x			
Mentha spicata	Spearmint	FACW+		x					x			
Monarda fistulosa	Wild Bergamot	FACU		x								
Muhlenbergia schreberi	Nimble-will	FAC					x		x			x
Myriophyllum pinnatum	Cut-leaf Water-milfoil	OBL	x									
Nelumbo lutea	American Lotus	OBL	x									
Nepeta cataria	Catnip	FAC-		x	x		x					
Nuphar variegata	Cow-lily	OBL	x									
Nymphaea odorata	White Water-lily	OBL	x									
Oenothera biennis	Common Evening Primrose	FACU										
Oxalis stricta	Common Yellow Wood Sorrel	FACU		x		x						
Panicum capillare	Witchgrass	FAC		x		x						
Panicum dichotomiflorum	Fall Panic Grass	FACW-			x							
Panicum virgatum	Switchgrass	FAC+		x	x							
Papavera sp.	Poppy	NL			x							
Parthenocissus quinquefolia	Virginia Creeper	FAC-		x			x	x	x	x	x	
Penstemon digitalis	Foxglove Beard Tongue	FAC-		x			x					
Phalaris arundinacea	Reed Canary Grass	FACW+	x	x	x		x		x	x		
Phleum pratense	Timothy	FACU			x							

Table 2.4-2 Plant Species Listed for the Fermi Site (Sheet 7 of 10)

Scientific Name[1]	Common Name[2]	Wetland Status[2]	Habitat[3]									
			CEW	GRW	GOF	GRC	SHB	TKT	FCS	FLH	FWL	DA
Phragmites australis	Common Reed	FACW+	x	x	x		x	x	x			
Phytolacca americana	Common Pokeweed	FAC-			x		x	x	x	x	x	
Plantago lanceolata	English Plantain	FAC		x	x							
Plantago major	Common Plantain	FAC+		x	x						x	
Plantago rugellei	Black-seed Plantain	FAC		x								
Poa annua	Annual Bluegrass	FAC-				x					x	
Poa compressa	Swallen's Bluegrass	FACW	x								x	
Poa pratensis	Kentucky Bluegrass	FAC-		x	x						x	
Poa sylvestris	Woodland Bluegrass	FAC								x		
Podophylum peltatum	May-apple	FACU		x								
Polanisia dodecandra	Clammy-weed	UPL							x	x		
Polygonum amphibium	Water Smartweed	OBL	x	x								
Polygonum aviculare	Prostrate Knotweed	FAC-			x	x			x		x	x
Polygonum convolvulus	Buckwheat	FAC-			x	x						
Polygonum lapathifolium	Willow-weed	FACW+	x						x			
Polygonum pensylvanicum	Pennsylvania Smartweed	FACW+							x	x		
Polygonum virginianum	Virginia Smartweed	FAC						x		x		
Populus deltoides	Cottonwood	FAC+	x	x		x		x	x	x	x	
Potamogeton spp.	Pondweed	OBL	x									
Potentilla simplex	Old Field Cinquefoil	FACU-		x								
Potentilla norvegica	Norwegian Cinquefoil	FAC										
Prunella vulgaris	Heal-all	FAC		x				x			x	
Pycnanthemum virginianum	Common Mountain Mint	FACU		x								
Quercus rubra	Red Oak	FACU								x	x	
Quercus macrocarpa	Bur Oak	FAC-								x	x	

Table 2.4-2 Plant Species Listed for the Fermi Site (Sheet 8 of 10)

Scientific Name[1]	Common Name[2]	Wetland Status[2]	Habitat[3]									
			CEW	GRW	GOF	GRC	SHB	TKT	FCS	FLH	FWL	DA
Ratibida pinnata	Yellow Coneflower	UPL		x								
Rhamnus cathcartica	Common Buckthorn	FACU		x	x		x	x				
Rhus glabra	Smooth Sumac	UPL					x					
Rhus typhina	Staghorn Sumac	UPL		x			x	x				
Ribes americanum	Wild Black Current	FACW		x			x					
Rosa carolina	Pasture Rose	FACU		x	x							
Rosa multiflora	Multiflora Rose	FACU		x			x					
Rubus allegheniensis	Common Blackberry	FACU+		x	x			x				
Rubus flagellaris	Northern Dewberry	FACU-			x		x					
Rubus occidentalis	Black Raspberry	UPL		x			x				x	
Rudbeckia hirta	Black-eyed Susan	FACU		x								
Rumex crispus	Curly Dock	FAC+		x			x			x	x	
Salix amygdaloides	Peach-leaved Willow	FACW	x						x		x	
Salix exigua	Sandbar Willow	OBL	x	x				x	x		x	
Sanicula marilandica	Black Snakeroot	FACU		x								
Scirpus americana	Olney's Bulrush	OBL	x						x			
Scirpus atrovirens	Green Bullrush	OBL	x	x								
Scirpus pendulus	Nodding Bulrush	OBL	x	x								
Scrophularia lanceolata	Lance-leaf Figwort	FACU+								x		
Setaria faberi	Giant Foxtail	FACU+		x		x						
Setaria glauca	Yellow Foxtail	FAC		x	x							
Setaria viridis	Green Foxtail	UPL			x	x						
Smilacina racemosa	False Spikenard	FACU		x						x		
Solanum nigrum	Black Nightshade	FACU-			x	x	x					
Solidago altissima	Tall Goldenrod	FACU		x	x		x		x			

Table 2.4-2 Plant Species Listed for the Fermi Site (Sheet 9 of 10)

Scientific Name[1]	Common Name[2]	Wetland Status[2]	Habitat[3]									
			CEW	GRW	GOF	GRC	SHB	TKT	FCS	FLH	FWL	DA
Solidago canadensis	Canada Goldenrod	FACU			x							
Sonchus arvensis	Perennial Sow Thistle	FAC-	x	x	x	x			x			
Sorghastrum avenaceum	Indiangrass	FACU+		x								
Spirodela polyrrhiza	Greater Duckweed	OBL	x									
Sporobolus aspera	Dropseed	NL			x							
Sporobolus vaginiflorus	Dropseed	NL				x						
Taraaecum officinale	Dandelion	FACU		x	x	x						x
Teucrium canadense	American Germander	FACW-			x			x	x			
Tilia americana	American Basswood	FACU								x		
Toxicodendron radicans	Poison Ivy	FAC+		x	x		x	x	x	x	x	x
Tridens flavus	Purpletop	UPL			x							
Trifolium pratense	Red Clover	FACU+		x	x							
Trifolium repens	White Clover	FACU+			x	x						x
Typha angustifolia	Narrow-leaf Cattail	OBL	x									
Typha x glauca	Blue Cattail	OBL	x									
Typha latifolia	Broad-leaf Cattail	OBL	x	x					x			
Ulmus americana	American Elm	FACW-	x				x	x	x	x		
Urtica dioica	Stinging Nettle	FAC+						x	x			
Verbascum thapsus	Velvetleaf	UPL		x								
Verbena hastata	Blue Vervain	FACW+		x								
Verbena urticifolia	White Vervain	UPL					x	x		x		
Verbena stricta	Hoary Vervain	UPL		x	x							
Vernonia missurica	Missouri Ironweed	FAC+		x	x							
Vitis aestivalis	Summer Grape	FACU		x			x	x		x		
Vitis riparia	Riverbank Grape	FACW-		x			x	x	x	x		

Table 2.4-2 Plant Species Listed for the Fermi Site (Sheet 10 of 10)

Scientific Name[1]	Common Name[2]	Wetland Status[2]	Habitat[3]									
			CEW	GRW	GOF	GRC	SHB	TKT	FCS	FLH	FWL	DA
Zanthoxylum americanum	Prickly-ash	FACU		x			x	x				
Zizia aurea	Golden Alexander	FAC+		x								
Total Species = 217	**Total Species Per Community**		**56**	**110**	**74**	**34**	**47**	**36**	**49**	**40**	**29**	**22**

Notes:

1. Scientific names are primarily taken from Michigan Flora (Reference 2.4-4).
2. Common names and wetland status are primarily taken from the National List of Plant Species that Occur in Wetlands: North Central (Region 3) (Reference 2.4-5).
   OBL = Obligate Wetland, plants occurring almost always (estimated probability >99%) under natural conditions in wetlands.
   FACW = Facultative Wetland; plants usually occurring in wetlands (estimated probability 67-99%, but occasionally found in non wetlands.
   FAC = Facultative; plants equally likely to occur in wetlands or non wetlands (estimated probability 34-66%).
   FACU = Facultative Upland; plants usually occurring in non wetlands (estimated probability 67-99%), but occasionally found in wetlands (estimated probability 1-33%).
   UPL = Upland; plants occur almost always under natural conditions in non wetlands areas (estimated probability >99%)
   NL = Not listed
3. Acronyms for habitats derived from Michigan's Wildlife Action Plan, Terrestrial Systems: Southern Lower Peninsula (Reference 1).
   CEW = Coastal Emergent Wetland (Vegetated) GRW = Grassland Right-of-way GOF = Grassland Idle/Old Field/Planted
   GRC = Grassland Row Crop SHB = Shrubland TKT = Thicket FCS = Forest Coastal Shoreline
   FLH = Forest Low Hardwood FWL = Forest Woodlot DA = Disturbed Areas

Table 2.4-3 Common Mammals Directly or Indirectly Observed on the Fermi Site Between 1973 and 2008

Common Name	Scientific Name
Woodchuck*	*Marmota monax*
Red Fox*	*Vulpes vulpes*
Badger*	*Taxidea taxus*
Opossum*	*Didelphis virginiana*
Coyote*	*Canus latrans*
Eastern Cottontail Rabbit*	*Sylvilagus floridanus*
Raccoon*	*Procyon lotor*
Striped Skunk*	*Mephitis mephitis*
Eastern Fox Squirrel*	*Sciurus niger*
Red Squirrel*	*Tamiasciurus hudsonicus*
Gray Squirrel*	*Sciurus carolinensis*
White-tailed Deer*	*Odocoileus virginianus*
Muskrat*	*Ondatra zibethica*
Feral Cat	*Felis catus*
Norway Rat	*Rattus norvegicus*
House Mouse	*Mus musculus*
Masked Shrew	*Sorex cinereus*
Short-tailed Shrew	*Blarina brevicauda*
Prairie Deer Mouse	*Peromyscus maniculatus*
White-footed Mouse	*Peromyscus leucopus*
Meadow Vole	*Microtus pennsylvanicus*

* Observed 2007-2008

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 1 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

		Season[3]				
Common Name	**Scientific Name**	**Spring**	**Summer**	**Fall**	**Winter**	**Nest Locally**
Common Loon	*Gavia immer*	o[4]		o	r	
Horned Grebe	*Podiceps auritus cornutus*	u		u	o	
Eared Grebe	*Colymbus nigricollis californicus*	r		r		
Pied-billed Grebe	*Podilymbus p. podiceps*	c	c	c	r	+
***White Pelican	*Pelecanus erythrorhynchos*	r	r	r		
***Double-crested Cormorant	*Phalacrocoraz a. auritus*	o	o	o	r	
***Great Blue Heron	*Ardea h. herodias*	c	c	c	u	+
***Green Heron	*Butorides v. virescens*	c	c	c		+
Little Blue Heron	*Florida caerulea*	r	o	o		
Cattle Egret	*Bubulcus i. ibis*	u	u			
***Great Egret	*Casmerodius albus egretta*	c	c	c	x	+
***Snowy Egret	*Leucophoyx t. thula*	x	r	r	u	
***Black-capped Chickadee	*Parus a. atricapillus*	u		u	u	+
**Tufted Titmouse	*Parus bicolor*	u	u	u	o	+
White-breasted Nuthatch	*Sitta carolinensis cookie*	o	o	o	u	
Red-breasted Nuthatch	*Sitta canadensis*	u		u	u	
*Brown Creeper	*Certhia familiaris americana*	u		u	x	+
***House Wren	*Troglodytes troglodytes hiemalis*	c	c	c	u	
Winter Wren	*Troglodytes troglodytes hiemalis*	u		u	x	
Bewick's Wren	*Thryomanes bewickii*	x	x	x	r	+
**Carolina Wren	*Thryothorus l. ludovicianus*	r	r	r	r	+

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 2 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

		Season[3]				
Common Name	Scientific Name	Spring	Summer	Fall	Winter	Nest Locally
***Mockingbird	*Mimus p. polyglottos*	r	r	r	r	+
*Gray Catbird	*Dumetella carolinensis*	c	c	c	r	+
***Brown Thrasher	*Toxostoma r. rufum*	c	c	c	r	+
***American Robin	*Turdus m. migratorius*	c	a	c	u	+
*Wood Thrush	*Hylocichla mustellina*	u	u	o		+
*Hermit Thrush	*Catharus guttata faxoni*	c		c	r	
*Swainson's Thrush	*Catharus ustulata swainsoni*	c		c		
*Gray-Cheeked Thrush	*Catharus m. minima*	u		u		
*Veery	*Catharus fuscescena*	u	u	o		+
***Eastern Bluebird	*Siala s. sialis*	u	u	u	r	+
Blue-gray Gnatcatcher	*Polioptiala c. caerulea*	c	u	c		+
*Golden-crowned Kinglet	*Regulus s. satrapa*	c		c	u	
**Ruby-crowned Kinglet	*Regulus c. calendula*	c		c	r	
*Water Pipit	*Anthus spinoletta rubescens*	u		u	r	
Bohemian Waxwing	*Bombycilla garrulous pallidiceps*				x	
*Cedar Waxwing	*Bombycilla cedrorum*	c	u	c	u	+
Northern Shrike	*Lanius excubitor*	r		r	r	
Loggerhead Shrike	*Lanius ludovicianus*	o	o	o	r	+
***European Starling	*Sturnus v. vulgaris*	a	a	a	a	+
White-eyed Vireo	*Vireo griseus noveboracensis*	o		o		
Yellow-throated Vireo	*Vireo flavifrons*	u	u	u		+

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 3 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

		Season[3]				
Common Name	Scientific Name	Spring	Summer	Fall	Winter	Nest Locally
*Oldsquaw	*Clangula hyemalis*	r		r	r	
King Elder	*Somaterai spectabilis*			x		
White-winged Scoter	*Scoter melanitta d. deglandi*	o		o	o	
*Surf Scoter	*Melanitta perspicillata*	o		o	o	
Black Scoter	*Melanitta nigra*			o	r	
Ruddy Duck	*Oxyura jamaicensis rubida*	a	u	c	u	+
Hooded Merganser	*Lophodytes cucullatus*	c	u	c	u	+
*Long-billed Marsh Wren	*Telmatodytes palustris dissaptus*	c	c	c	x	+
Short-billed Marsh Wren	*Cistothorus platensis stellaris*	r	r	r	r	+
***Common Merganser	*Mergus merganser americanus*	a	r	a	a	
*Red-breasted Merganser	*Mergus s. serrator*	u		u	r	
***Turkey Vulture	*Cathartes aura septentrionalis*	c	u	u		+
Goshawk	*Accipiter gentilis atricapillus*	r		r	r	
*Sharp-shinned Hawk	*Accipiter striatus velox*	c		u	r	
*Coopers Hawk	*Accipiter cooperii*	u	u	u	u	+
***Red-tailed Hawk	*Buteo jamaicensis borealis*	c	c	c	c	+
Red-shouldered Hawk	*Buteo lineatus*	u	u	u	o	+
Broad-winged Hawk	*Buteo p. platypterus*	c		c		
Rough-legged Hawk	*Buteo lagopus*	u		u	c	
Golden Eagle	*Aquila chrysaetos canadensis*	r		r	r	
***Bald Eagle	*Haliaeetus leucocephalus*	u	u	u	u	+

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 4 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

Common Name	Scientific Name	Season[3] Spring	Summer	Fall	Winter	Nest Locally
***Marsh Hawk	*Circus cyaneus hudsonius*	u	u	u	u	+
***Osprey	*Pandion haliatus carolinensia*	u	r	u		
Gyrfalcon	*Falco rusticolus obsoletus*	x		x	x	
*Peregrine Falcon	*Falco peregrinus anatum*	r		r	r	
Pigeon Hawk	*Falco c. columbarus*	r		r	r	
***American Kestrel	*Falco s. sparverius*	c	c	c	c	+
Bobwhite	*Colinus v. virginianus*	u	u	u	u	+
*Ring-necked Pheasant	*Phasianus colchicus*	c	c	c	c	+
Sandhill Crane	*Grus canadensis tabida*	r		x		
King Rail	*Rallus e. elegans*	o	o	o	r	+
Virginia Rail	*Rallus l. limicola*	o	o	o	r	+
*Sora	*Porzana carolina*	c	u	c	r	+
Yellow Rail	*Coturnicops n. noveboracensis*	x		x		
Black Rail	*Laterallus j. jamaicensis*	x		x		
*Common Gallinule	*Gallinula chloropus cachinnana*	c	c	c	x	+
***American Coot	*Fulica americana*	a	c	a	u	+
*Semipalmated Plover	*Charadrius semipalmatus*	c	x	c		
Piping Plover	*Charadrius m. melodus*	r	r	r		+
Wilson's Plover	*Charadrius w. wilsonia*		x			
***Killdeer	*Charadrius v. vociferous*	c	c	c	r	+
*American Golden Plover	*Pluvialis d. dominica*	c	u	u		
*Black-bellied Plover	*Pluvialis squatarola*	c	u	u		
*Ruddy Turnstone	*Arenaris interpres morinells*	c	u	c		

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 5 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

		Season[3]				
Common Name	**Scientific Name**	**Spring**	**Summer**	**Fall**	**Winter**	**Nest Locally**
*American Woodcock	*Philohela minor*	u	u	u		+
*Common Snipe	*Capella gallingo delicate*	c	c	c	r	+
Whimbrel	*Numenius p. phaeopus*	r	r	r		
Upland Sandpiper	*Bartrima longicauda*	u	u	u		+
**Spotted Sandpiper	*Actitus macularia*	c	c	c		+
*Solitary Sandpiper	*Tringa s. solitaria*	c	c	c		
Willet	*Catoptrophoirus semipalmatus*	r	x	r		
*Greater Yellowlegs	*Tringa melanoleucus*	c	c	c		
*Lesser Yellowlegs	*Tringa flavipes*	c	c	c		
*Red Knot	*Calidris canutus rufa*	u	o	o		
*Pectoral Sandpiper	*Calidris melanotos*	c	c	c		
White-rumped Sandpiper	*Calidris fuscicollis*	r	r	r		
Baird's Sandpiper	*Calidris bairdii*	r	r	r	x	
*Least Sandpiper	*Calidris minutilla*	c	c	c		
*Dunlin	*Calidris alpine pacifica*	a	c	a	r	
*Short-billed Dowitcher	*Limnodromus griseus hendersoni*	c	c	c		
Long-billed Dowitcher	*Limnodromus scopaceus*	u	u	u		
Stilt Sandpiper	*Micropalama himantopus*	x	u	u		
*Semipalmated Sandpiper	*Calidris pusillus*	a	c	c		
Western Sandpiper	*Calidris mauri*	r	r	r		
Buff-breasted Sandpiper	*Tryngites subruficollis*	r	r	r		
Marbled Godwit	*Limosa fedoa*	r	r	r		

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 6 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

		Season[3]				
Common Name	**Scientific Name**	**Spring**	**Summer**	**Fall**	**Winter**	**Nest Locally**
Hudsonian Godwit	*Limosa haemastica*	x	r	r		
Sanderling	*Crocethia alba*	o	c	c	x	
American Avocet	*Recurvirostra americana*	r		r		
Red Phalarope	*Phalaropus fulicarius*			r	x	
Wilson’s Phalarope	*Stegenopus tricolor*	o	o	o		
Northern Phalarope	*Lobipes lobatus*	o	o	o	x	
Parasitic Jaeger	*Stercorarius parasiticus*		x	r		
Skua	*Catharacta s. skua*			x		
Glaucous Gull	*Larus h. hyperboreus*	r	x	r	r	
Iceland Gull	*Larus g. glaucoides*			r	r	
**Great Black-backed Gull	*Larus marinus*	c	u	c	c	
***Herring Gull	*Larus argentatus smithsonianus*	a	c	a	a	+
***Ring-billed Gull	*Larus delewarensis*	a	c	a	a	+
Franklin’s Gull	*Larus pipixcan*	x	r	r	x	
***Bonaparte’s Gull	*Larus philadelphia*	c	o	a	a	
Forster’s Tern	*Sterna forsteri*	r	o	u		
***Common Tern	*Sterna h. hirundo*	c	c	c	x	+
Least Tern	*Sterna albifrons*		x	x		
*Caspian Tern	*Hydroprogne caspia*	u	c	c		
Black Tern	*Chlidonias niger surinamensis*	c	c	c		+
***Mourning Dove	*Zenaida macroura carolinensis*	c	c	c	c	+
Rock Dove (Pigeon)	*Colomba livia*	c	c	c	c	+
*Yellow-billed Cuckoo	*Coccyzus a. americanus*	u	u	u		+

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 7 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

		Season[3]				
Common Name	**Scientific Name**	**Spring**	**Summer**	**Fall**	**Winter**	**Nest Locally**
*Black-billed Cuckoo	*Coccyzus erythropthalmus*	o	o	o		+
Groove-billed Ani	*Crotophaga s. sulcirostris*			x		
Barn Owl	*Tyto alba pratincola*	u	u	u	u	+
**Screech Owl	*Otus osio naevius*	c	c	c	c	+
*Great Horned Owl	*Bubo v. virginianus*	c	c	c	c	+
Snowy Owl	*Nyctea scandiaca*	o		o	o	
Barred Owl	*Strix v. varia*	r	r	r	r	+
Long-eared Owl	*Asio otus wilsonianus*	o	o	o	o	+
Short-eared Owl	*Asio f. flammeus*	o		o	o	
Saw-whet Owl	*Aegolius a. acadicus*	o	x	o	r	+
Whip-poor-will	*Caprimulgus v. vociferous*	u		r		
***Common Nighthawk	*Chordeiles m. minor*	c	a	c		+
*Chimney Swift	*Chaetura pelagica*	c	u	a		+
*Ruby-throated Hummingbird	*Ardchilochus colubris*	u	u	u		+
***Belted Kingfisher	*Megaceryle a. alcyon*	c	c	c	o	+
***Yellow-shafted Flicker	*Colaptes a. auratus*	c	c	c	u	+
Red-bellied Woodpecker	*Centurus carolinus zebra*	u	u	u	u	+
***Red-headed Woodpecker	*Melanerpes e. erythrocephalus*	c	c	c	u	+
*Yellow-bellied Sapsucker	*Sphyrapicus v. varius*	c		c	r	
*Hairy Woodpecker	*Dendrocopos villosus*	u	u	u	u	+
***Downy Woodpecker	*Dendrocopos p. pubescens*	c	c	c	c	+
***Eastern Kingbird	*Tyrannus tyrannus*	c	c	c		+

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 8 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

Common Name	Scientific Name	Season[3] Spring	Summer	Fall	Winter	Nest Locally
Western Kingbird	*Tyrannus verticalis*		x	x		
*Great Crested Flycatcher	*Mylarchus crinitus boreus*	c	c	c		+
*Eastern Phoebe	*Sayornis phoebe*	u	u	u		+
Yellow-bellied Flycatcher	*Empidonax flaviventria*	u		u		
Acadian Flycatcher	*Empidonax virescens*	r	r	r		+
*Traill's Flycatcher	*Empidonax trailli*	c	c	c		+
*Least Flycatcher	*Empidonax minimus*	c	c	c		+
*Eastern Wood Pewee	*Contopus virens*	c	c	c		+
Olive-sided Flycatcher	*Nuttallornis borealis*	u	u	u		
***Horned Lark	*Ermophila alpestris*	c	u	c	c	+
**Tree Swallow	*Iradoprocne bicolor*	c	a	a	x	+
*Bank Swallow	*Riparia r. riparia*	c	a	c		+
*Rough-winged Swallow	*Stelgidopteryx ruficollis serripennis*	c	c	c		+
***Barn Swallow	*Hirundo rustica erythrogaster*	c	c	c		+
*Cliff Swallow	*Petrachelidon pyrrhonata*	u	r	u		+
***Purple Martin	*Progne s. subis*	c	c	c		+
***Blue Jay	*Cyanocitta cristata bromia*	a	c	c	c	+
Black-billed Magpie	*Pica pica*	x			x	
***Common Crow	*Corvus b. brachrhynchos*	c	u	c	u	+
*Black-crowned Night Heron	*Nycticorax nycticorax hoactli*	c	c	c	o	+
Yellow-crowned Night Heron	*Nyctanassa v. violacea*	r	r			

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 9 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

		Season[3]				
Common Name	**Scientific Name**	**Spring**	**Summer**	**Fall**	**Winter**	**Nest Locally**
Least Bittern	*Ixobrychus e. exilis*	u	u	u	x	+
American Bittern	*Botaurus lentiginosus*	u	u	u	r	+
Glossy Ibis	*Plegadis f. falcinellus*	o	o			
**Mute Swan	*Cygnus olor*	r	r	r	r	
Whistling Swan	*Olor columbianus*	a	x	c	o	
***Canada Goose	*Branta canadensis*	a	c	a	a	
Brant	*Branta bernicla*	x		r		
Barnacle Goose	*Branta leucopsis*		x	x	x	
White-fronted Goose	*Anser albifrons frontalis*			x	x	
***Snow Goose	*Chen c. caerulescens*	o		c	u	
Blue Goose	*Chen c. caerulescens*	o		c	u	
Fulvous Tree Duck	*Dendrocygna bicolor helva*			x		
***Mallard	*Anas p. platyrhynchos*	a	a	a	a	+
**Black Duck	*Anas rubripes*	a	c	a	a	+
*Gadwall	*Ana strepera*	c	u	c	r	+
***Pintail	*Anas acuta*	a	u	a	c	+
***American Green-winged Teal	*Anas crecca carolinensis*	c	u	c	o	+
**Blue-winged Teal	*Anas d. discors*	c	c	a	x	+
European Wigeon	*Anas penelope*	r		r	x	
*American Wigeon	*Anas americana*	a	u	a	o	+
Northern Shoveler	*Anas clypeata*	c	u	c	r	+
***Wood Duck	*Aix sponsa*	c	c	a	r	+
*Redhead	*Aythya americana*	c	u	c	o	+
Ring-necked Duck	*Aythya collaris*	c	x	c	r	
Canvasback	*Aythya valisineria*	a	x	a	c	
Greater Scaup	*Aythya marilla*	u		u	r	

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 10 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

Common Name	Scientific Name	Season[3] Spring	Summer	Fall	Winter	Nest Locally
**Lesser Scaup	*Aythya affinis*	a	u	c	u	+
*Common Goldeneye	*Bucephala clangula americana*	c		c	c	
***Bufflehead	*Bucephala albeola*	c		c	u	
Solitary Vireo	*Vireo s. solitarius*	u		u		
*Red-eyed Vireo	*Vireo olivaceus*	c	c	c		+
*Philadelphia Vireo	*Vireo philadelphicus*	u		u		
*Warbling Vireo	*Vireo g. gilvus*	c	c	c		+
Black and White Warbler	*Mniotilta varia*	c		c		
Prothontary Warbler	*Protonotaria citrea*	u	u	u		+
Worm-eating Warbler	*Helmitheros vermivorus*	r		x		
Golden-winged Warbler	*Vermivora chyrysoptera*	u		u		
Blue-winged Warbler	*Vermivora pinus*	u	r	u		+
Tennessee Warbler	*Vermivora peregrina*	c		c		
*Orange-crowned Warbler	*Vermivora celata*	o		o	x	
*Nashville Warbler	*Vermivora r. ruficapilla*	c		c		
Northern Parula	*Parula americana*	o		o		
*Yellow Warbler	*Dendroica petechia aestiva*	c	c	c		+
*Magnolia Warbler	*Dendroica magnolia*	c	x	c		
*Cape May Warbler	*Dendroica tigrina*	c		c		
*Black-throated Blue Warbler	*Dendroica c. caerulescens*	c		c		
*Myrtle Warbler	*Dendroica c. coronata*	a		a	o	
*Black-throated Green Warbler	*Dendroica v. virens*	c		c		

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 11 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

Common Name	Scientific Name	Season[3] Spring	Summer	Fall	Winter	Nest Locally
Cerulean Warbler	*Dendroica cerulea*	u	x	o		+
*Blackburnian Warbler	*Dendroica fusca*	c		c		
Yellow-throated Warbler	*Dendroica dominica albilora*	x				
*Chestnut-sided Warbler	*Dendroica pennyslvanica*	c	o	c		+
*Bay-breasted Warbler	*Dendroica castanea*	c		c		
*Blackpoll Warbler	*Dendroica striata*	c		c		
Pine Warbler	*Dendroica p. pinus*	o		o	x	
Prairie Warbler	*Dendroica d. discolor*	o		o		
*Palm Warbler	*Dendroica p. palmarum*	c		c		
*Ovenbird	*Seiurus a. aurocapillus*	c	c	c		+
*Northern Waterthrush	*Seiurus noveboracensis*	c		c		
Louisiana Waterthrush	*Seiurus motacilla*	r	x	x		
Kentucky Warbler	*Oporonis formosus*	r	r	r		+
Connecticut Warbler	*Oporornis agilis*	r		r		
*Mourning Warbler	*Oporonrnis philadelphia*	u		u		
*Common Yellowthroat	*Geothlypis trichas brachidactylus*	c	c	c	r	+
*Yellow-breasted Chat	*Icteria v. virens*	u	u	u		
Hooded Warbler	*Wilsonia citrina*	r	r	r		+
*Wilson's Warbler	*Wilsonia p. pusilla*	c		c		
*Canada Warbler	*Wilsonia canadensis*	c		c		
*American Redstart	*Setophaga ruticilla*	c	r	c		+

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 12 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

		Season[3]				
Common Name	Scientific Name	Spring	Summer	Fall	Winter	Nest Locally
*House Sparrow	*Passer domesticus*	a	a	a	a	+
*Bobolink	*Dolichonyx oryzivorus*	u	u	u		+
***Eastern Meadowlark	*Sturnella m. magna*	c	c	c	u	+
Western Meadowlark	*Sturnella neglecta*	u	u	u		+
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	r	x	x		
***Red-winged Blackbird	*Agelaius phoeniceus*	a	a	a	a	+
Orchard Oriole	*Icterus spurius*	r	r	r		+
***Baltimore Oriole	*Icterus g. galbula*	c	u	u	x	+
Rusty Blackbird	*Euphagus c. carolinus*	c		c	u	
Brewer’s Blackbird	*Euphagus cyanocephalus*	o		o	r	
***Common Grackle	*Quiscalus quiscula versicolor*	a	a	a	u	+
***Brown-headed Cowbird	*Molothrus a. ater*	c	c	c	u	+
*Scarlet Tanager	*Piranga olivacea*	c	u	c		+
Summer Tanager	*Piranga r. rubra*	r	x	x		
***Cardinal	*Cardinalis c. cardinalis*	c	c	c	c	+
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	c	r	c		+
*Indigo Bunting	*Passerina cyanea*	c	c	c		+
***Dickcissel	*Spiza americana*	u	u	u		+
*Evening Grosbeak	*Hesperiphona v. vespertina*	o		o	o	
Purple Finch	*Carpodacus p. purpureus*	u	x	u	u	
Hoary Redpoll	*Acanthis hornemanni*	x		x		
Common Redpoll	*Acanthis flammea*	o		o	o	

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 13 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

		Season[3]				
Common Name	Scientific Name	Spring	Summer	Fall	Winter	Nest Locally
Pine siskin	*Spinus p. pinus*	u		u	o	
***American Goldfinch	*Spinus t. tristis*	c	c	c	c	+
*Rufous-sided Towhee	*Pipilo e. erythrophthalmus*	c	c	c	u	+
*Savannah Sparrow	*Passerculus sandwichensis*	c	c	c	x	+
Grasshopper Sparrow	*Ammodramus savannarum pratensis*	o	o	o		+
Iienslow's Sparrow	*Ammodramus henslowii*	x	x			
Le Conte's Sparrow	*Ammospiza leconteii*	x		r		
Sharp-tailed Sparrow	*Ammospiza caudacuta*	r		r		
*Vesper Sparrow	*Pooecetes g. gramineus*	u	u	u	x	+
**Slate-colored Junco	*Junco h. hyemalis*	c		c	u	
Oregon Junco	*Junco hyemalis organus*	o		o	o	
*Tree Sparrow	*Spizella a. arborea*	c		c	c	
**Chipping Sparrow	*Spizella p. passerine*	u	u	u		+
*Field Sparrow	*Spizella p. pusilla*	u	u	u	r	+
Harris' Sparrow	*Zonotrichia guerula*	x		x		
*White-crowned Sparrow	*Zonotrichia leucophrys*	c	x	c	u	
*White-throated Sparrow	*Zonotrichia albicollis*	c	x	c	u	
Fox Sparrow	*Passerella i. iliaca*	c		c	r	
*Lincoln's Sparrow	*Melospiza lincolnii*	u		u	x	
*Swamp Sparrow	*Melospiza Georgiana*	u	r	c	o	+
**Song Sparrow	*Melospiza melodia euphonis*	c	c	c	u	+
House Sparrow	*Passer domesticus*	c	c	c	c	+

Table 2.4-4 Birds Potentially Occurring in the Monroe, Michigan Region and Seasonal Abundance[1] (Sheet 14 of 14)

(Asterisks in the left column indicated species observed on the Fermi property since 2000[2])

Common Name	Scientific Name	Season[3] Spring	Summer	Fall	Winter	Nest Locally
Lapland Longspur	*Calcarius l. lapponicus*	u		u	u	
*Snow Bunting	*Plectrophenax n. nixalis*	c		c	c	

Notes:

1 Potential species, season, and nesting is derived from surveys conducted on the Ottawa National Wildlife Refuge at Oak Harbor, OH, located about 30 miles southeast of Fermi.

2 Observed on the Fermi property
  * Last observation reported in 2000 Detroit Edison Wildlife Management Plan
  ** Last observation reported 2002 Detroit Edison Wildlife Habitat Program Re-certification
  *** Last observation during 2006-08 Fermi 3 Terrestrial Studies

3 Spring = March – May; Summer = June – August; Fall = September – November; Winter = December – February

4 a = abundant – a common species which is very numerous
c = common – certain to be seen in suitable habitat
u = uncommon – present, but not certain to be seen
o = occasional – seen only a few times during a season
r = rare – seen at intervals of 2 to 5 years
x = accidental – has been seen only once or twice
+ = species nest locally

Table 2.4-5 Amphibians and Reptiles Occurring on the Fermi Site

Common Name	Scientific Name
Reptiles	
Banded Water Snake*	*Natrix sipedon fasciata*
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*
Eastern Milk Snake	*Lampropeltis doliata triangularius*
Eastern Spiny Softshell Turtle*	*Trionix spiniferus*
Eastern Fox Snake*	*Pantherophis gloydi*
Northern Water Snake	*Natrix sipedon sipedon*
Snapping Turtle*	*Chelydra serpentine serpentina*
Speckled Kingsnake*	*Lampropeltis getulus holbrooki*
Three-toed Box Turtle*	*Terrapene carolina triunquis*
Painted Turtle	*Chrysemys picta*
Map Turtle	*Graptemys geographica*
Amphibians	
American Toad*	*Bufo americanus*
Blanchard's Cricket Frog	*Acris crepitans blanchardi*
Bullfrog*	*Rana catesbiana*
Northern Leopard Frog	*Rana pipiens pipiens*
Chorus Frog	*Pseudacris triseriata*

*Observed 2007-08

Table 2.4-6 Flora and Fauna Noted on the Fermi Site during Wildlife Habitat Council (WHC) Site Visit, July 2000 (Sheet 1 of 2)

Species Type	Common Name	Scientific Name
Birds	American robin	*Turdas migratorius*
	Killdeer	*Charadrius vociferus*
	Chimney swift	*Chaetura pelagica*
	Great blue heron	*Ardea Herodias*
	American goldfinch	*Carduelis tristis*
	Indigo bunting	*Passerian cyanea*
	Red-winged blackbird	*Agelaius phoeniceus*
	Turkey vulture	*Cathartes aura*
	Great egret	*Casmerodius albus*
Trees, shrubs, & vines	Staghorn sumac	*Rhus typhina*
	Cottonwood	*Populus deltoids*
	Sandbar willow	***Salix exigua***
	Willow sp.	*Salix* sp.
	Grey dogwood	*Cornus racemosa*
	Wild grape sp.	*Vitis* sp.
	Bush honeysuckle	*Diervilla lonicera*
	Trumpet creeper	*Campsis radicans*
	Boxelder	*Acer negundo*
	Sycamore	*Platanus occidentalis*
	Multiflora rose	*Rosa multiflora*
Herbaceous plants	**Purple loosestrife**	***Lythrum salicaria***
	Giant reed grass	*Phragmites* sp.
	Cattail sp.	***Thpha* sp.**
	Softstem bulrush	***Scirpus* sp.**
	Common milkweed	*Asclepias syracia*
	Goldenrod sp.	*Solidago* sp.
	Common mullein	*Verbascum thapsis*
	Daisy fleabane	*Erigeron annus*
	Black-eyed susan	*Rudbeckia hirta*

Table 2.4-6 Flora and Fauna Noted on the Fermi Site during Wildlife Habitat Council (WHC) Site Visit, July 2000 (Sheet 2 of 2)

Species Type	Common Name	Scientific Name
	Poppy	*Papavera* sp.
	Coreopsis sp.	*Coriopsis* sp.
	Teasel	*Dipsacus* sp.
	Tiger lily	*Lilium lancifolium*
	Jewelweed	*Impatiens capensis*
	May apple	*Potophyllum peltatum*
	Raspberry sp.	*Rubus* sp.
	American lotus*	***Nelumbo lutea***
Reptiles & amphibians	Soft shell turtle*	*Trionix spiniferus*
	Blanding's turtle*	*Emydoidea blandingii*
	American toad	*Bufo americanus*
Insects	Spittle bug	*Philaenus spumarius*
	Fishfly	***Carydalidae***
	Monarch butterfly	*Danaus plexippus*
Mammals	Coyote*	*Canis latrans*
	White-tailed deer**	*Odocoileus virginiana*
	Red fox*	*Vulpes fulva*
	Raccoon*	*Procyon lotor*
	Eastern cottontail rabbit	*Syvilagus floridana*
	Fox squirrel	*Sciurus niger*

Bold-type indicates aquatic species. Aquatic plants listed above are designated as Obligate (OBL) species by the U.S. Fish & Wildlife Service-National Wetlands Inventory. Occurrence of these species may indicate potential wetland habitat. This is further discussed in Subsection 2.4.1.

* Reported by employees as occurring onsite
** Identified by tracks

Table 2.4-7 Individual Phytoplankton Taxa from Lake Erie Near the Davis Besse Power Plant (1978) (Sheet 1 of 2)

Bacillariophyceae

Asterionella formosa
Diatoma sp.
Fragilaria crotonensis
Gyrosigma sp.
Melosira sp.
Navicula sp.
Nitzschia sigmoidea
Nitzschia sp.
Sceletonema subsalsa
Stephanodiscus binderanus
Stephanodiscus sp.
Surirella sp.
Synedra actinastroides
Synedra sp.
Tabellaria sp.

Chlorophyceae

Actinastrum hantzchii
Actinastrum sp.
Ankistrodesmus falcatus
Binuclearia tatrana
Botryococcus sudeticus
Closteriopsis longissima
Closterium acerosum
Closterium sp.
Coelastrum sp.
Cosarium sp.
Dictyospahaerium sp.
Kirchneriella sp.
Oocystis sp.
Pediastrum duplex
Pediastrum simplex
Scenedesmus sp.
Selenastrum sp.
Spirogyra crassa
Spirogyra sp.

Table 2.4-7 Individual Phytoplankton Taxa from Lake Erie Near the Davis Besse Power Plant (1978) (Sheet 2 of 2)

Staurastrum paradoxum
Chlorophyceae
Tetraspora sp.
Trentepohlia sp.
Unidentified

Chrysophyseae
Dinobryon sp.

Dinophyceae
Ceratium hirudinella
Peridinium sp.

Euglenophyceae
Euglena sp.

Myxophyceae
Anabaena spiroides
Anabaena sp.

Myxophyceae
Aphanizomenon flos-aquae
Chroococcus sp.
Coelsphaerium sp.
Merismopedia sp.
Microcystis sp.
Oscillatoria sp.
Raphidiopsis sp.
Unidentified

Protozoa
Domatomonas sp.
Unidentified flagellate

Source: Reference 2.4-85

Table 2.4-8 Individual Zooplankton Taxa from Lake Erie Near the Davis Besse Power Plant (1978) (Sheet 1 of 2)

Rotifera

Asplianchna priodonta

Brachionus angularis

B. calyciflorus

B. diversicornus

Cephadella spp.

Chromogaster sp.

Filinia terminalis

Kellicottia longispina

Keratella cochlearis

K. quadrata

K. vulga

Lecane spp.

Lepadella sp.

Notholca spp.

Polyarthra vulgaris

Synchaeta spp.

Trichocerca spp.

T. multicrinis

Unknown Rotifer A

Unknown Rotifer B

Copepoda

Calanoid Copepods

Diaptomus minutus

D. sicilis

D. siciloides

Eurytemora affinis

Copepodids, calanoid

Nauplii, calanoid

Table 2.4-8 Individual Zooplankton Taxa from Lake Erie Near the Davis Besse Power Plant (1978) (Sheet 2 of 2)

Copepoda

Cyclopoid Copepods

Cyclops bicuspidatus thomasi

C. vernalis

Mesocyclops edax

Tropocyclops pransnex

Copepodids, cyclopoid

Naupleii, cyclopoid

Cladocera

Bosmina longirostris

Chydorus sphaericus

Diaphanosoma leuchtenbergianum

Daphnia galeata mendote

D. retrocurva

Eubosmina corregoni (mature)

E. corregoni (immature)

Leptodora kindtii

Protozoa

Difflugia sp.

Source: Reference 2.4-86

Table 2.4-9 Individual Benthic Macroinvertebrate Taxa in Lake Erie Near the Davis Besse Power Plant (1978)

Coelenterata
Hydra sp. (single polyp)
Hydra sp. (budding polyp)

Annelida
Helobdella elongata
H. stagnalis

Oligochaeta
Immatures (hair setae)
Immatures (no hair setae)
Branchuira sowerbyi
Limnodrilus cervix
L. claparedeanus
L. maumeensis
Ophidonais serpentina
Potamothrix moldaviensis

Arthropoda
Caenis sp.
Chironomus sp.
Cryptochironomus sp.
Ephemeridae
Gammarus fasciatus
Glyptotendiples sp.
Hyallela azteca
Leptodora kindtii
Polypedilum sp.
Procladius sp.
Tanytarsus pupae
Tanytarsus sp.

Mollusca
Amblema sp.

Source: Reference 2.4-87

Table 2.4-10 Fish Species Collected in Ichthyoplankton Studies in Western Lake Erie from 1974 to 1986

Common Name	Scientific Name	Family
Bluegill sunfish	*Lepomis macrochirus*	Centrarchidae
Channel catfish	*Ictalurus punctatus*	Ictaluridae
Common carp	*Cyprinus carpio*	Cyprinidae
Emerald shiner	*Notropis atherinoides*	Cyprinidae
Freshwater drum	*Aplodinotus grunniens*	Sciaenidae
Gizzard shad	*Dorosoma cepedianum*	Clupeidae
Lake whitefish	*Coregonus clupeaformus*	Salmonidae
Logperch darter	*Percina caprodes*	Percidae
Rainbow smelt	*Osmerus mordax*	Osmeridae
Spottail shiner	*Notropis hudsonius*	Cyprinidae
Troutperch	*Percopsis omiscomaycus*	Percopsidae
Unidentified		
Unidentified crappie	*Pomoxis* spp.	Centrarchidae
Unidentified shiner	*Notropis* spp.	Cyprinidae
Unidentified sucker		Catostomidae
Unidentified sunfish	*Lepomis* spp.	Centrarchidae
Walleye	*Sander vitreus*	Percidae
White bass	*Morone chrysops*	Moronidae
White sucker	*Catostomus commersoni*	
Yellow perch	*Perca flavescens*	Percidae

Source: Reference 2.4-88 and Reference 2.4-89

Table 2.4-11 Fish Species Impinged at Bayshore Power Station in the Ohio Waters of Western Lake Erie 1976-1977, Michigan Waters, and Waters of the DRIWR, 2005 (Sheet 1 of 2)

Family	Common Name	Scientific Name
Bowfins	Bowfin	*Amia calva*
Bullhead catfishes	Brown bullhead	*Ameiurus nebulosus*
	Yellow bullhead	*Ameiurus natalis*
	Black bullhead	*Ameiurus melas*
	Stonecat madtom	*Noturus flavus*
	Tadpole madtom	*Noturus gyrinus*
	Brindled madtom	*Noturus miurus*
	Channel catfish	*Ictalurus punctatus*
Carps and Minnows	Common carp	*Cyprinus carpio*
	Goldfish	*Carassius auratus*
	Spotfin shiner	*Cyprinella spiloptera*
	Spottail shiner	*Notropis hudsonius*
	Emerald shiner	*Notropis atherinoides*
	Mimic shiner	*Notropis volucellus*
	Sand shiner	*Notropis stramineus*
	Common shiner	*Luxilus cornutus*
	Golden shiner	*Notemigonus crysoleucas*
	Bluntnose minnow	*Pimephales notatus*
	Silver chub	*Macrhybopsis storeriana*
	Fathead minnow	*Pimephales promelas*
Drums	Freshwater drum	*Aplodinotus grunniens*
Gars	Longnose gar	*Lepisosteus osseus*
Gobies	Round goby	*Neogobiusmelanostomus*
	Tubenose goby	*Proterorhinus marmoratus*
Herrings	Alewife	*Alosa pseudoharengus*
	Gizzard shad	*Dorosoma cepedianum*
Killifishes	Banded killifish	*Fudulus diaphanus*
Lampreys	Silver lamprey	*Ichthyomyzon unicuspis*
	Sea lamprey	*Petromyzon marinus*
Mooneyes	Mooneye	*Hiodon tergisus*
Perches	Yellow perch	*Perca falvescens*
	Walleye	*Sander vitreus*
	Johnny darter	*Etheostoma nigrum*
	Logperch	*Percina caprodes*
	Channel darter	*Percina copelandi*
	Sauger	*Sander canadensis*

Table 2.4-11 Fish Species Impinged at Bayshore Power Station in the Ohio Waters of Western Lake Erie 1976-1977, Michigan Waters, and Waters of the DRIWR, 2005 (Sheet 2 of 2)

Family	Common Name	Scientific Name
Pikes	Northern pike	*Esox lucius*
Salmons	Chinook salmon Coho salmon	*Oncorhychus tshawytscha* *Oncorhychus kisutch*
Sculpins	Mottled sculpin	*Cottus bairdii*
Silversides	Brook silverside	*Labidesthes sicculus*
Smelts	Rainbow smelt	*Osmerus mordax*
Sticklebacks	Threespine stickleback	*Gasterosteus aculeatus*
Striped basses	White perch White bass	*Morone americana* *Morone chrysops*
Suckers	Quillback Bigmouth buffalo Shorthead redhorse White sucker Northern hog sucker	*Carpiodes cyprinus* *Ictiobus cyprinellus* *Moxostoma macrolepidotum* *Catostomus commersonii* *Hypentelium nigricans*
Sunfishes	Orangespotted sunfish Green sunfish Longear sunfish Bluegill Pumpkinseed Rock bass Largemouth bass Smallmouth bass White crappie Black crappie	*Lepomis humilis* *Lepomis cyanellus* *Lepomis megalotis* *Lepomis macrochirus* *Lepomis gibbosus* *Ambloplites rupestris* *Micropterus salmoides* *Micropterus dolomieu* *Pomoxis annularis* *Pomoxis nigromaculatus*
Trout-perches	Trout-perch	*Percopsis omiscomaycus*

Source: Reference 2.4-88

Table 2.4-12 Fish Species Collected in Stony Creek

Common Name	Scientific Name
Blackside darter	*Percina Maculata*
Bluegill	*Lepomis macrochirus*
Bluntnose minnow	*Pimephales notatus*
Carp	*Cyprinus carpio*
Central mudminnow	*Umbridae limi*
Creek chub	*Semotilus atromaculatus*
Fathead minnow	*Pimephales promelus*
Golden redhorse	*Moxostoma erythrurum*
Grass pike	*Esox americanus*
Green sunfish	*Lepomis cyanellus*
Greenside	*Etheostoma blennioides*
Johnny darter	*Etheostoma nigrum*
Logperch	*Percina caprodes*
Northern hog sucker	*Hypentelium nigricans*
Northern pike	*Esox lucius*
Pumpkinseed	*Lepomis gibbosus*
Rainbow darter	*Etheostoma caruleum*
Rock bass	*Ambloplites rupestris*
Trout	*Salmonidae*
Western sucker	*Catostomus commersomi*
White bass	*Morone chrysops*
White sucker	*Catostomus commersoni*
Yellow perch	*Perca flavescens*

Source: Reference 2.4-90 and Reference 2.4-91

Table 2.4-13 Fish Species Known to Occur in the Ottawa-Stony Watershed HUC #4100001 (Sheet 1 of 3)

Common Name	Scientific Name	Occurrence Status
Bigeye chub	*Hybopsis amblops*	Current
Bigmouth buffalo	*Ictiobus cyprinellus*	Current
Black bullhead	*Ameiurus melas*	Current
Blackchin shiner	*Notropis heterodon*	Current
Blacknose shiner	*Notropis heterolepis*	Current
Blackside darter	*Percina maculata*	Current
Bluegill	*Lepomis macrochirus*	Current
Bluntnose minnow	*Pimephales notatus*	Current
Brindled madtom	*Noturus miurus*	Current
Brook stickleback	*Culaea inconstans*	Current
Brown bullhead	*Ameiurus nebulosus*	Current
Central mudminnow	*Umbra limi*	Current
Central stoneroller	*Campostoma anomalum*	Current
Channel catfish	*Ictalurus punctatus*	Current
Channel darter	*Percina copelandi*	Current
Common shiner	*Luxilus cornutus*	Current
Creek chubsucker	*Erimyzon oblongus*	Current
Fantail darter	*Etheostoma flabellare*	Current
Fathead minnow	*Pimephales promelas*	Current
Flathead catfish	*Pylodictis olivaris*	Current
Freshwater drum	*Aplodinotus grunniens*	Current
Gizzard shad	*Dorosoma cepedianum*	Current
Golden redhorse	*Moxostoma erythrurum*	Current
Greenside darter	*Etheostoma blennioides*	Current
Hornyhead chub	*Nocomis biguttatus*	Current
Iowa darter	*Etheostoma exile*	Current
Johnny darter	*Etheostoma nigrum*	Current
Lake chubsucker	*Erimyzon sucetta*	Current
Largemouth bass	*Micropterus salmoides*	Current

Table 2.4-13 Fish Species Known to Occur in the Ottawa-Stony Watershed HUC #4100001 (Sheet 2 of 3)

Common Name	Scientific Name	Occurrence Status
Least darter	*Etheostoma microperca*	Current
Logperch	*Percina caprodes*	Current
Longear sunfish	*Lepomis megalotis*	Current
Mottled sculpin	*Cottus bairdi*	Current
Northern hog sucker	*Hypentelium nigricans*	Current
Northern pike	*Esox lucius*	Current
Orangespotted sunfish	*Lepomis humilis*	Current
Orangethroat darter	*Etheostoma spectabile*	Current
Pugnose minnow	*Opsopoeodus emiliae*	Current
Pumpkinseed	*Lepomis gibbosus*	Current
Quillback	*Carpiodes cyprinus*	Current
Rainbow darter	*Etheostoma caeruleum*	Current
Redfin or Grass Pickerel	*Esox americanus*	Current
Redfin shiner	*Lythrurus umbratilis*	Current
River chub	*Nocomis micropogon*	Current
River darter	*Percina shumardi*	Current
Rosyface shiner	*Notropis rubellus*	Current
Sauger	*Sander canadensis*	Current
Shorthead redhorse	*Moxostoma macrolepidotum*	Current
Silver redhorse	*Moxostoma anisurum*	Current
Silverjaw minnow	*Ericymba buccata*	Current
Smallmouth bass	*Micropterus dolomieu*	Current
Spotfin shiner	*Cyprinella spiloptera*	Current
Spottail shiner	*Notropis hudsonius*	Current
Spotted gar	*Lepisosteus oculatus*	Current
Spotted sucker	*Minytrema melanops*	Current
Stonecat	*Noturus flavus*	Current
Striped shiner	*Luxilus chrysocephalus*	Current
Tadpole madtom	*Noturus gyrinus*	Current

Table 2.4-13 Fish Species Known to Occur in the Ottawa-Stony Watershed HUC #4100001 (Sheet 3 of 3)

Common Name	Scientific Name	Occurrence Status
Trout-perch	*Percopsis omiscomaycus*	Current
Walleye	*Sander vitreus*	Current
White bass	*Morone chrysops*	Current
Yellow bullhead	*Ameiurus natalis*	Current
Yellow perch	*Perca flavescens*	Current
Creek chub	*Semotilus atromaculatus*	Historical
Emerald shiner	*Notropis atherinoides*	Historical
Golden shiner	*Notemigonus crysoleucas*	Historical
Green sunfish	*Lepomis cyanellus*	Historical
Rock bass	*Ambloplites rupestris*	Historical

Source: Reference 2.4-90 and Reference 2.4-91

Table 2.4-14 Commercial and Recreational Fish Species in the Vicinity of the Fermi Site (Sheet 1 of 2)

Common Name	Scientific Name	Watershed	Commercial Importance	Recreational Importance
Alewife	*Alosa pseudoharengus*	Lake Erie Stony Creek Swan Creek	Processed for animal food	Baitfish
Black crappie	*Pomoxis nigromaculatus*	Lake Erie Stony Creek Swan Creek	Food species	Sportfish
Bluegill	*Lepomis macrochirus*	Lake Erie Stony Creek Swan Creek	Food species	Sportfish
Bluntnose minnow	*Pimephales notatus*	Lake Erie Stony Creek Swan Creek	n/a	Baitfish
Channel catfish	*Ictalurus punctatus*	Lake Erie Stony Creek Swan Creek	Commercial fishery	Sportfish
Common shiner	*Luxilus cornutus*	Lake Erie Stony Creek Swan Creek	n/a	Baitfish
Emerald shiner	*Notropis atherinoides*	Lake Erie	n/a	Baitfish
Freshwater drum	*Applodinotus grunniens*	Lake Erie	Commercial Fishery	Sportfish
Gizzard shad	*Dorosoma cepadianum*	Lake Erie Stony Creek Swan Creek	n/a	Baitfish
Largemouth bass	*Micropterus salmoides*	Lake Erie Stony Creek Swan Creek	Food species	Sportfish

Table 2.4-14 Commercial and Recreational Fish Species in the Vicinity of the Fermi Site (Sheet 2 of 2)

Common Name	Scientific Name	Watershed	Commercial Importance	Recreational Importance
Pumpkinseed	*Lepomis gibbosus*	Lake Erie Stony Creek Swan Creek	n/a	Sportfish
Rainbow smelt	*Osmerus mordax*	Lake Erie	Processed for animal foods	Sportfish
Rock bass	*Ambloplites rupestris*	Lake Erie Stony Creek Swan Creek	Food species	Sportfish
Spottail shiner	*Notropis hudsonius*	Lake Erie Stony Creek Swan Creek	n/a	Baitfish
Walleye	*Sander vitreus*	Lake Erie Stony Creek Swan Creek	Food species	Sportfish
White bass	*Morone chrysops*	Lake Erie	Food species	Sportfish
White crappie	*Pomoxis annularis*	Lake Erie Stony Creek Swan Creek	Food species	Sportfish
White perch	*Morone Americana*	Lake Erie Stony Creek Swan Creek	n/a	Sportfish
Yellow perch	*Perca flavescens*	Lake Erie Stony Creek Swan Creek	Food species	Sportfish

Table 2.4-15 Threatened and Endangered Fish and Mollusk Species Within a 50-mi Radius of the Fermi Site (Sheet 1 of 4)

Location	Scientific Name	Common Name	Federal Status	State Status
Monroe County	**Fish**			
	Acipenser fulvescens	Lake sturgeon		T
	Ammocrypta pellucida	Eastern sand darter		T
	Erimyzon oblongus	Creek chubsucker		E
	Notropis photogenis	Silver shiner		E
	Opsopoedus emiliae	Pugnose minnow		E
	Percina copelandi	Channel darter		E
	Percina shumardi	River darter		E
	Phoxinus erythrogaster	Southern redbelly dace		E
	Sander canadensis	Sauger		T
	Mollusks			
	Epioblasma obliquata perobliqua	White catspaw		E
	Epioblasma torulosa rangiana	Northern riffelshell	E	E
	Epioblasma triquetra	Snuffbox		E
	Lampsilis fasciola	Wavy-rayed lampmussel		T
	Obovaria subrotunda	Round hickorynut		E
	Simpsonaias ambigua	Salamander mussel		E
	Toxolasma lividus	Purple lilliput		E
Wayne County	**Fish**			
	Acipenser fulvescens	Lake Sturgeon		T
	Opsopoedus emiliae	Pugnose minnow		E
	Percina shumardi	River darter		E
	Sander canadensis	Sauger		T
Livingston County	**Fish**			
	Ammocrypta pellucida	Eastern sand darter		T
	Notropis photogenis	Silver shiner		E
	Phoxinus erythrogaster	Souther redbelly dace		E

Table 2.4-15 Threatened and Endangered Fish and Mollusk Species Within a 50-mi Radius of the Fermi Site (Sheet 2 of 4)

Location	Scientific Name	Common Name	Federal Status	State Status
Washtenaw County	**Fish**			
	Notropis photogenis	Silver shiner		E
	Phoxinus erythrogaster	Souther redbelly dace		E
Lenawee County	**Fish**			
	Ammocrypta pellucida	Eastern sand darter		T
	Erimyzon oblongus	Creek chubsucker		E
	Phoxinus erythrogaster	Southern redbelly dace		E
Macomb County	**Fish**			
	Ammocrypta pellucida	Eastern sand darter		T
Oakland County	**Fish**			
	Ammocrypta pellucida	Eastern sand darter		T
Ohio Lucas County	**Fish**			
	Acipenser fulvescens	Lake sturgeon		E
	Percina copelandi	Channel darter		T
Ohio Lucas County	**Mollusks**			
	Ligumia nasuta	Eastern pondmussel		E
	Ligumia recta	Black sandshell		T
	Obliquaria reflexa	Threehorn wartyback		T
	Truncilla donaciformis	Fawnsfoot		T
	Villosa fabalis	Rayed bean		E
Ohio Fulton County	**Fish**			
	Moxostoma valenciennesi	Greater redhorse		T
Ohio Wood County	**Fish**			
	Fundulus diaphanus menona	Western banded killifish		E
	Notropis heterolepis	Blacknose shiner		E

Table 2.4-15 Threatened and Endangered Fish and Mollusk Species Within a 50-mi Radius of the Fermi Site (Sheet 3 of 4)

Location	Scientific Name	Common Name	Federal Status	State Status
Ohio Ottawa County	**Fish**			
	Acipenser fulvescens	Lake Sturgeon		E
	Fundulus diaphanus menona	Western banded killifish		E
	Notropis heterolepis	Blacknose shiner		E
	Percina copelandi	Channel darter		T
	Truncilla donaciformis	Fawnsfoot		T
	Mollusks			
	Epioblasma torulosa rangiana	Northern riffelshell	E	E
	Epioblasma triquetra	Snuffbox		E
	Lampsilis ovata	Pocketbook		E
	Ligumia nasuta	Eastern pondmussel		E
	Ligumia recta	Black sandshell		T
	Obliquaria reflexa	Threehorn wartyback		T
	Uniomerus tetralasmus	Pondhorn		T
	Villosa fabalis	Rayed bean		E
Ohio Sandusky County	**Fish**			
	Fundulus diaphanous menona	Western banded killifish		E
Ohio Seneca County	**Fish**			
	Moxostoma valenciennesi	Greater redhorse		T
Ohio Erie County	**Fish**			
	Acipenser fulvescens	Lake Sturgeon		E
	Catostomus catostomus	Longnose sucker		E
	Fundulus diaphanus menona	Western banded killifish		E
	Percina copelandi	Channel darter		T
	Truncilla donaciformis	Fawnsfoot		T
Ohio Erie County	**Mollusks**			
	Ligumia nasuta	Eastern pondmussel		E
	Ligumia recta	Black sandshell		T

Table 2.4-15 Threatened and Endangered Fish and Mollusk Species Within a 50-mi Radius of the Fermi Site (Sheet 4 of 4)

Location	Scientific Name	Common Name	Federal Status	State Status
	Obliquaria reflexa	Threehorn wartyback		T
Canada Ontario Province	**Fish**			
	Ammocrypta pellucida	Eastern sand darter		T
	Coregonus reighardi	Shortnose cisco		E
	Erimyzon sucetta	Lake chubsucker		T
	Lepisosteus oculatus	Spotted gar		T
	Noturus stigmosus	Northern madtom		E
	Notropis anogenus	Pugnose shiner		E
	Percina copelandi	Channel darter		T
	Salvelinus fontinalis timagamiensis	Aurora trout		E
	Mollusks			
	Villosa fabalis	Rayed bean		E
	Obovaria subrotunda	Round hickorynut		E
	Ptychobranchus fasciolaris	Kidneyshell		E
	Lampsilis fasciola	Wavy-rayed lampmussel		E
	Simpsonaias ambigua	Mudpuppy mussel		E
	Pleurobema sintoxia	Round pigtoe		E
	Epioblasma torulosa rangiana	Northern riffleshell		E
	Epioblasma triquetra	Snuffbox		E

Table 2.4-16 Fish Species Impinged at Fermi 2 Plant (Oct 1991 – Sep 1992)

Family	Common Name	Scientific Name
Sunfishes	Rock Bass Green sunfish Pumpkinseed Bluegill Largemouth bass White crappie Black crappie	*Ambloplites rupestris* *Lepomis cyanellus* *Lepomis gibbosus* *Lepomis macrochirus* *Micropterus salmoides* *Pomoxis annularis* *Pomoxis nigromaculatus*
Herrings	Alewife Gizzard shad	*Alosa pseudoharengus* *Dorosoma cepedianum*
Carps and Minnows	Common carp Goldfish Spottail shiner Emerald shiner	*Cyprinus carpio* *Carassius auratus* *Notropis hudsonius* *Notropis atherinoides*
Catfish	Channel catfish Stonecat Tadpole madtom	*Ictalurus punctatus* *Noturus flavus* *Noturus gyrinus*
Smelts	Rainbow smelt	*Osmerus mordax*
Striped basses	White perch White bass	*Morone americana* *Morone chrysops*
Perches	Yellow perch Logperch	*Perca falvescens* *Percina caprodes*
Trout-perches	Trout-perch	*Percopsis omiscomaycus*
Drums	Freshwater drum	*Aplodinotus grunniens*

Source: Reference 2.4-80

Table 2.4-17 Land Use and Vegetation Types Within the 300-ft Fermi to Milan Transmission Corridor

	Acres	
Vegetation/Land Use	**Within 300-ft Corridor**	**Within 50-mile Region**
Open Water	1.5	725,910
Developed, Open Space	77.7	346,966
Developed, Low Intensity	71.2	371,809
Developed Medium Intensity	9.2	264,167
Developed, High Intensity	0.8	106,853
Barren Land (Rock/Sand/Clay)	2.8	10,346
Deciduous Forest	151.5	282,046
Evergreen Forest	0.2	6,717
Mixed Forest	0.8	5,765
Shrub/Scrub	5.0	3,197
Grassland/Herbaceous	35.1	41,308
Pasture/Hay	152.2	219,241
Cultivated Crops	454.8	1,217,689
Woody Wetlands	93.4	128,090
Emergent Herbaceous Wetlands	13.0	56,711
Total	1069.1	3,786,795

Figure 2.4-1 Topographic Map for 7.5 Mile Radius Vicinity Around the Fermi Site at Monroe, Monroe County, MI (Base Map: USGS 1:100,000 Scale Metric Topographic Map Series)

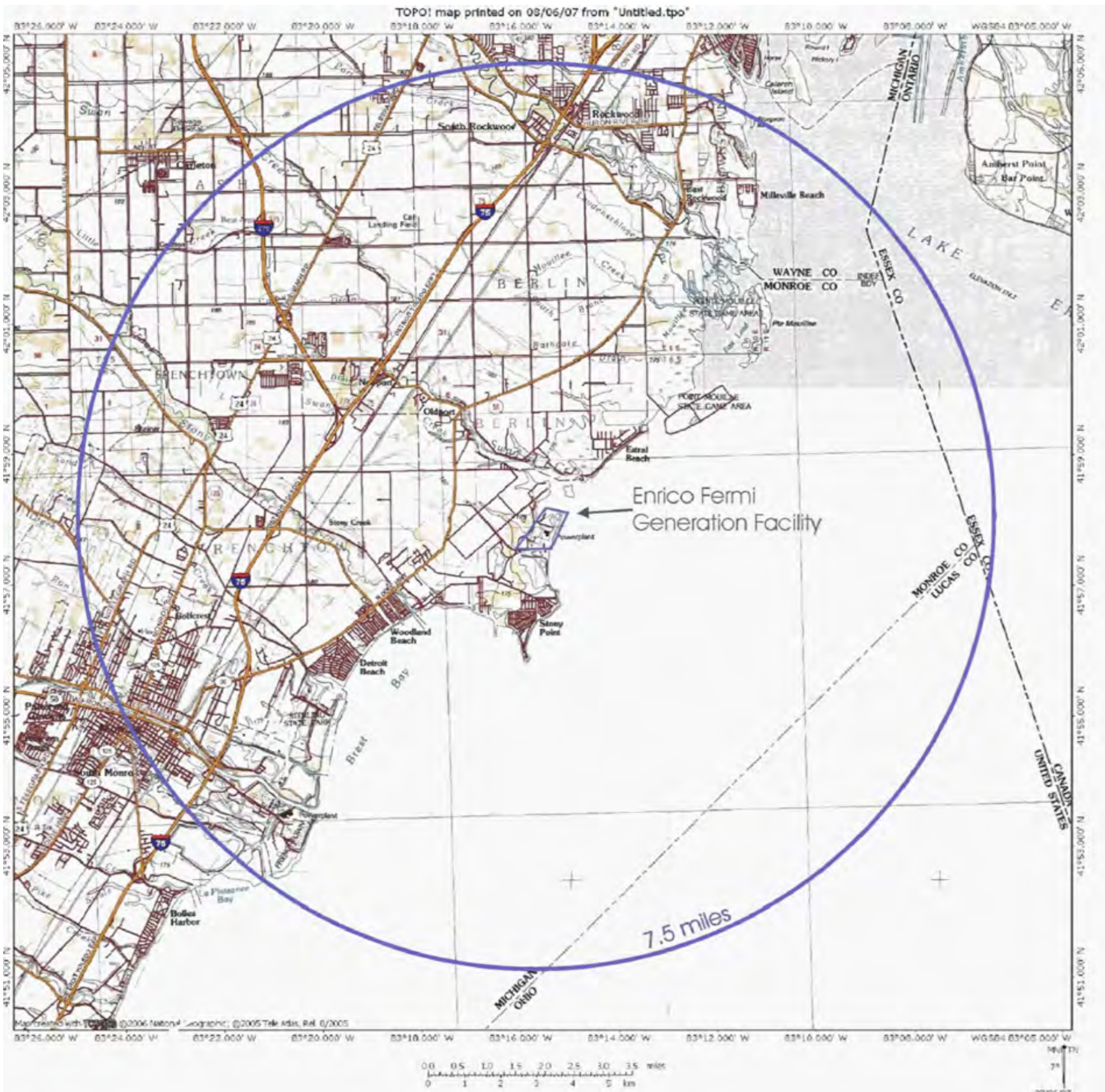


Figure 2.4-2 Topographic Map Showing Fermi Property Boundary (Base map: USGS 1:24,000 7.5 Minute Topographic Series)

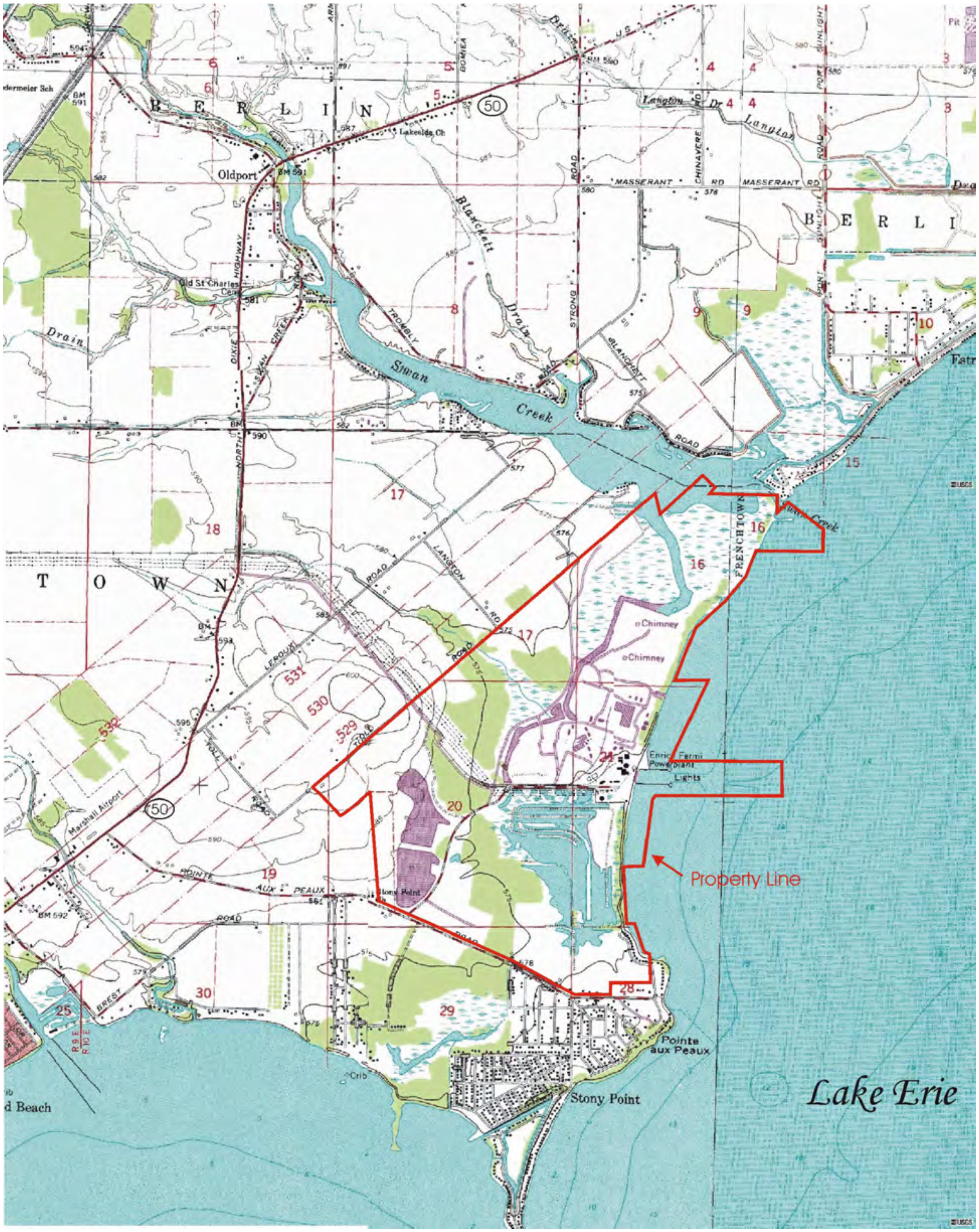


Figure 2.4-3 Aerial Photograph of the Fermi Site Taken in 1981

Figure 2.4-4 Aerial Photograph of the Fermi Site Taken in 2005

Figure 2.4-5 Terrestrial Habitats and Developed Areas at the Fermi Site

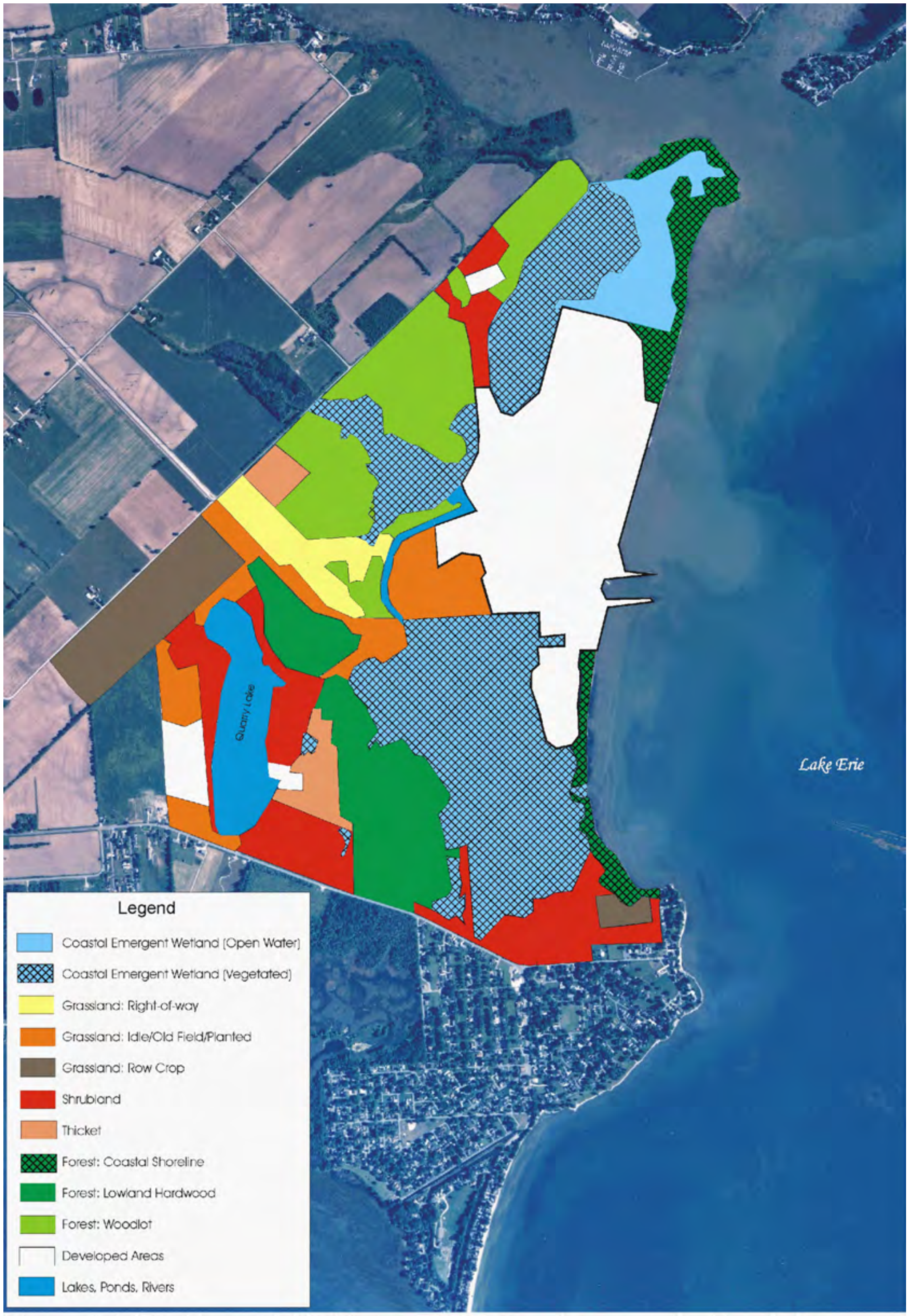


Figure 2.4-6 Boundaries of the Detroit River International Wildlife Refuge, Lagoona Beach Unit, Monroe County, MI

Figure 2.4-7 Fermi Site Map

Figure 2.4-8 Fermi Site Radius Map

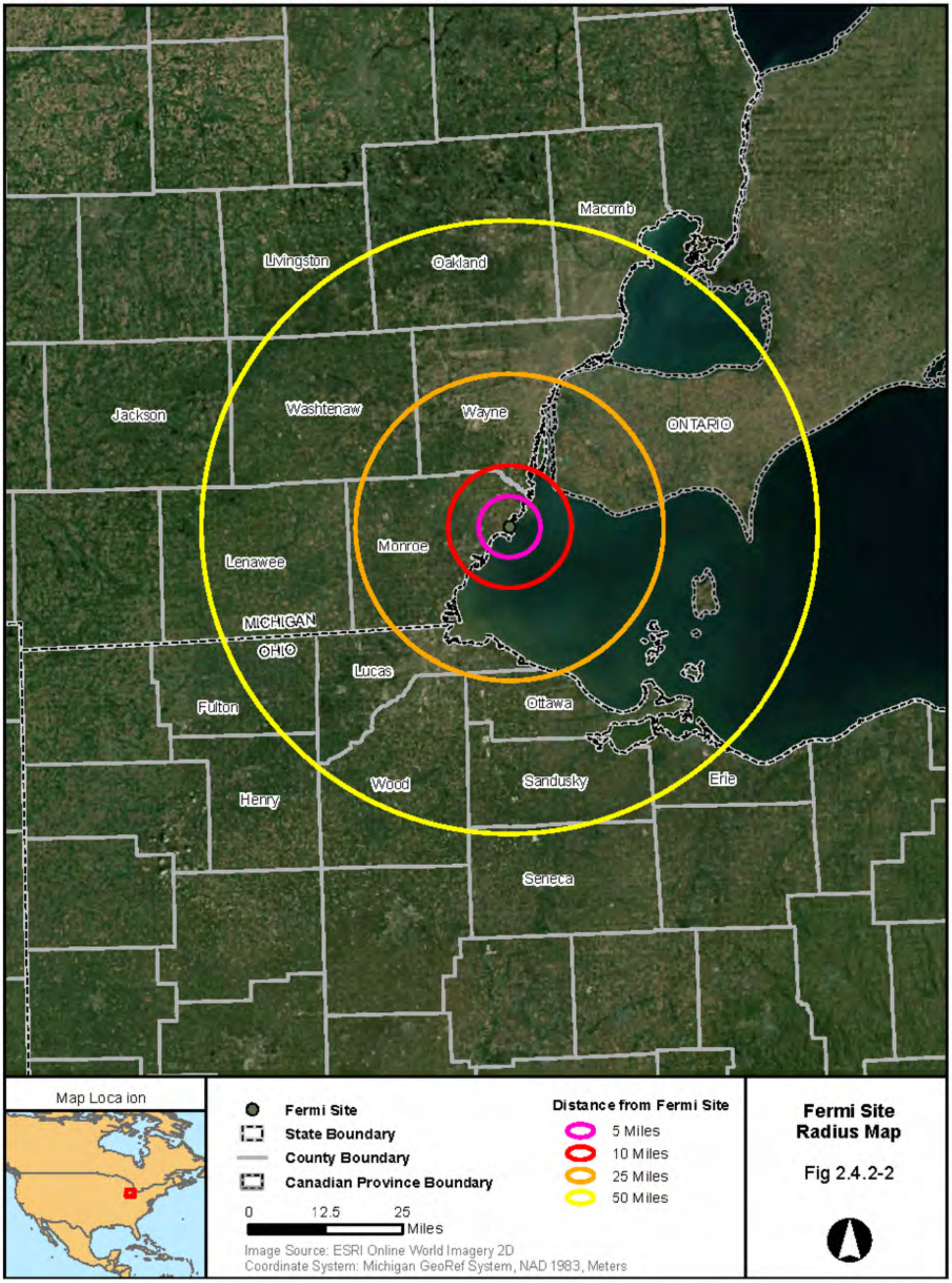
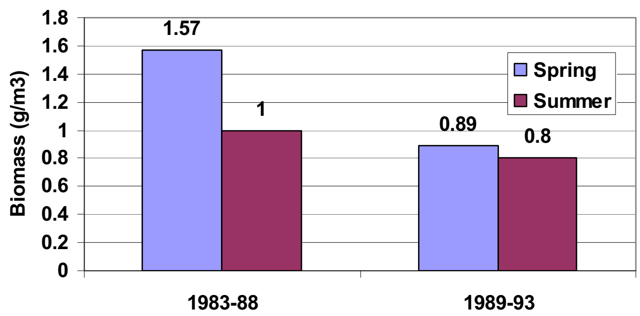
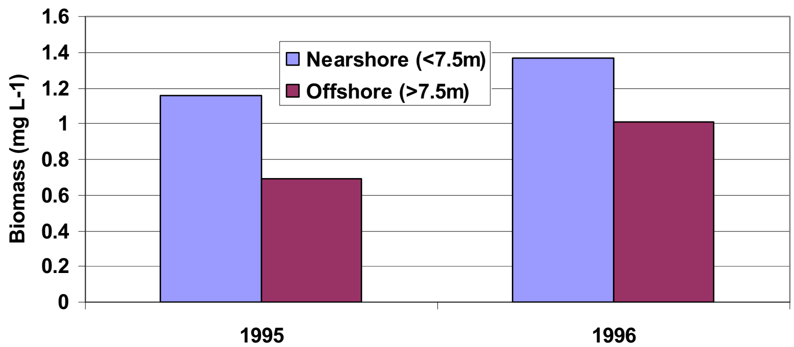


Figure 2.4-9 Average Phytoplankton Biomass in the Western Basin of Lake Erie



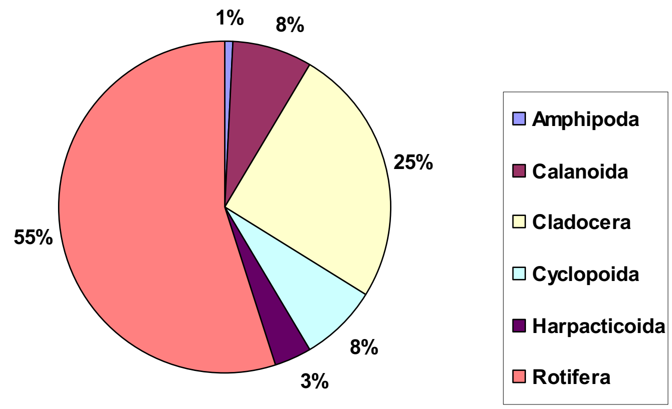
Source: Reference 2.4-86

Figure 2.4-10 Phytoplankton Biomass in Nearshore vs. Offshore Waters of Western Lake Erie



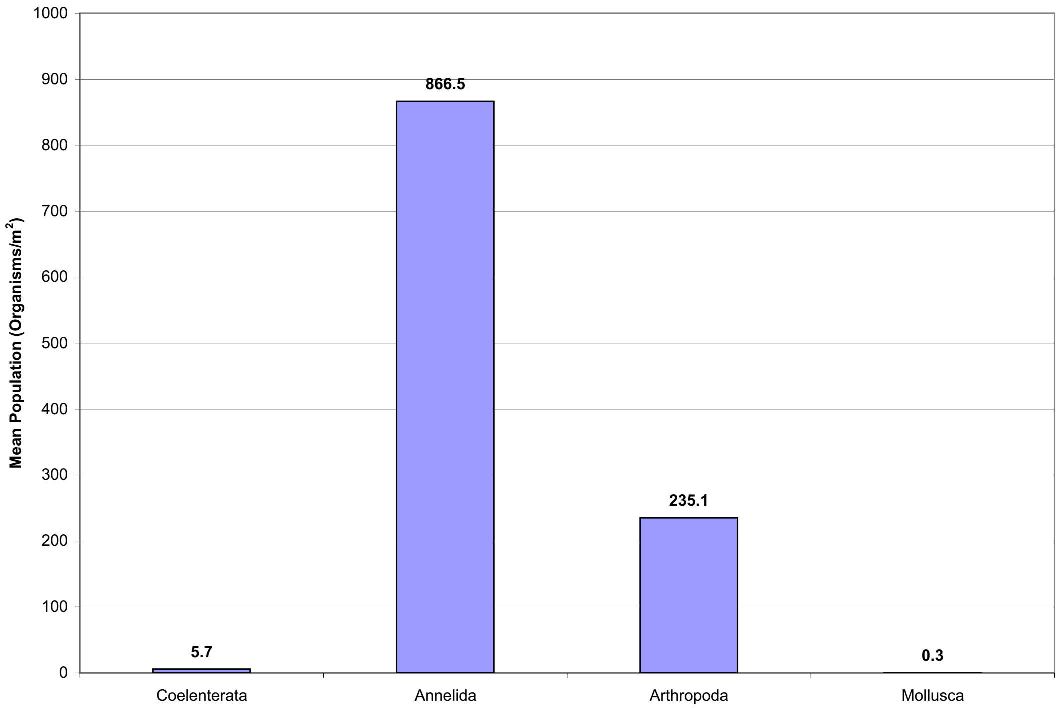
Source: Reference 2.4-86

Figure 2.4-11 Percent Composition of Zooplankton Species Observed in Lake Erie, 1983-1987



Source: Reference 2.4-86 and Reference 2.4-92

Figure 2.4-12 Mean Population of Individual Macroinvertebrate Taxa at Locust Point, Lake Erie, 1978



Source: Reference 2.4-87

Figure 2.4-13 Percent Composition of Benthic Macroinvertebrates in Western Basin of Lake Erie, 2006

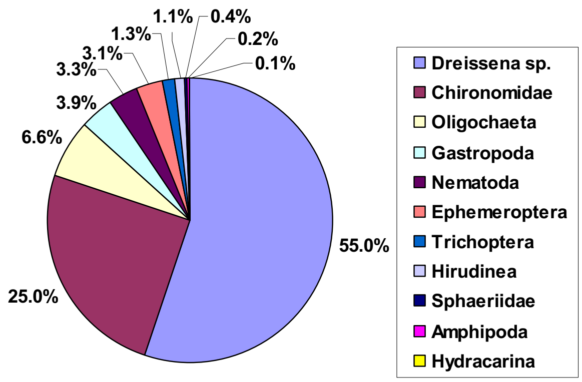
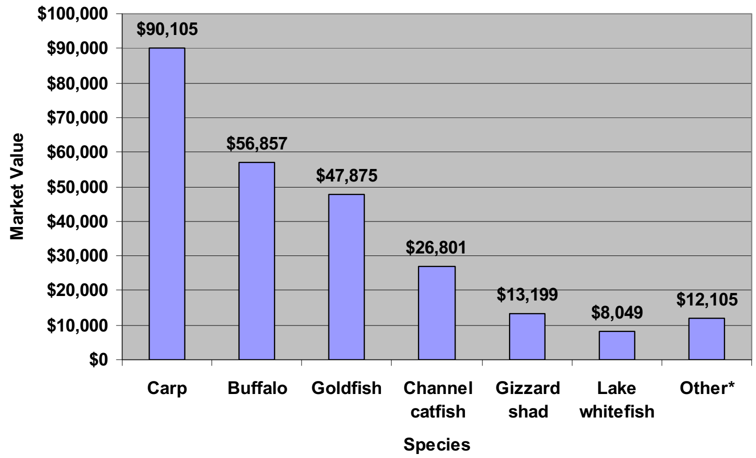
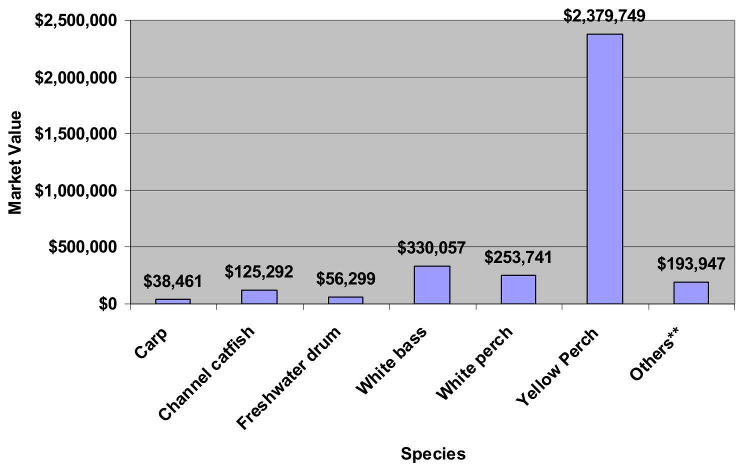


Figure 2.4-14 Michigan Market Value of Commercial Harvest Landings from Lake Erie



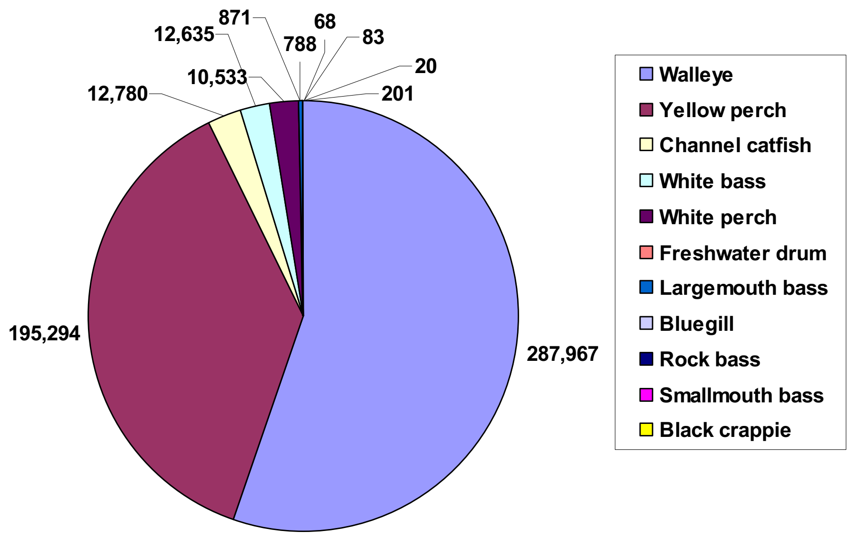
*Others include bullheads, suckers, quillback, white bass, white perch, and freshwater drum.

Figure 2.4-15 Ohio Market Value of Commercial Harvest Landings in Lake Erie (2006)



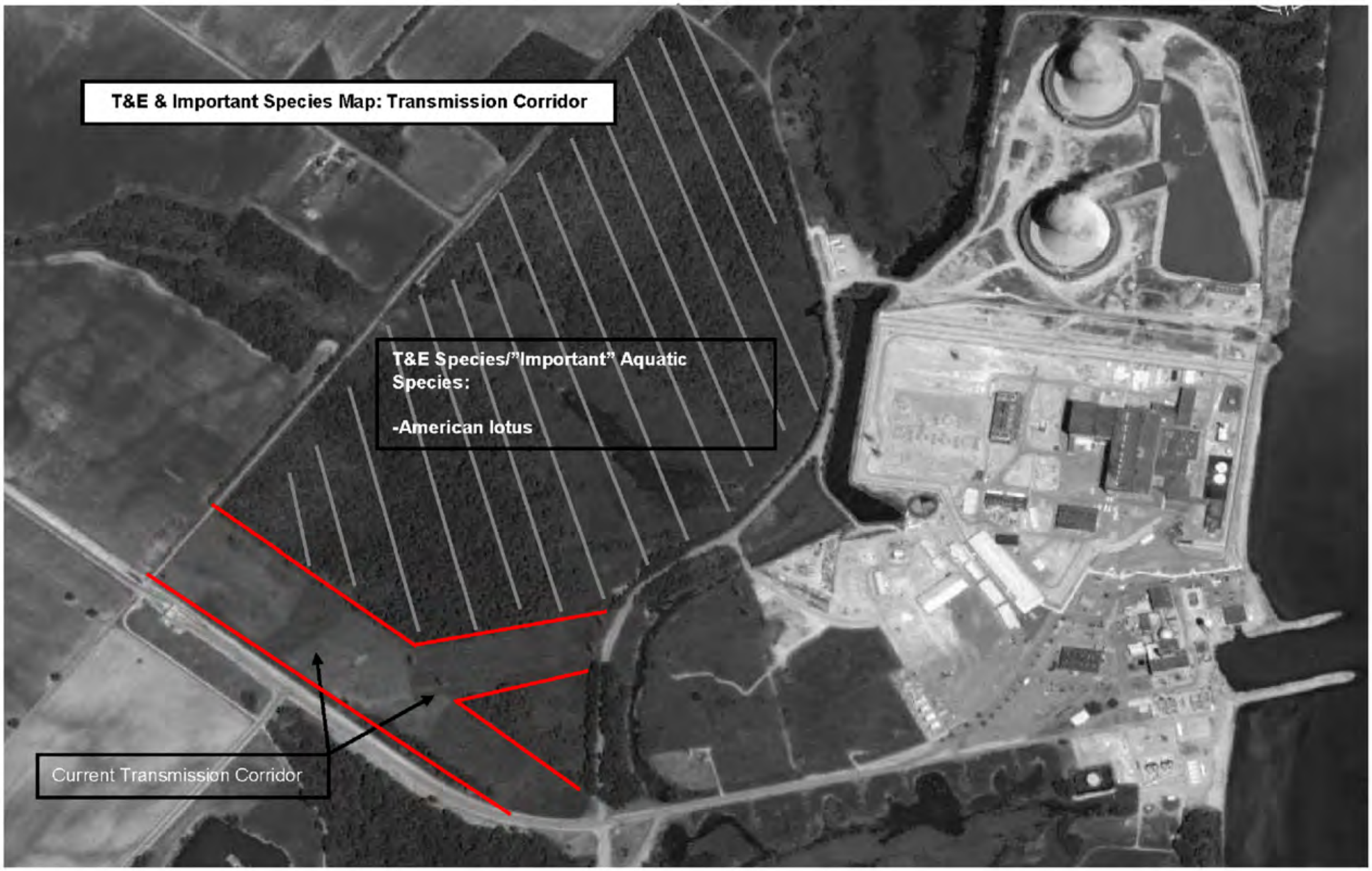
**Others include largemouth bass, rock bass, blue gill, rainbow smelt, bowfin, chinook salmon, black crappie, common carp, and goby.

Figure 2.4-16 Non-Charter Boat Fishery Season Totals*, Michigan, 2006



*Totals are number of specimens harvested
Source: Reference 2.4-72

Figure 2.4-17 T&E & Important Species Map: Current On-site Transmission Corridor



Hatched area indicates wetland habitat. The only T&E and/or important aquatic species identified in the current transmission corridor was the American lotus. More specific information is further discussed in Appendix 2B.

Figure 2.4-18 Offsite transmission route from Fermi to Milan Substation showing location of wetlands and other potentially regulated waters

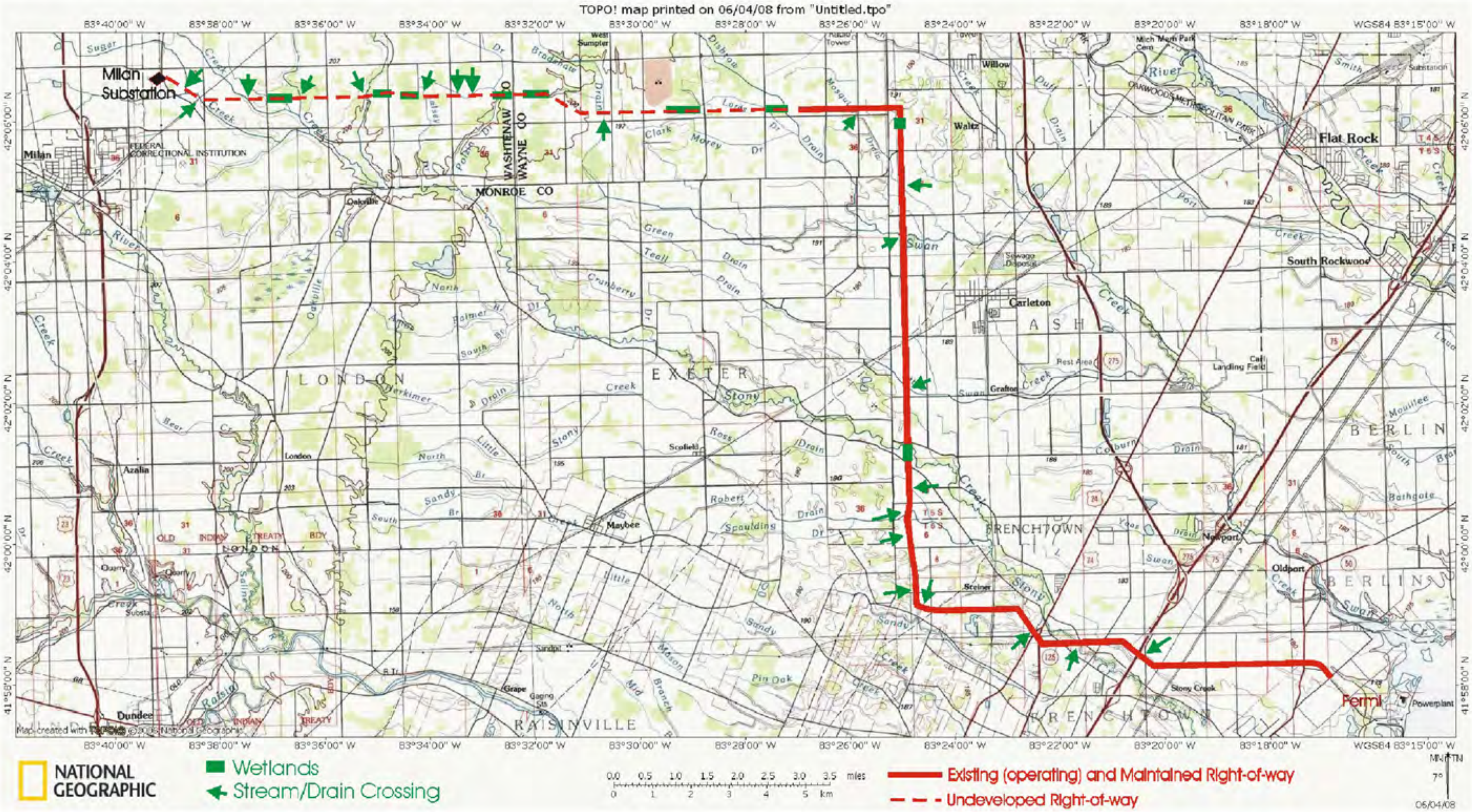


Figure 2.4-19 Fermi Site Wetlands Delineation