U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-2105, Vol. 1

Draft Environmental Impact Statement for Combined License (COL) for Enrico Fermi Unit 3

Draft Report for Comment

U.S. Nuclear Regulatory Commission
Office of New Reactors
Washington, DC 20555-0001

Regulatory Office
Permit Evaluation, Eastern Branch
U.S. Army Engineer District, Detroit
U.S. Army Corps of Engineers
Detroit, MI 48226

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Abstract

This environmental impact statement (EIS) has been prepared in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by Detroit Edison for a construction permit and operating license (combined license, or COL). The proposed actions related to the Detroit Edison application are (1) NRC issuance of a COL for a new power reactor unit at the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site in Monroe County, Michigan, and (2) U.S. Army Corps of Engineers (USACE) permit action to perform certain construction activities on the site. The USACE is participating with the NRC in preparing this EIS as a cooperating agency and participates collaboratively on the review team.

This EIS includes the NRC staff's analysis that considers and weighs the environmental impacts of constructing and operating a new nuclear unit at the Fermi site and at alternative sites, and mitigation measures available for reducing or avoiding adverse impacts. Based on its analysis, the staff determined that there are no environmentally preferable or obviously superior sites.

The EIS includes the evaluation of the proposed action's impacts on waters of the United States pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Appropriations Act of 1899. The USACE will base its evaluation of Detroit Edison's permit application, after public notice, on the requirements of USACE regulations, the Clean Water Act Section 404(b)(1) Guidelines, and the USACE public interest review process.

After considering the environmental aspects of the proposed action, the staff's preliminary recommendation to the Commission is that the COL be issued as proposed. This recommendation is based on (1) the application, including the Environmental Report (ER) submitted by Detroit Edison; (2) consultation with Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of comments related to the environmental review that were received during the public scoping process; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS. The USACE permit decision would be made following issuance of the final EIS.

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Executive Summary

By letter dated September 18, 2008, the U.S. Nuclear Regulatory Commission (NRC or the Commission) received an application from Detroit Edison Company (Detroit Edison) for a combined license (COL) for a new power reactor unit, the Enrico Fermi Unit 3 (Fermi 3), at the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site in Monroe County, Michigan.

The proposed actions related to the Fermi 3 application are (1) NRC issuance of COLs for construction and operation of a new nuclear unit at the Fermi site and (2) U.S. Army Corps of Engineers (USACE) permit action pursuant to Section 404 of the Federal Water Pollution Control Act, as amended (33 USC 1251, *et seq*.) (Clean Water Act), and Section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 USC 403 *et seq.*) (Rivers and Harbors Act of 1899) to perform certain construction activities as appropriate to the USACE scope of analysis on the site. The USACE is participating with the NRC in preparing this environmental impact statement (EIS) as a cooperating agency and participates collaboratively on the review team. The reactor specified in the application is an Economic Simplified Boiling Water Reactor (ESBWR) designed by GE-Hitachi Nuclear Energy Americas, LLC (GEH).

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 *et seq*.), directs that an EIS be prepared for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in Title 10 of the Code of Federal Regulations (CFR), Part 51. Further, in 10 CFR 51.20, the NRC has determined that the issuance of a COL under 10 CFR Part 52 is an action that requires an EIS.

The purpose of Detroit Edison's requested NRC action – issuance of the COL – is to obtain a license to construct and operate a new nuclear unit. This license is necessary but not sufficient for construction and operation of the unit. A COL applicant must obtain and maintain the necessary permits from other Federal, State, Tribal, and local agencies and permitting authorities. Therefore, the purpose of the NRC's environmental review of the Detroit Edison application is to determine if a new nuclear power plant of the proposed design can be constructed and operated at the Fermi site without unacceptable adverse impacts on the human environment. The objective of Detroit Edison's anticipated request for USACE action would be to obtain a decision on a permit application proposing structures and/or work in, over, or under navigable waters and/or the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands. Upon acceptance of the Detroit Edison application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing in the *Federal Register* (FR) a Notice of Intent (73 FR 75142) to prepare an EIS and conduct scoping. On January 14, 2009, the NRC held two scoping meetings in Monroe, Michigan, to obtain public input on the scope of the environmental review. To gather information and to become familiar with the sites and their environs, the NRC and its contractors, Argonne National Laboratory, Energy Research, Inc., and Ecology and Environment, Inc., visited the Fermi site in February 2009 and the four alternative sites, Belle River/St. Clair, Greenwood Energy Center, and two greenfield sites (Petersburg and South Britton sites) in January 2009.

During the Fermi site visit, the NRC staff, its contractors, and the USACE staff met with Detroit Edison staff, public officials, and the public. The NRC staff reviewed the comments received during the scoping process and contacted Federal, State, Tribal, regional, and local agencies to solicit comments. Included in this EIS are (1) the results of the review team's analyses, which consider and weigh the environmental effects of the proposed action (i.e., issuance of the COL) and of building and operating a new nuclear unit at the Fermi site; (2) mitigation measures for reducing or avoiding adverse effects; (3) the environmental impacts of alternatives to the proposed action; and (4) the staff's recommendation regarding the proposed action.

To guide its assessment of the environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on Council on Environmental Quality guidance (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, provides the following definitions of the three significance levels – SMALL, MODERATE, and LARGE:

> 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.

Mitigation measures were considered for each resource category and are discussed in the appropriate sections of the EIS.

In preparing this EIS, the NRC staff and USACE staff reviewed the application, including the Environmental Report (ER) submitted by Detroit Edison; consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in NUREG-1555, *Environmental Standard Review Plan*. In addition, the NRC staff considered the public comments related to the environmental review received during the scoping process. Comments within the scope of the environmental review are included in Appendix D of this EIS.

The NRC staff's preliminary recommendation to the Commission related to the environmental aspects of the proposed action is that the COL be issued as requested. This recommendation is based on (1) the application, including the ER submitted by Detroit Edison; (2) consultation with other Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of public comments related to the environmental review that were received during the scoping process; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS. The USACE will base its evaluation of Detroit Edison's permit application, when received and after public notice, on the requirements of USACE regulations, the Clean Water Act Section 404(b)(1) Guidelines, and the USACE public interest review process. The USACE's permit decision will be based, in part, on this EIS and will be made after issuance of the final EIS.

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency Notice of Availability of the draft EIS that was filed by the NRC and USACE to allow members of the public to comment on the results of the NRC and USACE staffs' review. During this period, the NRC staff will conduct a public meeting near the Fermi site to describe the results of the environmental review, provide members of the public with information to assist them in formulating comments on this EIS, respond to questions, and accept public comment. After the comment period, the review team will consider and disposition all the comments received. These comments and staff responses will be included in the final EIS.

The NRC staff's evaluation of the site safety and emergency preparedness aspects of the proposed action will be addressed in the NRC's Safety Evaluation Report anticipated to be published in the future.

Abbreviations/Acronyms

χ/Q	dispersion values
°F	degree(s) Fahrenheit
ABWR	advanced boiling water reactor
ac	acre(s)
AC	alternating current
ACHP	Advisory Council on Historic Preservation
ADAMS	Agencywide Documents Access and Management System
ADG	ancillary diesel generator
ADT	average daily traffic
AEC	Atomic Energy Commission
AHS	Auxiliary Heat Sink
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
APE	area of potential effects
AQCR	Air Quality Control Region
Argonne	Argonne National Laboratory
AST	aboveground storage tank
AWEA	American Wind Energy Association
BA	Biological Assessment
BACT	Best Available Control Technology
BEA	Bureau of Economic Analysis (U.S. Department of Commerce)
BEIR	Biological Effects of Ionizing Radiation
BGEPA	Bald and Golden Eagle Protection Act of 1940
BIA	Bureau of Indian Affairs
BiMAC	basemat internal melt arrest and coolability
BMP	best management practice
Bq	Becquerel
Bq/MTU	Becquerel per metric ton uranium
Btu	British thermal unit(s)
BWR	boiling water reactor
CAA	Clean Air Act
CAES	compressed air energy storage
CAIR	Clean Air Interstate Rule
CCR	coal combustion residuals
CCRG	Commonwealth Cultural Resources Group, Inc.

CCS	carbon capture and sequestering/sequestration
CDC	Centers for Disease Control and Prevention
CDF	core damage frequency
CEQ	Council on Environmental Quality
CER	Capital Expenditure and Recovery
CFR	Code of Federal Regulations
cfs	cubic feet per second
cfu	colony forming units
CH_4	methane
CHP	combined heat and power
Ci	curie(s)
CIRC	Circulating Water System
CIS	containment isolation system
CN	Canadian National
CNF	Capacity Need Forum (MPSC)
CO	carbon monoxide
CO_2	carbon dioxide
CO_2-e	carbon dioxide-equivalent
COL	combined construction permit and operating license
CSAPR	Cross-State Air Pollution Rate
CSP	concentrated solar power
CSX	CSX Transportation
CT	combustion turbine
CWA	Clean Water Act
CWIS	Cooling Water Intake Structure
CZMA	Coastal Zone Management Act
DA	Department of the Army
dB	decibel
dBA	A-weighted decibel
DBA	design-basis accident
dbh	diameter at breast height
DC	direct current
DCD	Design Control Document
DDT	dichlorodiphenyltrichloroethane
Detroit Edison	Detroit Edison Company
DNL	equivalent continuous sound level
DNR	Designated Network Resource
DOC	U.S. Department of Commerce
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy

DOT	Department of Transportation
D/Q	deposition factor
DRIWR	Detroit River International Wildlife Refuge
DSM	demand-side management
DTW	Detroit Metropolitan Wayne County Airport
DWSD	Detroit Water and Sewerage Department
E&E	Ecology and Environment, Inc.
EAB	Exclusion Area Boundary
EERE	U.S. Department of Energy Office of Energy Efficiency and Renewable Energy
EGS	engineered geothermal system
EIA	Energy Information Administration
EIS	environmental impact statement
ELF	extremely low frequency
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EPT	Ephemeroptera, Plecoptera Trichoptera (index)
ER	Environmental Report
ERI	Energy Research, Inc.
ESA	Endangered Species Act of 1973, as amended
ESBWR	Economic Simplified Boiling Water Reactor
ESRP	Environmental Standard Review Plan
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
Fermi 1	Enrico Fermi Unit 1
Fermi 2	Enrico Fermi Unit 2
Fermi 3	Enrico Fermi Unit 3
FES	Final Environmental Statement
FIRM	Flood Insurance Rate Map
FIS	Financial Reporting and Analysis
FP	fire pump
fps	feet per second
FPS	Fire Protection System
FR	*Federal Register*
FSAR	Final Safety Analysis Report
ft	foot (feet)
ft/day	feet per day
ft^3	cubic feet

FTE	full-time equivalent
FWS	U.S. Fish and Wildlife Service
FY	fiscal year
GAF	Generation and Fuel
gal	gallon
GBq	gigabecquerel
GC	gas centrifuge
GD	gaseous diffusion
GEH	GE-Hitachi Nuclear Energy Americas, LLC
GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
GEIS-DECOM	*Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*
GHG	greenhouse gas
GIS	geographical information system
GLC	Great Lakes Commission
GLENDA	Great Lakes Environmental Database
GLWC	Great Lakes Wind Council
gpd	gallon(s) per day
gpm	gallon(s) per minute
GWh	gigawatt hour(s)
GWP	global warming potential
ha	hectare
HAP	hazardous air pollutant
HCMA	Huron-Clinton Metropolitan Authority
HDR	hot dry rock
HEPA	high-efficiency particulate air
HFC	hydrofluorocarbon
HFE	hydrofluorinated ether
HLW	high-level waste
HQUSACE	U.S. Army Corps of Engineers Headquarters
hr	hour(s)
HRSG	heat recovery steam generator
HUD	U.S. Department of Housing and Urban Development
HVAC	heating, ventilating, and air-conditioning
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection

IEEE	Institute of Electrical and Electronics Engineers
IGCC	integrated gasification combined cycle
IGLD 85	International Great Lakes Datum of 1985
IJC	International Joint Commission
in.	inch(es)
INAC	Indian and Northern Affairs Canada
IOU	investor-owned utility
IPCS	Integrated Plant Computer System
IPP	independent power producer
IRP	Integrated Resource Plan
ISD	Intermediate School District
ISFSI	Independent Spent Fuel Storage Installation
ITC	ITC Holdings Corporation
JPA	Joint Permit Aplication
KiKK	Childhood Cancer in the Vicinity of Nuclear Power Plants (German acronym)
km	kilometer(s)
km^2	square kilometer(s)
kV	kilovolt(s)
kW	kilowatt(s)
kWh	kilowatt hour(s)
L	liter(s)
L_{90}	sound level exceeded 90 percent of the time
LaMP	Lakewide Management Plan
lb	pound(s)
L_{dn}	day-night average sound level
LEDPA	least environmentally damaging practicable alternative
LEOFS	Lake Erie Operational Forecast System
L_{eq}	equivalent continuous sound level
LET	Lake Erie Transit
LFA	Load Forecasting Adjustment
LOLE	Loss of Load Expectation
LOS	level of service
LPZ	low population zone
LRF	large release frequency
LTRA	Long-Term Reliability Assessment (NERC)
LWR	light water reactor

µg	microgram(s)
m	meter(s)
m^3	cubic meter(s)
MACCS2	MELCOR Accident Consequence Code System
MBTA	Migratory Bird Treaty Act of 1918
MCCC	Monroe County Community College
mCi	millicurie
MCL	maximum contaminant level; Michigan Compiled Laws
MCRC	Monroe County Road Commission
MDCH	Michigan Department of Community Health
MDCT	mechanical draft cooling tower
MDELEG	Michigan Department of Energy, Labor and Economic Growth
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
MDSP	Michigan Department of State Police
MEI	maximally exposed individual
METC	Michigan Electric Transmission Company
mGy	milliGray
MGD	million gallons per day
mi	mile(s)
mi^2	square mile(s)
MichCon	Michigan Consolidated Gas Company
MISO	Midwest Independent System Operator
MIT	Massachusetts Institute of Technology
mL	milliliter(s)
MMT	million metric tons
$MMTCO_2$-e	million metric tons of carbon dioxide equivalent
MNFI	Michigan Natural Features Inventory
mo	month(s)
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	mile(s) per hour
MPSC	Michigan Public Service Commission
mrad	milliradian
mrem	millirem(s)
MSA	Metropolitan Statistical Area
MSW	municipal solid waste
MT	metric ton(s) (or tonne[s])
MTEP	MISO Transmission Expansion Plan
MTU	metric ton(s) of uranium

MW	megawatt(s)
MW(e)	megawatt(s) electrical
MW(t)	megawatt(s) thermal
MWd	megawatt-day(s)
MWd/MTU	megawatt-day(s) per metric ton of uranium
MWh	megawatt hour(s)
NAAQS	National Ambient Air Quality Standard
NACD	Native American Consultation Database
NaCl	sodium chloride
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NAVD 88	North American Vertical Datum of 1988
NCI	National Cancer Institute
NCRP	National Council on Radiation Protection and Measurements
NDCT	natural draft cooling tower
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969, as amended
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NESHAP	National Emission Standards for Hazardous Air Pollutants
NF_3	nitrogen trifluoride
NGCC	natural gas combined-cycle
NHPA	National Historic Preservation Act of 1966, as amended
NIEHS	National Institute of Environmental Health Sciences
NML	noise monitoring location
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPHS	normal power heat sink
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NREPA	Natural Resources and Environmental Protection Act
NRHP	*National Register of Historic Places*
NS	Norfolk Southern
NSPS	New Source Performance Standard
NSR	new source review
NTC	Nuclear Training Center

NTU	nephelometric turbidity unit
NWI	National Wetland Inventory
NWIS	National Water Information System
NWR	National Wildlife Refuge
O_3	ozone
ODCM	Offsite Dose Calculation Manual
ODNR	Ohio Department of Natural Resources
OGS	off-gas system
OSHA	Occupational Safety and Health Administration
PAP	personnel access portal
Pb	lead
PC	personal computer
PCB	polychlorinated biphenyl
pCi/L	picocurie(s) per liter
PCTMS	Plant Cooling Tower Makeup System
PEM	palustrine emergent marsh
PESP	Pesticide Environmental Stewardship Program
PFC	perfluorocarbon
PFO	palustrine forested wetland
P-IBI	Planktonic Index of Biotic Integrity
PIPP	Pollution Incident Prevention Plan
PJM	PJM Interconnection
PM	particulate matter
$PM_{2.5}$	particulate matter with a mean aerodynamic diameter of less than or equal to 2.5 µm
PM_{10}	particulate matter with a mean aerodynamic diameter of less than or equal to 10 µm
PRA	probabilistic risk assessment
PRB	Powder River Basin
PSD	Prevention of Significant Deterioration
psia	pounds per square inch absolute
PSR	Physicians for Social Responsibility
PSS	palustrine scrub-shrub wetland
PSWS	Plant Service Water System
PTE	potential to emit
Pu-239	plutonium-239
PV	photovoltaic
PWSS	pretreated water supply system

RAI	Request for Additional Information
RCRA	Resource Conservation and Recovery Act of 1976, as amended
RDF	refuse-derived fuel
rem	roentgen equivalent man
REMP	radiological environmental monitoring program
RESA	Regional Educational Service Agency
RFC	Reliability*First* Corporation
RHAA	Rivers and Harbors Appropriation Act of 1899
RHR	residual heat removal
RIMS II	Regional Input-Output Modeling System
ROI	region of interest
ROW	right-of-way
RPS	Renewable Portfolio Standard
RRD	Remediation and Redevelopment Division
RTP	Regional Transportation Plan
RV	recreational vehicle
Ryr	reactor-year
SACTI	Seasonal/Annual Cooling Tower Impact
SAMA	severe accident mitigation alternative
SAMDA	severe accident mitigation design alternative
SCPC	supercritical pulverized coal
SCR	selective catalytic reduction
SDG	standby diesel generator
sec	second(s)
SEGS	Solar Energy Generating System
SEMCOG	Southeast Michigan Council of Governments
SER	Safety Evaluation Report
SESC	soil erosion and sedimentation control
SF_6	sulfur hexafluoride
SHPO	State Historic Preservation Office(r)
SO_2	sulfur dioxide
SO_x	sulfur oxides
SRHP	*State Register of Historic Places*
SSC	system, structure, and component
STG	steam turbine generator
STORET	Storage and Retrieval Database
SUV	sport-utility vehicle
Sv	sievert
SWMS	solid radioactive waste management system

SWPPP	Stormwater Pollution Prevention Plan
SWS	Station Water System
TDS	total dissolved solids
TEDE	total effective dose equivalent
THPO	Tribal Historic Preservation Office
TIP	Transportation Improvement program
TLD	thermoluminescent dosimeter
TMDL	total maximum daily load
TRAGIS	Transportation Routing Analysis Geographic Information System
TRU	transuranic
U.S.	United States
USC	United States Code
U_3O_8	triuranium octoxide (“yellowcake”)
UF_6	uranium hexafluoride
UMTRI	University of Michigan Transportation Research Institute
UO_2	uranium dioxide
USACE	U.S. Army Corps of Engineers
USBLS	U.S. Bureau of Labor Statistics
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VIB	Vehicle Inspection Building
VOC	volatile organic compound
WHO	World Health Organization
WPSCI	Wolverine Power Supply Cooperative, Inc.
WRA	Wind Resource Area
WTE	waste-to-energy
WWSL	wastewater stabilization lagoon
WWTP	wastewater treatment plant
yd^3	cubic yard(s)
yr	year(s)

1.0 Introduction

By letter dated September 18, 2008, the Detroit Edison Company (Detroit Edison) submitted to the U.S. Nuclear Regulatory Commission (NRC) an application for a combined license (COL) for Enrico Fermi Unit 3 (Fermi 3) to be located adjacent to the existing Units 1 (Fermi 1) and 2 (Fermi 2) on the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site. The site proposed by Detroit Edison for Fermi 3 is located in Monroe County, Michigan, approximately 30 mi southwest of Detroit, Michigan, and 7 mi from the United States-Canada international border. The proposed Fermi 3 and facilities would be completely within the confines of the current Fermi site, and would be located adjacent to the existing Fermi 2. Fermi 1, also on the Fermi site, is in the process of being decommissioned.

Detroit Edison is a wholly owned subsidiary of DTE Energy, and would be the owner of Fermi 3. Detroit Edison is the licensed operator of the existing Fermi 2 nuclear power plant and would be responsible for construction and operation of the proposed project.

The U.S. Army Corps of Engineers (USACE) is participating with the NRC in the preparation of this environmental impact statement (EIS) as a cooperating agency. As a cooperating agency, the USACE participates collaboratively with the NRC staff on the review. Throughout this EIS, the staff from the NRC and USACE are collectively referred to as the "review team." The NRC staff and USACE staff focused their review on Revision 3 of the COL application, responses to requests for additional information, and supplemental letters. Part 3 of the application contains Detroit Edison's Environmental Report (ER) (Detroit Edison 2011a).

The proposed actions related to the Fermi 3 application are (1) NRC issuance of a COL for construction and operation of a power reactor at the Fermi site in Monroe County, Michigan, and (2) USACE permit action pursuant to Section 404 of the Federal Water Pollution Control Act, as amended (33 USC 1251 *et seq.*) (Clean Water Act) (CWA), and Section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 USC 403) (RHAA) to perform certain preconstruction activities, as appropriate to the USACE scope of analysis, on the site.

As a first step in the joint USACE/Michigan Department of Environmental Quality (MDEQ) permit application process, Detroit Edison initiated coordination with USACE through pre-application and jurisdictional determination meetings and submitted a Joint Permit Application (Detroit Edison 2011b) to MDEQ for activities associated with the proposed Fermi 3 project. On September 9, 2011, Detroit Edison subsequently submitted a permit application to USACE (Detroit Edison 2011c).

1.1 Background

A COL is a Commission approval for the construction and operation of one or more nuclear power facilities. NRC regulations related to COLs are primarily found in Title 10 of the Code of Federal Regulations (CFR) Part 52, Subpart C.

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 *et seq*.), requires the preparation of an EIS for major Federal actions that have the potential to significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in 10 CFR Part 51. Further, in 10 CFR 51.20, the NRC has determined that the issuance of a COL under 10 CFR Part 52 is an action that requires an EIS.

According to 10 CFR 52.80(b), an application for a COL must contain an ER. The ER provides input that the staff evaluates in preparing the NRC's EIS. NRC regulations related to ERs and EISs are found in 10 CFR Part 51.

The reactor specified in the Detroit Edison application is an Economic Simplified Boiling Water Reactor (ESBWR) designed by GE-Hitachi Nuclear Energy Americas, LLC (GEH). Subpart B of 10 CFR Part 52 contains NRC regulations related to standard design certification. An application for a standard design certification undergoes an extensive review, usually taking several years. The GEH ESBWR design was approved by the NRC in March 2011. The final design certification rule was published in the Federal Register on March 16, 2011 (76 FR 14437). Where appropriate, this EIS incorporates the results of the ESBWR design review.

1.1.1 Applications and Reviews

The purpose of Detroit Edison's requested NRC action is to obtain from the NRC a COL to construct and operate a baseload nuclear power plant. This license is necessary but not sufficient by itself for construction and operation of Fermi 3. In addition to the COL, Detroit Edison must obtain and maintain permits from other Federal, State, and local agencies and permitting authorities. The objective of Detroit Edison's eventual request for USACE action would be to obtain a decision on a permit application proposing structures and/or work in, over, or under navigable waters and/or the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands.

1.1.1.1 NRC COL Application Review

The NRC regulations setting standards for review of a COL application are listed in 10 CFR 52.81. Detailed guidance for the NRC staff to use in conducting its environmental review is set forth in NUREG-1555, *Environmental Standard Review Plan* (NRC 2000), and recent updates, hereafter referred to as the ESRP. Additional guidance on conducting environmental reviews is provided in the NRC Staff Memorandum *Addressing Construction and Preconstruction, Greenhouse Gas Issues, General Conformity Determinations, Environmental Justice, Need for Power, Cumulative Impact Analysis, and Cultural/Historic Resources Analysis Issues in Environmental Impact Statements* (Staff Memo) (NRC 2011).

In this EIS, the NRC staff evaluates the environmental effects of construction and operation of one new boiling water reactor of the GEH ESBWR design, with a thermal power rating of 4500 MW(t) at the Fermi site. The new unit would use a closed cycle, wet cooling system that uses a natural draft cooling tower for heat dissipation. In addition to considering the environmental effects of the proposed action, the NRC considers alternatives to the proposed action including the no-action alternative and the construction and operation of new reactors at one of four alternative sites. Also, the benefits of the proposed action (e.g., need for power) and measures and controls to limit adverse impacts are evaluated.

Upon acceptance of the Detroit Edison application, the NRC began the environmental review by publishing in the *Federal Register* (FR) on December 10, 2008 (73 FR 75142), a Notice of Intent to prepare an EIS and conduct scoping. On January 14, 2009, the NRC held two scoping meetings in Monroe, Michigan, to obtain public input on the scope of the environmental review and contacted Federal, State, Tribal, regional, and local agencies to solicit comments. A list of the agencies and organizations contacted is provided in Appendix B. The staff reviewed the comments received during the scoping process, and responses were written for each comment. Comments within the scope of the NRC environmental review and their associated responses are included in Appendix D. A complete list of the scoping comments and responses is documented in the Fermi 3 combined license scoping summary report (NRC 2009).

To gather information and to become familiar with the sites and their environs, the NRC, its contractors Argonne National Laboratory (Argonne), Energy Research, Inc. (ERI), and Ecology and Environment, Inc. (E&E), and the USACE visited the Fermi site in February 2009 and the alternative sites of Belle River-St. Clair, the Greenwood Energy Center, and two greenfield sites (Petersburg and South Britton sites) in January 2009. During the Fermi site visit, the NRC staff and USACE met with Detroit Edison staff, public officials, and the public. Documents related to the Fermi site were reviewed and are listed as references where appropriate.

To guide its assessment of environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on Council on Environmental Quality guidance (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, provides the definitions of the three significance levels established by the NRC – SMALL, MODERATE, or LARGE – which are defined 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.

This EIS presents the NRC staff's and the review team's analysis and presents impact level determinations based on the three significance levels discussed above. The analysis considers and weighs the environmental impacts of the proposed action at the Fermi site, including the environmental impacts associated with construction and operation of the proposed new reactor at the site, the cumulative effects of the proposed action and other actions, the impacts of construction and operation of a reactor at alternative sites, the environmental impacts of alternatives to granting the COL, and the mitigation measures available for reducing or avoiding adverse environmental effects. This EIS also provides the NRC staff's preliminary recommendation to the Commission regarding the issuance of the COL for the proposed Fermi Unit 3.

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency (EPA) Notice of Availability of the draft EIS to allow members of the public to comment on the results of the NRC and USACE staff review. A public meeting will be held near the Fermi site during the comment period to describe the results of the environmental review, respond to questions, and accept comments. After the comment period, the NRC and USACE staffs will consider all submitted comments. Comments within the scope of the environmental review will be addressed in the final EIS.

1.1.1.2 USACE Permit Application Review

This draft EIS provides environmental information the USACE needs to complete, in part, its NEPA and public interest factor reviews, and draw conclusions regarding the least environmentally damaging practicable alternative (LEDPA) and the public good for its permitting decision.

Once a completed permit application is received, the USACE would issue a Public Notice to solicit comments from local, State and Federal agencies and the public about Detroit Edison's proposal and proposed mitigation measures to guide the USACE permitting decision.

The USACE's independent regulatory permit decision documentation will reference relevant analyses from the EIS and, as necessary, include a supplemental public interest factor review, a CWA 404(b)(1) evaluation, an evaluation of cumulative impacts, and other information and evaluations that may be outside the NRC's scope of analysis and not included in this EIS, but are required by the USACE to support its permit decision. In its capacity as a cooperating agency in the preparation of this EIS, the USACE role also involves verification that the information presented is adequate to fulfill the requirements of USACE regulations applicable to regulated activities within the USACE scope of analysis associated with construction and operation of the preferred alternative identified in the EIS.

In this EIS, USACE evaluates the impacts of certain construction and maintenance activities proposed in waters of the United States, including jurisdictional wetlands that would be affected by the proposed activities. The USACE decision would reflect the national concern for both protection and use of important resources. The benefit, which reasonably may be expected to accrue from the proposal, must be balanced against its reasonably foreseeable detriments.

The decision whether to issue a permit would be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. Evaluation of the probable impacts that the proposed activity may have on the public interest requires a careful weighing of all of the factors that become relevant in each particular case, as well as application of the Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR Part 230) (Guidelines). If a permit application is submitted, a decision by USACE to authorize Detroit Edison's proposal, and if so, the conditions under which it would be allowed to occur, are therefore determined by the outcome of this general balancing process. All factors that may be relevant to the proposal must be considered including the cumulative effects. Some of the public interest review factors that may be relevant to the anticipated Detroit Edison permit application proposal are considered in this draft EIS. USACE public interest review factors are listed and described more fully in Appendix J.

For activities involving discharges regulated by the CWA Section 404, a permit would be denied if the discharge would not comply with the Guidelines, which contain the substantive environmental criteria used by USACE in evaluating discharges of dredged or fill material into waters of the United States. Among the criteria, the Guidelines stipulate that no discharge of dredged or fill material shall be permitted if there is a practicable alternative that would have less adverse impact on the aquatic environment, so long as the alternative does not have other significant adverse environmental consequences. If an applicant's preferred alternative is determined to be the LEDPA, the USACE must still determine its effect on the other criteria contained in the Guidelines as well as the applicable public interest factors. A permit would not be issued for an alternative that is not the LEDPA.

In addition, subject to the Guidelines as discussed above, and criteria (see 33 CFR 320.2 and 320.3), a permit will be granted unless the USACE District Engineer determines that it would be contrary to the public interest. The following general criteria are considered by the USACE in the evaluation of every application:

- The relative extent of the public and private need for the proposed work;

- Where there are unresolved conflicts about resource use, the practicability of using practicable and reasonable alternative locations and methods to accomplish the objective of the proposed structure or work; and
- The extent and permanence of the beneficial and/or detrimental effects that the proposed structure or work is likely to have on the public and private uses to which the area is suited.

The USACE would address LEDPA and public interest review issues and criteria in its permit decision documentation.

1.1.2 Preconstruction Activities

In a final rule dated October 9, 2007 (72 FR 57416), the Commission limited the definition of "construction" to those activities that fall within its regulatory authority in 10 CFR 51.4. Many of the activities required to construct a nuclear power plant are not part of the NRC action to license the plant. Activities associated with building the plant that are not within the purview of the NRC action are grouped under the term "preconstruction." Preconstruction activities include clearing and grading, excavating, dredging, discharge of fill, erection of support buildings and transmission lines, and other associated activities. These preconstruction activities may take place before the application for a COL is submitted, during the staff's review of a COL application, or after a COL is granted. Although preconstruction activities are outside the NRC's regulatory authority, many are within the regulatory authority of local, State, or other Federal agencies, and certain preconstruction activities require permits from USACE.

Because the preconstruction activities are not part of the NRC action, their impacts are not reviewed as a direct effect of the NRC action. Rather, the impacts of the preconstruction activities are considered in the context of cumulative impacts. Certain preconstruction activities (e.g., those actions related to work or the building of structures in navigable waters or to the discharge of dredged or fill material into waters of the United States) require USACE authorization, and impacts are viewed as direct effects of a USACE permit action. Such activities are included in the EIS as part of the USACE review. For purposes of this EIS, both construction and preconstruction activities are described in Chapter 4. Chapter 4 of this EIS describes the relative magnitude of impacts related to preconstruction and construction activities. It should be noted that Chapter 4 contains a partial evaluation of the public interest factors required as part of the USACE permit decision-making process. The USACE's independent regulatory permit decision documentation will reference relevant analyses from the EIS, and, as necessary, include supplemental public interest factor evaluations that may be outside the NRC's scope of analysis and not included in the EIS, but required by the USACE in support of its permit decision.

1.1.3 Cooperating Agencies

Most proposed nuclear power plants require a permit from the USACE if work would occur in, over, or under waters of the United States, in addition to a license from the NRC. Therefore, the NRC and USACE decided that the most effective and efficient use of Federal resources in the review of nuclear power projects would be achieved by a cooperative agreement. On September 12, 2008, the NRC and USACE signed a Memorandum of Understanding (MOU) regarding the review of nuclear power plant license applications (USACE and NRC 2008). Therefore, the Detroit District of USACE is participating as a cooperating agency as defined in 10 CFR 51.14.

As described in the MOU, the NRC is the lead Federal agency and the USACE is a cooperating agency in the development of a COL EIS. Under Federal law, each agency has jurisdiction related to portions of the proposed project as major Federal actions that could significantly affect the quality of the human environment. The goal of this cooperative agreement is the development of one EIS that serves the needs of the NRC license decision process and the USACE permit decision process. While both agencies must meet the requirements of NEPA, both agencies also have mission requirements that must be met in addition to the NEPA requirements.

The NRC makes license decisions under the Atomic Energy Act, and the USACE makes permit decisions under the RHAA and CWA, and the USACE is cooperating with the NRC to ensure that the information presented in the EIS is adequate to fulfill the requirements, to the extent possible, of USACE regulations, Section 404 of the CWA, Section 10 of the RHAA, and the Guidelines and the USACE public interest review process.

As a cooperating agency, USACE is part of the NRC review team and is involved in all aspects of the environmental review, including scoping, public meetings, public comment resolution, and EIS preparation. USACE refers to public meetings as hearings, but there is no judge or legal process involved as there is for NRC hearings conducted by the Atomic Safety and Licensing Board. For the purposes of the assessment of environmental impacts under NEPA, the EIS uses the SMALL/MODERATE/LARGE criteria discussed in Section 1.1.1.1 of this EIS; this approach has been vetted by the Council on Environmental Quality. However, for permit decisions under Section 404 of the CWA, USACE can only permit the LEDPA and must address public interest review factors. The EIS is intended to provide the information needed to support the USACE's regulatory permit decision document for the anticipated Detroit Edison's permit application.

The USACE would complete its assessment of the LEDPA and other criteria when it receives a complete application and public feedback in the form of public comments on the draft EIS and its individual public notice. USACE will address whether the LEDPA criterion is met in a permit decision document. The goal of the process is that USACE will have the information necessary to make a permit decision when the final EIS is issued, if a permit application is received. However, it is possible that USACE will still need some information from the applicant to complete its permit documentation-information that the applicant could not make available by the time of final EIS issuance. Also, any conditions required by USACE, such as compensatory mitigation, would be addressed in the USACE permit (if issued). Compensatory mitigation may only be employed after all appropriate and practical steps to avoid and minimize adverse impacts to aquatic resources, including wetlands and streams, have been taken. All remaining unavoidable impacts must be compensated to the extent appropriate and practicable. The USACE permit, if issued, would include special conditions under which Detroit Edison must confirm that the proposed mitigation meets the Federal wetland criteria outlined in the report, "Corps of Engineers Wetlands Delineation Manual" (Environmental Laboratory 1987), in accordance with Compensatory Mitigation for Losses of Aquatic Resources; Final Rule, as published in April 10, 2008, *Federal Register*, Vol. 73, No. 70, pages 19594–19705 (33 CFR Parts 325 and 332), and replace lost aquatic functions and values. If the USACE does not find the mitigation satisfactory, it would determine the need for project and/or mitigation modifications necessary for compliance with permit conditions. Detroit Edison would assume all liability for accomplishing the permitted work including any required mitigation.

1.1.4 Concurrent NRC Reviews

In reviews separate from but parallel to the EIS process, the NRC analyzes the safety characteristics of the proposed site and emergency planning information. These analyses are documented in a Safety Evaluation Report (SER) issued by the NRC. The SER presents the conclusions reached by the NRC regarding (1) whether there is reasonable assurance that one new Detroit Edison ESBWR unit can be constructed and operated at the Fermi site without undue risk to the health and safety of the public; (2) whether the emergency preparedness program meets the applicable requirements in 10 CFR Part 50, 10 CFR Part 52, 10 CFR Part 73, and 10 CFR Part 100; and (3) whether site characteristics are such that adequate security plans and measures can be developed. The final SER for Detroit Edison's COL application is anticipated to be published in the future.

The reactor design referenced in the application is the ESBWR. The ESBWR design was approved by the NRC in March 2011, and the final design certification rule was published in the *Federal Register* on March 16, 2011 (76 FR 14437).

On July 18, 2011, DTE Energy submitted a letter of intent to the NRC to file an application in 2014 for renewal of the operating license of Fermi 2 (DTE Energy 2011). As part of that application review process, the NRC will analyze the environmental impacts of renewing the license for an extended period of operation and document its analysis in an EIS. The NRC will also evaluate whether the effects of aging on plant equipment will be managed such that Fermi 2 can be operated during the period of extended operation without undue risk to the health and safety of the public, and will document its conclusions in an SER.

1.2 The Proposed Federal Actions

The proposed NRC Federal action is issuance, under the provisions of 10 CFR Part 52, of a COL authorizing the construction and operation of one new GEH ESBWR at the Fermi site. The proposed USACE Federal action would be the decision whether to issue a permit pursuant to the CWA and RHAA for the authorization of certain preconstruction activities that could affect waters of the United States, including jurisdictional wetlands, based on an evaluation of the probable impacts, including cumulative impacts, on the public interest.

This EIS presents the NRC and USACE analyses of the environmental impacts that could result from the building and operation of a new unit at the Fermi site or at one of the four alternative sites. These impacts are analyzed by the NRC to determine if the proposed site is suitable for the new unit and whether any of the alternative sites is considered obviously superior to the proposed site. These impacts are analyzed by USACE to determine effects on public interest review factors and if there is a practicable alternative with less adverse impact on the aquatic ecosystem and public interest review factors, provided that the alternative does not have other significant adverse consequences. However, the USACE's independent regulatory permit decision documentation will reference relevant analyses from the EIS, and, as necessary, include supplemental public interest factor reviews, a CWA 404(b)(1) evaluation, a cumulative impact evaluation, and other information and evaluations that may be outside the NRC's scope of analysis and not included in the EIS, but required by the USACE to support its permit decision.

1.3 The Purpose and Need for the Proposed Action

The purpose and need for the proposed NRC and USACE actions is described below.

1.3.1 NRC's Proposed Action

The purpose and need for the proposed NRC action is to provide for additional large baseload electrical generating capacity to address Michigan's expected future peak electric demand. Detroit Edison has indicated that new baseload electric generating capacity will be needed to compensate for the expected retirement of aging baseload generating units and diminishing availability of the Midwest Independent Service Operator region's baseload generation capacity (Detroit Edison 2009). Chapter 8 of this EIS evaluates the need for power. Chapter 9 of the EIS discusses the alternatives to the proposed action, including the no-action alternative.

A license from the NRC is necessary for the construction and operation of the power plant. Preconstruction and certain long lead-time activities, such as ordering and procuring certain components and materials necessary to construct the plant, may begin before the COL is granted. Detroit Edison must obtain and maintain permits or authorizations from other Federal, State, and local agencies and permitting authorities prior to undertaking certain activities. The ultimate decisions on whether or not to build a facility and the schedule are not within the purview of the NRC or USACE and would be determined by the license holder if the authorization is granted.

1.3.2 The USACE Permit Action

The anticipated Detroit Edison permit application that would be submitted to the USACE would involve work to prepare the site and build support facilities for a nuclear power plant at the existing Fermi site. Defining the project purpose is critical to the evaluation of any project and in evaluating compliance with the Guidelines. The Guidelines and subsequent Section 404(q) guidance require that the USACE define the basic project purpose and the overall project purpose to ensure appropriate consideration of alternatives.

The basic purpose is the simplest purpose of the project and is used when discharges are proposed in special aquatic sites to determine whether the applicant's proposed activity is "water dependent" (Section 230.10(a)(3)). The water dependency test contained in the Guidelines requires a determination as to whether or not activities require access or proximity to or siting within special aquatic sites. If the activity is not water dependent, the Guidelines state that practicable alternatives to the use of special aquatic sites are presumed to exist, are less damaging, and are environmentally preferable to alternatives that involve discharges into special aquatic sites (e.g., wetlands) (40 CFR 230.10(a)(3)). The basic purpose of the Fermi 3 project is to generate electricity for additional baseload capacity. Generating electricity does not require siting in wetlands, and in accordance with the Guidelines, practicable, less damaging alternatives that do not involve discharges into special aquatic sites are presumed to exist unless clearly demonstrated otherwise (40 CFR 230.10(a)(3)).

In addition to defining the basic project purpose, the USACE must also define the overall project purpose. The overall project purpose establishes the scope of the alternatives analysis and is used for evaluating practicable alternatives under the Guidelines. In accordance with the Guidelines and USACE Headquarters guidance, the overall project purpose must be specific enough to define the applicant's needs, but not so narrow and restrictive as to preclude a proper evaluation of alternatives. USACE is responsible for controlling every aspect of the Guidelines analysis. In this regard, defining the overall project purpose for issuance of USACE permits is the sole responsibility of USACE. While generally focusing on the applicant's statement, USACE will in all cases exercise independent judgment in defining the purpose and need for the project from both the applicant's and the public's perspective in accordance with 33 CFR Part 325, Appendix B (9)(c)(4) (also 53 FR Part 3136).

The overall purpose of the project is to provide baseload electrical generating capacity to address future peak electric demand in the Detroit Edison service area. USACE concurs with the stated project purpose and long-term need to generate electricity to meet this need.

1.4 Alternatives to the Proposed Action

The review team addresses five categories of alternatives in Chapter 9 and Appendix J: (1) the no-action alternative, (2) energy source alternatives, (3) system design alternatives, (4) alternative sites, and (5) alternatives related to the location of proposed facilities on the Fermi site.

Under the no-action alternative, the proposed action would not go forward. NRC could deny Detroit Edison's application for a COL or USACE deny a Detroit Edison permit request. If the application and/or permit were denied, the construction and operation of a new unit at the existing Fermi site would not occur nor would any benefits intended by an approved COL be realized. Energy source alternatives, focusing on those alternatives that could generate baseload power, include energy replacement technologies such as oil- and gas-fired generation and wind power. System design alternatives include heat dissipation and circulating water systems, intake and discharge structures, and water use and treatment systems; the proposed system is a natural draft cooling tower. Onsite alternatives evaluated by the USACE including actions to reduce impacts on wetlands and shoreline resources are presented in Appendix J.

In its ER, Detroit Edison defines a region of interest for use in identifying and evaluating potential sites for power generation (Detroit Edison 2011a). In this EIS, the review team evaluates the region of interest and the process by which alternative sites and the proposed site were selected by Detroit Edison and evaluates the environmental impacts of construction and operation of a new power reactor at these sites. For alternative sites, the review team evaluation uses reconnaissance-level information. The alternative sites include a coal-fired plant site (Belle River-St. Clair) and an oil- and gas-fired plant site (Greenwood Energy Center), both owned by Detroit Edison, and two greenfield sites (Petersburg and South Britton) that are in multiple private ownership. The objective of the comparison of environmental impacts is to determine if any of the alternative sites is obviously superior to the Fermi site.

As part of the evaluation of permit applications subject to Section 404 of the CWA, USACE is required by regulation to apply the criteria set forth in the Guidelines. These Guidelines establish criteria that must be met in order for the proposed activities to be permitted pursuant to Section 404. Specifically, these Guidelines state, in part, that no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, provided the alternative does not have other significant adverse consequences. An area not presently owned by the applicant that could reasonably be obtained, used, expanded, or managed in order to fulfill the overall purpose of the proposed activity may be considered if it is otherwise a practicable alternative. Alternative site layouts and their impacts on wetlands and waters of the United States are evaluated in Appendix J of this EIS.

1.5 Compliance and Consultations

Prior to construction and operation of a new unit, Detroit Edison is required to hold certain Federal, State, and local environmental permits, as well as to meet applicable statutory and regulatory requirements. Potential authorizations, permits, and certifications relevant to the proposed COL are included in Appendix H. The NRC staff reviewed this list and has contacted the appropriate Federal, State, Tribal, and local agencies to identify any compliance, permit, or significant environmental issues of concern to the reviewing agencies. A chronology of the correspondence is provided in Appendix C. A list of the key consultation correspondence is provided in Appendix F.

1.6 Report Contents

The subsequent chapters of this EIS are organized as follows. Chapter 2 describes the proposed site and discusses the environment that would be affected by the addition of the new unit. Chapter 3 describes the power plant layout, structures, and the activities related to construction and operation to be used as the basis for evaluating the environmental impacts. Chapters 4 and 5 examine site acceptability by analyzing the environmental impacts of construction (Chapter 4) and operation (Chapter 5) of the proposed Fermi Unit 3. Chapter 6 analyzes the environmental impacts of the uranium fuel cycle, transportation of radioactive materials, and decommissioning, while Chapter 7 discusses the cumulative impacts of the proposed action as defined in 40 CFR Part 1508. Chapter 8 addresses the need for power. Chapter 9 discusses alternatives to the proposed action and analyzes energy sources, alternative sites, and system designs, and compares the proposed action with the alternatives. Chapter 10 summarizes the findings of the preceding chapters, provides a benefit-cost evaluation, and presents the NRC staff's preliminary recommendation with respect to the Commission's approval of the proposed site for a COL based on the staff's evaluation of environmental impacts.

The appendices to the EIS provide the following additional information:

- Appendix A – Contributors to the Environmental Impact Statement
- Appendix B – Organizations Contacted
- Appendix C – Chronology of NRC and USACE Staff Environmental Review Correspondence Related to Detroit Edison Company's Application for a Combined License for the Proposed Fermi Nuclear Power Plant Unit 3
- Appendix D – Scoping Comments and Responses
- Appendix E – Draft Environmental Impact Statement Comments and Responses (Reserved)

- Appendix F – Key Consultation Correspondence Regarding the Fermi Nuclear Power Plant Unit 3 Combined License Application
- Appendix G – Supporting Documentation on Radiological Dose Assessment
- Appendix H – Authorizations, Permits, and Certifications
- Appendix I – Severe Accident Mitigation Alternatives
- Appendix J – USACE Public Interest Review Factors and Onsite Alternatives Analysis
- Appendix K – Detroit Edison's Proposed Fermi 3 Conceptual Aquatic Resource Mitigation Strategy
- Appendix L – Carbon Dioxide Footprint Estimates for a 1000 MW(e) Light Water Reactor

1.7 References

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy,* Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy,* Part 52, "Early Site Permits, Standard Design Certifications, and Combined Licenses for Nuclear Power Plants."

10 CFR Part 73. Code of Federal Regulations, Title 10, *Energy*, Part 73, "Physical Protection of Plants and Materials."

10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

33 CFR 320. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 320, "General Regulatory Policies."

33 CFR Part 325. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 325, "Processing of Department of the Army Permits."

33 CFR Part 332. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 332. "Compensatory Mitigation for Losses of Aquatic Resources."

40 CFR Part 230. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 230, "Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material."

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

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72 FR 57416. October 9, 2007. "Limited Work Authorizations for Nuclear Power Plants." *Federal Register*. U.S. Nuclear Regulatory Commission.

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DTE Energy. 2011. Letter from Joseph Plona (DTE Energy) to NRC, dated July 18, 2011, "Subject: Notice of Intent to Submit License Renewal Application." Accession No. ML112010179.

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*. U.S. Department of the Army, Vicksburg, Mississippi.

National Environmental Policy Act of 1969, as amended (NEPA). 42 USC 4321, *et seq.*

Rivers and Harbors Appropriation Act of 1899. 33 USC 403, as amended.

U.S. Army Corps of Engineers and U.S. Nuclear Regulatory Commission (USACE and NRC). 2008. *Memorandum of Understanding: Environmental Reviews Related to the Issuance of Authorizations to Construct and Operate Nuclear Power Plants*. Accession No. ML082540354.

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2.0 Affected Environment

The proposed Enrico Fermi Unit 3 (Fermi 3) would be located in Monroe County in rural southeastern Michigan. Detroit Edison Company (Detroit Edison) applied to the U.S. Nuclear Regulatory Commission (NRC) for a combined license (COL) for Fermi 3. In addition to the COL application, Detroit Edison plans to apply for a Department of Army permit from the U.S. Army Corps of Engineers (USACE) to conduct activities that affect waters of the United States, including wetlands. The proposed new unit would be situated wholly within the existing Enrico Fermi Atomic Power Plant (Fermi) site and adjacent to the existing Enrico Fermi Unit 2 (Fermi 2). Enrico Fermi Unit 1 (Fermi 1), also located on the Fermi site, is being decommissioned. The Fermi site is located approximately 30 mi southwest of Detroit, Michigan, and 7 mi from the United States-Canada border. The proposed Fermi 3 location is described in Section 2.1, followed by descriptions of the land, water, ecology, socioeconomics, environmental justice, historic and cultural resources, geology, meteorology and air quality, and radiological environment of the site presented in Sections 2.2 through 2.11, respectively. Section 2.12 examines related Federal projects, and references are presented in Section 2.13.

2.1 Site Location

Detroit Edison's selected location for the proposed Fermi 3 is entirely within the Fermi site and is adjacent to and southwest of existing operating Fermi 2 and west of Fermi 1, which is in the process of being decommissioned (Figure 2-1). Lake Erie borders the Fermi site on the east. Toll Road is located along the west boundary, Swan Creek is to the north, and Pointe Aux Peaux Road is to the south. The entire site is relatively flat, with large areas of developed land, but also extensive emergent wetlands, early successional habitats, and forest.

The population centers nearest to the Fermi site that have more than 25,000 residents are Detroit, Michigan, with approximately 900,000 residents; Windsor, Ontario, with approximately 200,000 residents; and Toledo, Ohio, with approximately 300,000 residents. Figure 2-2 shows the location of Fermi 3 in relationship to the counties and important cities and towns within a 50-mi radius of the site. Figure 2-3 shows the location of Fermi 3 in relation to features in the vicinity of the project, defined as the area within 7.5 mi of the site.

2.2 Land Use

This section discusses land use for the Fermi site; Section 2.2.1 describes the site and the vicinity around the site (i.e., the area within 7.5 mi of the site); Section 2.2.2 discusses the existing and proposed transmission line corridors; and Section 2.2.3 briefly discusses the region, defined as the area within 50 mi of the Fermi site boundary.

Figure 2-1. Fermi Site Boundary (Detroit Edison 2011a)

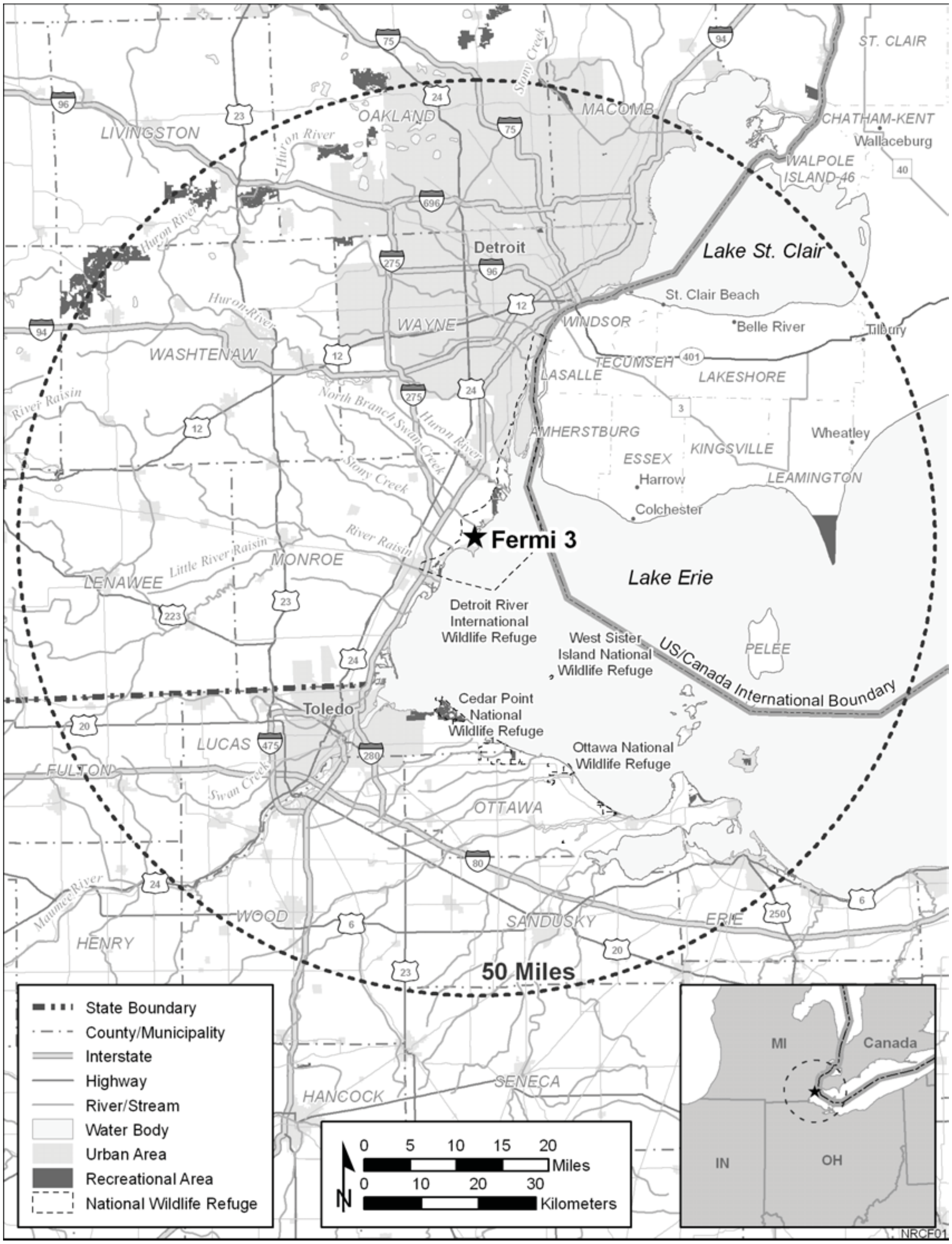


Figure 2-2. Proposed Location of Fermi 3 and 50-mi Region (Detroit Edison 2011a)

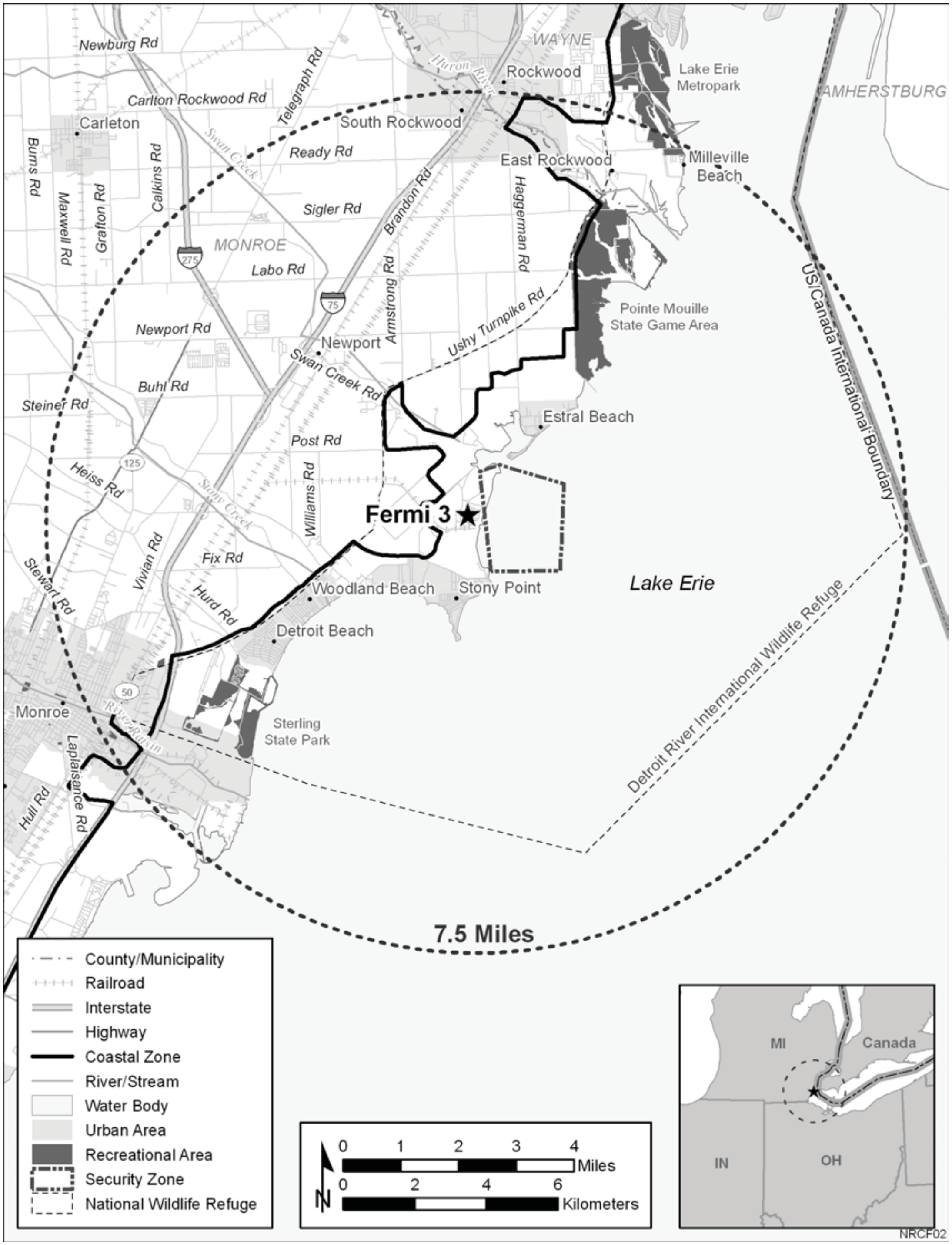


Figure 2-3. Proposed Location of Fermi 3 and 7.5-mi Region (Detroit Edison 2011a)

2.2.1 The Site and Vicinity

The Fermi site includes the entire Fermi tract owned by Detroit Edison, including, but not limited to, the land where Fermi 3 would be constructed. The site consists of approximately 1260 ac within Frenchtown Township, in an unincorporated part of Monroe County, Michigan. The site is approximately 30 mi southwest of the southern suburbs of Detroit, Michigan; about 24 mi northeast of the northern extent of Toledo, Ohio; and 7 mi from the United States-Canada border (Figure 2-2) (Detroit Edison 2011a). The existing site layout and property boundary are shown in Figure 2-1.

The Fermi site contains one existing nuclear generating unit, Fermi 2, with a generating capacity of 1122 MW(e). Fermi 2 began commercial operation in 1988 (NRC 2010a). The first unit at the site, Fermi 1, a prototype fast breeder reactor, had a generating capacity of 94 MW(e) and began commercial operation in 1957. It was deactivated in 1972, and decommissioning, which is still in progress, began in 1975 (NRC 2010b).

Approximately 212 ac (16.8 percent) of the Fermi site are occupied by existing Fermi 2 facilities, the partially decommissioned Fermi 1 plant, and associated support facilities (Table 2-1). The northern and southern portions of the site feature large lagoons, while the western area is partially forested. Vegetated wetlands, forested areas, and open water make up approximately 744 ac (59.0 percent) of the site; and grassland and other uses make up approximately 304 ac (24.1 percent), which includes approximately 30 ac of grassland underlying onsite transmission corridors. The Quarry Lakes, in the western part of the site, occupy two adjacent quarries that were used to provide construction materials for Fermi 2. The eastern portion of the site, adjacent to Lake Erie, contains the existing power plant structures.

Table 2-1. Onsite Land Use at the Fermi Site

Land Use	Acres	Percent
Developed areas[(a)]	212	16.8
Coastal wetlands[(b)]	273	21.6
Forest	256	20.3
Water	215	17.1
Grassland (including onsite agricultural land and onsite transmission corridor)	168	13.3
Shrubland and thicket	136	10.8
Total	1260	100.0

Source: Detroit Edison 2011a

(a) Developed land includes existing power generation facilities and associated infrastructure

(b) Includes coastal emergent wetlands only. Other wetlands are a subcomponent of the other land uses shown in the table.

Approximately 656 ac of undeveloped lands on the Fermi site are managed as part of the Detroit River International Wildlife Refuge (DRIWR). The DRIWR extends along the shore of Lake Erie from the River Raisin in the south to the Detroit River in the north, and it contains habitat for common species as well as some wetland and water dependent species (FWS 2010a). Detroit Edison has had a cooperative agreement with the U.S. Fish and Wildlife Service (FWS) since 2003 that allows the FWS to assist in managing the refuge areas while Detroit Edison retains ownership and control of the entire site (Detroit Edison 2009a).

The topography of the Fermi site and vicinity is generally flat, with the largest wetland areas located along the Lake Erie shoreline. In addition to Lake Erie, natural features in the vicinity of the Fermi site include Stony Point, a distinctively shaped landform projecting into Lake Erie south of the Fermi site, and several other bodies of water, including Swan Creek and the Huron River to the north and Stony Creek and River Raisin to the southwest.

Access to the Fermi site is provided by Fermi Drive, which connects US Route 24 (Dixie Highway) with the main gate. Interstate 75 (I-75) is the major transportation route in the vicinity. It runs north-south through Monroe and Wayne Counties and is located about 4 mi of the northwest side of the Fermi site. Major rail lines near the site include the Canadian National and Norfolk Southern lines, both of which run in a roughly north-south direction, about 3 mi to the west. A rail spur off the Canadian National main line extends into the Fermi site for large and heavy equipment transport (MichiganRailroads.com 2010). Two natural gas pipelines are located in the vicinity of the Fermi site, running roughly southwest-northeast, about 10 mi to the west.

Detroit Edison has surface ownership of all the land within the Fermi site property boundary and controls nearly all of the mineral rights. The only exception is that the Michigan Department of Natural Resources (MDNR) owns 0.88 ac of mineral rights in the southeastern part of the site, located away from the area occupied by existing power plant and auxiliary facilities as well as the area where the proposed Fermi 3 facilities would be situated. Currently there is no exploration or commercial mineral production on the Fermi site or on properties adjoining the site, and none is expected in the foreseeable future (Detroit Edison 2011a). In addition, there has been no commercial harvesting of timber onsite, and none is anticipated in the future (Detroit Edison 2009b).

Because of its proximity to Lake Erie, the Fermi site falls under the Coastal Zone Management Act of 1972, which intended to encourage a balance between conservation and economic activities typical of coastal areas. Individual states are responsible for their own coastal management programs, and the Michigan program is administered by the Michigan Department of Environmental Quality (MDEQ). Section 307(c)(3)(A) of the Coastal Zone Management Act (16 USC 1456(c)(3)(A)) requires applicants for Federal permits who propose activities in a coastal zone area to provide a certification that the proposed activity complies with the enforceable policies of the State's coastal zone program. NRC would not issue a COL for

Fermi 3 unless Detroit Edison had obtained a Coastal Zone Management Act Certification from the MDEQ. Detroit Edison applied for certification when they submitted their Joint Permit Application to the MDEQ on June 17, 2011 (Detroit Edison 2011f).

Three agencies are responsible for land use planning in the vicinity of the Fermi site. The Monroe County Planning Department and Commission is responsible for land use planning, zoning, specialized research, interfacing with State and Federal agencies, and reviewing all township zoning applications and providing recommendations on zoning cases to individual townships (Monroe County Planning Department and Commission 2010). The Southeast Michigan Council of Governments (SEMCOG) addresses local and county issues at a regional level, including governmental efficiency, economic development, water quality, and transportation, thus providing assistance to county and local governments' efforts (SEMCOG 2010a). Frenchtown Township, in which the Fermi site is located, has a local planning authority that provides local land use planning, including housing and transportation planning. Berlin Township, which adjoins Frenchtown Township close to the Fermi site, has a similar local planning authority (Detroit Edison 2011a).

Land on the Fermi site is zoned as "industrial" by Monroe County and as "public service" by Frenchtown Township, and future land use maps produced by both planning agencies indicate that industrial and utility uses are anticipated to continue on the Fermi property (Monroe County Planning Department and Commission 2010; James D. Anulewicz Associates, Inc. and McKenna Associates, Inc. 2003).

In the vicinity of the Fermi site, most land is rural and zoned agricultural by Monroe County and Frenchtown Township. In 2000, agriculture accounted for more than 63 percent of the acreage in Monroe County, although agricultural acreage had declined 7 percent from 1990 (Monroe County Planning Department and Commission 2010). Residential land use occupied approximately 13 percent of the county, forest cover made up approximately 10 percent, nonresidential land uses made up approximately 6 percent, and grassland and shrub made up approximately 3 percent. Approximately 2 percent of the county consisted of water, while approximately 1 percent consisted of nonforested wetlands, and approximately 1 percent was used for extractive purposes or was barren land. Industrial and commercial/office land uses, while making up less than 1 percent each of the county in 2000, grew at 41 percent and 32 percent, respectively, between 1990 and 2000 (Monroe County Planning Department and Commission 2010). In Frenchtown Township, agricultural land use, wooded land, and vacant land accounted for approximately 57 percent of the total acreage in 2002, followed by residential land use (approximately 20 percent), transportation and utility uses (approximately 14 percent), parks and recreational land (approximately 6 percent), and other nonresidential developed land (approximately 4 percent) (James D. Anulewicz Associates, Inc. and McKenna Associates, Inc. 2003).

Although agricultural land uses adjoin most of the landward boundary of the Fermi site, there are areas of residential and limited industrial development near the City of Monroe, approximately 8 mi to the southwest (Figure 2-4). Most land to the north of the Fermi site, near Swan Creek, is designated as residential and agricultural in the Monroe County land use plan, while the Stony Point area, directly southeast of the Fermi site, is residential (Monroe County Planning Department and Commission 2010). The majority of the land west of the Fermi site is zoned agricultural. There are a number of industrial areas located to southwest of the site along the Lake Erie shoreline and in the city of Monroe, including the Detroit Edison Monroe Power Plant, the Automotive Components Holdings plant, and the Port of Monroe (Monroe County Planning Department and Commission 2010). Uses in areas to the south of the site are anticipated to remain low- and medium-density residential uses. Elsewhere, the site will continue to be surrounded primarily by agricultural lands, with open areas and woodlands to the west and north. Frenchtown Township has designated a Waterfront Opportunity Area northeast of the Fermi site where commercial development would be allowed (James D. Anulewicz Associates, Inc. and McKenna Associates, Inc. 2003).

Approximately 64 ac in the southwestern part of the Fermi site consists of prime farmland and is currently used as cropland (Detroit Edison 2011a). Prime farmland is defined by the U.S. Department of Agriculture as available cultivated land, pastureland, forestland, or other land that has the appropriate combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. Substantial areas of prime farmland occur in the vicinity of the Fermi site as well. A program of farmland preservation and conservation that includes prime farmland is an important part of planning in Monroe County and may prevent additional residential and other development from occurring on undeveloped land used for agriculture in close proximity to the Fermi site (Monroe County Planning Department and Commission 2010).

Recreational facilities within 5 mi of the Fermi site include Stony Point Beach and Estral Beach, Swan Creek and Swan Creek Boat Club, Pointe Aux Peaux State Wildlife Area, Pointe Mouillee State Game Area, and William C. Sterling State Park (Detroit Edison 2011a). There are various other areas in the vicinity of the site used for wildlife conservation, hiking, fishing, and other recreation opportunities.

Part of the Fermi site lies in the 100-year floodplain associated with the shore of Lake Erie. Floodplains and other surface water hydrology elements are discussed further in Section 2.3.1.1. Cultural resources and historic properties have been identified within the area. Cultural resources include archaeological and architectural resources; historic properties consist only of architectural resources. Cultural resources are discussed in Section 2.7.

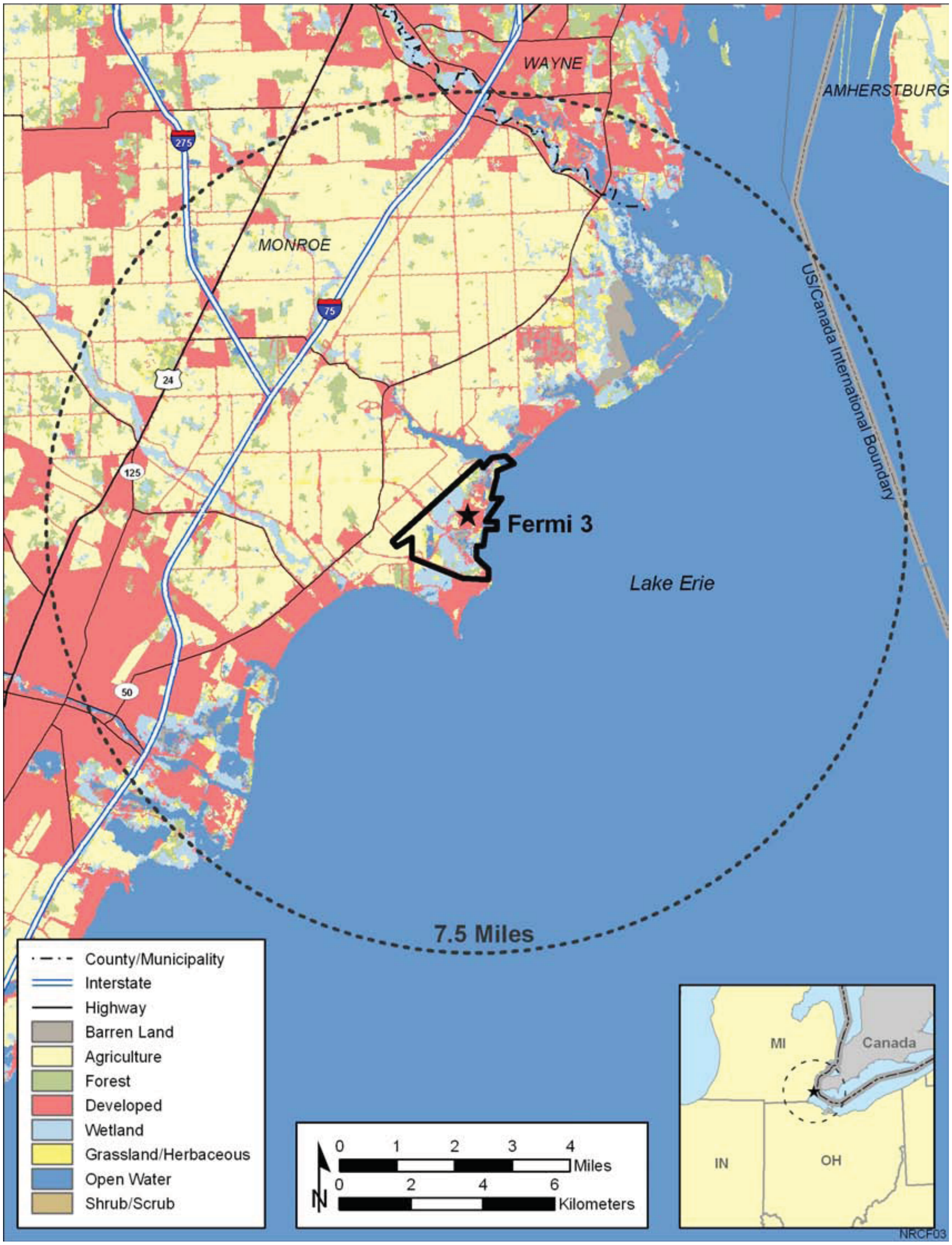


Figure 2-4. Land Use within 7.5 mi of the Fermi Site (Detroit Edison 2011a)

2.2.2 Transmission Lines

A single onsite transmission corridor accommodates the existing 345-kV transmission lines that originate at the Fermi 2 switchyard and extend to the west perimeter fence, near Doxy Road and Fermi Drive (Detroit Edison 2011a). A portion of the onsite transmission corridor just east of the site boundary and north of Fermi Drive has been restored to native tallgrass prairie vegetation. A new onsite corridor would be developed for a new 345-kV transmission line carrying power from Fermi 3 (Detroit Edison 2011a). Existing offsite transmission infrastructure serving Fermi 2 consists of two 345-kV power lines extending from the Fermi site approximately 5 mi to a point west of I-75 where the lines turn north for about 12 mi adjacent to I-75 (Figure 2-5) (Detroit Edison 2011a).

ITC*Transmission* has not yet selected a route for the offsite portion of the proposed new transmission line serving Fermi 3. Detroit Edison expects that the proposed new transmission line would be built within the existing Fermi 2 transmission corridor for approximately 18.6 mi extending outward from the Fermi site boundary. Detroit Edison expects that the remaining 10.8 mi, extending to the Milan Substation, would be built within an undeveloped right-of-way (ROW) possessed but not yet used by ITC*Transmission* (Detroit Edison 2011a). No data are available on existing land uses in the anticipated 10.8-mi undeveloped ROW segment, but the review team expects that it crosses mostly agricultural and forest land and scattered wetlands. No part of the anticipated route crosses designated or protected natural or recreational areas or areas with planned minerals development, although the route likely crosses some prime farmland. Land use restrictions within the corridor segments are governed by agreements between ITC*Transmission* and individual property owners along the corridor (Detroit Edison 2011a).

2.2.3 The Region

The 50-mi region surrounding the Fermi site is shown in Figure 2-2. The region includes all of the Toledo metropolitan area (approximately 300,000 residents) and most of the Detroit metropolitan area (approximately 900,000 residents. Land use within the U.S. portion of the 50-mi region is generally similar to land use in the vicinity of the Fermi site as shown in Table 2-2. Agriculture and urban land development are the most important land uses. Principal agricultural products and livestock in the region include soybeans, corn, wheat, milk, cattle, and pigs (Detroit Edison 2011a). In the Canadian portion of the 50-mi region, more than 57 percent of the total acreage is open water, approximately 35 percent is agricultural, and approximately 5 percent is urban.

The City of Monroe and various smaller communities in Monroe County and in the surrounding counties are shown in Figure 2-5, together with the principal highways, parks, and wildlife refuges. The topography of the region around the Fermi site is fairly flat, with wetland areas

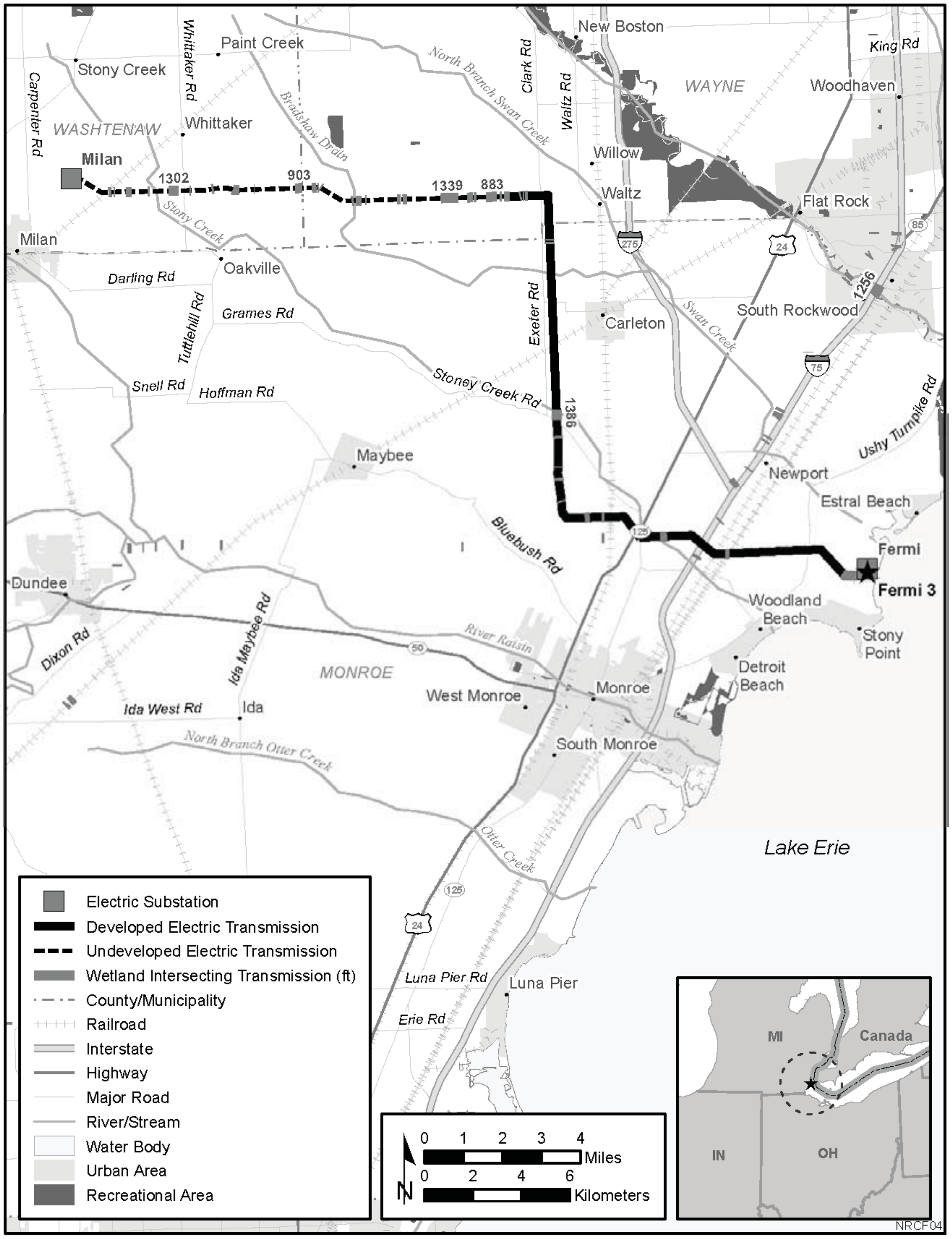


Figure 2-5. Proposed Transmission Corridor from Fermi 3 to the Milan Substation (Detroit Edison 2011a)

Table 2-2. Land Use within 50 mi of the Fermi Site

Land Use	United States Acres	United States Percent	Canada Acres	Canada Percent
Agriculture	1,436,930	37.9	413,825	35.0
Urban	1,089,795	28.8	60,749	5.1
Open water	725,910	19.2	678,492	57.4
Forest or undeveloped	349,361	9.2	22,173	1.9
Wetlands	184,801	4.9	6826	0.6

Source: Detroit Edison 2011a

concentrated along the Lake Erie shoreline. The Detroit Arsenal is located in Warren, near northern Detroit, and the Selfridge Air National Guard Base is located 30 mi to the northeast of Detroit (Global Security.org 2011). There are no wild and scenic rivers within the region (National Wild and Scenic Rivers System 2011).

There are no lands of Tribal entities recognized and eligible for funding and services from the U.S. Bureau of Indian Affairs within the U.S. portion of the 50-mi region (Michigan Department of Human Services 2010). Additional discussion of Federally recognized Indian Tribes is provided in Section 2.7.

Eighty-seven percent of employees currently working at the Fermi site reside in Monroe County, Wayne County, or Lucas County in Michigan (Detroit Edison 2011a).

2.3 Water

This section describes the hydrological processes governing the movement and distribution of water in the existing environment at and around the Fermi site, the existing and potential future water use, and the quality of water in the Fermi site environment. Descriptions of the building impacts, operating impacts, cumulative impacts, and alternative sites and alternative plant systems are provided in Chapters 4, 5, 7, and 9, respectively.

During the operation of the proposed Fermi 3, the western basin of Lake Erie would be the source of cooling system water and the only recipient of plant blowdown discharge water. Lake Erie would also be the only source of water used during building activities. The Frenchtown Water Plant would be the source for potable sanitary water and for makeup demineralized water during operations. Sanitary effluent would be discharged to the Frenchtown Township Sewage Treatment Facility. Although dewatering would occur during construction, groundwater would not be used for any purpose during construction and operation of Fermi 3.

Detroit Edison (2011a) presents the elevations of various hydrologic and plant features by using three different reference data sources. The three sources referenced in Section 2.3 of the

Fermi 3 Environmental Report (ER) include the North American Vertical Datum of 1988 (NAVD 88), the Fermi plant grade datum (Plant), and the International Great Lakes Datum of 1985 (IGLD 85). Table 2-3 displays elevations of important hydrological features in each datum. The NAVD 88 coordinate system (current mean sea level) is used throughout this document to describe hydrological features.

Table 2-3. Reference Datums for Fermi Site Elevations

	Elevations by Reference Datum (ft)		
Feature	**NAVD 88**	**Plant**	**IGLD 85**
Current Fermi plant grade	581.8	583.0	581.5
Fermi 3 safety structures	589.3	590.5	589.0
Lake Erie low water datum	569.5	570.7	569.2
Elevation of water intake pipe	553.3	554.5	553.0
100-year lake level calculated by the applicant (Detroit Edison 2011b, Section 2.4.5)	575.1	576.3	574.8
100-year lake level calculated by FEMA (2000)	578.5	579.4	577.9
Average elevation of Lake Erie, 1918–2010 (USACE 2011a)	571.6	572.8	571.3

2.3.1 Hydrology

This section describes the site-specific and regional hydrological features that could be altered by building and operating the proposed Fermi 3. A summary of the hydrological conditions of the proposed Fermi 3 site is provided in Section 2.3 of the ER (Detroit Edison 2011a). A description of the site's hydrological features related to site safety (e.g., probable maximum flood) was presented in Section 2.4 of the Final Safety Analysis Report (FSAR) (Detroit Edison 2011b). The elevations of all safety-related systems, structures, and components (SSCs) of Fermi 3 would be at or above 589.3 ft NAVD 88. Both the FSAR and ER were informed by the hydrology characterization conducted prior to building the Fermi 2 and the results of investigations performed to support the Fermi 3 COL application.

2.3.1.1 Surface Water Hydrology

Figure 2-3 shows the location of Fermi 3 on the western edge of Lake Erie. Historically, surface wetlands dominated the Fermi site vicinity. Much of the wetland area was drained in the 1800s to accommodate the development of local agriculture. Fermi 2 lies entirely on fill material placed and graded after significant volumes of natural material were excavated. However, much of the Fermi site is currently characterized by surface wetlands. As shown in Figure 2-3, much of the Fermi site is located in the coastal zone of Lake Erie. Approximately 656 ac of undeveloped lands on the Fermi site are managed as part of the DRIWR (see Section 2.2.1).

The Fermi property is bordered by Lake Erie along its eastern edge, and the site drains to Lake Erie and to Swan Creek. The Fermi site is partially bounded by the 100-year floodplain of these water bodies (FEMA 2000). Swan Creek drains into Lake Erie approximately 0.5 mi north of the Fermi site (Figure 2-1). Other nearby water bodies near the Fermi site include Stony Creek about 3 mi southwest, the River Raisin about 6 mi southwest, the Huron River about 6 mi north, and the mouth of the Detroit River approximately 6.5 mi northeast (Figure 2-2).

Lake Erie has an open water surface area of 9910 mi^2 and a total watershed area of 30,140 mi^2 (EPA 1995). Lake retention time is approximately 2.6 years. The volume of Lake Erie is approximately 116 mi^3 or about 128 trillion gallons (EPA 1995). Because of the lake's large size, there is considerable uncertainty in the estimates of the Lake Erie water balance (Neff and Nicholas 2005). The Detroit River, which connects Lake Huron and Lake Erie, contributes to about 80 percent of Lake Erie's total inflow. The other major inputs to Lake Erie are from precipitation (11 percent) and tributaries (9 percent) flowing through watersheds in Michigan, Ohio, Pennsylvania, New York, and Ontario (Environment Canada and EPA 2005). Annual average rainfall over Lake Erie is about 35 in./yr and is estimated to contribute approximately 25,497 cubic feet per second (cfs) (+/- 15 to 45 percent) to the water balance (NOAA 2003; Neff and Nicholas 2005). Runoff from tributaries to Lake Erie is estimated to be 21,189 cfs (+/- 15 to 35 percent) (Neff and Nicholas 2005). The inflow from the Detroit River is estimated to be 188,333 cfs (+/- 5 to 15 percent), and the outflow to Lake Ontario is estimated to be 206,202 cfs (+/- 4 to 10 percent) (Neff and Nicholas 2005). The average annual evaporation from Lake Erie is estimated to be 36 in./yr and is estimated to remove approximately 26,027 cfs (+/- 10 percent) from the water balance (NOAA 2003; Neff and Nicholas 2005). Between 2000 and 2006, the average water use in the basin was 53,285 million gallons per day (MGD) or about 19,449 billion gallons per year (GLC 2005a, b, c; 2006a, b; 2009a, b).

Lake Erie is usually divided into three separate drainage basins: western basin, central basin, and eastern basin. The western basin of Lake Erie is situated east of the Fermi site and would provide the operational water for Fermi 3. The western basin of Lake Erie is very shallow, with an average depth of 24 ft, and is partially restricted from the rest of Lake Erie by chains of barrier beaches and islands. Major streams that flow into the western basin are the Detroit River, River Raisin, and Maumee River. The typical wind current pattern for the western basin is west to east (EPA 1995). Flow velocity varies due to wind currents and seasonal climate variations and was measured to be an average of 0.4 ft/second (fps) in the western basin of Lake Erie during an experiment and 0.3 fps between the Detroit River and the Toledo water intake after a salt spill (Verber 1953; Kovacik 1972).

The average water elevation for Lake Erie is estimated to be 571.6 ft NAVD 88 (NOAA 2009a). A rock barrier is present along the shoreline on the eastern edge of the Fermi site at 581.8 ft

NAVD 88, which is also the current plant grade, to protect the Fermi site against high water levels of Lake Erie. According to the Federal Emergency Management Agency (FEMA 2000), the 100-year flood level is at 578.5 ft NAVD 88 at the Fermi site. Lake Erie water levels are measured hourly by the National Oceanic and Atmospheric Administration (NOAA) at the Fermi site gage (ID 9063090). Water levels are typically higher in the spring and summer and lower in the fall and winter. The record low water elevation of Lake Erie at the Fermi gage is 563.9 ft NAVD 88. The highest recorded water elevation at the Fermi gage is 576.8 ft NAVD 88. Winds blowing across the lake can cause surges in lake levels and subsequent seiches, which are oscillations of water levels in response to atmospheric conditions. USACE estimates that the maximum 100-year storm-induced surge on Lake Erie is 3.9 ft at the Fermi site (USACE 2011b). In the FSAR, Detroit Edison (2011b) presented the historical records of seiches recorded in the western basin of Lake Erie in Toledo. The maximum recorded rise was 6.3 ft and the maximum recorded fall was 8.9 ft for the period from 1941 to 1981.

Over the past 30 years, the Lake Erie shoreline at the Fermi site has remained fairly stable. Erosion and sediment transport in the western basin of Lake Erie near the proposed Fermi 3 are dictated primarily by two major streams: the Detroit River to the north and the River Raisin to the south. The Maumee River further south, however, is the major sediment source to Lake Erie and contributes the highest amount of suspended solids per year of any other tributary to the Great Lakes (Bridgeman 2006).

The Swan Creek watershed has a drainage area of 106 mi^2. The watershed is an elliptically shaped basin trending northwest-southeast. The average slope of the creek is 5.15 ft/mi. The Swan Creek watershed has a maximum elevation of approximately 700 ft NAVD 88 at 25 mi inland, and it drains to Lake Erie to the east, where elevations at the mouth of the creek are approximately 575 ft NAVD 88. The entire Swan Creek watershed is situated within flat to gently rolling plains. In general, the surface soils within the basin are primarily lacustrine clay, with some sand ridges at the head of the watershed. The soils have low infiltration capacity, resulting in poor surface drainage. Floodplains occupy areas along the creek, and wetlands are well developed at its mouth near Lake Erie. No significant impoundments or reservoirs are present along Swan Creek, according to the *National Inventory of Dams* (USACE 2007).

Currently, Swan Creek is ungaged. The Michigan Department of Environmental Quality (MDEQ 2009a) calculated Swan Creek flows by using data collected from a gaging station installed in a neighboring watershed with similar geologic characteristics. The harmonic mean annual daily flow rate was estimated to be 4.6 cfs. Monthly mean flows were estimated to vary from 6 cfs in August to 140 cfs in March. The 90-day mean low flow rate that occurs, on average, once in 10 years (10 percent chance of occurring in any one year) was estimated to be 0.9 cfs.

Other nearby watersheds include Stony Creek (120 mi^2) about 3 mi southwest, River Raisin (1072 mi^2, average flow rate of 671 cfs) about 6 mi southwest, and Huron River (908 mi^2, average flow rate of 565 cfs) about 5.75 mi north (Herdendorf 1987). These watersheds are not likely to be affected by the Fermi site because of their distances from the site.

The North Lagoon and South Lagoon are located near the proposed Fermi 3 site. They are hydraulically connected to Lake Erie through direct contiguous waterways (Figure 2-6). There are two manmade canals on the western side of the Fermi site. The north canal (also known as the overflow canal), located northwest of the proposed Fermi 3, flows to the North Lagoon. The south canal (also known as the discharge canal), west of the proposed Fermi 3, flows to the South Lagoon. A small pond (the central canal) is located between the north and south canals. Nearby wetlands are hydraulically connected to the canals through culverts, but the central canal is not directly connected to any surface water features. The wetlands, canals, and lagoons are all hydraulically connected to the western basin of Lake Erie.

There are two Quarry Lakes and one manmade water basin on the Fermi site (Figure 2-6). The Quarry Lakes resulted from rock quarry operations in support of the building of Fermi 2. They are located about 3000 ft southwest of the proposed location of Fermi 3 in the area of office buildings (Figure 2-6). The manmade water basin is in the northern part of the Fermi site and is part of the circulating water system for Fermi 2. Fermi 3 would not use the water basin.

The intake from Lake Erie for Fermi 2 is located between the two rock groins that extend into Lake Erie to minimize shoaling and protect the Fermi 2 water intake (Figure 2-6). Dredging is periodically performed in the area between the two groins. The current dredge cycle is 4 years (Detroit Edison 2011a). Dredging activities are regulated by two existing permits: (1) the USACE permit for the Fermi site, which addresses activities under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act, and (2) the MDEQ permit issued under the Natural Resources and Environmental Protection Act of 1994, Act 451, Part 325, "Great Lakes Submerged Lands," in Michigan Compiled Laws (451 MCL 325). Dredge spoils are placed in the Spoils Disposal Pond that is supported by embankments and located near the Lake Erie shore to the south of the proposed location for Fermi 3. The Spoils Disposal Pond has an outfall associated with the Fermi 2 National Pollutant Discharge Elimination System (NPDES) Permit MI0037028 (MDEQ 2005). NPDES regulated outfalls are shown in Figure 2-6.

Fermi 2 discharges water directly to both Lake Erie through a discharge pipe and to Swan Creek through the north canal under the MDEQ NPDES permit (Figure 2-6). The Fermi 2 cooling water discharge is located along the shoreline of Lake Erie, north of Fermi 2 and east of the cooling towers (Outfall 001 in Figure 2-6). The discharge structure from the Fermi 2 circulating water reservoir consists of a subgrade pipe entering into an onshore concrete basin with an invert elevation of 575 ft NAVD 88 (NRC 1981). At the end of the concrete basin, discharge enters a riprap-covered open channel at a 2:1 horizontal-to-vertical slope to an elevation of 571 ft NAVD 88. The open channel has 3-ft channel sides that also have a 2:1 horizontal-to-vertical slope. The riprap-covered channel continues out into Lake Erie at a 100:1 horizontal-to-vertical slope for approximately 100 ft (NRC 1981).

Figure 2-6. Surface Water Features, Discharge Outfalls, and Water Quality Sampling Locations on the Fermi Site

The Fermi 3 discharge pipe would be located 1300 ft out into Lake Erie where the lake bed has an elevation of approximately 563 ft NAVD 88. The average elevation of Lake Erie at the Fermi site is 571.6, so there would be an average depth of 8.6 ft of water in the vicinity of the discharge pipe (NOAA 2007).

2.3.1.2 Groundwater Hydrology

In this section, “regional” refers to Monroe County, Michigan, and the five counties adjacent to Monroe County. “Local” refers to the Fermi site and its vicinity. The following descriptions are based on information from the ER, the FSAR, and independent sources.

The Fermi site is located on a glacial plain. The local groundwater system is composed of two zones: unconsolidated overburden and several carbonate bedrock aquifers. The overburden materials consist of the fill material and clay dikes in addition to the native lacustrine and glacial deposits. The uppermost carbonate bedrock formation is the Bass Islands Group, composed of dolomite bedrock. The geology of the Fermi site is discussed further in Section 2.8.

During the building of Fermi 2, gravel and cobble gravel fill were placed to provide a structural base for the power plant. Some of the fill material came from an onsite quarry that mined the Bass Islands Group carbonate bedrock. The fill extends across most of the area associated with the construction of Fermi 2 (Detroit Edison 2009c). In logs for boreholes drilled in the immediate location of Fermi 3, the fill was classified as cobbles, well graded gravel, poorly graded gravel, graded gravel with silt, and boulders. The fill ranges from 10 to 15 ft thick across most developed plant areas (Detroit Edison 2009c). However, the fill is estimated to extend to below the original top of the bedrock in the vicinity of Fermi 2 buildings that also extend to below bedrock. In addition to the fill, a system of clay dikes was installed on the Fermi site (Detroit Edison 2009c; 2011a). The presence of the dikes restricts the lateral movement of infiltrated water in the fill beyond the areas enclosed by the dike. Recharge of the fill is through precipitation that discharges to the underlying geologic units (lacustrine sediments, glacial till, or carbonate bedrock).

The native overburden of the Fermi site is composed of peaty silt and clay of lacustrine origin (0 to 9 ft thick) and a brown and gray glacial till of late Pleistocene age (6 to 19 ft thick) (Detroit Edison 2011a). The native overburden has a relatively low hydraulic conductivity and an average thickness of about 28 ft, which is consistent with the regional conditions in much of Monroe County, Michigan. It should be noted that as much as 20 ft of the overburden was excavated and replaced with fill material in most of the areas of the Fermi site during the building of Fermi 2 (Detroit Edison 2011a). The overburden is recharged with precipitation and is hydraulically connected to nearby water bodies.

Two regional aquifers, the Bass Islands Group aquifer and the Salina Group aquifer, lie beneath the overburden at the Fermi site. There is a weathered zone at the boundary of the Bass Islands Group aquifer and the glacial overburden. The Bass Islands Group aquifer is composed of dolomite bedrock, and the thickness of the unit varies between approximately 50 and 100 ft beneath the Fermi site.

Unit F of the Salina Group underlies the Bass Islands Group at the site. The unit is primarily composed of dolomite, shale, breccia, and limestone and is considered to be an aquifer. The thickness of the unit is over 100 ft. It is recharged by the Bass Islands Group aquifer.

As a part of the Fermi 3 hydrogeologic investigation, 17 monitoring wells and/or piezometers were installed into the overburden at the site, 11 monitoring wells and/or piezometers were installed into the Bass Islands Group, and one piezometer was installed in the Salina Group Unit F (Detroit Edison 2011a).

Hydraulic Properties

Slug tests were performed in monitoring wells and piezometers screened in both the rock fill and the overburden to estimate hydraulic conductivity (Detroit Edison 2011a). Hydraulic conductivity of the rock fill from six slug tests was found to be very high and ranged from 251 to 1776 ft/day (Detroit Edison 2011a). The hydraulic conductivity of the glacial overburden from five slug tests ranged from 0.028 to 16.5 ft/day (Detroit Edison 2011a).

Packer tests were performed at multiple depths in wells screened in the Bass Islands Group (Detroit Edison 2011a). Hydraulic conductivity values calculated from the packer tests ranged from 0.11 to 40.1 ft/day. However, the average hydraulic conductivity was calculated to be 3.28 ft/day in wells with no suspected hydraulic connection to zones above or below the zone being tested (Detroit Edison 2011a). Regional estimates of hydraulic conductivities of the Bass Islands Group have ranged from 5 to 36 ft/day (Reeves et al. 2004; Detroit Edison 2011a).

Potentiometric Surfaces

Figure 2-7 shows the water table contour map for the overburden at the site. Groundwater mounds are present in the areas of lower hydraulic conductivity, and flow in the overburden is primarily toward the surface water bodies. The groundwater flow velocity in the overburden is expected to vary locally because of the complex arrangement of natural and fill material with widely varying hydraulic conductivities.

Figure 2-8 shows the potentiometric surface of the Bass Islands Group aquifer at the site. This deeper groundwater flows to the south-southwest and then to the west at the Fermi site, discharging at the Quarry Lakes. The regional groundwater flow in the bedrock aquifer is shown in Figure 2-9 and is dominated by the dewatering operations of two quarries that are located

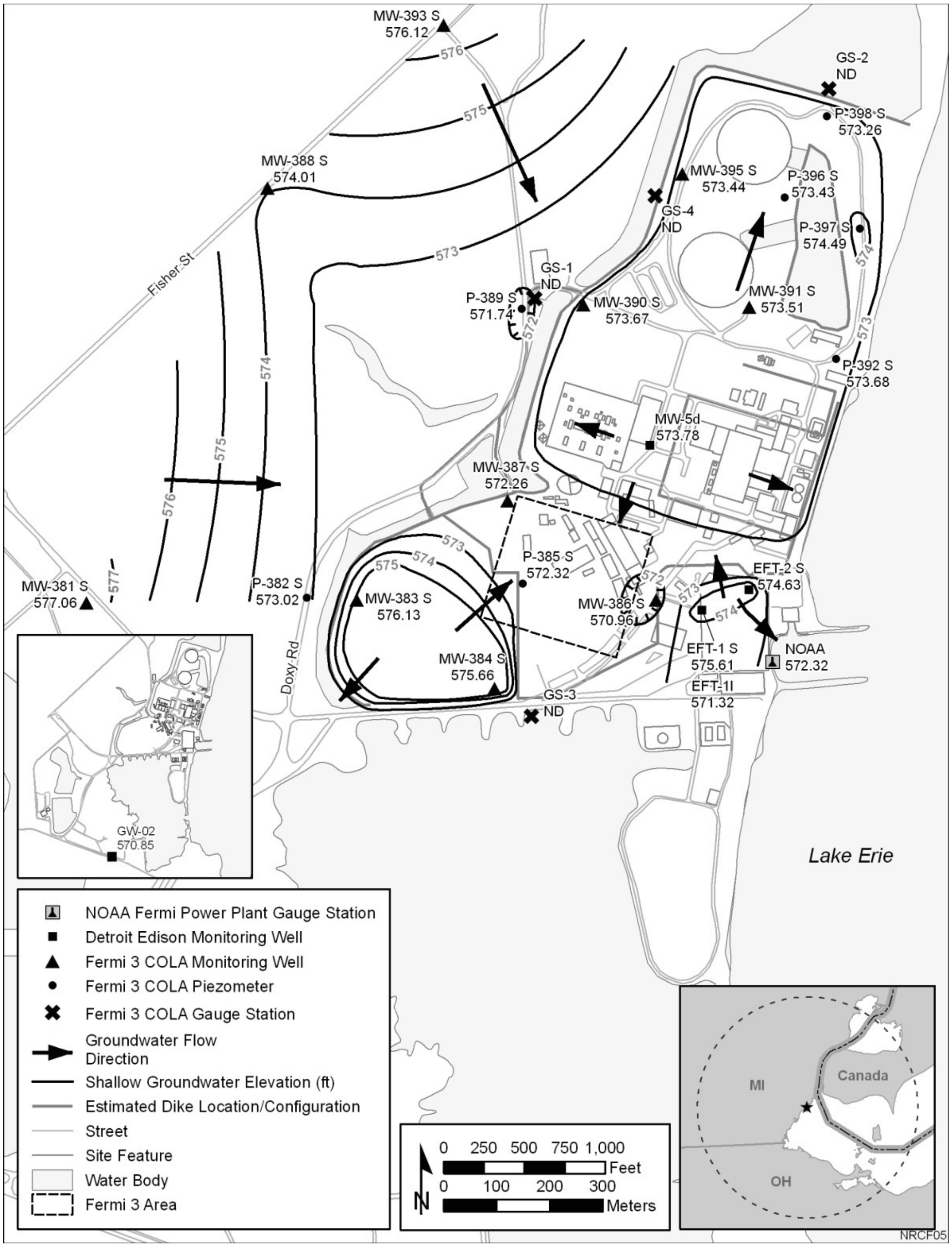


Figure 2-7. Overburden Water Table Map on March 29, 2008 (Detroit Edison 2011a)

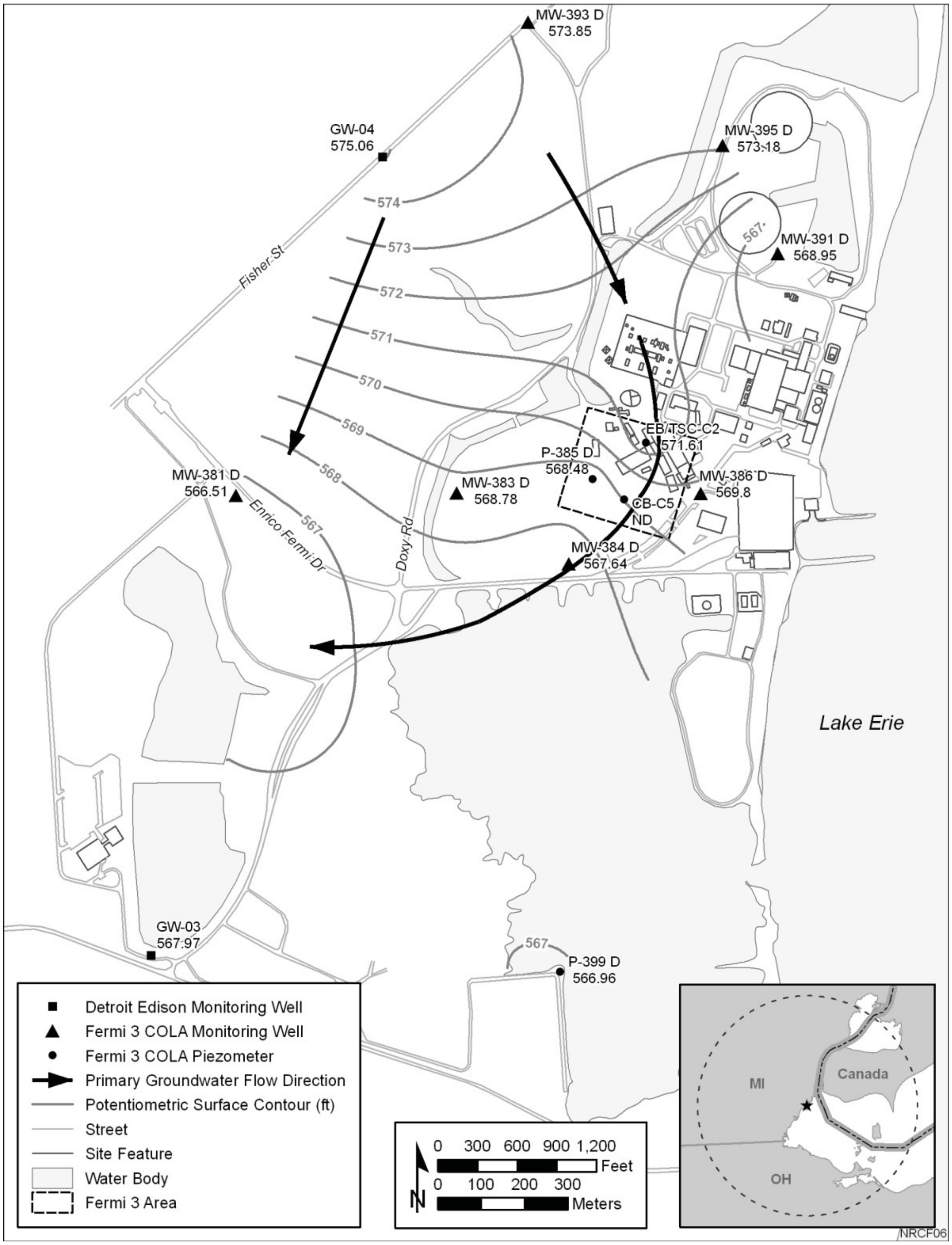


Figure 2-8. Potentiometric Surface Map of the Bass Islands Group Aquifer at the Fermi Site on March 29, 2008 (Detroit Edison 2011a)

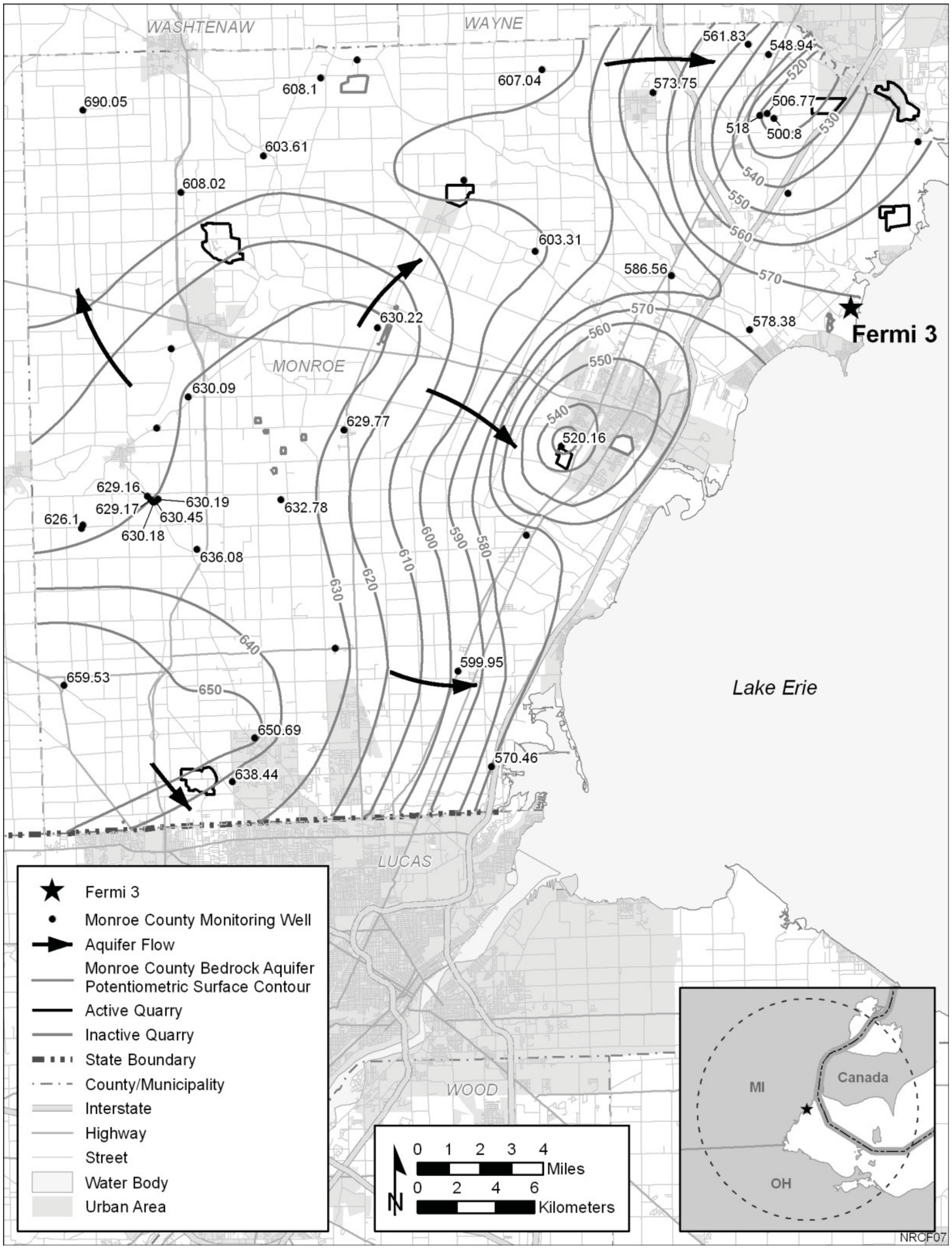


Figure 2-9. Regional Potentiometric Surface Map of the Bass Islands Group Aquifer (Detroit Edison 2011a)

northwest and southwest of the site. The dewatering activities create a groundwater divide in a northwest-southeast direction south of the Fermi site. The dewatering wells for the quarries are two regional groundwater discharge zones. However, regional gradients historically were to the east toward Lake Erie (NRC 1981; Detroit Edison 2011a).

On the basis of an average hydraulic gradient of 0.002 ft/ft and an assumed effective porosity of 0.1 percent, the groundwater flow velocities in the Bass Islands Group at the Fermi site are between 0.2 and 35 ft/day for minimum and maximum hydraulic conductivity, respectively. Groundwater in the aquifer is thought to flow along fractures in the bedrock and the weathered zone near its top (Detroit Edison 2011a). All wells except one installed in the aquifer demonstrate that the groundwater is under artesian conditions. The direction of the vertical gradient in groundwater at the site is downward, so water moves from the overburden to the Bass Islands Group aquifer below. The regional aquifer is recharged from the west and from the glacial overburden from above.

2.3.2 Water Use

This section describes water use near the Fermi site, including the use of water resources from Lake Erie and groundwater. The total water use is divided into consumptive use and nonconsumptive use. Consumptive use is the portion of water withdrawn or withheld from a water source and assumed to be lost or otherwise not returned to the source as a result of its evapotranspiration, its incorporation into products (e.g., crops), or other processes (e.g., export from the basin). Nonconsumptive use is the portion of water withdrawn from a water source that returns to the source.

2.3.2.1 Surface Water Use

Lake Erie is a major water source in southeastern Michigan. The existing Fermi 2 uses the lake water for cooling, and Fermi 3 would also use Lake Erie water for cooling. Lake Erie would also be the source of water used during building activities. The Fermi site uses the local water supply (Frenchtown Township) for potable water. This water is withdrawn from Lake Erie. The Great Lakes Commission (GLC) issues yearly reports on use of water withdrawn from Lake Erie, and a summary of the last seven reports is provided in Table 2-4.

Mean total consumptive use within the Lake Erie basin was 1.0 percent between 2000 and 2006. Power plants withdrew the largest amount of water in each of the years listed in Table 2-4; however, public water supply and industrial categories were the top two consumptive water uses. Between 2000 and 2006, the U.S. and Canadian nuclear power industry withdrew an average of 168 MGD from Lake Erie and consumed an average of 14 MGD, amounting to an average consumptive use rate of approximately 8 percent (GLC 2005a, b, c; 2006a, b; 2009a, b). The average consumptive use of Fermi 2 was estimated as approximately 40 percent of total withdrawal according to the Fermi 2 Final Environmental Statement (FES)

Table 2-4. Annual Lake Erie Water Use

Year	Total Withdrawn (MGD)[a]	Power Plant Withdrawals (MGD)	Public Supply Withdrawals (MGD)	Total Consumptive Use (MGD)
2000	50,455	48,448	1189	526
2001	47,786	45,737	1228	525
2002	53,938	51,991	1205	504
2003	49,440	47,500	1243	495
2004	56,543	54,723	1106	486
2005	58,812	55,185	1234	496
2006	56,024	50,518	1212	477

Sources: GLC 2005a, b, c; 2006a, b; 2009a, b
(a) MGD = million gallons per day.

(NRC 1981). Different cooling systems account for the variance in consumptive water use among nuclear plants in the Lake Erie basin.

Mean water withdrawals from Lake Erie in Monroe County, Michigan, from 2000 to 2006 were 1740 MGD for thermoelectric power and 12.4 MGD for public water supply (MDEQ 2000, 2001, 2002, 2003, 2004). Average Monroe County use of Lake Erie water for all uses between 2000 and 2004 was 1735 MGD (MDEQ 2000, 2001, 2002, 2003, 2004). Average use of other surface water resources in Monroe County was 4.8 MGD between 2000 and 2004 (MDEQ 2000, 2001, 2002, 2003, 2004).

To estimate future water use in Monroe County to 2060, the review team used projected population estimates presented in Section 2.5.1 of the ER and the reported water use in Monroe County as presented in the ER. If it is assumed that per capita water use does not change from present amounts and that the population will increase 74 percent by 2060 (Detroit Edison 2011a), the quantity of Lake Erie water used for the public water supply in Monroe County would increase from approximately 12 MGD in 2000 to 23 MGD in 2060. The total surface water used in Monroe County for public water supply, agricultural irrigation, self-supply industrial, and golf course irrigation would increase from 4.4 MGD in 2000 to 7.8 MGD in 2060. If water use for thermoelectric power generation increased linearly at the same rate as population growth in the county, then the total Lake Erie water used in Monroe County for thermoelectric power generation would increase from approximately 1700 MGD in 2000 to 2990 MGD in 2060. Between 2000 and 2006, the average water use in the basin was 53,285 MGD or about 19,449 billion gallons per year, with approximately 1 percent (507 MGD or 185 billion gallons per year) as consumptive use (GLC 2005a, b, c; 2006a, b; 2009a, b). The total volume of Lake Erie is approximately 128 trillion gallons, so the average annual consumptive use in the Lake Erie basin is approximately 0.14 percent of the total lake volume.

With the passing of the Great Lakes Compact in 2008, any new water withdrawals within the Great Lakes Basin that would result in a consumptive use of 5 MGD or more were made subject to review by all of the States and provinces in the region. Recent studies of the effects of climate change indicate that there could be declines in the overall Lake Erie water levels of 1 to 2 m (Hartig et al. 2007). There are no known studies of potential future surface water use in the Lake Erie Basin or the entire Great Lakes Basin.

2.3.2.2 Groundwater Use

Groundwater withdrawal in Monroe County is substantially less than withdrawal from Lake Erie. Between 2000 and 2004, groundwater withdrawals ranged from 9.4 to 17.7 MGD and averaged 14.0 MGD (MDEQ 2000, 2001, 2002, 2003, 2004). Self-supply industrial companies were the largest users of groundwater in Monroe County, accounting for 83 to 93 percent between 2000 and 2006 (Detroit Edison 2011a). The remaining water use was for thermoelectric power facilities, public water supply, agricultural irrigation, and golf course irrigation.

Fermi 2 does not use groundwater, and Detroit Edison does not plan to use groundwater for the proposed Fermi 3.

Detroit Edison (2011a) relied on groundwater use information for the year 2000 from U.S. Geological Survey (USGS) Water-Resources Investigations Report 03-4312 (Reeves et al. 2004) and population estimates presented in Section 2.5.1 of the ER to estimate future water use. The USGS report presented groundwater use at quarries in Monroe County and at nearby quarries in Wayne County that are higher than those presented by the MDEQ for Monroe County (2000). The USGS estimate is conservative because it includes withdrawals from outside Monroe County that impact water levels within the county. Detroit Edison (2011a) used the USGS values to estimate that total freshwater groundwater withdrawals in Monroe County would increase from approximately 28 MGD in 2000 to 49 MGD in 2060.

2.3.3 Water Quality

The water quality of Lake Erie, Swan Creek, Fermi site surface water bodies, and the groundwater in the vicinity of the Fermi site is described in the following sections. Shallow groundwater at the Fermi site is hydraulically connected with the surface water, as discussed in Section 2.3.1.2.

Water quality data are available from the following sources: (1) U.S. Environmental Protection Agency (EPA), which maintains the Great Lakes Environmental Database (GLENDA) and Storage and Retrieval Database (STORET); (2) MDEQ; (3) USGS, which maintains the National Water Information System (NWIS) database; (4) National Oceanic and Atmospheric Administration (NOAA); and (5) Fermi site data.

2.3.3.1 Surface Water Quality

Surface water bodies whose quality could be affected by the proposed Fermi 3 include Lake Erie, Swan Creek, and various onsite water bodies. Onsite surface water bodies include the North Lagoon, South Lagoon, overflow canal, discharge canal, small pond between the two canals, and the two Quarry Lakes. However, the primary water body of concern is Lake Erie, which would be the sole source of water to Fermi 3 and would receive the majority of discharges from Fermi 3. Swan Creek would receive stormwater discharge and discharge from the dewatering system during construction of Fermi 3. The overflow canal, discharge canal, and pond would be either fully or partially filled in during Fermi 3 building activities. In addition, onsite water bodies would receive some stormwater runoff during building and operations.

Lake Erie water is used for public water supply in Monroe County and many other locations across the Lake Erie Basin. Current water quality concerns with regard to Lake Erie include (1) increased phosphorus loading from regional agricultural activities, which cause toxic algal blooms, and (2) elevated concentrations of three bioaccumulative contaminants (mostly from historical industrial activities): dioxin, polychlorinated biphenyls (PCBs), and mercury (Hartig et al. 2007; Brannan 2009). In 2005, the EPA Large Lakes and Rivers Forecasting Research Branch began the Detroit River-Western Lake Erie Basin Indicator Project (Hartig et al. 2007). The EPA identified the following current challenges to the Detroit River-Western Lake Erie Basin water resources: (1) population growth and accompanied land use changes, (2) nonpoint source pollution, (3) toxic substances contamination, (4) habitat loss and degradation, (5) exotic species, and (6) greenhouse gases and global warming (Hartig et al. 2007).

The MDEQ is responsible for assessing the support of beneficial uses of surface water bodies in Michigan and subsequently listing water bodies on the Clean Water Act Section 303(d) list of impaired waters, if they do not support those beneficial uses. Currently Lake Erie waters under Michigan jurisdiction are on the 303(d) list for not supporting fish consumption because of the elevated concentrations of PCBs and dioxins in fish tissue. The total maximum daily load (TMDL) determination is scheduled to be completed in 2015 (MDEQ 2009b). In general, Lake Erie public water supply use was not assessed and neither were total/partial body contact uses. The Lake Erie shoreline from the Detroit River to the Michigan-Ohio border has not been assessed for most beneficial uses, and there is insufficient information on total and partial body contact uses. However, the Lake Erie coastline at Luna Pier Beach, in Monroe County south of the Fermi site, is on the Section 303(d) list for not supporting total or partial body contact uses as a result of pathogen concentrations (MDEQ 2009b).

A TMDL for *Escherichia coli* (*E. coli*) in the Detroit River was issued by MDEQ in August 2008 (MDEQ 2008a). The TMDL addresses sources of *E. coli* in the U.S. portions of the Detroit River watershed. The Detroit River is also on the Section 303(d) list for dioxin (fish tissue only), dichlorodiphenyltrichloroethane (DDT) (fish tissue only), PCBs (both fish tissue and water column), and mercury (both fish tissue and water column) (MDEQ 2009b).

Swan Creek downstream of Sigler Road to Lake Erie is on the Section 303(d) list for not supporting fish and macroinvertebrate communities. MDEQ (2009b) noted the causes as direct habitat alterations, anthropogenic substrate alterations, and flow regime alterations.

Water quality in the western basin of Lake Erie is monitored at several stations. Surface water quality data for the vicinity of the Fermi site is collected by a number of agencies: EPA maintains the GLENDA and STORET databases; USGS maintains the NWIS database; and MDEQ performs monitoring in many locations. Temperature data are also available from NOAA from four gages on the coast of Lake Erie, with two stations being located within the western basin: Toledo, Ohio, and Marblehead, Ohio. Monthly average temperatures recorded at Toledo only vary between 50.4 and 59.0 °F annually and reflect temperatures of the Maumee River. Temperatures measured at the Marblehead station are presented in Table 2-5, along with the average monthly Lake Erie surface temperatures presented in the ER (Detroit Edison 2011a) that were modeled by the NOAA Great Lakes Environmental Research Laboratory. Additional monitoring of Lake Erie is done at the Fermi site, as described in text that follows.

Table 2-5. Measured and Modeled Lake Erie Monthly Average Temperatures

Month	Measured Temperature at Marblehead, OH (°F)[a]	Modeled Water Surface Temperature (°F)[b]
January	34.2	33.5
February	33.8	32.3
March	37.2	32.7
April	49.3	36.6
May	59.5	49.6
June	72.3	63.4
July	75.2	72.1
August	77.0	74.2
September	68.2	71.2
October	55.4	63.2
November	45.2	52.8
December	39.0	41.5

(a) Source: NOAA 2011
(b) Source: Detroit Edison 2011a

Depending on the constituent, monitoring required by Fermi NPDES Permit No. MI0037028 occurs daily, weekly, monthly, or quarterly at wastewater Outfall 001, Outfall 009, Outfall 011, and Outfall 013 and monthly at the Fermi 2 intake (MDEQ 2005). Figure 2-6 shows the locations of the NPDES outfalls, including stormwater discharge outfalls. Detroit Edison has reported spills to the MDEQ regularly and submitted copies of the notification letters to the review team. Leaks of chlorine, ethylene glycol, sanitary waste, oil and grease, and other constituents to both wastewater and stormwater outfalls have been reported at Fermi 2, and descriptions of some of the discharges reported to MDEQ by Detroit Edison follow (Detroit Edison 2009d).

- On March 6, 1987, fluid was observed to be emanating from sanitary sewer manholes. The spill was stopped within 30 minutes of the time of discovery, and waste was observed to reach Lake Erie. Estimates of the quantity of sanitary waste lost to Lake Erie were not made.
- On January 9, 1996, Detroit Edison (2009d) reported a leak of 200 gallons of 50 percent ethylene glycol solution to the cooling water reservoir, which discharges to Outfall 001.
- On March 15, 2000, a leak of cooling water with a chlorine concentration above the NPDES-permitted discharge limitations was found flowing overland from the south cooling tower to the overflow canal. Within two hours of the discovery of the leak, earthen berms were constructed to block the flow of water to the overflow canal. The cooling tower leak was repaired within 2 days of the discovery of the leak.

As a part of the COL application for Fermi 3, a year of quarterly surface water sampling was done at six locations throughout the site (see Figure 2-6), including two locations within Lake Erie (AECOM 2009a). The sampling indicated that the surface water quality at the Fermi site was typical of the area, with elevated levels of nutrients including total phosphorus, orthophosphorus, nitrate and nitrite nitrogen, and total Kjeldahl nitrogen. On average, concentrations of mercury in site surface water exceeded MDEQ Rule 57 for human noncancer values (0.0018 μg/L) and wildlife values (0.0013 μg/L); however, these values are consistent with values measured at the intake to Fermi 2 from Lake Erie. When surface water quality is compared to primary and secondary drinking water standards (EPA 2009a), color, turbidity, and fecal coliform concentration in most samples exceed drinking water standards. Concentrations of sulfate and total dissolved solids (TDS) exceed secondary drinking water standards in the southern Quarry Lake (location QU-W).

The ER presents 2007 sample results from two locations within Lake Erie near the Fermi site in which coliforms (total and fecal) were detected in the samples (Detroit Edison 2011a). Total coliforms were found at concentrations of 200 and 500 colony-forming units/100 mL (cfu/100 mL), and fecal coliforms were not detected in one sample and were detected at 100 cfu/100 mL in the other. Also, quarterly sampling at six surface water locations on the site from July 2008 through April 2009 was done to test for fecal coliform (AECOM 2009a). It was detected at five of the six locations (not detected at location QU-W); average concentrations were 8 to 39 cfu/100 mL (AECOM 2009a). Concentrations at Lake Erie location LE1-W, near where the Fermi 3 outfall pipe would end, were between 4 and 17 cfu/100 mL.

Grab samples from Swan Creek in the early 1970s and early 1990s showed that concentrations of nitrate nitrogen, total phosphorus, Kjeldahl nitrogen, and sulfate were elevated when compared with the most recent Fermi site data.

If water levels in Lake Erie were to decline significantly as a result of climate change, water temperatures would also likely rise in the summer, especially in the shallow western basin of Lake Erie. There are no known studies on the potential future quality of Lake Erie water.

2.3.3.2 Groundwater Quality

Groundwater samples were collected in Fermi site wells from 2007 through 2009 (Detroit Edison 2011a; AECOM 2009a). In 2007, 20 groundwater samples were analyzed, and the results were reported in the ER (Detroit Edison 2011a). Between July 2008 and April 2009, a year of quarterly groundwater sampling was done at four locations throughout the site (AECOM 2009a). When groundwater quality was compared to primary and secondary drinking water standards (EPA 2009a), color, turbidity, and concentrations of sulfate, iron, and TDS exceeded drinking water standards in many of the samples. In some cases, the pH values of the samples were more or less than the secondary drinking water standards.

Tritium has not been detected in most onsite monitoring wells (Detroit Edison 2009a). Data from four quarters of groundwater monitoring that were presented in the 2008 radiological environmental monitoring program (REMP) report indicated that tritium was detected in 1 of 9 deep wells and in 9 of 28 shallow monitoring wells at concentrations up to 1950 pCi/L (Detroit Edison 2009a). Wells where tritium was detected were located east and south of the Fermi 2 emissions stack. Detroit Edison proposed a realistic scenario of the washout of tritium by precipitation (Detroit Edison 2009a). All detected concentrations were below the EPA drinking water standard of 20,000 pCi/L.

Groundwater sampling at the Fermi site in 1969 and 1970 indicated high sulfate concentrations in all of the samples and high chloride concentrations in samples taken between 20 and 60 ft below ground surface (Detroit Edison 2011a).

In wells within a 5-mi radius of the Fermi site, elevated concentrations of arsenic above the EPA (2009a) maximum contaminant level (MCL) were found in groundwater samples (Detroit Edison 2011a). Forty-two samples were measured for arsenic between 1985 and 2007 from wells serving single-family dwellings, schools, industrial facilities, and the City of Monroe. Elevated concentrations of nitrate as nitrogen were also found in some wells, but these did not exceed the MCL (Detroit Edison 2011a). More than 1100 samples were measured for nitrate between 1983 and 2007 from wells serving single-family dwellings, golf courses, churches, schools, farms, industrial facilities, and the City of Monroe. Concentrations of volatile organic carbons (VOCs) measured in wells within 5 mi of the Fermi site between 1993 and 1999 were not above water quality standards (Detroit Edison 2011a).

Several spills associated with the operation of Fermi 2 have affected groundwater quality, and these were reported by Detroit Edison to MDEQ (Detroit Edison 2009e). They are as follows:

- In 1987, a leak of sodium hydroxide to groundwater was identified, and the pH of the groundwater in the area of the spill was measured to be 12.8. Detroit Edison excavated the soil in the area of the spill and pumped groundwater from the excavated area until the groundwater pH was diluted to a measurement of 9.5.
- According to MDEQ (2010), a diesel tank leak at the Fermi site was discovered on October 18, 2001. The investigation for this leak was closed on December 19, 2001 (MDEQ 2010).
- In 2002, 20 gal of 15 percent sodium hypochlorite solution were accidentally spilled on soil, and the soil was subsequently excavated and neutralized.
- Remedial action was taken to clean up a diesel spill to groundwater that was identified in 2002 (Envirosolutions 2007).
- Free phase diesel fuel was found in a dewatering sump within the Fermi 2 residual heat removal (RHR) complex in June 2002. A leak in the emergency fuel drain pipe was thought to be the source, and the leak was repaired. Diesel fuel contamination was monitored and remediated as regulated by the MDEQ Remediation and Redevelopment Division (RRD) under Part 201, "Environmental Remediation," of the Natural Resources and Environmental Protection Act (451 MCL 201). During the investigation and cleanup activities, 21 monitoring wells were installed to delineate the extent of the contamination at the site (Envirosolutions 2007). Concentrations of fuel fell below cleanup criteria specified in Part 201 (Subsection 20120a[1][a] to [e]) in November 2006 (Envirosolutions 2007). Closure of this site was accepted by the MDEQ in 2009 (MDEQ 2009c).

2.3.4 Water Monitoring

Monitoring of water flow and quality in Lake Erie, Swan Creek, Fermi site surface water, and the groundwater in the vicinity of the Fermi site are described in the following sections.

2.3.4.1 Lake Erie Monitoring

There is a NOAA gaging station (ID 9063090) on Lake Erie in the vicinity of the Fermi 2 intake structure. The Fermi gage has monitored water levels at the Fermi site hourly since 1970. Additional NOAA National Ocean Service gaging stations in the western basin of Lake Erie are at Marblehead, Ohio (water levels and temperatures monitored since 1959), and Toledo, Ohio (water levels monitored since 1904).

The EPA performs water quality monitoring at five locations within the western basin of Lake Erie, and the data are available on the GLENDA database. MDEQ also monitors Lake Erie at 109 stations, and the monitoring data are available on the EPA STORET database.

A full suite of historical Lake Erie water level and water quality data are presented in the ER (Detroit Edison 2011a).

2.3.4.2 Swan Creek Monitoring

There has been no consistent historical flow monitoring of Swan Creek. The review team identified measurements taken from 12 locations in the upper watershed of Swan Creek by the USGS, but the data were limited to between one and four measurements per site. In addition, the MDEQ performed water quality monitoring on Swan Creek in 1993. Results of Swan Creek monitoring are presented in the ER (Detroit Edison 2011a).

2.3.4.3 Fermi Site Surface Water Monitoring

Discharges at the Fermi 2 plant have been monitored in accordance with the NPDES permit since 1988 when operations began. The NPDES permit for Fermi 2 requires regular monitoring of four wastewater outfalls and the water intake; each has different monitoring requirements (see Section 2.3.3.1; Figure 2-6). In addition, Fermi 2 is required by the NPDES permit to analyze the intake water for total mercury on a monthly basis.

Between July 2008 and April 2009, a year of quarterly surface water sampling was done at six locations throughout the Fermi site, including two locations within Lake Erie (AECOM 2009a).

2.3.4.4 Groundwater Monitoring

Currently, Fermi 2 has four groundwater monitoring wells that are sampled quarterly for the radionuclides specified in the ODCM (Offsite Dose Calculation Manual) for the REMP. Samples are collected on a quarterly basis and are analyzed for tritium. In addition to these wells, 16 groundwater wells have been installed around Fermi 1 to support decommissioning activities, and 28 monitoring wells have been installed for the proposed Fermi 3.

Between July 2008 and April 2009, a year of quarterly groundwater sampling was done at four locations on the Fermi site (AECOM 2009a).

Section 4.2.4 describes the hydrologic and water quality groundwater monitoring proposed during facility building activities, and Section 5.2.4 describes the hydrologic and water quality groundwater monitoring proposed during operations. Radiological monitoring of groundwater is discussed in Sections 2.10 and 5.9.

2.4 Ecology

The Fermi 3 site is located on the western shore of Lake Erie in the Lower Peninsula physiographic province. The site is also situated in the Southern Lower Peninsula Ecoregion (MDNR 2005). This section describes the terrestrial and aquatic ecological environment on the Fermi 3 site and in the vicinity of the site, defined as the area within a 7.5-mi radius of the site, as described in Section 2.1 and shown in Figure 2-3. This section also describes the ecological environment of the proposed new transmission line corridor and other areas likely to be affected by development and operation of the proposed facilities.

2.4.1 Terrestrial and Wetland Ecology

Prior to development of Fermi 1 and 2, most of the Fermi site was used for agriculture or otherwise disturbed. Undeveloped areas on the Fermi site have reverted to vegetated cover types through ecological succession. The history of vegetative cover prior to development of Fermi 2 was documented in a study conducted from 1973 to 1974 (NUS Corporation 1974). That study found that nearly all of the habitats on the site at that time (after development of Fermi 1 but prior to development of Fermi 2) were in the early stages of succession. Vegetative cover currently is composed of a mix of emergent wetland, forest, grassland, developed areas, cropland, and shrubby vegetation (Detroit Edison 2011a). The primary types of vegetative cover are described below and shown in Figure 2-10.

Areas west of the Fermi site consist mostly of agricultural land (row crops) with scattered rural residences. To the south are residential properties and a narrow lagoon off Lake Erie that is surrounded by shrubland and thicket. Immediately north of the site is Swan Creek. Lake Erie lies to the east of the site.

2.4.1.1 Terrestrial Resources – Site and Vicinity

Existing Cover Types and Vegetation

Vegetation at the Fermi site was studied as part of field reconnaissance-level surveys between 2006 and 2008 (Detroit Edison 2011a) and again in detailed field surveys between 2008 and 2009 (Detroit Edison 2009e). Vegetation cover type boundaries were provisionally drawn by using aerial photography dated from 2006 to 2008. Field personnel refined the boundaries by using field survey observations (Detroit Edison 2011a). Cover types were identified according to the Michigan *Wildlife Action Plan* (MDNR 2005) categorization system, with minor modifications. The surveys were conducted during the spring, summer, and fall to account for the variation in flowering time for different plant species. Field surveys included characterizations of the structure and species composition of the plant communities of each area (Detroit Edison 2009e).

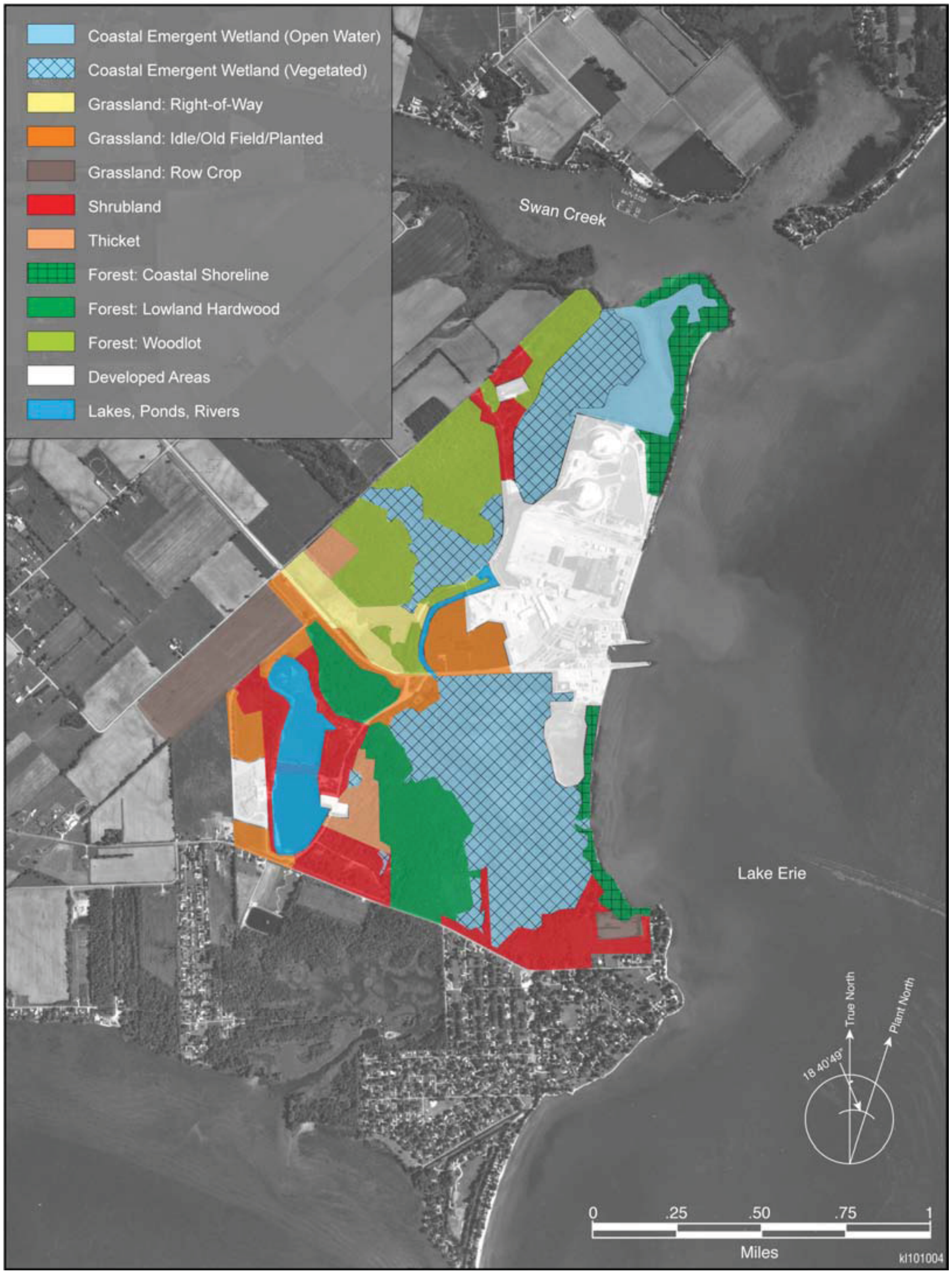


Figure 2-10. Primary Vegetation Cover Types of the Fermi Site (Detroit Edison 2011a)

Within each delineated cover type occurrence, representative transects were examined to identify dominant species and confirm the preliminary cover type assignments. At least two transects were examined in each cover type occurrence. Plants were randomly sampled within each transect to more thoroughly examine localized differences and better understand the species diversity present. The results of the field studies were used to better understand the character and refine the boundaries of the cover types. Twelve major cover types were identified. They are described in the following sections in order of decreasing extent on the site. Acreages are summarized in Table 2-6.

The following cover type descriptions are based on information provided by Detroit Edison (2011a), unless otherwise noted.

<u>Coastal Emergent Wetland</u>

Coastal emergent wetland is the most extensive cover type represented on the Fermi site, covering about 273 ac or 21.7 percent of the site. The largest coastal wetland features on the site include a North and South Lagoon and an unnamed drainage corridor that flows from the west. The hydrology of the coastal emergent wetlands is controlled almost entirely by Lake Erie and Swan Creek surface water elevations (Detroit Edison 2011e). From the most recent study, it is estimated that only about 238 ac of coastal emergent wetland is vegetated and that the remaining area that is so designated (approximately 35 ac) is actually open water. However, the extent of emergent vegetation appears to fluctuate annually, depending primarily on water conditions in Lake Erie. There is more open water in high-water years than in low-water years. For example, water conditions were relatively high in 1981 compared with 2005. Aerial photographs from the low-water year of 2005 show a marked increase in emergent vegetation in the lagoons.

At the present time, the lagoons are dominated by dense and extensive stands of common reed (*Phragmites australis*) and cattail species (*Typha* spp.). Purple loosestrife (*Lythrum salicaria*), an invasive non-native herbaceous wetland plant species, is present throughout most of the coastal emergent wetland areas on the Fermi site. The west-side drainage corridor has virtually no open water because of the dense growth of common reed, cattails, and purple loosestrife. Because the extent of dense common reed and other non-native plant cover, the coastal emergent wetlands on the Fermi site likely provide low-quality habitat for wildlife, especially waterfowl.

Moderately shallow areas of the South and North Lagoons and the south canal contain stands of American lotus (*Nelumbo lutea*), which is a State-listed threatened species. The status of the American lotus is discussed in detail in Section 2.4.1.3. Most of the South Lagoon is quite shallow, with fill deposits scattered throughout. Wading birds such as herons and egrets use the shallow water areas for foraging. Some species of songbirds, including the red-winged blackbird (*Agelaius phoeniceus*), use the cattails and reeds for nesting.

1 **Table 2-6**. Vegetative Cover Types on the Fermi Site

Cover Type (Habitat)[a]	Dominant Species	Acres	Percent of Site
Terrestrial and wetlands			
Coastal emergent wetland	Common reed *(Pragmites australis)*, cattail species *(Typha* spp.*)*, American lotus *(Nelumbo lutea)*	273	21.7
Grassland: right-of-way	Big bluestem *(Andropogon gerardii)*, Indiangrass *(Sorghastrum nutans)*	29	2.3
Grassland: idle/old field/planted	Smooth brome *(Bromus inermis)*, Canada goldenrod *(Solidago canadensis)*	75	6.0
Grassland: row crop	Corn *(Zea mays)*, soybeans *(Glycine max)*	64	5.1
Shrubland	Dogwood species (*Cornus* spp.), common buckthorn *(Rhamnus cathartica)*, multiflora rose *(Rosa multiflora)*, blackberry species (*Rubus* spp.)	113	9.0
Thicket	Hawthorn species (*Crataegus* spp.), box elder *(Acer negundo)*, dogwoods	23	1.8
Forest: coastal shoreline	Cottonwood *(Populus deltoides)*, peach-leafed willow *(Salix amygdaloides)*	47	3.7
Forest: lowland hardwood	Cottonwood, peach-leafed willow, oak species (*Quercus* spp.), basswood *(Tilia americana)*, hickory species (*Carya* spp.)	92	7.3
Forest: woodlot	Cottonwood, box elder, green ash *(Fraxinus pennsylvanica)*	117	9.3
Developed areas	NA[b]	212	16.8
Open water			0.0
Lakes, ponds, rivers	NA	44	3.5
Lake Erie (main body)	NA	171	13.6
Total		**1260**	**100**

Source: Adapted from Detroit Edison 2011a
(a) Vegetative cover types are based on MDNR 2005.
(b) NA = not applicable.

2
3

<u>Developed Areas</u>

Developed areas include buildings, parking areas, equipment storage areas, roadways, maintained lawns, and similar areas. Approximately 212 ac or 16.8 percent of the site is developed. Most plant species present have been planted for ornamental value or grow naturally in heavily disturbed settings. Wildlife value is generally low because of low plant species diversity, sparse cover, and frequent disturbance.

<u>Open Waters of Lake Erie</u>

The main body of Lake Erie lies north and east of the project. The open waters of Lake Erie account for about 171 ac or 13.6 percent of the site. Aquatic areas are addressed in Section 2.4.2.

<u>Forest: Woodlot</u>

The “forest: woodlot” cover type is found in the east-central and northwestern portions of the Fermi site and accounts for about 117 ac or 9.3 percent of the site. It occurs mostly on fill material from development of Fermi 1 and 2 or on land otherwise heavily disturbed by Fermi 1 and 2 activities. Until recently, the tree canopy was well developed and composed mostly of eastern cottonwood (*Populus deltoides*), box elder (*Acer negundo*), and green ash (*Fraxinus pennsylvanica*). Since 2002, an accidentally introduced non-native insect pest, the emerald ash borer (*Agrilus planipennis*), has killed many mature green ash trees on the Fermi site and surrounding areas. As a result, the canopy has become more open, and more light reaches the ground. Introduced tree species such as the tree-of-heaven (*Ailanthus altissimus*) are present in the canopy in some places. The understory is composed of saplings of tree canopy species of variable density. Vines of poison ivy (*Toxicodendron radicans*), grape (*Vitis* spp.), and trumpet creeper (*Campsis radicans*) form localized thickets. The non-native invasive shrub species European privet (*Ligustrum vulgare*) and common buckthorn (*Rhamnus cathcartica*) are relatively common. The ground cover is generally sparse and composed mostly of relatively aggressive native plant species and non-native invasive plant species. Some of the more common herbaceous species include burdock (*Arctium minus*) and heal-all (*Prunella vulgaris*) (both of which are native) and the highly invasive garlic mustard (*Alliaria petiolata*). The value of the forest: woodlot vegetation on the Fermi site to wildlife is generally limited to providing nesting and den areas and sheltered resting areas. Dead ash trees provide good foraging for woodpeckers, nuthatches, and creepers. Other foraging opportunities are limited because of reduced vegetative diversity caused by non-native understory and groundcover species.

Shrubland

Shrublands at the Fermi site are upland areas with relatively dry soils that are dominated by deciduous shrubs. Approximately 113 ac or 9.0 percent of the site is shrubland. On the Fermi site, most shrubland is located in areas that were filled or otherwise severely disturbed by development of Fermi 1 and 2, with the possible exception of some shrubland in the extreme southeastern corner of the site. Shrub species such as dogwoods (*Cornus* spp.), common buckthorn, multiflora rose (*Rosa multiflora*), and blackberries (*Rubus* spp.) dominate areas of shrubland vegetation on the Fermi site. Tree saplings such as honey locust (*Gleditsia triacanthos*), eastern cottonwood, and green ash are also common. Despite the cover of shrubs and saplings, there generally is substantial ground cover in the form of grasses and forbs. Since these areas have been previously disturbed, it is not surprising to find that many of the species present are introduced or, if they are native, tend to be opportunistic. Examples include smooth brome (*Bromus inermis*), prickly lettuce (*Lactuca serriola*), Canada goldenrod (*Solidago canadensis*), and Missouri ironweed (*Vernonia missurica*). Wildlife use would include cover, nesting sites, and bedding areas, but forage value is limited due to the prevalence of less palatable introduced plant species.

Forest: Lowland Hardwood

The “forest: lowland hardwood” cover type represents the most mature vegetation on the Fermi site. It accounts for about 92 ac or 7.3 percent of the site, mostly in areas immediately northeast of Quarry Lake and the south-central portion of the site along the west side of the South Lagoon. Eastern cottonwood and peach-leaved willow (*Salix amygdaloides*) are present, but oak species (*Quercus* spp.), American basswood (*Tilia americana*), and hickory species (*Carya* spp.) are better represented. Overall, the habitat is drier and more stable than that found in the “forest: coastal shoreline” cover type, and the topsoil is organic or clayey rather than sandy. The largest trees are found in the area northeast of the Quarry Lakes, where numerous specimens can be found that range from 18 to 26 in. in diameter at breast height (dbh). In the south-central area, scattered trees reach this size, but most are less than 14 in. dbh. Larger specimens appear to have been logged years ago, as evidenced by scattered old stumps. Shrubs are widely scattered in the understory. Ground cover is generally 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 is common, as are grapes. This vegetation provides substantial cover, shelter, and foraging for a variety of wildlife in the area, as evidenced by observed tracks, nests, and scat.

Grassland: Row Crops

"Grassland: row crop" areas are agricultural fields that are planted with a single species such as corn (*Zea mays*) or soybeans (*Glycine max*) and harvested annually. Approximately 64 ac or 5.1 percent of the Fermi site is of this cover type.

Grassland: Idle/Old Field/Planted

"Grassland: idle/old field/planted" vegetation comprises opportunistic plants that take over areas that had once been cleared for agriculture or other purposes. In some cases, these areas were initially planted with a cover grass, usually perennial brome or fescue. Areas of this vegetation at the Fermi site are dominated by smooth brome grasses but contain a mix of opportunistic (weedy and invasive) native and introduced species such as Canada thistle (*Cirsium arvense*), Canada goldenrod, and flattop-fragrant goldenrod (*Euthamia graminifolia*). Native shrubs such as blackberry and non-native invasive shrubs such as multiflora rose may also be present but are not dominant. This is a disturbed type of vegetation that has limited value for wildlife, although it provides shelter for small mammals, birds, and reptiles and has some forage value. Approximately 75 ac or 6.0 percent of the site is grassland: idle/old field/planted vegetation.

Forest: Coastal Shoreline

"Forest: coastal shoreline" vegetation occurs in a narrow, interrupted band along the east side of the site adjacent to Lake Erie. It covers about 47 ac of land, or 3.7 percent of the site. The area is dominated by large eastern cottonwoods, some of which are 2 ft or more dbh, and peach-leaved willow. Box elder is also scattered in the area. Green ash was formerly scattered in the area before the emerald ash borer killed virtually all ash trees on the site. 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, but the edges include dense stands of reed canarygrass (*Phalaris arundinacea*). Forbs are 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 forest: coastal shoreline vegetation at the Fermi site is a dynamic mix of opportunistic early-succession species. Wildlife value of the area includes roosting or nesting by birds and use by muskrat *(Ondatra zibethicus)*, red fox *(Vulpes vulpes)*, raccoon *(Procyon lotor)*, small mammals, and amphibians.

Lakes, Ponds, and Rivers

Lakes, ponds, and rivers (exclusive of Lake Erie) account for approximately 44 ac or 3.5 percent of the Fermi site. These water bodies include an unnamed stream draining east across the central portion of the site and Quarry Lakes, two adjacent abandoned rock quarries used as a source of materials during Fermi 1 construction. No substantial emergent or submerged aquatic vegetation communities have been described by Detroit Edison or others, except for noting that cut-leaf water-milfoil (*Myriophyllum pinnatum*) has been observed. These waters are discussed further in Section 2.4.2.

Grassland: Right-of-Way

"Grassland: right-of-way" vegetation is associated with linear features such as roadways, rail lines, transmission lines, pipelines, etc. Approximately 29 ac or 2.3 percent of the Fermi site supports grassland: right-of-way vegetation, including areas along roadways. An existing onsite transmission line corridor accounts for most of the land supporting this vegetation. The corridor is periodically mowed to keep it free of trees for line clearance. About one-half of the corridor is an intentionally established prairie area. 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 prairie is dominated by big bluestem (*Andropogon gerardii*) and Indiangrass (*Sorghastrum nutans*). Broomsedge (*Andropogon virginicus*), a less desirable native grass, is also relatively common, with dense localized patches. Undesirable plants are also present, including purple loosestrife, common reed, and teasel (*Dipsacus sylvestris*). Surveys of the area between 2006 and 2009, as well as earlier observations, note approximately 110 plant species in this area. To date, management has consisted of periodic mowing to discourage the growth of woody species. In the lowest elevation areas of grassland: right-of-way vegetation, large grasses like 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. Grasslike 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 corridor is dominated by broomsedge in the driest areas and by cattails in the lowest areas. The variation in hydrologic conditions across this area has encouraged the growth of a substantial variety of native and introduced forbs. The grassland: right-of-way vegetation presently has value for wildlife in the form of diverse foraging and shelter for small mammals, birds, and reptiles, especially those favoring forest edges. It may offer some grazing opportunities for white-tailed deer.

Thicket

Areas identified as thicket on the Fermi site are generally located in transitional areas between wetlands and uplands. This cover type occurs lower on the landscape than the shrubland cover type, but, like shrubland, this is a successional stage that is expected to progress over time toward forest conditions. Approximately 23 ac or 1.8 percent of the site is designated as thicket. These areas are densely covered with saplings and small trees such as hawthorns (*Crataegus* spp.) and box elder. Shrubs are also common and include European privet and dogwoods. Saplings of eastern cottonwood, peach-leaved willow, and green ash are also prevalent, and poison ivy is abundant. Ground cover is sparse except in a few open areas. The prevalence of aggressive early successional and non-native plant species suggests that most areas of this vegetation on the Fermi site were disturbed in the past. Successional change has occurred from shrub/grassland habitat to thicket, as evidenced by changes in aerial photographs taken more than 20 years apart. The thicket vegetation is probably most beneficial to small mammals and birds for shelter and foraging. Large mammals may sometimes find it difficult to move through the dense brush.

As indicated in Section 4.1, land cover in the vicinity of the Fermi site (other than the open waters of Lake Erie) is largely composed of row crop agriculture, pasture and hay, residential and other developed land uses, and some forest land. Vegetation in unfarmed and undeveloped areas is generally similar to that in similar areas on the Fermi site (Detroit Edison 2011a).

Wildlife

The Fermi site was extensively surveyed for wildlife during site reconnaissance between late 2006 and mid 2008 and during a detailed wildlife survey from mid 2008 until mid-2009 to evaluate the diversity of species potentially present (Detroit Edison 2009e).

<u>Mammals</u>

Terrestrial wildlife surveys of the Fermi site were conducted for Fermi 3 from mid 2008 to mid 2009 (Detroit Edison 2009e). During these Fermi 3 studies, 16 mammal species were observed. White-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), raccoon, eastern cottontail (*Sylvilagus floridanus*), and eastern fox squirrel (*Sciurus niger*) were among the most frequently observed mammals on the Fermi site.

The area surrounding the Fermi 1 and 2 and associated facilities is a mosaic of developed land, mowed grass, woodlots, and successional forest that does not appear to provide significant travel corridors, such as might be found along watercourses or entry/exit locations for desirable foraging or resting habitats. The Fermi site is surrounded by a high chain-link fence in terrestrial areas, which is expected to inhibit movement of larger mammals. 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 boundary fence does not appear capable of affecting the movement of small mammals that can move through fence openings or burrow underneath. The varied habitats around the site, however, are well-suited to small mammals, although the great extent of non-native and/or invasive species in most of the vegetation cover types provides less-than-ideal foraging opportunities. None of the mammal species observed or reported at the site are 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 on the Atlantic flyway, which is one of several major migratory flyways in North America.

Bird surveys conducted at the Fermi site between 1973 and 1974 by NUS Corporation (NUS Corporation 1974) listed about 150 species of birds on the site. The ER (Detroit Edison 2011a) cites a Wildlife Management Plan developed by Detroit Edison in 2000. Although the 2000 plan provided a list of 287 species potentially occurring in the Fermi vicinity, only 150 were noted as observed on the Fermi property. These species were the same 150 species noted in the 1973-1974 NUS Corporation study. The list of 287 species was derived from surveys conducted at the Ottawa National Wildlife Refuge, located along Lake Erie about 30 mi southeast of the Fermi site near Oak Harbor, Ohio. The ER (Detroit Edison 2011a) also cites Detroit Edison's Wildlife Habitat Program Re-certification as adding six new species to the list of species provided in the 2000 Wildlife Management Plan. According to the ER, a bird survey conducted in April 2002 by the Detroit Edison Wildlife Habitat Team at the Fermi site counted 293 individuals and 31 species. Five species accounted for 50 percent of the birds counted in the 2002 survey: common grackle (*Quiscalus quiscula*), red-winged blackbird (*Agelaius phoencieus*), herring gull (*Larus argentatus*), brown-headed cowbird (*Molothrus ater*), and northern pintail (*Anas acuta*).

Fermi 3 bird studies were conducted between late 2006 and mid 2008 (Detroit Edison 2009e; 2011a). Point surveys were conducted for 5 days during each quarter of the year. Surveys were conducted at different starting times on alternating days in areas across the Fermi site that were considered representative of the habitats present. The sampling periods accounted for seasonal variation, such as spring and fall migration periods. These surveys confirm that the birds at Fermi are diverse but also indicate that a small number of common species make up a large percentage of the individuals present. Among the most common birds observed on the Fermi site were the red-winged blackbird, ring-billed gull (*Larus delawarensis*), American robin *(Turdus migratorius),* Canada goose *(Branta canadensis),* and European starling *(Sturnus vulgaris).* The following are brief discussions of the bird groups observed at Fermi.

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

Waterfowl, Shorebirds, Wading Birds, and Other Wetland Birds. Approximately 38 percent of the observed bird species are in this classification (Detroit Edison 2011a). These birds occur on the Fermi site mostly in association with the Lake Erie shoreline and areas designated as coastal emergent wetlands (Figure 2-10) because they require surface water to complete at least part of their life cycle. Great blue herons (*Ardea herodias*), great egrets (*Ardea alba*), common mergansers (*Mergus merganser*), American coots (*Fulica americana*), and mallards (*Anas platyrhynchos*) have been observed foraging in the shallow open water areas of the lagoons. Red-winged blackbirds nest in the tall cattails and reeds. In most past surveys, red-winged blackbirds accounted for a large percentage of the birds observed on the Fermi site. Many more birds have been observed in the lagoons than along the shore of Lake Erie, where the most common sightings are of various gull species.

Birds of Prey (Raptors). Birds of prey have not been frequently observed on the Fermi site. The most common sightings were of turkey vultures (*Cathartes aura*) and red-tailed hawks (*Buteo jamaicensis)*. In 1973, a single peregrine falcon (*Falco peregrinus*) and a single osprey (*Pandion haliaetus*) were observed over the site (NUS Corporation 1974). No peregrine falcons were observed in recent studies, but several ospreys have been observed at the site. No evidence of nesting on the site by either species has been observed. In the fourth quarter of 2007, three bald eagle (*Haliaeetus leucocephalus*) nests were observed on the site: two were north and one was south of Fermi 2 in the large trees of the coastal shoreline forest adjacent to Lake Erie. Eagles may be more common around the plant during the winter months at locations where the warmer cooling water keeps some areas of the lake ice-free. Additional discussion regarding legislated protection of this species is found in Section 2.4.1.3. By May 2008, only the two bald eagle nests north of Fermi 2 remained because the southernmost nest had been destroyed by winter storms. Only one of the remaining nests was occupied. As of January 2011, none of the previously observed bald eagle nests could be seen on the Fermi site and had presumably deteriorated because of nonuse and weather (Detroit Edison 2011b).

Upland Game Birds. The mourning dove (*Zenaida macroura)* is the only upland game bird observed on the Fermi site during the 2008-2009 surveys (Detroit Edison 2009e). Wild turkey (*Meleagris gallopavo*) may be in the area, but none were observed directly or indirectly (i.e., observations of tracks, feathers, or calls) during site evaluations between 2006 and 2008.

<u>Reptiles and Amphibians</u>

The lagoons, other wetlands areas, and adjacent habitats on the Fermi site provide substantial areas of potential habitat for amphibians and reptiles. Direct and indirect observations, however, have been infrequent both in recent and past studies (Detroit Edison 2011a). The 2000 Wildlife Management Plan listed 18 species of amphibians whose geographic ranges include the Fermi site, but only three species were observed. The same report did not list any reptiles. The 2002 Wildlife Habitat Re-certification document listed three additional amphibian species and three reptile species. No surveys specifically for amphibians and reptiles were made for the Fermi 3 project, but observations were recorded during the course of other studies conducted for terrestrial resources. During the 2008–2009 surveys, six amphibian species and four reptile species were observed (Detroit Edison 2009e). The most commonly observed reptiles were the midland painted turtle (*Chrysemys picta marginata*) and eastern garter snake (*Thamnophis sirtalis sirtalis*). Among amphibians, only the American toad (*Bufo americanus*) was observed during two different counts. The western chorus frog (*Pseudacris triseriata)* was heard on the site, but only during the April 2009 count.

Existing Natural and Human-Induced Ecological Effects on the Fermi Site

While much of the Fermi site consists of natural habitats, most of these have been fragmented by roads and other development associated with Fermi 2 and decommissioned Fermi 1. The existing power blocks (for Fermi 1 and 2), support facilities, roads, parking areas, maintained landscaping, and deposited dredge spoils represent the most obvious disturbances. Other areas have been cleared and/or covered by fill materials during development of existing facilities. Some of the forested areas, such as those along the southern edge of the site, were logged in the past. The South Lagoon contains large deposits of dredged and other fill materials. These and similar past activities have degraded the habitat value of most vegetated areas on the site.

While there are no adequate historic quantitative data available with which to compare today's conditions, the current level of disturbance suggests a diminished quality of habitat for most wildlife compared with conditions prior to European settlement or conditions prior to initial industrial development of the Fermi site. The existing perimeter fence and other internal fences restrict movement and habitat use by most larger nonflying wildlife. The existing hyperbolic cooling towers (approximately 400 ft tall) may have a minor, localized impact on birds migrating through the area. Bird collisions are not monitored by Detroit Edison, but dead 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 at the Fermi 2 south cooling tower. More recently, during a one-week period in October 2007, 45 dead birds were found at the Fermi 2 south cooling tower (Detroit Edison 2011a).

Noise can be a deterrent to wildlife when it is abrupt and irregular. However, some wildlife at the Fermi site apparently have adapted to constant noise. For example, songbirds, wading birds, and waterfowl have consistently been observed in the North Lagoon immediately west of the cooling towers (Detroit Edison 2011a). This area has one of the highest outdoor noise levels on the site, with measured noise levels nearest the cooling towers being between 68 and 72 dBA (see Section 2.10.2).

No unusual human disease vectors or pest species were listed for the Fermi site in the ER (Detroit Edison 2011a) or other documents, and none have been identified by Federal or State agencies. Mosquitoes in the area, including *Culex pipiens,* could be carriers of West Nile disease. Ticks, including American dog tick *(Dermacentor variabilis),* black legged tick *(Ixodes scapularis)*, and lone star tick *(Amblyomma americanum*), could be carriers of Lyme disease.

The emerald ash borer is a non-native 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 (Iowa State University 2010). Because ash trees (*Fraxinus* spp.) in North America have no known resistance to the insect, and many natural diseases and predators from the insect's native range are not known to occur here, the emerald ash borer is thought to have the potential to kill more than 800 million ash trees in Michigan (Poland 2007). Since 2002, it has killed more than 20 million ash trees in the core of the infested area (Poland 2007), including most of the ash trees on the Fermi site. State and Federal agencies in Michigan and researchers at Michigan State University (MSU) are working to stop the emerald ash borer from spreading (MSU 2010). Activities to prevent the spread of the borer include initiating quarantines to stop the movement of infested ash wood and wood products, researching the pest's life cycle and methods and strategies that can control or eradicate it, and developing educational and informational materials to help communities detect and deal with borer infestations (MDA 2009).

Dutch elm disease is fatal to American elms and some other elm species and first entered Michigan about 1950. The disease is caused by any of three species of fungi (*Ophiostoma ulmi, O. himal-ulmi,* or *O. novo-ulmi)* and is transmitted by bark beetles. This disease probably accounts for the lack of large American elm specimens on the site and for the remains of old, fallen specimens.

Two non-native invasive plant species were observed in emergent wetlands on the site during the 2006 and 2008–2009 surveys: common reed and purple loosestrife. The widespread common reed forms dense monocultures within wetlands and moist soils, eliminating other native wetland plants and changing wetland ecology. Although common reed as a species is native to North America, it is thought that most monocultures observed today are the result of introduced non-native Eurasian genotypes (Saltonstall 2002). At the present time, parts of both lagoons are dominated by dense and extensive stands of common reed and native cattail species. The non-native invasive purple loosestrife is present throughout most wetlands on the Fermi site. The west-side drainage corridor has virtually no open water because of the common reed, cattails, and purple loosestrife. Because these stands are so uniform, they provide a low diversity of food sources for wildlife species and hence generally minimal habitat for most species, especially waterfowl.

Other invasive non-native plant species identified on the site include reed canarygrass, European privet, and garlic mustard. Reed canarygrass can form dense stands that crowd out native vegetation, especially in wet soils. European privet was observed in forest: woodlot cover type areas. It can form dense thickets in the understory of forests. Garlic mustard shades out native forest understory plants and produces allelopathic compounds that inhibit seed germination of other species (NPS 2010c). In upland areas, common buckthorn is a dominant species in shrubland areas. Once established, it can form dense understory stands that are difficult to eliminate and crowd out native species.

2.4.1.2 Terrestrial Resources – Transmission Lines

The existing 345-kilovolt (kV) transmission system and associated corridors outside the Fermi site are exclusively owned and operated by ITC*Transmission*. Any new transmission lines built outside of the Fermi site to serve Fermi 3 would also be owned and operated by ITC*Transmission*. Detroit Edison has no control over the design or operation of transmission lines off of its plant sites. Accordingly, the description presented here of the terrestrial resources that interface with the transmission line corridors is based on publicly available information and reasonable expectations of the configurations that ITC*Transmission* would likely use based on standard industry practice. The information described in this subsection does not imply commitments were made by ITC*Transmission* or Detroit Edison, unless specifically noted.

New offsite transmission lines built to support Fermi 3 would consist of three 345-kV lines running north from the Fermi site in a single corridor extending west to the Milan Substation for a distance of about 29.4 mi. The corridor is located in portions of Monroe, Wayne, and Washtenaw Counties and is illustrated in Figure 2-5. Approximately 18.6 mi of the new lines would be installed alongside existing 345-kV lines serving Fermi 2. For a portion of this eastern 18.6-mi segment of the proposed route, reconfiguring existing conductors may allow for the use of existing transmission infrastructure without the need for building additional transmission infrastructure. The need for additional transmission towers and additional corridor width will be determined by ITC*Transmission* when it designs the system. The final western 10.8 miles of transmission lines would be built in an undeveloped segment of an existing transmission ROW that was previously authorized for transmission line use. Some transmission tower footings were installed there as part of earlier plans but were never used, and the corridor has been only minimally maintained. Most of the eastern 18.6 mi of the corridor cross agricultural land, but the undeveloped western 10.8-mi portion crosses a variety of land cover types, including forest, agricultural lands, rural residential areas, and a golf course.

To accommodate the new transmission lines, it is assumed the Milan Substation would be expanded from its current size of 350 by 500 ft to approximately 1000 by 1000 ft, which would affect lands currently occupied by maintained grasses and cropland.

Existing Cover Types and Vegetation

Major vegetation types occurring along the proposed transmission corridor for Fermi 3 are summarized in Table 2-7. Except for Lake Erie and associated coastal and shoreline habitats (coastal emergent wetland and forest: coastal shoreline), which do not exist west of the Fermi site, the plant communities found along the corridor are similar to those described for the site in Section 2.4.1.1.

Table 2-7. Vegetative Cover Types Occurring in the Proposed 29.4-mi Fermi 3 Transmission Corridor

Vegetative Cover Type	Acres in Corridor (assumes 300-ft width)	Percent of Vegetative Cover Type in Region	Acres in Region[a]
Open water	1.5	0.00	725,910
Developed	158.9	0.01	1,089,795
Barren land	2.8	0.03	10,346
Deciduous forest	151.5	0.05	282,046
Evergreen forest	0.2	0.00	6717
Mixed forest	0.8	0.01	5765
Shrub/scrub	5.0	0.16	3179
Grassland/herbaceous	35.1	0.08	41,308
Pasture/hay	152.2	0.07	219,241
Cultivated crops	454.8	0.04	1,217,689
Woody wetlands	93.4	0.07	128,090
Emergent herbaceous wetland	13.0	0.02	56,711
Total	**1069.2**	**0.03**[b]	**3,786,797**

Source: Adapted from Detroit Edison 2011a

(a) The region is defined as the area within a 50-mi radius of the Fermi site. Only the areas of vegetation cover types in the United States are presented.

(b) Calculated as 1069.2 as a percent of 3,786,797.

The eastern 18.6 mi of the proposed corridor follows an existing transmission line corridor that crosses mostly cropland. Non-cropland areas are generally pasture, open developed space, and emergent wetlands. No forested areas are present within the corridor because normal maintenance has already removed most trees. The corridor passes through only a few small forested areas. Emergent wetlands and waters crossed by the corridor are generally narrow. As currently anticipated, 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 more than 1300 ft.

The western 10.8-mi segment of the proposed transmission corridor, which does not follow previously cleared and regularly maintained corridors, crosses a mosaic of pastures and forest, including forested wetlands, shrub/scrub, cropland, and developed land (Detroit Edison 2011a). Forested and emergent wetlands are present, and three wetlands extend more than 900 ft along the corridor (Detroit Edison 2011a). It is possible that towers may need to be placed in these wetlands in order to construct crossings (Detroit Edison 2011a). The proposed Milan Substation site is located entirely in an area of cropland and planted grassland (Detroit Edison 2011a).

Wildlife

The wildlife found along the proposed new transmission line corridor is expected to be similar to that found on the Fermi site, as described in Section 2.4.1.1. The corridor lies entirely within the same ecoregion as the Fermi site, and the habitats in and along the corridor are similar to those on the Fermi site. The exceptions are that there is no lakeshore habitat along the corridor and that the transmission line corridor crosses a number of habitats that are not present on the Fermi site in significant quantities, including low-intensity development and pasture/hay. Certain birds favoring areas near surface waters, such as the bald eagle and many waterfowl species, are less likely to be found along the new transmission corridor than they are on the Fermi site because of the proximity of the Fermi site to the coastline of Lake Erie. Wildlife habitat on developed land and pasture/hay is likely to include some of the species present in grassland and shrubland, but with less diversity and with more species tolerant of disturbance.

Existing Natural and Human-Induced Ecological Effects on the Transmission Corridor

The 18.6-mi eastern segment of the proposed route crosses mostly crop and pasture land and land uses resulting from development. Corridor maintenance, including the removal of undesirable vegetation by mechanical means and herbicides, imposes stress on terrestrial resources. Other areas of the eastern segment support herbaceous plant communities; however, rural residences are common and cropland is scattered throughout the section. Disease vectors and pests along the proposed new transmission line route are expected to be the same as those on the Fermi site as described in Section 2.4.1.1.

2.4.1.3 Important Terrestrial Species and Habitats – Site and Vicinity

NUREG-1555 (NRC 2000) defines "important species" as (1) species listed or proposed for listing as threatened, endangered, candidate, or species of special concern in Part 17, Title 50 of the *Code of Federal Regulations* (50 CFR 17.11 and 17.12) by the FWS 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 structure and function of local terrestrial ecosystems; or (5) species that could serve as biological indicators of effects on local terrestrial ecosystems. Several species meeting definitions (1) and (2) occur on the Fermi site and vicinity. "Important habitat" is defined by the NRC in NUREG-1555 (NRC 2000) as wildlife sanctuaries, refuges, or preserves, wetland, floodplains, and areas identified as critical habitat by the FWS. The terrestrial species and habitats deemed important by these definitions are addressed in the sections below (see Table 2-8). Section 4.3.1 describes the preconstruction and construction impacts on the terrestrial ecosystem and potential needs for mitigation.

Table 2-8. Protected Species Known or with Potential to Occur on the Fermi 3 Site

Common Name	Scientific Name	Federal Status[(a)]	State Status[(b)]
Plants			
American lotus	*Nelumbo lutea*	ESA-NL	T
Arrowhead	*Sagittaria montevidensis*	ESA-NL	T
Eastern prairie fringed orchid	*Platanthera leucophaea*	ESA-T	T
Red mulberry	*Morus rubra*	ESA-NL	T
Insects			
Karner blue butterfly	*Lycaeides melissa samuelis*	ESA-E	T
Reptiles			
Eastern fox snake	*Pantherophis gloydi*	ESA-NL	T
Birds			
Bald eagle	*Haliaeetus leucocephalus*	ESA-NL, BGEPA, MBTA	SC
Barn owl	*Tyto alba*	ESA-NL, MBTA	E
Common tern	*Sterna hirundo*	ESA-NL, MBTA	T
Mammals			
Indiana bat	*Myotis sodalis*	ESA-E	E

Sources: Detroit Edison 2009f; FWS 2009

(a) ESA-E = listed under the ESA as endangered, ESA-NL = not listed under the ESA, ESA-T = listed under the ESA as threatened, BGEPA = protected under the Bald and Golden Eagle Protection Act, MBTA = protected under the Migratory Bird Treaty Act. These birds are protected under the MBTA, but this is not an exhaustive list of species in the project area covered under the MBTA.

(b) E = endangered, SC = species of special concern, T = threatened.

The white-tailed deer is a recreationally important species in the vicinity of the Fermi site and is present on the Fermi site. This species is a valued game animal, but no hunting is allowed on the Fermi site. According to Detroit Edison (2011a), the mourning dove (*Zenaida macroura)* is the only upland game bird commonly observed on the Fermi property. Wild turkey and ring-necked pheasant (*Phasianus colchicus*) may be in the area, but none were observed directly or indirectly (e.g., tracks or feathers) during site evaluations between 2006 and 2008 (Detroit Edison 2011a). Canada geese and other waterfowl, including mallard ducks, are common to abundant on the Fermi site, at least during some parts of the year. Detroit Edison manages wildlife on the Fermi property in coordination with the FWS and the DRIWR.

The following discussion reflects information provided by the FWS, MDNR, the results of the detailed wildlife surveys conducted in 2008 and 2009 (Detroit Edison 2009e), and other information sources as cited.

Federally and State-Protected Species

Detroit Edison contacted FWS in 2007 concerning the occurrence or potential occurrence of species on or in the vicinity of the Fermi site that are protected under the Endangered Species Act of 1973 (ESA). In its initial response, FWS stated that the project occurs within the potential range of several Federally listed species, but that FWS had no records of occurrence, nor was there any designated critical habitat in the area (Detroit Edison 2010b). FWS further stated that because of the types of habitat present at the Fermi site, no further action was required under ESA. However, FWS requested that if more than six months passed before the project was initiated, FWS be contacted to ensure there had been no changes from a regulatory perspective (Detroit Edison 2011a). Furthermore, in later correspondence with the NRC (FWS 2009) FWS noted the potential for several Federally listed species to occur in Monroe, Washtenaw, and Wayne Counties. According to the FWS scoping letter (FWS 2009), three terrestrial species that are Federally listed as threatened or endangered may occur at the Fermi site: eastern prairie fringed orchid, Indiana bat, and Karner blue butterfly. Each is discussed further below.

Detroit Edison also contacted MDNR and consulted the Michigan Natural Features Inventory (MNFI) regarding the presence of known or potential occurrences of State-listed threatened and endangered animals and plants in the project area. Eight terrestrial species were identified by MDNR as occurring or being potentially present (Detroit Edison 2009f). Since that time, two species, the bald eagle and Frank's sedge, have been removed from threatened status. The bald eagle is now designated a "species of special concern," and Frank's sedge no longer has special status. Three of the species listed by the State (Indiana bat, Karner blue butterfly, and eastern fringed prairie orchid) are also listed by the FWS. Species listed by MDNR as "species of special concern" are not protected under State endangered species legislation. Terrestrial species listed as threatened by MDNR are discussed below.

In addition to the species noted by MDNR, the vegetation surveys conducted by Detroit Edison in 2000 and 2002 found red mulberry (*Morus rubra*), another plant species listed by the State as threatened (Detroit Edison 2009e). This species was not observed during the surveys conducted by Detroit Edison for the Fermi 3 project (Detroit Edison 2009e).

The bald eagle, which is protected by the Bald and Golden Eagle Protection Act of 1940 (BGEPA), has been observed on the Fermi site and in the site vicinity. The Indiana bat, Federally listed as endangered, has been sighted within the Fermi region but is not known to occur on the Fermi site (MNFI 2007b). These species are discussed further below.

<u>Bald Eagle</u>

The FWS delisted the bald eagle under ESA, effective August 8, 2007 (50 CFR Part 17). However, the species continues to receive Federal protection under the BGEPA, 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 FWS permit. It is also protected under the Migratory Bird Treaty Act (MBTA). The bald eagle also is a State-listed species of special concern. MDNR guidelines for bald eagle management follow those provided by the FWS *National Bald Eagle Management Guidelines* (FWS 2007).

Two bald eagle nests were observed on the Fermi site in May 2008; one was occupied (Detroit Edison 2011a). Both nests were located north of Fermi 2 in the large trees of the forested coastline immediately adjacent to Lake Erie. Biologists from FWS usually check the nests for young late each winter. If present, the young are banded, and blood samples are taken (Detroit Edison 2011a). As of January 2011, however, none of the previously observed bald eagle nests could be seen on the Fermi site (Detroit Edison 2011b).

As long as there is open water where they can forage, bald eagles typically remain in the region throughout the year, according to MNFI (MNFI 2007a). 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 4 to 5 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 built in the tallest tree in the area, often a white pine (*Pinus strobus*) or dead snag. From late March to early April, one to four eggs are laid. Both male and female bald eagles participate in incubation and feeding of the chicks, which 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 (Gehring 2006). A 1999 survey in Michigan found 343 nests that produced 321 young throughout the State. The productivity was calculated as 96 percent, based on the number of young per successful nest (MDNR 2010).

Eastern Prairie Fringed Orchid

The eastern prairie fringed orchid (*Platanthera leucophaea*), also known as the prairie white fringed orchid, is Federally listed as threatened and State-listed as endangered. The species has not been observed on the Fermi site, but it has been reported in Monroe County as recently as 2006 (MNFI 2007c). This species has not been observed on or near the Fermi site in any vegetation studies conducted on the site since 1973. The plant is known mostly from lakeplain prairies around Saginaw Bay and western Lake Erie. No such habitat occurs on the project site or in the immediate vicinity.

Indiana Bat

The Indiana bat (*Myotis sodalis*) is Federally and State-listed as endangered. In its scoping letter, FWS (2009) identified the Indiana bat as potentially occurring in Monroe County. MDNR expressed no specific concern for the species in informal correspondence in 2007 (Detroit Edison 2009f), and, according to MNFI, there are no reported occurrences of the Indiana bat in

Monroe County. The species has not been observed on the Fermi site, nor has it been reported from Monroe County according to MNFI (MNFI 2007b). However, MNFI records indicate that the Indiana bat has been observed in counties to the north and west of Monroe County. Also, FWS identified the Indiana bat as being at least potentially present in all three counties that the anticipated transmission line route would cross (FWS 2009), including 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. During the winter, the bats migrate south to hibernate in caves in the Ohio Valley or more southern areas. Hibernacula have been identified in southern Indiana, southern Ohio, and western Pennsylvania, among other States. The species is found in Michigan only during late spring to early fall when it roosts in forested areas beneath loose bark of large trees or in hollow snags (MNFI 2007b). They leave their roosts to forage for insects from one hour to one-half hour before dark in or near forested areas (MNFI 2007b). Although portions of the Fermi site are forested, large live trees with loose bark that would provide roosting habitat for the Indiana bat are not common there. However, with the death of many green ash trees caused by the emerald ash borer, there are some trees that may be suitable for summer roosting habitat. Mist-net surveys for Indiana bats using FWS protocols have not been conducted on the Fermi site.

Karner Blue Butterfly

The Karner blue butterfly (*Lycaeides melissa samuelis*) is Federally listed as endangered and State-listed as threatened. It has not been seen in Monroe County since 1986, but most recent observations have been in the west-central portion of lower Michigan. Suitable habitat, which consists of openings with lupine in dry forests, does not exist on the Fermi site or in the immediate vicinity (Detroit Edison 2011a; 2009e).

American Lotus

The American lotus (*Nelumbo lutea*) is State-listed as threatened. Healthy populations of the 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 nearshore areas of large rivers and lakes. This large perennial plant grows from thick tubers, and it flowers in mid-summer. American lotus is abundant in moderately shallow areas of the South and North Lagoons and in the south canal on the Fermi site (Detroit Edison 2011a).

Arrowhead

The arrowhead (*Sagittaria montevidensis*) is State-listed as threatened. It is primarily distributed sporadically along the Mississippi River drainage, but it is reported in other areas of the eastern United States. Southeastern Michigan populations represent a northern limit of distribution for the species (MNFI 2007f). 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 recorded on the Fermi site during the recent ecological surveys (Detroit Edison 2009e), but it is not clear if the surveys specifically looked for this species in suitable habitat. Arrowhead was observed in Monroe County as recently as 2001 (MNFI 2007f).

Barn Owl

The barn owl (*Tyto alba*) is State-listed as endangered. It is a distinctive species that uses a wide array of habitats, including agricultural lands and buildings. These birds may be found year-round if prey species (mostly small mammals) are abundant. Although reported in the region in the early 1980s (MNFI 2007d), there appear to be no recent reports of occurrence, and no observations were made during project-related studies. Preferred prey species are uncommon in the project area and nesting/roosting habitat does not occur. 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-listed as threatened. The species prefers nesting on islands to avoid terrestrial predators but may be observed using gravelly shores and bars (MNFI 2007e). This bird has not been observed in Monroe County (MNFI 2007e). 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-listed as threatened. Primarily an open wetland species, this snake inhabits emergent wetlands along Great Lakes shorelines and associated drainages where cattails (*Typha* spp.) are common. Although primarily an open wetland species, eastern fox snakes also occupy drier habitats such as vegetated dunes and beaches, and they occasionally travel along ditches and into nearby farm fields, pastures, and woodlots. 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 2 to 4 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 (Lee 2000). In 2007, nine occurrences were reported in Monroe County (Detroit Edison 2011a). The snake was sighted twice on the Fermi site in June 2008 (Detroit Edison 2011a). Detroit Edison records show 15 sightings on the Fermi site between 1990 and 2007. Sightings have occurred on or near roads and buildings. All undeveloped areas of the Fermi site can be considered habitat for the eastern fox snake (Detroit Edison 2010b).

Frank's Sedge

Frank's sedge (*Carex frankii*) was noted in a letter from MDNR to Detroit Edison as State-listed as threatened (Detroit Edison 2009f). However, this species was delisted in 2009 because it is more common than originally thought. Frank's sedge is no longer listed as endangered, threatened, or a species of special concern by MNFI (MNFI 2009).

Red Mulberry

Red mulberry (*Morus rubra*), which is listed by the State as threatened, was observed during the vegetation studies of the Fermi site in 2000 and 2002, but was not observed during any surveys conducted by Detroit Edison for the Fermi 3 project (Detroit Edison 2009e). Riparian floodplain is the red mulberry's preferred habitat (MNFI 2007h) and is where it was observed in earlier surveys (Detroit Edison 2009e). This environment is limited on the Fermi site to portions of the site near Swan Creek and the South Lagoon outlet to Lake Erie, both of which would not be affected by development of Fermi 3. Accordingly, no further consideration is being given to this species as being potentially affected by Fermi 3.

Important Habitats

No areas of the Fermi site are Federally designated as critical habitat for any ESA-listed species. Other important habitats present on the site are discussed below.

Wetlands

In 1984, Michigan received authorization from the Federal Government to administer Section 404 of the Federal Clean Water Act (CWA) in most areas of the State. A State-administered Section 404 program must be consistent with the requirements of the CWA and associated regulations set forth in the Section 404(b)(1) guidelines. Unlike applicants in most other States, applicants in Michigan generally need to receive only one wetland permit from the MDEQ to obtain the necessary authorizations under Section 404 and State wetland permit regulations. However, the USACE retains jurisdiction over wetlands adjacent to Great Lakes lakeshores, including many of the wetlands on the Fermi site. Hence, Detroit Edison would have to receive separate permits from both the MDEQ and the USACE for wetland impacts from the Fermi 3 project. Detroit Edison submitted a Joint Permit Application (JPA) to MDEQ on June 17, 2011 (Detroit Edison 2011f).

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. MDEQ has adopted administrative rules that provide clarification and guidance on interpreting Part 303. Wetlands that are within 1000 ft of a Great Lake or hydrologically connected to a Great Lake, including many of the wetlands on the Fermi site, 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 most wetlands on the Fermi site because the lagoons are connected to Lake Erie (Cwikiel 2003). MDEQ issued jurisdictional determination letters on November 7, 2008 (MDEQ 2008b), and March 30, 2009 (MDEQ 2009d).

Standard USACE guidelines with minor modifications are used for the delineation of wetlands in Michigan (USACE 1987). State and Federal authorities overlap in a coastal situation such as what occurs at Fermi. Activities in wetlands and other waters of the United States in such areas therefore require a joint permit application. In addition, the USACE retains Federal jurisdiction over traditionally navigable waters throughout Michigan. This jurisdiction includes the Great Lakes, connecting channels, other waters connected to the Great Lakes where navigational conditions are maintained, and wetlands adjacent to these waters. USACE issued a jurisdictional letter on November 9, 2010.

Description of Wetlands on the Fermi Site. In June 2008, a field delineation and assessment of wetlands on the Fermi site was completed. Wetland boundaries were flagged and data were collected between May 16, 2008, and June 13, 2008 (Detroit Edison 2010b). The boundaries were delineated in accordance with procedures outlined in the USACE's 1987 *Wetland Delineation Manual* (USACE 1987). 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 were collected on wetland vegetation and on primary and secondary indicators of hydrology and soils. The wetland delineation report was supplemented with vegetation community measurements for species richness and diversity and cover and wildlife observations.

Thirty-seven wetland units covering approximately 505 ac of vegetated wetlands and 98 ac of other waters of the United States were initially delineated on the Fermi site by Ducks Unlimited (Detroit Edison 2010b) for Detroit Edison. Four additional wetland units were identified during initial field inspection with regulators, and two units (wetlands CC and DD) were combined into one for a total of 40 wetland units (Figure 2-11). Areas within the delineation boundary did not include open water areas in Lake Erie. MDEQ identified 39 units as regulated under Michigan State law; these are identified as B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, BB, CC and DD (considered one unit), EE, FF, GG, HH, II, JJ, KK, WW, XX, YY, and ZZ in Figure 2-11. USACE identified 29 of those wetland units as regulated under Federal law; these are identified as B, C, D, E, F, G, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, Z, AA, BB, CC and DD, EE, FF, GG, HH, and KK in Figure 2-11. Neither USACE nor MDEQ claims to have regulatory jurisdiction over Wetland A, a wetland of approximately 1.9 ac lacking a surface connection to Federal or State waterways. The most extensive wetland type on the Fermi site is palustrine emergent marsh (PEM) making up 322 ac, followed by palustrine forested (PFO)

Figure 2-11. Wetlands Delineated on the Fermi Site (Detroit Edison 2011a)

making up 167 ac, and palustrine scrub-shrub (PSS) making up 16 ac. Wetland nomenclature is according to Cowardin et al. (1979).

Wetlands dominated by woody vegetation having a basal area larger than a 3-in. dbh were classified as PFO. Some herbaceous and woody vegetation with less than a 3-in. dbh may be present but contribute less than 50 percent combined of the basal area. According to the wetland delineation report (Detroit Edison 2010b), dominant vegetation in the PFO wetlands includes silver maple (*Acer saccharinum*), shellbark hickory (*Carya laciniosa*), swamp white oak (*Quercus bicolor*), American elm (*Ulmus americana*), and eastern cottonwood. The shrub layer in the PFO wetlands is dominated by American elm saplings, silky dogwood (*Cornus amomum*), and green ash saplings. Herbaceous vegetation is sparse. Common species included black raspberry (*Rubus* spp.), mayapple (*Podophyllum peltatum*), reed canary grass, poison ivy, and Virginia creeper (*Parthenocissus quinquefolia*). Because of the seasonally variable hydrology of these PFO wetlands, several of herbaceous species were plants that favor upland areas. Soils are hydric and saturated with pockets of standing water. Approximately 167 ac of wetlands were delineated as PFO and include locations marked B, D, F, G, I, L, O, P, S, T, V, X, Y, BB, GG, and KK on Figure 2-11.

Wetlands dominated by woody vegetation smaller than 3-in. dbh but greater than 3.2 ft in height were classified as PSS. PSS wetlands may have some woody plants larger than 3 in. dbh or some herbaceous vegetation that, combined, contribute less than 50 percent of ground cover. According to the wetland delineation report (Detroit Edison 2010b), common shrub species in PSS wetlands include silky dogwood, green ash, and hawthorn species (*Crataegus* spp.). PSS wetlands on the site are largely early successional woody communities located on the fringes of PFO and upland or PFO and PEM wetland habitats. Approximately 16 ac of wetland were delineated as PSS, including locations marked E, K, Q, HH, and JJ on Figure 2-11.

PEM wetlands are characterized by a predominance of the ground surface consisting of herbaceous vegetation or woody vegetation less than 3.2 ft tall without taller woody vegetation. According to the wetland delineation report (Detroit Edison 2010b), the PEM wetlands are dominated by reed canary grass, common reed, sedge species (*Carex* spp.), narrow-leaf cattail (*Typha angustifolia*), water lily (*Nymphaea* spp.), and coontail (*Ceratophyllum demersum*). Approximately 322 ac of wetlands were delineated as PEM and include locations marked A, C, J, M, N, R, U1, W, Z, AA, CC, DD, EE, FF, II, WW, XX, YY, and ZZ on Figure 2-11. Wetlands delineated as PEM span a range of periodically inundated wet meadows to deep-water marsh systems. Because of the well-developed stands of invasive plants, including common reed and reed canary grass, vegetation diversity is relatively low in most of the PEM wetlands. There is significant buildup of plant duff in the PEM wetlands, primarily from extensive stands of common reed.

Open water habitat is characterized by inundation to a depth of more than 4 ft with no emergent vegetation present. Several open water habitats are located within the delineation boundary, including Lake Erie, Swan Creek, the Quarry Lakes, and features marked by the wetland delineation as H1, H2, and U2. There are more than 100 ac of open water habitat within the site (Figure 2-11).

Wetland Functions and Values at the Fermi Site. The functions and values of the wetlands on the Fermi site were evaluated by Ducks Unlimited for Detroit Edison (Detroit Edison 2010b) by using the USACE Highway Methodology (USACE 1999). Thirteen functions and values are considered when this method is used to evaluate wetlands; these are groundwater recharge/discharge, flood-flow 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.

With the exception of a few wetlands upgradient of berms or roads, the majority of wetland communities at the Fermi site are hydrologically connected and thus, for the purposes of the functional assessment, are considered one wetland system. Separate functional assessments were, however, completed for woody (PFO and PSS) and nonwoody (PEM) wetland communities. The principal functions of the wetlands include flood-flow alteration, sediment/toxicant retention, nutrient removal, and fish and wildlife habitat. Additional functions and values of this wetland system, 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 (Detroit Edison 2009c). The principal functions of the wetland system are discussed further below:

- **Flood-flow alteration, sediment/toxicant retention, and nutrient removal.** The Fermi site's wetland complex is large relative to its watershed, is relatively flat with storage potential, and contains hydric soils and dense vegetation suitable for absorbing and slowing water flow. The wetland system can therefore be expected to be highly suitable for reducing flood damage by retaining and gradually releasing floodwater following precipitation events (Detroit Edison 2011a). Fermi 2, including cooling towers and control centers, is next to the wetland system. In the event of a large storm that resulted in flood-flow 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 also highly suitable for trapping sediments, toxicants, and pathogens as well as for nutrient retention. There are potential sources of excess sediment, chemicals, and nutrients upstream in the agriculturally dominated watershed and directly from roads, parking areas, and other impervious surfaces of the Fermi site. The EPA cites the Monroe County portion of the Ottawa-Stony watershed as being impaired by excessive nutrient levels (EPA 2010a). There is, therefore, the opportunity for sediment trapping and nutrient uptake in diffuse, slow-moving, and deepwater areas of the Fermi site wetlands that are edged or interspersed with dense herbaceous and woody vegetation.

- **Fish and wildlife habitat.** Deeper water emergent wetlands of the Fermi wetland system provide suitable fish habitat. There is an abundance of cover objects, and the wetland is large and part of a larger, persistent, contiguous water course with slow velocity. The wetlands have sufficient size and depth to retain open water areas during the winter. Direct observations of fish species were made in the wetland (Detroit Edison 2011a). The diverse wetland communities present across the entire wetland system provide suitable habitat for a significant number of wildlife species. Although notable direct and indirect disturbance has occurred in all wetlands on the site, significant abundance and diversity in habitat cover remain to support wildlife. However, the quality of the habitat is compromised in areas dominated by non-native invasive plant species such as common reed. 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 despite being overlaidd or crossed 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 CWA status report for the Monroe County portion of the Ottawa-Stony watershed cites loss of aquatic life benefits as the most common impairment of water bodies in the watershed (EPA 2010a).

<u>Detroit River International Wildlife Refuge (DRIWR)</u>

Detroit Edison entered into a cooperative agreement with FWS on September 25, 2003, placing some undeveloped portions of the Fermi site under management by the DRIWR. Lands on the Fermi site managed by the DRIWR constitute the DRIWR Lagoona Beach Unit (see Figure 2-12). The four areas of the DRIWR Lagoona Beach Unit contain areas of all the terrestrial habitats of the Fermi site, as described in Section 2.4.1.1, with the exception of the developed areas habitat type. The habitat types covering the greatest area of the DRIWR Lagoona Beach Unit are coastal emergent wetland, lowland hardwood forest, and woodlot forest.

The general public does not have access to this land without the permission of FWS and Detroit Edison because all areas are within the outer fenced area of the facility. The agreement can be cancelled by either party at any time (Detroit Edison 2009a).

<u>Transmission Line Corridor Prairie Planting</u>

FWS, ITC*Transmission*, and Detroit Edison cooperatively funded the restoration and planting of a 29-ac prairie area in the transmission corridor on the Fermi site along the north side of the

Figure 2-12. Boundaries of the Detroit River International Wildlife Refuge, Lagoona Beach Unit, Monroe County, Michigan (Detroit Edison 2011a)

existing facility approach road. The restoration began in 2005 and was completed in 2006. The area is described earlier in Section 2.4.1.1 as a grassland: right-of-way community and is illustrated in Figure 2-10.

2.4.1.4 Important Terrestrial Species and Habitats – Transmission Lines

Important Species

Important species potentially occurring along the proposed transmission line corridor may include some of the important species found at the Fermi site, as described in Section 2.4.1.3. Some species known to be present at the Fermi site may or may not occur along the corridor, but because the exact route of the corridor has not been finally determined, no surveys have yet been conducted to confirm the presence of any species. All Federally and State-listed terrestrial species that occur in the counties to be crossed by the proposed transmission line are identified in Table 2-9.

MDNR identified seven State-listed threatened or endangered terrestrial species for which the Fermi site may be suitable habitat (Detroit Edison 2009f). Two species, bald eagle and Frank's sedge, were later delisted from the State threatened and endangered list, leaving five possible State-listed species identified as potentially inhabiting the Fermi site. Since Detroit Edison did not provide details about the exact corridor and proposed areas of disturbance to MDNR, the agency did not provide concurrence for the project to proceed.

FWS (2009) identified several terrestrial species that are listed under the ESA or candidates for listing that could occur in the area of the proposed transmission line corridor, some of which are not known to occur at the Fermi site. Species identified as potentially present in Monroe County are the Indiana bat, Karner blue butterfly, and eastern prairie fringed orchid. For Wayne County, the species identified are the Indiana bat and eastern prairie fringed orchid. For Washtenaw County, the species identified are the Indiana bat, Mitchell's satyr butterfly, and eastern prairie fringed orchid. FWS also noted that the eastern massasauga, a candidate species, may be present in Washtenaw and Wayne Counties.

Prior to installation of the transmission line, FWS and MDNR would need to review detailed information on the transmission line corridor. The agencies may, at that time, require surveys of the proposed transmission line corridor for the presence of important species and habitat. A recreationally important species present in the vicinity of the proposed transmission line corridor is the white-tailed deer. This species is an important game animal. Transmission line corridors can provide habitat for the white-tailed deer and may be used for hunting. After installation of the transmission line, operation and maintenance of the corridor are unlikely to affect the white-tailed deer population in the project area.

Table 2-9. Federally and State-Listed Terrestrial Species That Have Been Observed in Monroe, Washtenaw, and Wayne Counties and May Occur within the Transmission Line Corridor

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Plants			
American chestnut	*Castanea dentata*	NL	E
American lotus	*Nelumbo lutea*	NL	T
Arrowhead	*Sagittaria montevidensis*	NL	T
Bald-rush	*Rhynchospora scirpoides*	NL	T
Beak grass	*Diarrhena obovata*	NL	T
Blue-eyed-grass	*Sisyrinchium hastile*	NL	Presumed extirpated
Bog bluegrass	*Poa paludigena*	NL	T
Canadian burnet	*Sanguisorba canadensis*	NL	E
Canadian milk vetch	*Astragalus canadensis*	NL	T
Compass plant	*Silphium laciniatum*	NL	T
Corn salad	*Valerianella umbilicata*	NL	T
Cup plant	*Silphium perfoliatum*	NL	T
Downy gentian	*Gentiana puberulenta*	NL	E
Downy sunflower	*Helianthus mollis*	NL	T
Edible valerian	*Valeriana edulis* var. *ciliata*	NL	T
False hop sedge	*Carex lupuliformis*	NL	T
Few-flowered nut rush	*Scleria pauciflora*	NL	E
Fire pink	*Silene virginica*	NL	E
Forked aster	*Aster furcatus*	NL	T
Gattinger’s gerardia	*Agalinis gattingeri*	NL	E
Ginseng	*Panax quinquefolius*	NL	T
Goldenseal	*Hydrastis canadensis*	NL	T
Hairy mountain mint	*Pycnanthemum pilosum*	NL	T
Hairy wild petunia	*Ruellia humilis*	NL	T
Jacob’s ladder	*Polemonium reptans*	NL	T
Least pinweed	*Lechea minor*	NL	Presumed extirpated
Leggett’s pinweed	*Lechea pulchella*	NL	T
Leiberg’s panic grass	*Dichanthelium leibergii*	NL	T
Lesser ladies’-tresses	*Spiranthes ovalis*	NL	T
Low-forked chickweed	*Paronychia fastigiata*	NL	Presumed extirpated
Mat muhly	*Muhlenbergia richardsonis*	NL	T
Nodding mandarin	*Prosartes maculata*	NL	Presumed extirpated
Northern bayberry	*Myrica pensylvanica*	NL	T
Orange- or yellow-fringed orchid	*Platanthera ciliaris*	NL	E
Plains blazing star	*Liatris squarrosa*	NL	Presumed extirpated
Prairie buttercup	*Ranunculus rhomboideus*	NL	T

Table 2-9. (contd)

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Prairie trillium	*Trillium recurvatum*	NL	T
Prairie white-fringed orchid	*Platanthera leucophaea*	T	E
Pumpkin ash	*Fraxinus profunda*	NL	T
Purple coneflower	*Echinacea purpurea*	NL	Presumed extirpated
Purple milkweed	*Asclepias purpurascens*	NL	T
Purple turtlehead	*Chelone obliqua*	NL	E
Raven's-foot sedge	*Carex crus-corvi*	NL	E
Red mulberry	*Morus rubra*	NL	T
Rosepink	*Sabatia angularis*	NL	T
Rosinweed	*Silphium integrifolium*	NL	T
Round-fruited St. John's-wort	*Hypericum sphaerocarpum*	NL	E
Sand cinquefoil	*Potentilla paradoxa*	NL	T
Sedge	*Carex seorsa*	NL	T
Short-fruited rush	*Juncus brachycarpus*	NL	T
Showy orchis	*Galearis spectabilis*	NL	T
Side-oats grama grass	*Bouteloua curtipendula*	NL	E
Smooth rose-mallow	*Hibiscus laevis*	NL	Presumed extirpated
Spike rush	*Eleocharis radicans*	NL	Presumed extirpated
Spike-rush	*Eleocharis geniculata*	NL	Presumed extirpated
Stiff gentian	*Gentianella quinquefolia*	NL	T
Sullivant's milkweed	*Asclepias sullivantii*	NL	T
Swamp candles	*Lysimachia hybrida*	NL	Presumed extirpated
Swamp or black cottonwood	*Populus heterophylla*	NL	E
Tall green milkweed	*Asclepias hirtella*	NL	T
Three-awned grass	*Aristida longespica*	NL	T
Tinted spurge	*Euphorbia commutata*	NL	T
Toadshade	*Trillium sessile*	NL	T
Umbrella-grass	*Fuirena pumila*	NL	T
Upland boneset	*Eupatorium sessilifolium*	NL	T
Vasey's rush	*Juncus vaseyi*	NL	T
Violet wood sorrel	*Oxalis violacea*	NL	Presumed extirpated
Virginia flax	*Linum virginianum*	NL	T
Virginia snakeroot	*Aristolochia serpentaria*	NL	T
Virginia water-horehound	*Lycopus virginicus*	NL	T
Water willow	*Justicia americana*	NL	T
Western mugwort	*Artemisia ludoviciana*	NL	T
White gentian	*Gentiana flavida*	NL	E
White lady slipper	*Cypripedium candidum*	NL	T
Whorled pogonia	*Isotria verticillata*	NL	T

1 **Table 2-9**. (contd)

Common Name	Scientific Name	Federal Status[a]	State Status[a]
Wild hyacinth	*Camassia scilloides*	NL	T
Wild rice	*Zizania aquatica* var. *aquatica*	NL	T
Winged monkey flower	*Mimulus alatus*	NL	Presumed extirpated
Wisteria	*Wisteria frutescens*	NL	T
Woodland lettuce	*Lactuca floridana*	NL	T
Insects			T
American burying beetle	*Nicrophorus americanus*	E	Presumed extirpated
Dukes' skipper	*Euphyes dukesi*	NL	T
Frosted elfin	*Incisalia irus*		T
Karner blue butterfly	*Lycaeides melissa samuelis*	E	T
Mitchell's satyr butterfly	*Neonympha mitchellii mitchellii*	E	E
Poweshiek skipperling	*Oarisma poweshiek*	NL	T
Regal fritillary	*Speyeria idalia*	NL	E
Silphium borer moth	*Papaipema silphii*	NL	T
Amphibians			
Blanchard's cricket frog	*Acris crepitans blanchardi*	NL	T
Smallmouth salamander	*Ambystoma texanum*	NL	E
Reptiles			
Eastern fox snake	*Pantherophis gloydi*	NL	T
Eastern massasauga	*Sistrurus catenatus catenatus*	C	Special concern
Kirtland's snake	*Clonophis kirtlandii*	NL	E
Spotted turtle	*Clemmys guttata*	NL	T
Birds			
Barn owl	*Tyto alba*	NL	E
Cerulean warbler	*Dendroica cerulea*	NL	T
Common moorhen	*Gallinula chloropus*	NL	T
Common tern	*Sterna hirundo*	NL	T
Forster's tern	*Sterna forsteri*	NL	T
Henslow's sparrow	*Ammodramus henslowii*	NL	E
King rail	*Rallus elegans*	NL	E
Least bittern	*Ixobrychus exilis*	NL	T
Louisiana waterthrush	*Seiurus motacilla*	NL	T

Table 2-9. (contd)

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Peregrine falcon	*Falco peregrinus*	NL	E
Prairie warbler	*Dendroica discolor*	NL	E
Red-shouldered hawk	*Buteo lineatus*	NL	T
Mammals			
Indiana bat	*Myotis sodalis*	E	E
Least shrew	*Cryptotis parva*	NL	T

Source: MNFI 2010
(a) C = candidate for listing, E = endangered, NL = not listed, T = threatened.

Important Habitats

Within the Fermi site, the proposed transmission line route crosses the DRIWR. Outside the Fermi site, with the exception of wetlands, no important habitat features are known to occur along the estimated corridor. The corridor crosses about 30 wetlands or other waters that may be regulated by the USACE and/or MDEQ, according to FWS National Wetland Inventory (NWI) mapping (FWS 2010b). The undeveloped western 10.8-mi segment of the corridor crosses eight wetlands and nine drainages or narrow streams. The majority of the wetlands in this undeveloped segment are 100 to 400 ft wide where, but three wetlands are much wider, at 1302 ft, 903 ft, and 1339 ft. Since the upper limit of spans between transmission structures is typically 900 ft, it is anticipated that development of this undeveloped segment of corridor might require the placement of one tower or pole in each of these wetlands. The wetlands include woody and emergent herbaceous community types. The 18.6-mi existing eastern section of the corridor crosses two wetlands and 12 narrow drains or small streams. The existing lines span all of these wetlands, with the exception of a 1386-ft-long wetland crossing at Stony Creek, where one set of towers is currently located in wetland.

Terrestrial Monitoring

Detroit Edison has stated that other than the biological studies performed by Detroit Edison and described above, no formal monitoring of the terrestrial environment has been conducted or is planned on the Fermi site or along the proposed transmission line corridor. The only recent study, besides the 2008-2009 vegetation and wildlife surveys discussed above, is that of the onsite transmission line corridor prairie planting that was surveyed for plant species occurrences in 2005 and 2007. FWS, ITC*Transmission*, and Detroit Edison cooperatively funded the restoration and planting of this 29-ac prairie area in the onsite transmission line corridor along the north side of the existing facility approach road (Fermi Drive). The restoration was begun in 2005 and completed in 2006 (Detroit Edison 2011).

2.4.2 Aquatic Ecology

This section describes the aquatic environment and aquatic biota in the vicinity of the Fermi site and other areas that could be affected by the building, operation, or maintenance of the proposed Fermi 3.

The Fermi site is located on 1260 ac of developed and undeveloped land on the shoreline of the western basin of Lake Erie between Swan Creek and Stony Creek (Figure 2-1). Approximately 656 ac of this land (called the Lagoona Beach Unit) is managed as part of the DRIWR. As in many areas bordering the Great Lakes, coastal freshwater marshes are common in the vicinity of the Fermi site. These freshwater marshes play a pivotal role in the aquatic ecosystem of the Great Lakes, including storing and cycling nutrients and organic material from the land into the aquatic food web (Bouchard 2007). Most of the fish species in the Great Lakes depend on freshwater marshes during at least some portion of their life cycles (Wei et al. 2004). Freshwater marshes associated with the Great Lakes typically contain aspects of both riverine and lacustrine (standing water) habitats, are usually found in the vicinity of river mouths, and are influenced by both the level of the adjacent lake and riverine inflows. The Fermi site is located near the mouth of Swan Creek, which borders the site to the north, and it is surrounded by coastal freshwater marsh habitat. The largest water body near the site is Lake Erie, which borders the site to the east. Lake Erie would serve as the source of cooling water for Fermi 3 and would receive discharge water from Fermi 3.

2.4.2.1 Aquatic Resources – Site and Vicinity

The aquatic resources on the Fermi site and vicinity occur in a variety of natural and constructed freshwater habitats (Figure 2-6). The discussion of aquatic resources present within the potentially affected area is divided among the prominent surface water features associated with the site, including:

- circulating water reservoir
- overflow and discharge canals
- drainage ditches
- Quarry Lakes
- wetland ponds and marshes managed as part of the DRIWR
- Swan Creek
- Stony Creek
- Lake Erie.

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 in the northern portion of the developed part of the Fermi site (Figure 2-6). This manmade reservoir encompasses an area of approximately 5 ac, is approximately 20 ft deep, and is clay-lined. Although the circulating water reservoir is periodically treated with chemicals to inhibit excessive growth of vegetation and the production of aquatic organisms, some benthic organisms and aquatic vegetation do occur in the reservoir. Overall, the habitat provided by the circulating water reservoir is not suitable for supporting significant populations of aquatic species.

Overflow and Discharge Canals

One clay-lined canal, approximately 5 to 10 ft deep and 70 ft wide, originates in the central portion of the Fermi site (along the western edge of the developed portion of the site) and extends northward, where it connects with Swan Creek after passing through a marshy area known as the North Lagoon. This constructed canal is referred to as the overflow canal (Figure 2-6). The overflow canal was historically used as a cooling water discharge and overflow canal for operation of Fermi 1 but ceased being used when Fermi 1 was temporarily shut down in the mid 1960s. Currently, the Fermi site uses the canal as a permitted wastewater discharge (Outfall 009; Figure 2-6). The outfall and discharge points of the Fermi site are further discussed in Section 2.3.3. Thirty fish species were captured in the overflow canal during surveys conducted in 2008; the most abundant species were bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*), emerald shiner (*Notropis atherinoides*), and gizzard shad (*Dorosoma cepedianum*) (AECOM 2009b).

A second manmade canal, referred to as the discharge canal, originates in the central portion of the Fermi site and extends southward, where it flows into the South Lagoon (Figure 2-6). This canal is approximately 5 to 10 ft deep and 70 ft wide and serves as a drainage for wetland areas located west of the developed portion of the Fermi site. Twenty-eight fish species were collected in the discharge canal during surveys conducted in 2008; the most abundant species were goldfish (*Carrasius auratus*), common carp (*Cyprinus carpio*), bluegill, pumpkinseed, and golden shiner (*Notemigonus crysoleucas*) (AECOM 2009b).

There is a third small water body located between the overflow and discharge canals. This manmade feature, referred to as the central canal, is stagnant and has no connections to the overflow canal or the discharge canal (Figure 2-6). Thirteen fish species were collected in the central canal during surveys conducted in 2008; the most abundant species were bluegill, gizzard shad, largemouth bass (*Micropterus salmoides*), white crappie (*Pomoxis annularis*), green sunfish (*L. cyanellus*), and bluntnose minnow (*Pimephales notatus*) (AECOM 2009b).

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 drainage ditches are periodically dry, and the habitat provided by the ditches is not suitable for supporting significant populations of aquatic species.

Quarry Lakes

The North and South Quarry Lakes are located in the southwestern portion of the Fermi site. The two lakes are approximately 50 ft deep and, in total, cover an area of approximately 100 ac. The quarry lakes were created when water filled abandoned rock quarries that were used for site development and for construction of Fermi 2 (Detroit Edison 1977).

The Quarry Lakes support a limited variety of aquatic species common to Lake Erie coastal marsh habitats. Nine fish species were collected in the Quarry Lakes during surveys conducted in 2008; the most abundant species were bluegill, gizzard shad, green sunfish, goldfish, and common carp (AECOM 2009b).

Wetland Ponds and Marshes Managed as Part of the DRIWR

The acreage managed as part of the DRIWR surrounds the developed portion of the Fermi site on the northern, western, and southern borders. This area encompasses approximately 656 ac that includes coastal wetlands and palustrine wetlands, such as freshwater emergent wetlands and small lakes that are semipermanently or seasonally inundated. These types of coastal wetlands are essential to many aquatic species because of the spawning, nursery, and feeding grounds they provide (Kellys Island Birds and Natural History 2006).

A fisheries survey of coastal marshes managed as part of the DRIWR was conducted in September 2005 as a joint venture by the MDNR and FWS to document fish communities associated with Michigan waters of Lake Erie and to inventory the fishery resources of the refuge. This survey used electrofishing and seining to sample four marsh complexes within the refuge, one of which was the Swan Creek Estuary located near the northern extent of the Fermi site. A total of 38 species of fish from 13 families were collected at this sampling site. Species most common in the catch included gizzard shad, bluntnose minnow, mimic shiner (*Notropis volucellus*), bluegill, pumpkinseed, goldfish, and largemouth bass. Thirty-three fish species were collected during fishery surveys conducted near the mouth of Swan Creek in 2008. The most abundant species in those collections were gizzard shad, emerald shiner, bluegill, brook silverside (*Labidesthes sicculus*), pumpkinseed, and golden shiner (AECOM 2009b).

Swan Creek

Swan Creek is located on the northern boundary of the Fermi site. It originates approximately 12 mi 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.

Swan Creek forms a freshwater estuary where it flows into Lake Erie. The aquatic habitat in this area is shallow, with large stands of submerged aquatic vegetation. Many areas along the shoreline support water lilies, cattails, common reed, and other emergent vegetation (Francis and Boase 2007; AECOM 2009b). The benthic habitat associated with this area of Swan Creek consists of sandy sediment interspersed with small pockets of gravel and flat stone (AECOM 2009b).

Benthic macroinvertebrates were collected during eight sampling events from July 2008 through June 2009 near the location where water from the North Lagoon area enters Swan Creek (AECOM 2009b). These collections were dominated by aquatic worms (*Haplotaxida,* 31 percent), small crustaceans (*Amphipoda,* 23 percent), and midge larvae (*Diptera,* 19 percent), among others (AECOM 2009b).

A fisheries survey of the Swan Creek estuary was conducted in September 2005 by the MDNR and FWS using electrofishing and seining to sample nine sites along Swan Creek ranging from approximately 0.5 to 2.5 mi from the Fermi site (Francis and Boase 2007). A total of 38 species from 13 families were collected at these sampling sites. Frequently encountered species included gizzard shad, bluntnose minnow, emerald shiner, mimic shiner, bluegill, pumpkinseed, goldfish, and largemouth bass (Francis and Boase 2007).

Fish were also collected from Swan Creek monthly from July 2008 to June 2009 (excluding winter months) near the location where water from the North Lagoon area enters Swan Creek (AECOM 2009b). Overall, the fish species encountered during these surveys were similar to those observed in the survey by Francis and Boase (2007) described above. A total of 1790 fish (33 species), were represented in the samples; dominant species included gizzard shad, emerald shiner, bluegill, brook silverside, and pumpkinseed (AECOM 2009b).

Swan Creek is popular with recreational anglers. Recreational fisheries data, discussed in Section 2.4.2.3, identify several species common to Michigan as being frequent catches in Swan Creek, including smallmouth bass (*Micropterus dolomieu*), largemouth bass, and bluegill.

Stony Creek

Stony Creek is located generally to the west of the Fermi site in Washtenaw and Monroe Counties, Michigan, and drains directly into the western basin of Lake Erie at a location approximately 3 mi southwest of the Fermi site boundary. Stony Creek is about 35 mi long. Land cover within the watershed includes forested areas, agricultural lands, and residential developments (Gustavson and Ohren 2005).

Some biological data were collected from Stony Creek and its tributaries. The Stony Creek Watershed Project performed studies focusing on water quality, nutrients, and indicator species, although the majority of the data from these studies were not collected near the Fermi site. A macroinvertebrate survey was conducted in 2004 at several sampling sites along Stony Creek to assess water quality. The nearest sampling site was located approximately 2.5 mi south-southwest of the Fermi site. Data on 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 abundance and diversity of mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*), and caddisflies (*Trichoptera*), which are three orders of insects that are considered sensitive to poor water quality. Together, the abundance of taxa in these three orders are used to calculate the "EPT index," (*Ephemeroptera-Plecoptera-Trichoptera* index) a measure of water quality, with a higher number of taxa from each of these orders generally indicating better water quality. The downstream sites (located nearest to the Fermi site) had a higher EPT index than did the upstream survey sites (Gustavson and Ohren 2005).

Fish surveys conducted in portions of Stony Creek located in Monroe County during 1997 indicated that the fish community in Stony Creek was dominated by taxa that are tolerant of degraded water quality conditions, although the fish community was rated as acceptable (MDEQ 1998). Dominant species found to be present included green sunfish, rock bass, (*Ambloplites rupestris*), common carp, and blackside darter (*Percina maculata*) (MDEQ 1998).

Lake Erie

The Fermi site is situated along the shoreline of Lake Erie. Lake Erie would serve as the source of cooling water for Fermi 3 and would also receive cooling water discharge from Fermi 3. Consequently, aquatic habitats and organisms in Lake Erie in the vicinity of the Fermi site have the greatest potential for being affected by building and operation of Fermi 3. This section describes the ecological setting and recent ecological history of Lake Erie, with a focus on the vicinity of the Fermi site.

Lake Erie is one of the five lakes included in the Great Lakes system and is the smallest of the group in volume (116 mi^3). Measuring 241 mi across and 57 mi from north to south, Lake Erie has a surface area of nearly 10,000 mi^2, with 871 mi of shoreline. The average depth of Lake Erie is approximately 62 ft (210 ft at its maximum depth) (EPA 2008).

Lake Erie is divided into three basins on the basis of the bathymetry of the lake: eastern basin, central basin, and 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 with regard to construction and operation of Fermi 3. The western basin receives 95 percent of the water that drains into Lake Erie, including five major river drainages (Maumee River, River Raisin, Huron River, and Detroit River) as well numerous smaller 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 ft in depth (LaMP Work Group 2008). While thermal stratification is a frequent and persistent condition during summer months for the central basin, stratification events are relatively rare and brief in the western basin (LaMP Work Group 2008; Bolsenga and Herdendorf 1993). As a consequence, the western basin is less likely to experience severe or prolonged episodes of oxygen depletion in deeper waters, which can result in large mortality events for aquatic species that are physiologically restricted to cooler water conditions.

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 ft. Lake Erie also experiences seiches in response to such surges. A seiche is a periodic oscillation of the water level set in motion by an atmospheric disturbance passing over the lake. Major shifts in winds, a significant storm front, or strong high- or low-pressure weather systems can initiate a seiche event. Seiche events can cause shoreline flooding in low-lying areas of the eastern basin and can cause shallow bay areas of the western basin to become exposed (LaMP Work Group 2008).

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 Great Lakes basins (LaMP Work Group 2008). The fertile soils associated with the Lake Erie watershed support intense agricultural production throughout the entire drainage basin. Greater urbanization, industrialization, and agricultural development, along with the smaller volume of water, make the Lake Erie ecosystem more susceptible to external stressors than the ecosystems of the other Great Lakes. This became apparent by the 1960s, when decades of nutrient enrichment (eutrophication) and chemical contamination resulted in severe degradation of the Lake Erie ecosystem. By the 1980s, positive recovery of Lake Erie's water quality was observed as a result of the implementation of remediation plans through the NPDES that helped meet targets for nutrient levels (especially phosphorus) established under the Great Lakes Water Quality Agreement (LaMP Work Group 2008). In addition to pollution abatement programs, colonization of Lake Erie by invasive zebra mussels (*Driessena polymorpha*) and quagga mussels (*D. rostriformi)* during this same period helped return the lake to more mesotrophic (i.e., less nutrient-rich) conditions.

There are indications, however, that total phosphorus concentrations in Lake Erie waters have again started to increase over the past decade; this trend has been hypothesized to be related to changes in lakewide nutrient dynamics and more frequent storm events (LaMP Work Group 2008). Coincident with (and perhaps attributable to) these increasing dissolved phosphorus loads, there have been increases in blooms of some undesirable algal taxa (e.g., *Cladophora* spp. and *Microcystis spp.*). In recent years, *Lyngbya wollei*, an invasive filamentous cyanobacterial (blue-green algae) species, has become a nuisance in some areas of the western basin, such as Maumee Bay (approximately 18 mi south-southeast of the Fermi site), that continue to experience higher levels of nutrient enrichment via riverine inputs (LaMP Work Group 2008).

The following sections summarize information for major ecological groups of aquatic organisms, including plankton, benthic invertebrates, and fish, that are present in the waters of Lake Erie.

Plankton

Plankton are very small aquatic organisms that drift in the water column and are unable to move or are too small or too weak to swim against water currents. Plankton serve as the base of the aquatic food chain in Lake Erie, providing food for larger aquatic organisms. The plant-like portion of the plankton community is called phytoplankton, and the animal-like portion is called zooplankton. Most phytoplankton serve as food for zooplankton, which is directly eaten by many species of fish (at least during early fish life stages). Zooplankton include animals that spend their entire lives in the plankton community (holoplankton) and the larval forms of many species of invertebrates and fish that are planktonic during early life stages. Fish eggs, larvae, and juveniles, called ichthyoplankton, also make up an important part of the overall zooplankton community.

Phytoplankton studies conducted in the 1980s and 1990s in nearshore waters of the western basin of Lake Erie demonstrated that phytoplankton biomass fluctuates seasonally, with the highest overall phytoplankton densities occurring in the spring. Phytoplankton density also varies spatially throughout the western basin, with increased phytoplankton abundance along the entire southern shore and decreased abundance offshore and throughout deeper waters. The types of phytoplankton typically documented in greatest abundance during those earlier studies were diatoms (*Bacillariophyceae*) and green algae (*Chlorophyceae*). Millie et al. (2009) found that the phytoplankton community in the western basin during the late summer from 2003 to 2005 was dominated by various species of green algae, diatoms, and cyanobacteria (blue-green algae).

Periodically, there can be a rapid increase in the population of particular species of planktonic algae that results in unusually high densities. Such events are referred to as algal blooms. Sometimes algal blooms can discolor water or produce other undesirable conditions. Decomposition of dead cells from algal blooms (regardless of the species involved) can sometimes lower the concentration of dissolved oxygen in the water, causing hypoxic (low oxygen) or anoxic (no oxygen) conditions that can result in fish kills. Of particular concern in Lake Erie is *Microcystis* spp., a phytoplanktonic species of blue-green alga that can produce a substance (cyanotoxin) that is toxic to fish and other organisms when concentrations are high enough (EPA 2009b). Under certain conditions (such as high nutrient concentrations, increased light levels, and calm weather, usually in summer), *Microcystis* can form dense aggregations of cells that form a thick layer (mat) on the surface of the water. At higher concentrations, *Microcystis* blooms can resemble bright green paint. *Mycrocystis* blooms can affect water quality as well as the health of human and natural resources.

Dominant zooplankton taxa in Lake Erie include various species of species of crustaceans such as copepods (e.g., *Cyclops* spp. and *Diaptomus* spp.), cladocerans (e.g., *Daphnia* spp., *Bosmina* spp., and *Leptodora* spp.), and rotifers (e.g., *Keratella* spp. and *Asplanchna* spp.), as well as other taxonomic groups. The very small early life stages of some fish species can be planktonic (Bolsenga and Herdendorf 1993). Zooplankton populations are typically lowest during winter months and most abundant during summer months (Bolsenga and Herdendorf 1993). 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 discussed further in Section 2.4.2.3.

Because plankton responds quickly to changes in nutrient inputs, phytoplankton and zooplankton are important indicators of nutrient pollution. One measure that has been developed to assess the biological health and diversity of offshore waters of Lake Erie is the Planktonic Index of Biotic Integrity (P-IBI) (Kane et al. 2009). This indicator, which is based on the abundance and number of different species groups of phytoplankton and zooplankton present in water samples, is used to evaluate the productivity level of the lake. Plankton productivity in formerly oligotrophic lakes is related to the anthropogenic introduction of phosphorus into lake waters from point sources (e.g., permitted discharge sites) or nonpoint sources (e.g., surface water runoff). Low productivity (oligotrophic condition) is associated with low phosphorus enrichment, moderate productivity (mesotrophic condition) is associated with moderate phosphorus levels, and high productivity (eutrophic condition) is associated with high phosphorus levels. Application of the P-IBI to the waters of the western basin of Lake Erie suggests that the overall condition of the western basin was mesotrophic during 1995 and became more eutrophic during the period from 2000 to 2003 (EPA 2009c).

<u>Benthic Invertebrates</u>

Benthic species inhabit the bottom of aquatic environments and serve as valuable indicators of the surrounding ecosystem. Benthic species include epifauna, which live on substrate surfaces, and infauna, which burrow into bottom sediments. Benthic communities consist of many different types of organisms and many different species. Examples of benthic invertebrates present in Lake Erie include mollusks (i.e., snails, mussels, and clams), various insect species (such as midges, mosquitoes, mayflies, stoneflies), and worms. The distribution and density of benthic organisms can be quite variable and are especially affected by the type of substrate (e.g., mud, sand, gravel, or cobble) and the water conditions present at a particular location. As are plankton, benthic organisms are an important link in the aquatic food chain, and the presence, absence, and abundance of some species or species groups can serve as indicators of local water conditions.

Benthic invertebrates were sampled by the applicant from two locations in Lake Erie just offshore from the Fermi site during 2008 and 2009 (AECOM 2009b) to determine those species that could be present in areas potentially affected by building and operating Fermi 3. One site (Lake Erie intake), located in water approximately 3–5 ft deep near the existing cooling water intake for Fermi 2 and the proposed intake location for Fermi 3, had a substrate that consisted of mud and sand. The benthic organisms collected at this site consisted primarily of various species of amphipods (62 percent of the organisms collected), dipterans (fly and midge larvae; 18 percent), and tubificid worms (10 percent) (AECOM 2009b). The second site, located in water approximately 1–4 ft deep at the southern end of the Fermi site near the South Lagoon, had a rocky substrate. Dominant taxa collected from this site included various species of ephemeropterans (mayflies; 19 percent), amphipods (18 percent), dipterans (14 percent), tubificid worms (13 percent), molluscs (13 percent), and water mites (11 percent) (AECOM 2009b).

There are four families of bivalve mollusks that live in the streams and lakes of Michigan: freshwater unionid mussels (*Unionidae*), fingernail and pea clams (*Sphaeriidae*), Asian clams (*Corbiculidae*), and zebra and quagga mussels (*Dreissenidae*). Unionid mussels and sphaeriid clams are native to North America, while Asian clams and zebra and quagga mussels are not native to this continent. The Asian clam (*Corbicula fluminea*) was introduced to North America in 1938 as a food species and has since spread throughout the United States. The Asian clam is present in Lake Erie. Pea clams and fingernail clams are fairly widespread and common in Michigan. Unionid mussels are of particular interest because of their unique life history, importance to aquatic ecosystems, and use as indicators of change in water and habitat quality. They have also undergone significant declines in range and abundance over the past century. Federally and State-listed threatened and endangered unionid mussels for Monroe County, Michigan, are identified in Section 2.4.2.3.

Unionid mussels require a fish host to complete their life cycle, whereas other bivalve families produce free-swimming larvae that develop into the adult form without a host. Eggs of unionid mussels are fertilized and develop into larvae within the gills of the female mussel. These larvae, called glochidia, are released into the water and must attach to the gills or fins of a suitable fish or amphibian host to survive and transform into the adult form. Glochidia are very small (approximately 0.1 mm in length) and do not significantly harm their hosts. Some unionids are known to have only one or two suitable host species, while others are generalists and use several fish species as hosts. Without the presence of healthy fish host populations, unionid mussels are unable to reproduce.

Although they were once widely distributed and common in the western basin of Lake Erie, declines in the abundance of unionid mussels have been documented since 1961 (Schloesser and Nalepa 1994). Although earlier declines were largely attributable to declines in water quality, the introduction and subsequent proliferation of zebra and quagga mussels in the late 1980s is believed to have been a primary factor in the large declines in (i.e., near extirpation of) unionid mussel populations in a large portion of western Lake Erie between 1989 and 1991 (Schloesser and Nalepa 1994).

Lake Erie was one of the first water bodies to be colonized by zebra mussels and quagga mussels in the late 1980s. Believed to have been introduced in ballast water of ocean-going vessels entering the Great Lakes, these non-native, invasive mussels have caused extensive economic and environmental impacts on Lake Erie as well as many other freshwater systems in the United States. Many power plants, including Fermi 2, have implemented control programs specifically to address these species, which can accumulate on intake and discharge structures, potentially affecting the efficiency of cooling water operations. Populations of native mussel species have also been affected by the introduction and proliferation of zebra and quagga mussels (USGS 2008; Schloesser and Nalepa 1994). Invasive nuisance species, including zebra and quagga mussels, are further discussed in Section 2.4.2.3.

Fish

Human activities have resulted in considerable changes in the nature of the Lake Erie fish community during the past century. These changes have resulted from many causes, including overfishing, introduction and expansion of invasive exotic species, nutrient enrichment (and reversal of nutrient enrichment), deterioration of tributaries and other habitat features, and introduction of contaminants (Regier and Hartman 1973).

Van Meter and Troutman (1970) listed 138 species of fish documented to occur in Lake Erie or its tributaries. Since then, additional non-native fish species have been introduced into Lake Erie, including ghost shiner (*Notropis buchanani*) and round goby (*Neogobius melanostomus*). Prior to 1900, lake trout (*Salvelinus namaycush*) was the dominant predator in the eastern basin of Lake Erie, with walleye (*S. vitreus*) and burbot (*Lota lota*) as subdominants. Before 1950, the dominant predatory fish species in the western and central basins included walleye and blue pike (*Sander vitreus glaucus*). The forage fish community in the western and central basins was dominated by emerald shiner, spottail shiner (*Notropis hudsonius*), and gizzard shad. In the eastern basin, the prey fish community was dominated by cisco (formerly called lake herring, *Coregonus artedi*). Changes in the structure of the fish community began to occur in the early 1900s, and fish community structure was very different by 1960 (Tyson et al. 2009). These changes were primarily attributed to invasions of fish such as sea lamprey (*Petromyzon* *marinus*), alewife (*Alosa pseudoharengus*), and rainbow smelt (*Osmerus mordax*); over-exploitation of important species, including the extinction of the blue pike; and declines in water quality and habitat degradation in nearshore areas and tributaries (Tyson et al. 2009). By the 1980s, Lake Erie's water quality started to improve as a result of reductions in nutrient inputs caused by remediation programs and a result of the colonization of Lake Erie by invasive zebra mussels and quagga mussels. These changes in the nutrient status of the lake, together with additional invasions by non-native species such as the round goby, have resulted in further changes in the structure of the fish community.

The western basin contains important fish spawning and nursery areas and is also important to commercial and recreational fisheries. Although movements of fish among basins make it difficult to explicitly define a fish community by basin, examples of dominant fish species in the western basin include yellow perch *(Perca flavescens*), walleye, smallmouth bass, channel catfish (*Ictalurus punctatus*), alewife, gizzard shad, carp, freshwater drum (*Aplodinotus grunniens*), and emerald shiner.

Fish were collected monthly from July 2008 to June 2009 (excluding winter months) at two sampling locations in Lake Erie just offshore from the Fermi site (AECOM 2009b) to determine those species that could be present in areas potentially affected by building and operating Fermi 3.. The intake location was near the existing cooling water bay for Fermi 2 and the proposed intake location for Fermi 3, while the other sampling location was along the Lake Erie shoreline near the South Lagoon. The two locations differed in the types of aquatic habitat that were present and had comparatively different species richness and abundance. The intake location was located along a sand and gravel beach in the open waters of Lake Erie and had little or no structure that would provide cover or spawning features. The South Lagoon location was near sand and gravel shoreline areas as well as vegetated shoreline areas that could provide cover and spawning areas for some fish species. In addition, the South Lagoon location was near the mouth of the drainage area for the South Lagoon, which has extensive aquatic vegetation; fish within that drainage can move freely from the lagoon out into the main body of the lake.

Overall, 5765 individual fish, composed of 40 species, were collected from the two Lake Erie sampling locations (Table 2-10). The most abundant species encountered in those collections were gizzard shad, goldfish, white perch (*Morone americana*), emerald shiner, spottail shiner, and bigmouth buffalo (*Ictiobus cyprinellus*) (Table 2-9) (AECOM 2009b).

Additional data on fish from the waters of Lake Erie near the Fermi site are provided in entrainment and impingement study results.

The rates at which fish eggs and fish larvae were entrained by the existing cooling water intake of Fermi 2 were measured from July 2008 through July 2009, excluding the months of December through February when ice cover was present and it was anticipated that spawning

Table 2-10. Percent Abundance of Fish Species Collected in Lake Erie near the Fermi Site during 2008 and 2009[(a)]

Common Name	Scientific Name	Intake Location	South Lagoon	Overall
Alewife	*Alosa pseudoharengus*	0.1	0.0	<0.1
Banded killifish	*Fundulus diaphanus*	0.5	0.5	0.4
Bigmouth buffalo	*Ictiobus cyprinellus*	2.7	4.8	4.1
Black bullhead	*Ameiurus melas*	0.0	2.9	1.9
Bluegill	*Lepomis macrochirus*	0.6	0.9	0.8
Bluntnose minnow	*Pimephales notatus*	0.3	5.5	3.8
Bowfin	*Amia calva*	0.0	0.1	0.1
Brook silverside	*Labidesthes sicculus*	0.0	2.6	1.7
Brown bullhead	*Ameiurus nebulosus*	0.0	0.3	<0.1
Channel catfish	*Ictalurus punctatus*	0.4	0.3	0.1
Common carp	*Cyprinus carpio*	0.5	5.6	3.8
Common shiner	*Luxilus cornutus*	0.0	0.3	<0.1
Emerald shiner	*Notropis atherinoides*	6.8	13.6	11.3
Freshwater drum	*Aplodinotus grunniens*	0.0	0.1	0.1
Gizzard shad	*Dorosoma cepedianum*	44.9	15.8	25.4
Golden redhorse	*Moxostoma erythrurum*	0.0	0.1	0.1
Golden shiner	*Notemigonus crysoleucas*	0.0	2.2	1.4
Goldfish	*Carassius auratus*	4.0	28.0	19.7
Green sunfish	*Lepomis cyanellus*	0.0	0.2	0.2
Largemouth bass	*Micropterus salmoides*	0.1	2.5	1.7
Longnose gar	*Lepisosteus osseus*	0.2	0.0	0.1
Logperch	*Percina caprodes*	0.0	0.5	<0.1
Longear sunfish	*Lepomis megalotis*	0.0	0.2	<0.1
Northern pike	*Esox lucius*	0.0	0.3	0.2
Pumpkinseed	*Lepomis gibbosus*	0.0	3.2	2.1
Quillback	*Carpiodes cyprinus*	0.1	0.7	0.5
Rock bass	*Ambloplites rupestris*	0.3	0.4	0.3
Round goby	*Neogobius melanostomus*	0.0	0.6	0.4
Sand shiner	*Notropis stramineus*	0.3	0.2	0.2
Smallmouth bass	*Micropterus dolomieu*	0.0	0.3	<0.1
Spotfin shiner	*Cyprinella spiloptera*	0.8	1.9	1.5
Spottail shiner	*Notropis hudsonius*	5.8	3.2	4.1
Spotted gar	*Lepisosteus oculatus*	0.0	0.3	<0.1

Table 2-10. (contd)

Common Name	Scientific Name	Intake Location	South Lagoon	Overall
Spotted sucker	*Minytrema melanops*	0.0	0.3	<0.1
Tadpole madtom	*Noturus gyrinus*	0.0	0.5	<0.1
Western mosquitofish	*Gambusia affinis*	0.0	0.3	<0.1
White perch	*Morone americana*	33.5	1.9	12.4
White sucker	*Catostomus commersoni*	0.3	0.2	0.2
Yellow bullhead	*Ameiurus natalis*	0.0	0.3	0.0
Yellow perch	*Perca flavescens*	0.0	1.8	1.2

Source: AECOM 2009b
(a) Percent of the individuals collected at site location.

by fish would be at minimum levels (AECOM 2009b). Entrainment rates (fish eggs plus larvae per unit volume of water) ranged from 4.82/m^3 in July 2009 to 0.00/m^3 in November 2008 and March 2009. The average annual entrainment rate for all species collected from July 2008 through July 2009 was 0.98/m^3. Of the 12 fish species identified in entrainment samples, the species with the highest annual entrainment rates included gizzard shad, emerald shiner, bluntnose minnow, and yellow perch (AECOM 2009b). Overall estimates of the total numbers of fish eggs and larvae entrained during the study period, calculated by multiplying monthly entrainment estimates by the volume of water drawn into the cooling system during each period, are presented in Table 2-11.

In general, fish species entrained during the 2008–2009 study (AECOM 2009b) were similar to those captured during a previous entrainment study (Lawler, Matusky, and Skelly Engineers 1993) conducted at the Fermi site from October 1991 to September 1992. The most abundant larval fish taxa entrained during the earlier study included Cyprinids (22.9 percent), *Morone* spp. (20.0 percent), gizzard shad (19.5 percent), Clupeids (8.8 percent), and white perch (6.2 percent); the taxa for which fish eggs were most abundant in entrainment samples included *Cyprinidae* (42.1 percent of eggs) and *Percidae* (22.4 percent of eggs).

Impingement data collected from 1991 to 1992 from the Fermi 2 intake indicated that the dominant species impinged was the gizzard shad, which accounted for 71.5 percent of the estimated total number of individual fish impinged during the study period. White perch was the second most abundant species impinged (6.8 percent of the estimated total). Third, fourth, and fifth species ranked by the estimated number of individuals affected were the rock bass, freshwater drum, and emerald shiner, respectively. Estimated numbers of fish impinged (by species) in 2008–2009 from Fermi 2 are presented in Table 2-12. During that period, gizzard shad accounted for approximately 39 percent, emerald shiner accounted for approximately 29 percent, and white perch accounted for approximately 10 percent of the total estimated numbers of fish impinged at the plant (AECOM 2009b). Overall, it is estimated that

Table 2-11. Estimated Numbers of Fish Eggs and Larvae Entrained by the Fermi 2 Cooling Water Intake from July 2008 through July 2009[a]

Common Name	2008					2009					Annual Total[b]
	Jul	Aug	Sep	Oct	Nov	Mar	Apr	May	Jun	Jul	
Gizzard shad	62,048							1,452,781	1,191,501	27,531,802	30,238,132
Emerald shiner	1,054,814	1,897,015					109,500	2,994,507	911,148	3,933,115	10,900,099
Bluntnose minnow		72,962					15,643	4,892,017	560,707		5,541,329
Yellow perch							140,786	4,121,154	560,707		4,822,647
Unidentified spp.				4,298,465							4,298,465
Freshwater drum										2,317,728	2,317,728
Round goby	62,048	510,735	141,109					770,863	210,265	70,234	1,765,254
Bigmouth buffalo								1,274,889	420,530		1,695,419
Channel catfish	434,335										434,335
Largemouth bass							62,571	88,946			151,517
Sunfish sp.								148,243			148,243
White perch	124,096										124,096
Unknown centrarchidae									70,088		70,088
Brook silverside								59,297			59,297
Total	**1,737,341**	**2,480,712**	**141,109**	**4,298,465**	**0**	**0**	**328,500**	**15,802,697**	**3,924,946**	**33,852,879**	**62,566,649**

Source: AECOM 2009b

(a) Based on measured entrainment rates and actual operational flow volume reported by Detroit Edison from July 2008 through July 2009.

(b) Annual estimate does not include data from December through February. The numbers of eggs and larvae are expected to be low during these months because it is outside the normal spawning period for most Lake Erie fish species.

Table 2-12. Estimated Numbers of Fish Impinged by the Fermi 2 Cooling Water Intake from August 2008 through July 2009[a]

	2008					2009							Annual	% of
Common Name	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr[b]**	**May**	**Jun**	**Jul**	**Total**	**Total**
Gizzard shad			62	150	930	62							1204	38.8
Emerald shiner	31	30	31		62	93	84	558					889	28.7
White perch	62	30	31	30	31		28	93					305	9.8
Bluegill					31	31	28	124					214	6.9
Round goby	31	30				31				31			123	4.0
Smallmouth bass	31							31					62	2.0
Spottail shiner										31		31	62	2.0
Banded killifish			31										31	1.0
Brook silverside	31												31	1.0
Largemouth bass			31										31	1.0
Bluntnose minnow		30											30	1.0
Channel catfish		30											30	1.0
Freshwater drum											30		30	1.0
Green sunfish		30											30	1.0
Rock bass		30											30	1.0
Total	**186**	**210**	**186**	**180**	**1054**	**217**	**140**	**806**		**62**	**30**	**31**	**3102**	**100.0**

Source: AECOM 2009b

(a) Based on measured impingement rates and actual operational flow volume reported by Detroit Edison from August 2008 through July 2009.

(b) Annual estimate does not include data from April 2009 because heavy debris prevented sample collection.

3102 individual fish were impinged by the Fermi 2 cooling water intake during the 2008–2009 sampling period (Table 2-12). Most of the fish species identified in impingement samples are considered forage species for other fishes. On the basis of an analysis conducted by the Lake Erie Forage Task Group (2010), it is estimated that the long-term average density of forage fish in size classes capable of being captured in nets and trawls is approximately 1,384,680 fish per square mile in the western basin. Assuming an estimate of approximately 1200 mi^2 for the western basin as a whole, the long-term average number of forage fish within the basin is estimated to be approximately 1.7 billion.

2.4.2.2 Aquatic Habitats – Transmission Lines

Aquatic habitats within or adjacent to the transmission line corridor that would serve Fermi 3 and are identified in the ER (Detroit Edison 2011a) include several small streams and numerous small drainage ditches. The new transmission line corridor does not cross any lakes, ponds, or reservoirs. Stony Creek, which is located in the developed eastern portion of the assumed route, is the largest stream crossed by the transmission line corridor and is described in Section 2.4.2.1.

Because of the small size of the streams and ditches present along the presumed transmission line path, detailed information regarding the aquatic species present in most of these water bodies is not readily available. Because of the small size of the drainages and because of the intermittent nature of flows in these surface water features, it is assumed that species diversity is similar to or lower than that described for Stony Creek in Section 2.4.2.1. There are no important commercial or recreational fisheries present within the assumed 300-ft ROW as a result of the small sizes of the drainages present.

2.4.2.3 Important Aquatic Species and Habitats – Site and Vicinity

Several criteria (see Section 2.4.1.3) identify important species that may be affected by building, operating, or maintaining a new facility. Aquatic species meeting these criteria include commercially or recreationally important fishery species, species considered to have vital roles in ecosystem dynamics, and Federally or State-listed species. On the basis of these criteria, 37 species that inhabit the freshwater habitats near the Fermi site were identified as important species (Table 2-13).

Brief summaries of distribution and life history information for important species are also provided; these summaries were developed from information provided by NatureServe (2009) unless otherwise indicated. Where applicable, information about impingement and entrainment during Fermi 2 operations is presented for each species based on recently collected impingement and entrainment data for the Fermi site (AECOM 2009b).

Table 2-13. Important Aquatic Species That Have Been Observed in the Vicinity of the Fermi Site[(a)]

Common Name	Scientific Name	Category[(b)]
Mollusks		
Elktoe	*Alismidonta marginata*	ESA-NL, MI-SC
Northern riffleshell	*Epioblasma torulosa rangiana*	ESA-E, MI-T
Purple lilliput	*Toxolasma lividus*	ESA-NL, MI-T
Purple wartyback	*Cyclonaias tuberculata*	ESA-NL, MI-T
Rayed bean	*Villosa fabalis*	ESA-PE, MI-E
Round hickorynut	*Obovaria subrotunda*	ESA-NL, MI-T
Round pigtoe	*Pleurobema sintoxia*	ESA-NL, MI-SC
Salamander mussel	*Simpsonaias ambigua*	ESA-NL, MI-T
Slippershell	*Alismidonta viridis*	ESA-NL, MI-T
Snuffbox mussel	*Epioblasma triquetra*	ESA-PE, MI-E
Wavyrayed lampmussel	*Lampsilis fasciola*	ESA-NL, MI-T
White catspaw	*Epioblasma obliquata perobliqua*	ESA-E, MI (presumed extirpated in Michigan)
Fish		
Bigmouth buffalo	*Ictiobus cyprinellus*	Commercial fishery
Brindled madtom	*Noturus miurus*	ESA-NL, MI-SC
Channel catfish	*Ictalurus punctatus*	Commercial fishery, recreational fishery
Channel darter	*Percina copelandi*	ESA-NL, MI-E
Common carp	*Cyprinus carpio*	Commercial fishery
Creek chubsucker	*Erimyzon claviformis*	ESA-NL, MI-E
Eastern sand darter	*Ammocrypta pellucida*	ESA-NL, MI-T
Freshwater drum	*Aplodinotus grunniens*	Commercial fishery
Gizzard shad	*Dorosoma cepedianum*	Commercial fishery
Goldfish	*Carassius auratus*	Commercial fishery
Lake whitefish	*Coregonus clupeaformis*	Commercial fishery
Largemouth bass	*Micropterus salmoides*	Recreational fishery
Orangethroat darter	*Etheostoma spectabile*	ESA-NL, MI-SC
Pugnose minnow	*Opsopoedus emiliae*	ESA-NL, MI-E
Quillback	*Carpiodes cyprinus*	Commercial fishery
River darter	*Percina shumardi*	ESA-NL, MI-E
Sauger	*Sander canadensis*	ESA-NL, MI-T
Silver chub	*Macrhybopsis storeriana*	ESA-NL, MI-SC
Silver shiner	*Notropis photogenis*	ESA-NL, MI-E
Smallmouth bass	*Micropterus dolomieu*	Recreational fishery
Southern redbelly dace	*Phoxinus erythrogaster*	ESA-NL, MI-E
Walleye	*Sander vitreus*	Commercial fishery, recreational fishery
White bass	*Morone chrysops*	Commercial fishery, recreational fishery
White perch	*Morone americana*	Commercial fishery
Yellow perch	*Perca flavescens*	Commercial fishery; recreational fishery

(a) Commercial and recreationally important species and Federally and State-listed species that could occur in the waters of the western basin of Lake Erie near the Fermi site and freshwater habitats of Monroe County, Michigan.
(b) ESA-E = listed under ESA as endangered, ESA-NL = not listed under ESA, ESA-PE = proposed for listing under ESA as endangered, MI-E = listed by the State as endangered, MI-SC = listed by the State as a species of concern, MI-T = listed by the State as threatened.

Commercially Important Species

While other waters in the vicinity of the Fermi site do not support commercial fisheries, Lake Erie supports one of the largest freshwater commercial fisheries in the world, with the majority of commercial fishing occurring along the Canadian border. Commercial landings in Lake Erie are dominated by yellow perch, walleye, rainbow smelt (*Osmerus mordax*), and white bass (*Morone chrysops*). In the western basin of Lake Erie, management of commercial fisheries falls under the jurisdiction of the MDNR, the Ohio Department of Natural Resources (ODNR), or Ontario Ministry of Natural Resources, depending upon where the fishing occurs. The Great Lakes Fisheries Commission coordinates fisheries research and facilitates cooperative fishery management among the State, Provincial, Tribal, and Federal agencies that manage fishery resources within the Great Lakes and has established a Lake Erie Committee that considers issues pertinent to Lake Erie waters.

Commercial harvest in the Michigan waters of Lake Erie for 2007 (the year for which the most recent report is available) was conducted by using shoreline seining and trap-net fishing gear. Overall, 13 species of fish were included in the harvest, for a total of 1,058,253 lb with an estimated value of $398,251 (Thomas and Haas 2008). Total weight of the 2007 commercial harvest was the highest since 1985 (Thomas and Haas 2008). As shown in Table 2-14, the commercial catch was dominated by five species that accounted for over 80 percent of the total harvest by weight: gizzard shad (23 percent), carp (23 percent), bigmouth buffalo (20 percent),

Table 2-14. Commercial Fishery Statistics for Michigan Waters of Lake Erie during 2007

Species	Harvest (lb)	% of Total Harvest	Reported Market Value	% of Total Value
Gizzard shad	242,695	22.9	$63,445	15.9
Common carp	241,066	22.8	$64,290	16.1
Bigmouth buffalo	215,632	20.4	$93,126	23.4
Channel catfish	98,979	9.4	$40,340	10.1
White bass	77,249	7.3	$64,113	16.1
Freshwater drum	67,072	6.3	$10,935	2.7
Goldfish	38,515	3.6	$26,278	6.6
White perch	35,946	3.4	$18,199	4.6
Lake whitefish	8800	0.8	$8540	2.1
Other species[a]	32,299	3.1	$8985	2.3
Total	1,058,253	100	$398,251	100

Source: Thomas and Haas 2008

(a) Other species included bullheads, suckers, quillback, and chub.

channel catfish (9 percent), and white bass (7 percent) (Thomas and Haas 2008). Other species harvested include freshwater drum, goldfish, white perch, and lake whitefish (*Coregonus clupeaformis*).

Commercial harvest in the Ohio waters of Lake Erie (western, central, and eastern basins combined) for 2009 was conducted by using trap-net, seining, and trotline fishing gear. Overall, 14 species (or species groups) of fish were included in the reported harvest, for a total of more than 5 million pounds with an estimated value of more than $4 million (ODNR 2010). Total weight of the 2009 commercial harvest was the highest reported in the past 10 years (ODNR 2010). Of these totals, the commercial harvest in the Ohio waters of the western basin of Lake Erie for 2009 was composed of 12 species of fish and totaled almost 2.3 million lb (Table 2-15).

Table 2-15. Commercial Fishery Statistics for Ohio Waters of the Western Basin of Lake Erie during 2009

Species	Harvest (lb)	% of Total Harvest
White bass	593,626	25.9
White perch	535,367	23.4
Freshwater drum	321,629	14.0
Lake whitefish	287,278	12.5
Channel catfish	200,839	8.8
Quillback	162,486	7.1
Bigmouth buffalo	111,881	4.9
Common carp	41,547	1.8
Suckers	27,209	1.2
Bullhead	3998	0.2
Goldfish	1694	0.1
Gizzard shad	1686	0.1
Total	2,289,240	100

Source: ODNR 2010

The catch was dominated by five species, which accounted for approximately 75 percent of the total catch by weight: white bass, white perch, freshwater drum, lake whitefish, and channel catfish (Table 2-15). Although yellow perch has historically been a significant component of the commercial fishery in the Ohio waters of the western basin, this area was closed to commercial yellow perch harvest in 2008 and 2009.

Additional information about the distribution and life history for commercially important species that could be present in Lake Erie in the vicinity of the Fermi site is summarized below.

<u>Bigmouth Buffalo (*Ictiobus cyprinellus*)</u>

The bigmouth buffalo is fairly common throughout North America from the Mississippi River Basin stretching from Louisiana to Ohio, to southern Michigan, Wisconsin, Minnesota, North Dakota, Montana, the lower Great Lakes Basin, the Hudson Bay Basin (Nelson River drainage) and Saskatchewan. This species makes up a portion of the commercial fishery in the western basin of Lake Erie.

The preferred habitat for bigmouth buffalo consists of the main channels, pools, and backwaters of small to large sluggish rivers, oxbows, bayous, reservoirs, and lakes. The bigmouth buffalo is tolerant of low oxygen levels and high temperatures. These fish prefer to spawn after spring floods, doing so in flooded marshes and river bottoms or in tributary streams. Both juvenile and adult members of this species rely mainly on planktonic and bottom dwelling invertebrates as food sources.

It is estimated that approximately 1.7 million bigmouth buffalo eggs and larvae were entrained at the Fermi site during 2008, primarily during the months of May and June (AECOM 2009b; Table 2-11). No bigmouth buffalo juveniles or adults were observed during impingement studies conducted at the Fermi site during 2008 and 2009 (AECOM 2009b).

<u>Channel Catfish (*Ictalurus punctatus*)</u>

Channel catfish occur mostly in the central drainages of North America, from southern Canada to northern Mexico. This species has been widely distributed throughout the United States as well as other countries. Channel catfish prefer clean, well-oxygenated water of rivers and streams but also inhabit ponds and lakes. They occur in locations ranging from clear, rapid-flowing waters over firm bottoms to turbid, slow-moving water over mud substrates.

Channel catfish have been known to migrate hundreds of miles throughout their lifetime. They generally spawn between April and July, and females lay up to 20,000 eggs in nests dug in sandy substrates. Males then guard and fan water across the nest during the 3- to 8-day incubation period. Larval development lasts about 2 weeks, and schools of larvae may persist for weeks after leaving the nest. Sexual maturity is reached anywhere from 2 to 8 years, and adults may reach over 130 cm and live up to 16 years.

Juvenile channel catfish eat mainly small invertebrates and insects and prey increasingly on crayfish and fishes as they grow. Adults eat mainly fish but will also feed on insects, small mammals, and vegetation.

The potentially large size and food quality of channel catfish make it a highly sought-after sport fish, and this species also has a significant commercial value in Lake St. Clair and Lake Erie. It was estimated that approximately 435,000 channel catfish eggs and larvae were entrained and 30 individual fish were impinged by the Fermi 2 cooling water intake during studies conducted in 2008 and 2009 (Tables 2-11 and 2-12).

Common Carp (*Cyprinus carpio*)

The common carp is native to temperate Eurasia, where it has been domesticated and bred for human food for several centuries. Common carp were first introduced into the United States around 1872, and the species was subsequently stocked throughout the United States. Carp are now found in every State except Hawaii and Alaska, in five Canadian provinces, and on every continent except Antarctica.

This species is typically found in rivers, lakes, ponds, reservoirs, swamps, or low-salinity estuaries, usually in shallow water with abundant vegetation and little or no current. The species is tolerant of a wide range of oxygen, salinity, turbidity, and bottom conditions. Common carp usually spawn in shallows and flooded areas, although deeper water may also be used. Eggs are dispersed and stick to submerged objects. Fry remain attached to the vegetation for about 2 days before dropping to the bottom, and inhabit shallow, warm, and slow-moving water during their first summer.

Common carp are omnivorous, and adults eat primarily invertebrates, detritus, fish eggs, and plant material. Fry feed on zooplankton but will also eat phytoplankton if zooplankton densities are low.

Common carp make up a relatively large portion of the commercial fishery within the western basin of Lake Erie, as described above. No common carp were identified in impingement or entrainment samples collected at the Fermi site during 2008 and 2009 (AECOM 2009b).

Freshwater Drum (*Aplodinotus grunniens*)

The freshwater drum occurs throughout North and Central America. The species ranges from the St. Lawrence, Great Lakes, Hudson Bay, and Mississippi River Basins, Gulf Coast drainages, south through eastern Mexico and down to Guatemala.

Freshwater drum occur in a variety of habitats but are usually found in large, silty lakes and large rivers. They generally occur over mud bottoms in open water. Freshwater drum spawn from spring to late summer as water temperatures reach 51–72°F. They broadcast eggs in shallow water, which float on the surface and hatch in about 1 day. Males generally reach sexual maturity in 2 to 4 years, while females take 4 to 6 years. Maximum life expectancy for this species is 10 years. Juvenile drum feed primarily on small crustaceans and insect larvae.

Adults are mostly benthic foragers, and prey items include insect larvae, crustaceans, fishes, and mollusks such as clams and snails.

Freshwater drum are harvested commercially in Lake Erie, although there is not a significant recreational fishery for this species. It is estimated that approximately 2.3 million freshwater drum eggs and larvae were entrained by the Fermi 2 cooling water intake during a study conducted in 2008 and 2009; entrainment was observed only in July 2009 (AECOM 2009b; Table 2-11). Approximately 30 individual freshwater drum were impinged during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009 (AECOM 2009b; Table 2-12).

Gizzard Shad (*Dorosoma cepedianum*)

The gizzard shad is distributed widely in the continental United States from Utah and Arizona eastward to the Atlantic seaboard. This species occurs throughout the Great Lakes region within both the United States and Canada and is common within the western basin of Lake Erie.

As an adult, the gizzard shad can reach 9 to 14 in. in length and can weigh up to 2 lb. This fish can thrive in a wide variety of habitats, including large rivers, reservoirs, lakes, swamps, bays, sloughs, and similar quiet open waters. Young and juveniles live in relatively clear and shallow waters, while adult gizzard shad tend to stay in deeper waters or near the bottom. Although gizzard shad are capable of withstanding temperatures from approximately 43 to 91°F, they are very sensitive to cold water temperatures, and large numbers are often found dead in the spring when the ice melts off of reservoirs and lakes.

Female gizzard shad can produce as many as 500,000 eggs, which are spawned by scattering them over sandy or rocky substrates. The eggs adhere to objects on the bottom until hatching 2 to 4 days later. Sexual maturity is generally reached in 2 to 3 years. Their lifespan is approximately 4 to 6 years, although a few individuals survive beyond 3 years of age. Because of the large numbers of eggs produced, gizzard shad populations are often capable of rebounding quickly following overwinter die-offs.

Juvenile gizzard shad are planktivores, feeding on both zooplankton and phytoplankton. Adults are primarily bottom filter-feeding detritivores, mostly eating plants and animals that live attached to hard substrates such as sand and rocks.

Gizzard shad often travel in large schools, and young gizzard shad are ecologically significant because they serve as prey for many species of commercially and recreationally important fish. Because of their rapid growth rates, many individuals are too large to be eaten by most other fish by the end of their first year of life. Recreational anglers commonly use gizzard shad as a bait fish, and the species makes up a substantial portion of the commercial harvest in the Michigan waters of Lake Erie.

Gizzard shad was the most commonly entrained species during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, and it is estimated that approximately 30.2 million gizzard shad eggs and larvae were entrained during the 1-year study period (AECOM 2009b; Table 2-11). In addition, gizzard shad was the most commonly impinged species during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, with approximately 1200 individuals impinged during the year (AECOM 2009b; Table 2-12).

Goldfish (*Carrasius auratus*)

Goldfish are native to Eurasia and have been introduced throughout the United States and in parts of southern Canada. They were first introduced in the Great Lakes around 1885 and have since become well established in the region. They are abundant in the shallow bays and marshes of western Lake Erie and can also be found in slow-moving tributaries.

Goldfish can grow to be 12 in. or larger, although most individuals are considerably smaller. Goldfish spawn during the spring and summer in shallow water, and the eggs adhere to vegetation and substrates. A single female can produce several lots of eggs within a season. Hatching occurs in 2 to 14 days, depending on water temperature.

Goldfish feed on a variety of small aquatic invertebrates and vegetation. Because of their abundance within shallow habitats, including marsh habitats, of the western basin and because of their relatively small size, goldfish are a potentially important prey species for fish-eating fish and birds. Goldfish also have some commercial importance within the western basin, making up approximately 4 percent of the commercial harvest in Michigan waters of the basin. Although goldfish were relatively abundant in collections made during fish surveys on and near the Fermi site, no goldfish were identified in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

Lake Whitefish (*Coregonus clupeaformis*)

Lake whitefish occur throughout most of Canada and Alaska, south to northern New England, in the Great Lakes region, and in central Minnesota. Lake Erie is considered to be at the southern extent of the range for this species. Lake whitefish have also been introduced as forage and food fish in other areas, including the states of Montana, Idaho, and Washington.

The lake whitefish is a cool water species that has a narrow temperature tolerance and requires cold, well oxygenated bottom waters throughout the summer in order to survive. Optimum temperature for the lake whitefish ranges from 50 to 57°F for adults and 60 to 67°F for juveniles. This species usually spawns during late fall or early winter over rocky or sandy substrates in water less than 25 ft deep. Eggs hatch in the early spring, and sexual maturity is generally reached in 5 to 7 years. Young lake whitefish subsist primarily on zooplankton, while adults usually eat bottom-dwelling invertebrates and small fishes.

Lake whitefish are an indicator of ecosystem health and an important component of the Great Lakes food web. During the late 19th and early 20th centuries, large numbers of lake whitefish entered the Detroit River each year to spawn (EPA 2009d). Reports indicate that the lower Detroit River was a prolific spawning area prior to the construction of the Livingstone Shipping Channel. The timing of this construction coincides with the degradation of whitefish populations in the river and western Lake Erie (EPA 2009d). Recently, populations of lake whitefish were once again discovered in the Detroit River, but further studies are necessary to ascertain their presence in other tributaries of western Lake Erie (EPA 2009d).

Lake whitefish historically made up a large proportion of the commercial fishery in the western basin of Lake Erie. In the late 1800s and early 1900s, more than 500,000 lb of lake whitefish were commercially harvested each year, but catches declined drastically after that period. There have been improvements in the fishery more recently, and the commercial lake whitefish landings in all of Lake Erie exceeded 1 million lb in 2000 (EPA 2009d). In the western basin, the commercial harvest of lake whitefish was only 8800 lb in Michigan waters during 2007, and it was more than 287,000 lb in Ohio waters during 2009 (Tables 2-14 and 2-15). Lake whitefish were not observed in collections made during fish surveys on and near the Fermi site, and no lake whitefish were identified in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

Quillback (*Carpiodes cyprinus*)

The quillback has a wide distribution in North America, with inhabited areas encompassing an area with a northward boundary from the Alberta to Quebec Provinces in Canada, southward to the Gulf Slope, and eastward to the Atlantic slope drainages. The species is relatively common in the Great Lakes, including Lake Erie.

These fish are suited to a variety of aquatic habitat conditions, including pools, backwaters, and main channels and clear to turbid waters of creeks, rivers, and lakes. Spawning usually occurs in April through May over sand and mud bottoms in quiet waters of streams, overflow areas in bends of rivers, or the bays of lakes. Quillbacks sometimes migrate up small streams and creeks during the spring and summer in order to find suitable spawning habitat. Both adults and juveniles are omnivorous, feeding on organic matter in bottom sediments, insect larvae, and plant material.

The quillback is a small component of the commercial fisheries in the Michigan and Ohio waters of the western basin (Tables 2-14 and 2-15). In Ohio, commercial harvest of quillback averaged more than 200,000 lb per year from 2000 through 2009 (ODNR 2010). Although small numbers of quillback were collected during fish surveys on and near the Fermi site, no quillback were present in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

Walleye (*Sander vitreus*)

The walleye is the largest member of the perch family and can be found in all of the Great Lakes, where it is a native species. Walleye have been introduced and are stocked widely in the United States; the distribution for the species now extends across most of the continental United States and Canada.

The walleye can be found in a variety of large bodies of freshwater, including lakes, pools, backwaters, rivers, and flooded marshes. It prefers deep waters and avoids bright light. This species spawns in late spring or early summer in turbulent rocky areas in rivers, coarse gravel shoals in lakes, or in flooded marshes. Eggs hatch in approximately 26 days. Adults may migrate up to 100 mi between spawning habitat and nonspawning habitat. Sexual maturity is reached in 2 to 4 years for males and in 3 to 8 years for females. Young walleye up to 6 weeks of age primarily eat zooplankton and small fishes, whereas adults feed upon fishes and larger invertebrates. Adults typically range in length from 13 to 25 in. and weigh 1 to 5 lb.

The walleye is considered an extremely important commercial and recreational fishery resource in Lake Erie. Although the commercial fisheries for walleye in the Michigan and Ohio waters of Lake Erie have been closed for many years, commercial fishing for walleye in the western basin waters of Ontario has continued, and the annual harvest since 1976 has averaged approximately 1.5 million fish per year (range is approximately 113,000 to approximately 2.8 million fish) (Lake Erie Walleye Task Group 2010). The western basin also supports a popular recreation fishery, with average harvests of approximately 1.6 million, 293,000, and 39,000 fish in the western basin waters of Ohio, Michigan, and Ontario, respectively, since 1975 (Lake Erie Walleye Task Group 2010).

Because of the importance of walleye to the commercial and recreational fisheries in Lake Erie, the status of walleye populations in the lake are closely monitored by various agencies. The Lake Erie Committee of the Great Lakes Fishery Commission has formed the Walleye Task Group to bring together information from various agencies so that the population status of walleye in Lake Erie can be monitored each year. This task group maintains and updates centralized datasets, improves population models so that scientifically defensible abundance estimates and forecasts can be produced, makes recommendations regarding allowable harvest levels, and helps identify studies that need to be conducted to address data gaps (Lake Erie Walleye Task Group 2010). Modeled abundance estimates of walleye in Lake Erie for the period from 1980 to 2010 indicate that the overall numbers of walleye aged 2 and older have varied considerably, ranging from a low of approximately 15 million individuals in 2004 to a high of approximately 74 million individuals in 1988 (Figure 2-13). Estimated abundance for 2010 was approximately 30 million fish (Lake Erie Walleye Task Group 2010).

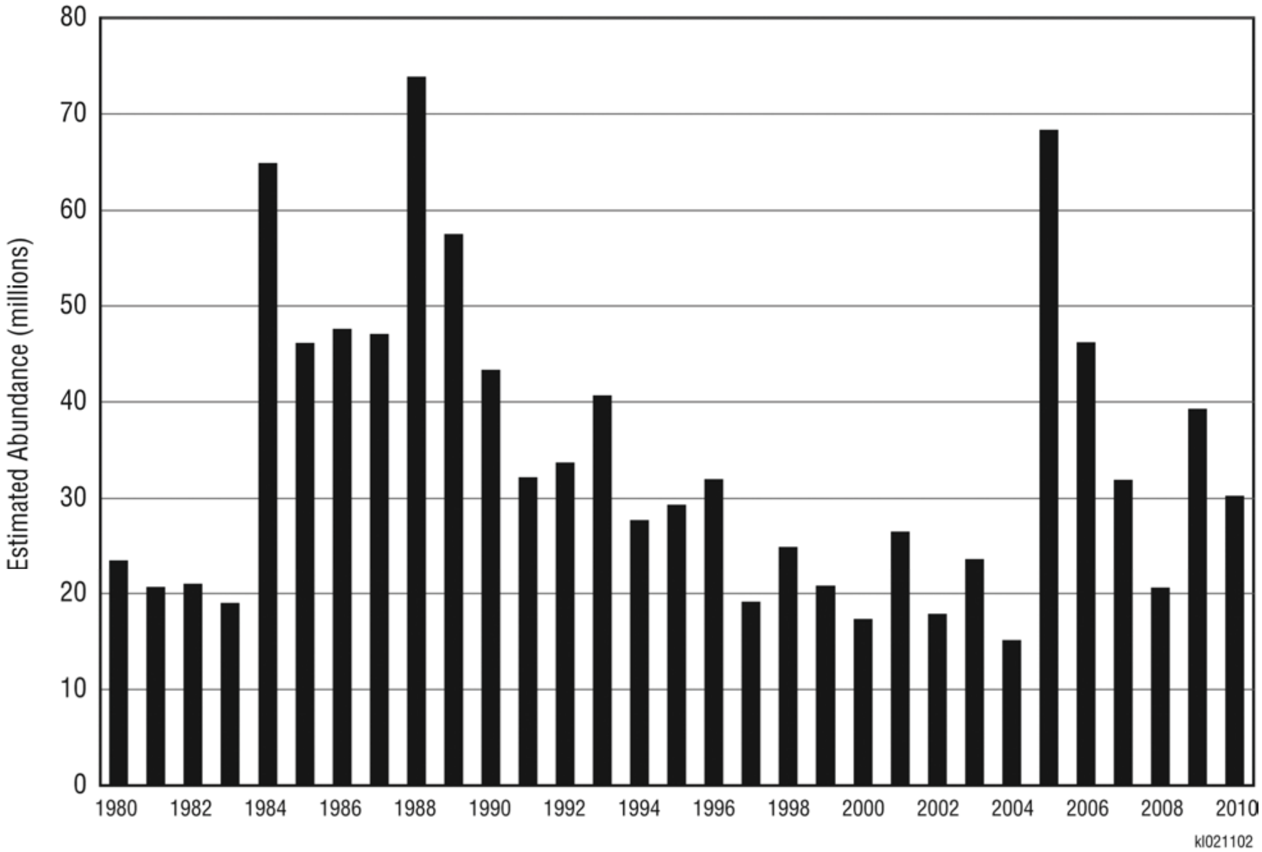


Figure 2-13. Estimated Abundance of Walleye Aged 2 and Older in Lake Erie, 1980–2010 (Lake Erie Walleye Task Group 2010)

No walleye were observed in collections made during fish surveys in aquatic habitats on and near the Fermi site, and no walleye were present in impingement or entrainment samples collected at the Fermi 2 cooling water intake during 2008 and 2009 (AECOM 2009b).

White Bass (*Morone chrysops*)

The white bass is distributed across the United States and eastern Canada. It is a relatively common species in the Great Lakes, including Lake Erie. White bass typically inhabit open waters of large lakes and reservoirs and pools of slow-moving rivers. Often travelling in schools, white bass tend to occur in offshore waters during the day and in inshore waters at night.

Tributary streams appear to be the preferred spawning habitat, but white bass may also spawn along lake shores with high wave action. Spawning occurs during the spring, usually over rock or gravel substrate in water up to 10 ft deep. After hatching, the young fish generally remain in shallow water for a period of time before migrating to deeper areas. White bass become sexually mature at 1 to 3 years of age and usually do not live past 4 years of age. As adults, they can reach up to 16 in. in length and can weigh up to 4 lb. White bass are carnivores, eating zooplankton, insect larvae, and other fish.

White bass is a notable component of the commercial fisheries in the Michigan and Ohio waters of the western basin (Tables 2-14 and 2-15). By weight, white bass accounted for approximately 7 percent of the fish commercially harvested from Michigan waters of Lake Erie in 2007 (Table 2-14) and for 25 percent of the fish commercially harvested from Ohio waters of the western basin in 2009 (Table 2-15).

White bass are also an important recreational fishing species in each of these States. In general, it is reported that very few angler boat trips specifically target white bass, and the majority of white bass are harvested as incidental catch from anglers targeting other species (ODNR 2010). However, when adult fish are moving into major tributaries to spawn during the spring, the aggregations of fish can attract many anglers, especially in major spawning tributaries such as the Maumee River (Bolsenga and Herdendorf 1993). The recreational noncharter boat harvest of white bass from Michigan waters in the western basin during 2007 was estimated to be 7911 individual fish (Thomas and Haas 2008). From 2000 to 2009, the recreational white bass harvest in the Ohio waters of the western basin averaged over 72,000 individual fish per year, with a peak of 121,000 fish caught in 2009 (ODNR 2010).

Although small numbers of white bass were collected on and near the Fermi site, no white bass were present in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

<u>White Perch (*Morone americana*)</u>

White perch are native to the east coast of the United States and Canada but can be found in the Great Lakes area, where they are considered an introduced species. This species was first observed in Lake Erie in 1954 and has been abundant in the lake since the 1980s (Bolsenga and Herdendorf 1993). On the Atlantic coast, they are typically found in brackish waters, but they have adapted to inland freshwater lakes and tributaries.

White perch spawn in the spring by releasing their eggs in the shallow waters of tributaries. The eggs sink and stick to the bottom until hatching approximately 4 days later. After hatching, the young feed initially on small planktonic organisms, and, as they grow larger, their diet changes to include aquatic insects, invertebrates, other fishes, and the eggs of other fish species.

White perch make up a component of the commercial fish harvest in the western basin of Lake Erie. In 2007, approximately 36,000 lb (3.4 percent of the commercial harvest) of white perch were reported in Michigan waters of the western basin (Table 2-14). In Ohio waters of the western basin, white perch was the second most dominant species in the commercial catch during 2009, with more than 535,000 lb reported (23.4 percent of the commercial catch by weight) (Table 2-15). Although white perch is generally regarded as an undesirable sport fish in the Great Lakes, it is considered an excellent sport fish in the eastern United States.

White perch was one of the dominant fish species collected during fish surveys on and near the Fermi site during 2008 and 2009. Overall, white perch accounted for more than 12 percent of the individual fish collected during the surveys and more than 33 percent of the individuals collected in areas near the existing Fermi 2 cooling water intake location (Table 2-10). It is estimated that more than 124,000 white perch eggs and larvae were entrained during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009 (AECOM 2009b; Table 2-11). In addition, white perch was the third most commonly impinged species during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, with approximately 305 individuals being impinged during the year (AECOM 2009b; Table 2-12).

Yellow Perch (*Perca flavescens*)

The yellow perch is native to the Great Lakes region but can be found in almost all 50 States as well as most of Canada. This species is one of the most common fish in Michigan waters; is commonly found in Lake Erie; and is assumed to occur throughout the Detroit River, Swan Creek, Stony Creek, and in other surface water habitats on the Fermi site.

Yellow perch usually travel in schools and are generally associated with the clear, shallower waters of lakes or weedy backwaters of creeks and rivers. Yellow perch usually grow to be 6 to 10 in. long and weigh between 6 and 16 oz. Yellow perch spawn in the spring in shallower waters over submerged beds of aquatic vegetation or over sand, gravel, or rubble. The eggs, which are laid in gelatinous strands that can be several feet long, usually hatch in 10 to 20 days. Sexual maturity is reached in 2 to 3 years for males and in 3 to 4 years for females; the maximum lifespan is about 10 years. Larval and young yellow perch feed primarily on zooplankton, whereas adults feed on larger invertebrates and small fish.

Yellow perch is one of the most popular and economically valuable sport and commercial fish in Lake Erie and is considered an indicator of the ecological condition of Lake Erie (EPA 2009f). Because of the importance of yellow perch in Lake Erie, the status of yellow perch populations in the lake is closely monitored by various agencies. The Lake Erie Committee of the Great Lakes Fishery Commission has formed the Yellow Perch Task Group to bring together information from various agencies so that the population status of yellow perch in Lake Erie can be monitored each year. This task group maintains and updates centralized datasets of information needed to evaluate population status and support population and harvest modeling efforts and makes recommendations regarding sustainable harvest levels (Lake Erie Yellow Perch Task Group 2010).

After peaking in the late 1800s, commercial catches of yellow perch in the Detroit River and the western basin of Lake Erie decreased substantially through the 1960s. These decreases are attributed primarily to a combination of high levels of fishing pressure and deteriorating water quality. Improvement in yellow perch population levels occurred during the 1970s as fishing pressure declined and as water quality improved as a result of lakewide pollution control programs that were implemented (EPA 2009f). Numbers of yellow perch in Lake Erie dropped again to very low levels during the early 1990s, possibly because of the combined effects of a lakewide invasion of zebra and quagga mussels, fishing pressure, and unsuitable weather conditions (EPA 2009f). Yellow perch populations increased again beginning in the latter portion of the 1990s, and, while they are not at the levels observed during the 1970s and 1980s, they have remained relatively stable since that time (Figure 2-14) (EPA 2009f; Lake Erie Yellow Perch Task Group 2010). In addition to potentially being affected by water quality, fishing pressure, and invasive species, yellow perch are one of the principal prey items for walleye. As a consequence, as walleye populations increase, there is often a corresponding decrease in yellow perch populations (EPA 2009f).

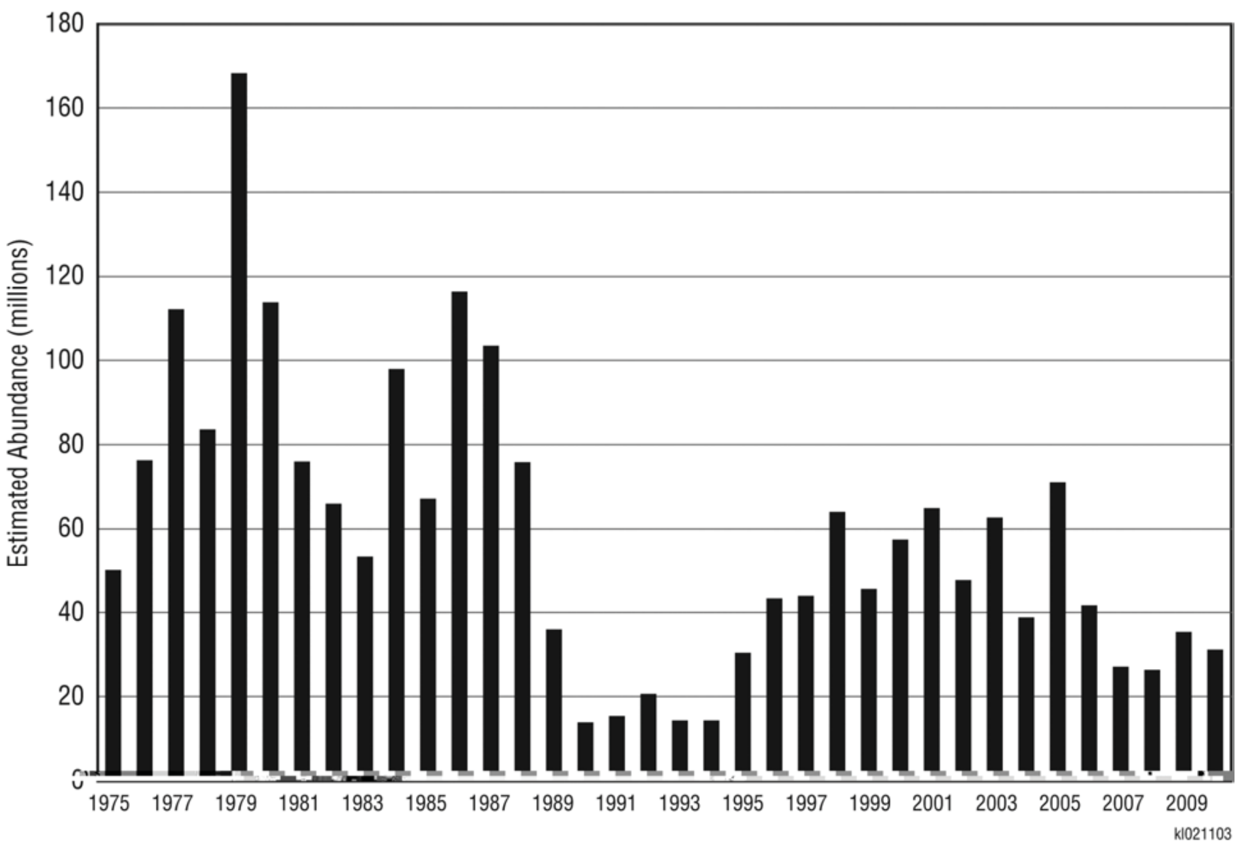


Figure 2-14. Estimated Abundance of Yellow Perch Aged 2 and Older in the Western Basin of Lake Erie, 1975–2010 (Lake Erie Yellow Perch Task Group 2010)

Although yellow perch historically made up a large portion of commercial fishery in the western basin of Lake Erie, the commercial perch fishery in Michigan waters has been closed since 1970, and the commercial perch fishery in the western basin waters of Ohio has been closed since 2008. From 1999 to 2008, the annual commercial harvest of yellow perch in Ohio waters of the western basin ranged from approximately 179,000 lb to 357,000 lb (mean of approximately 255,000 lb). Commercial fishing for yellow perch also occurs in the western basin waters of Ontario, Canada, where it ranged from approximately 534,000 lb to 1.7 million lb (mean of approximately 1.1 million lb) from 1999 to 2009 (Lake Erie Yellow Perch Task Group 2010).

Yellow perch is present in at least low numbers in most of the surface water habitats on the Fermi site, on the basis of fish surveys conducted in 2008 and 2009 (AECOM 2009b). Yellow perch was among the most common species observed during entrainment studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, and it is estimated that more than 4.8 million yellow perch eggs and larvae were entrained during the year-long study (AECOM 2009b; Table 2-11). No yellow perch adults or juveniles were observed during impingement studies conducted at the Fermi 2 cooling water intake during the same period (AECOM 2009b; Table 2-12).

Recreationally Important Species

Lake Erie is the warmest and most biologically productive of the Great Lakes, producing more fish each year than any of the other Great Lakes (Bolsenga and Herdendorf 1993). Walleye and yellow perch are the most popular recreational species in the western basin of Lake Erie.

The total noncharter sport harvest from the Michigan waters of Lake Erie for 2009, based on creel surveys, was estimated at 460,425 fish (Thomas and Haas 2010). Walleye and yellow perch together accounted for 93 percent of the reported recreational fishing harvest. Walleye harvest rates had declined since the previous estimate obtained in 2007, while yellow perch harvest rates were at the highest levels observed since 1998. It is estimated that noncharter boat anglers harvested 85,348 walleye and 344,811 yellow perch during 2009, whereas charter boat anglers harvested 10,258 walleye and 9989 yellow perch (Thomas and Haas 2010). Reported recreational harvests of other species from the Michigan waters of Lake Erie were considerably lower than those of walleye and yellow perch; they included white perch, channel catfish, freshwater drum, largemouth bass, smallmouth bass, and rainbow trout (Thomas and Haas 2010).

In 2009, sport anglers made more than 300,000 trips to fish in the Ohio waters of the western basin of Lake Erie, and the private sport boat fishing effort within the Ohio waters of the basin totaled more than 1.6 million hours (ODNR 2010). Charter boat fishing effort within the Ohio waters of the western basin in 2009 totaled approximately 158,000 hours (ODNR 2010). Estimates of angler hours indicate that most of the private boat angling effort was directed toward walleye (56 percent of angler hours) and yellow perch (35 percent). Smallmouth bass (4 percent), white bass (2 percent), and largemouth bass (2 percent) were less commonly targeted by private boat anglers (ODNR 2010). Charter boat anglers mainly targeted walleye (95 percent of angler hours), followed by yellow perch (4 percent) and smallmouth bass (<1 percent). The total (combined private and charter boat) recreational harvest of fish from the Ohio waters of the western basin in 2009 was estimated at approximately 2.6 million fish, made up primarily of walleye (21 percent of harvest), yellow perch (72 percent of harvest), and white bass (5 percent of harvest). Smallmouth bass, white perch, freshwater drum, channel catfish, and other species accounted for less than 2 percent of the recreational harvest within the Ohio waters of the western basin of Lake Erie (ODNR 2010). On the basis of fish surveys conducted in 2008 and 2009, each of these recreationally important species, with the exception of walleye, is present in Lake Erie adjacent to the Fermi site and/or in onsite surface water habitats (AECOM 2009b).

Sport fish landings are managed by using State-implemented fishing regulations, such as harvest quota systems and requirements for fish to be within certain length limits to be harvested. Typical goals of such regulations are to maintain the numbers of catchable-sized and reproductive-sized individuals at desired levels and to maintain sustainable population levels. For example, walleye fisheries throughout Lake Erie were affected by reduced spawning, which resulted in a lower adult abundance during the 1990s. Harvest quotas and other fishing regulations for walleye became more restrictive because of this reduced adult population, and the result was a rebound in the adult walleye population. Subsequently, less restrictive fishing regulations for the walleye have been implemented in more recent years. Other species-specific fishing regulations have been implemented by the States of Michigan and Ohio.

Recreational angling also occurs in other waters within the vicinity of the Fermi site, such as ponds and tributary drainages of Lake Erie. Swan Creek supports a recreational fishery for common game fish, including largemouth bass and bluegill. Portions of the creek located near recreational areas, such as public parks, receive the largest share of fishing pressure. There are no significant recreational fisheries within the boundaries of Stony Creek, the area managed as part of the DRIWR, or other water bodies located at the Fermi site.

Because many of the recreationally important aquatic species that occur in the vicinity of the Fermi site are also commercially important, the distribution and life history information for those species was summarized above. The distribution and life history information for other recreationally important species that may occur in the vicinity of the site is summarized below.

<u>Bluegill (*Lepomis macrochirus*)</u>

The bluegill is popular with many recreational anglers and is important ecologically because it can affect the composition of aquatic communities by controlling zooplankton populations and by serving as an important prey item for many larger fishes, including largemouth bass and northern pike.

The bluegill is native to the Great Lakes and Mississippi River Basins from Quebec and New York to Minnesota and south to the Gulf of Mexico. It is also native to the Atlantic and Gulf Slope drainages from the Cape Fear River, Virginia, to the Rio Grande, Texas, and New Mexico, and also northern Mexico (Page and Burr 1991). It has been introduced throughout North America and is now found in many other parts of the world. This sunfish species most commonly inhabits shallow lakes, ponds, reservoirs, sloughs, and slow-flowing streams. It is often associated with rooted aquatic vegetation and silt, sand, or gravel substrates.

Bluegills lay eggs in a nest excavated in shallow water by the male on bottoms of gravel, sand, or mud that contain pieces of debris. Adult bluegills can reach sizes of between 10 and 16 in. and may live longer than 10 years. Young bluegill feed primarily on planktonic crustaceans, insects, and worms. Adults eat mainly aquatic insects, small crayfish, and small fishes; in some bodies of water, adults may primarily consume zooplankton.

The bluegill is very common in the immediate vicinity of the Fermi site, according to recent fish surveys. Francis and Boase (2007) found that bluegills made up approximately 9 percent of the individual fish collected during surveys in Swan Creek. Bluegills were also found in most aquatic habitats associated with the Fermi site during surveys conducted in the 2008–2009 period, and, overall, they accounted for 13 percent of the individual fish collected (AECOM 2009b). Impingement rates measured at the cooling water intake indicate that an estimated 214 bluegills were impinged at the Fermi 2 cooling water intake from August 2008 through July 2009 (Table 2-12; AECOM 2009b), accounting for approximately 7 percent of the fishes impinged by Fermi 2 during the sampling period. No bluegill eggs or larvae were specifically identified in entrainment samples collected at the Fermi 2 cooling water intake from August 2008 through July 2009 (AECOM 2009b). However, it was estimated that approximately 70,000 eggs or larval stages of fish in the same fish family (*Centrarchidae*) would be entrained annually on the basis of the presence of eggs and larvae not identifiable to the species level (AECOM 2009b). Some portion or all of these unidentified eggs and larvae could have been those of bluegill.

<u>Largemouth Bass (*Micropterus salmoides*)</u>

The largemouth bass is native to the Great Lakes, Hudson Bay (Red River), and Mississippi River Basins from southern Quebec to Minnesota and south to Texas, throughout the Gulf Coast and southern Florida, and in Atlantic coast drainages from North Carolina to Florida. Because of its popularity as a sport fish, this species has been introduced throughout the United States, southern Canada, and much of world. Largemouth bass occur in a variety of habitats, including clear and turbid waters of lakes, ponds, reservoirs, and swamps and pools or in backwater areas of creeks and rivers. They are often found in areas containing aquatic vegetation.

Largemouth bass spawn primarily in the spring and summer in water temperatures of 60°F or higher. Males excavate nests in shallow water. After a female deposits eggs in the nest, the male guards the eggs, which hatch within a few days. Largemouth bass reach sexual maturity in 2 to 5 years and can attain sizes as large as 38 in., although approximately 28 in. is a typical size for older adult fish. This species feeds mainly upon zooplankton as fry. As the juvenile grows, it begins to prey on larger organisms, including insects, crustaceans, and small fish. Adults prey mainly on fish but are also known to eat other organisms, including crayfish and frogs.

The largemouth bass is a popular sport fish in the Great Lakes region, including Lake Erie and its tributaries. This species is present, at least in low numbers, in most of the surface water habitats on the Fermi site, according to fish surveys conducted in 2008 and 2009 (AECOM 2009b). Largemouth bass was among the species observed during entrainment studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, and it is estimated that approximately 152,000 largemouth bass eggs and larvae were entrained during the year-long study (AECOM 2009b; Table 2-11). On the basis of species-specific impingement rates measured at the Fermi 2 cooling water intake, it is estimated that a total of 31 largemouth bass individuals were impinged at the Fermi 2 cooling water intake during the period from August 2008 through July 2009 (AECOM 2009b; Table 2-12).

<u>Smallmouth Bass (*Micropterus dolomieu*)</u>

The smallmouth bass is native to the St. Lawrence-Great Lakes, Hudson Bay (Red River), and Mississippi River Basins from southern Quebec to North Dakota and south to northern Alabama and eastern Oklahoma. It has been widely introduced throughout the United States, southern Canada, and other countries. Smallmouth bass prefer large, clear lakes (especially in the northern part of the range) and clear, intermediate-sized streams that contain large pools and abundant cover (rocks, shelves, logs, etc.), and they prefer cool summer temperatures. Adults typically seek the shelter of pools or deep water during the day.

Spawning habitat includes shallow water in lakes or quiet areas of streams, often fairly close to shore. In lakes, spawning adults sometimes move a short distance up a stream to spawn. Spawning generally occurs in late spring or early summer. Females deposit eggs in nests that are constructed by the males; nests usually occur near cover on gravel or sand bottoms. Eggs typically hatch in 2 to 10 days, and males guard eggs and hatchlings for a period of 4 weeks or longer. Individuals usually attain sexual maturity at 2 to 6 years of age, depending on local conditions. Young fish eat primarily small crustaceans and aquatic insects (e.g., midge larvae and pupae) until the fish are about 2 in. in length. After that, smallmouth bass primarily eat fish, although crayfish, amphibians, and larger insects often become dominant foods of local populations or seasonally.

In addition to being a species that has recreational importance, smallmouth bass have ecological importance as being one of the top-level predators in aquatic habitats in the Great Lakes region. Smallmouth bass make up a small component of the aquatic community in the immediate vicinity of the Fermi site, according to recent fish surveys. Francis and Boase (2007) captured low numbers of smallmouth bass in collections from Swan Creek. Smallmouth bass were not found in most aquatic habitats on the Fermi site during surveys conducted in the 2008–2009 period (AECOM 2009b), perhaps because many of these habitats have conditions (e.g., warm summer water temperatures and high turbidity) that are not optimal for smallmouth bass. On the basis of impingement rates measured at the cooling water intake, it is estimated that 62 smallmouth bass were impinged at the Fermi 2 cooling water intake from August 2008 through July 2009 (AECOM 2009b;Table 2-12), accounting for approximately 2 percent of the fishes impinged by Fermi 2. No smallmouth eggs or larvae were identified in entrainment samples collected at the Fermi 2 cooling water intake from August 2008 through July 2009 (AECOM 2009b). However, it was estimated that approximately 70,000 eggs or larval stages of fish in the same fish family (*Centrarchidae*) would be entrained annually, on the basis of the presence of eggs and larvae not identifiable to the species level (AECOM 2009b). Some portion or all of these unidentified eggs and larvae could have been those of smallmouth bass.

Federally and State-Listed Aquatic Species

This section presents information about the Federally and Michigan State-listed threatened and endangered aquatic species in the vicinity of the Fermi site. Federally and State-listed aquatic species that may occur on or near the Fermi site or in the counties through which the proposed transmission line corridor would pass (Monroe, Washtenaw, and Wayne Counties) are indicated in Table 2-16.

A freshwater mussel (northern riffleshell, *Epioblasma torulosa rangiana,* federally listed as endangered) could occur in waters of Monroe and Wayne Counties in Michigan. A second freshwater mussel (white catspaw, *E. obliquata perobliqua*, federally listed as endangered) was last reported from Wayne and Monroe Counties in 1930 and is believed to have been extirpated from the State of Michigan. In addition, two freshwater mussels, the rayed bean (*Villosa fabalis*) and the snuffbox mussel (*E. triquetra*), have been proposed for listing by the FWS (75 FR 67552) and have a potential to occur within Monroe, Washtenaw, or Wayne Counties. None of these species has been specifically documented to occur either on the Fermi site or along the proposed transmission line route, although they have a potential to occur within one or more of the counties where project activities (including the proposed transmission line ROW) could occur. No Federally designated aquatic critical habitats occur near the Fermi site.

Table 2-16. Federally and State-Listed Aquatic Species That Have Been Observed in Monroe, Washtenaw, and Wayne Counties, Michigan, and the Potential for Their Occurrence on the Fermi Site

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Monroe County[c]	Wayne County[c]	Washtenaw County[c]	Fermi Site[d]
Mollusks							
Elktoe	*Alismidonta marginata*		SC	X		X	U
Ellipse	*Venustaconcha ellipsiformis*		SC			X	U
Gravel pyrg	*Pyrgulopsis letsoni*		SC	X		X	U
Hickorynut	*Obovaria olivaria*		E		X	X	U
Northern riffleshell	*Epioblasma torulosa rangiana*	E	E	X	X		U
Purple lilliput	*Toxolasma lividus*		E	X			U
Purple wartyback	*Cyclonaias tuberculata*		T	X	X	X	U
Rainbow	*Villosa iris*		SC		X	X	U
Rayed bean	*Villosa fabalis*	PE	E	X	X		P
Round hickorynut	*Obovaria subrotunda*		E	X	X		U
Round pigtoe	*Pleurobema sintoxia*		SC	X	X	X	U
Salamander mussel	*Simpsonaias ambigua*		E	X	X		P
Slippershell	*Alismidonta viridis*		T	X		X	U
Snuffbox mussel	*Epioblasma triquetra*	PE	E	X	X	X	P
Wavyrayed lampmussel	*Lampsilis fasciola*		T	X		X	U
White catspaw	*Epioblasma obliquata perobliqua*	E[e]	E[e]	X	X		U
Fish							
Brindled madtom	*Noturus miurus*		SC	X	X	X	P
Channel darter	*Percina copelandi*		E	X	X		U
Creek chubsucker	*Erimyzon claviformis*		E	X			U
Eastern sand darter	*Ammocrypta pellucida*		T	X	X		U
Lake sturgeon	*Acipenser fulvescens*		T		X		U
Northern madtom	*Noturus stigmosus*		E		X	X	U
Orangethroat darter	*Etheostoma spectabile*		SC	X		X	U
Pugnose minnow	*Opsopoedus emiliae*		E	X	X		P

Table 2-16. (contd)

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Monroe County[c]	Wayne County[c]	Washtenaw County[c]	Fermi Site[d]
Pugnose shiner	*Notropis anogenus*		E		X	X	U
Redside dace	*Clinostomus elongatus*		E		X	X	U
River darter	*Percina shumardi*		E	X	X		U
River redhorse	*Moxostoma carinatum*		T		X		U
Sauger	*Sander canadensis*		T	X	X		P
Silver chub	*Macrhybopsis storeriana*		SC	X	X		O
Silver shiner	*Notropis photogenis*		E	X		X	U
Southern redbelly dace	*Phoxinus erythrogaster*		E	X		X	U
Spotted gar	*Lepisosteus oculatus*		SC			X	U

(a) Federal status rankings determined by the FWS under the Endangered Species Act: E = endangered; PE = proposed for Federal listing as endangered.
(b) State species information provided by MNFI (2007g): E = endangered; T = threatened; SC = species of special concern.
(c) County-level occurrence based on information provided by MNFI (2007g): X = the species has been observed within the identified county.
(d) O = species observed on or adjacent to the Fermi site; P = possible occurrence due to presence of potentially suitable habitat and nearby populations, but has not been reported on or adjacent to the Fermi site; U = unlikely to occur due to absence of nearby populations and/or lack of suitable habitat on or adjacent to the Fermi site. Species for which there was no record of occurrence reported by the MNFI (2007g) for Monroe County were considered unlikely to occur on the Fermi site.
(e) The white catspaw is considered extirpated from Michigan (MNFI 2007g).

The State of Michigan has listed 33 aquatic species as endangered (17 species), threatened (7 species), or of special concern (9 species) in Monroe, Wayne, or Washtenaw County (Table 2-16) (MNFI 2007g). Of these, 17 species are fish and 16 species are mollusks (15 freshwater mussels and 1 snail species). Species of special concern are those that are considered to be rare in Michigan or those for which the status of the population is uncertain.

Additional information about the distribution, life history, population status, and potential for occurrence of Federally and State-listed threatened and endangered aquatic species that could be present in the vicinity of the Fermi site is provided below. MNFI (2007g) presents additional information about distribution, life history, and ecology of species of special concern to the State of Michigan.

Hickorynut (*Obovaria olivaria*)

The hickorynut is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the hickorynut includes eastern North America, from western Pennsylvania and New York to Missouri, Iowa, and Kansas, and from Michigan and the St. Lawrence drainage southward to Alabama and Arkansas (Badra 2004a). In Michigan, the historic range for this species included the Kalamazoo, Grand, Menominee, Saginaw, and Detroit Rivers, as well as Lake Erie and Lake St. Clair (Badra 2004a). Habitat for the hickorynut consists of sand or mixed sand and gravel substrates in large rivers and lakes (Badra 2004a).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid individuals of the hickorynut retain larvae internally over the winter and release glochidia in the spring (Badra 2004a). The shovelnose sturgeon (*Scaphirhynchus platorynchus*) and freshwater drum have been shown to be suitable hosts, and it is possible that additional species are used as hosts in natural environments (Badra 2004a). Like all freshwater mussels, the hickorynut is a filter feeder.

Principal threats to the hickorynut include siltation and runoff from human activities, damming and dredging of rivers, and the spread of introduced invasive species. Zebra mussels pose a threat for freshwater mussels because they compete for food and benthic habitat and because they attach to the shells of native mussels, making it difficult for the mussels to move and feed properly. The hickorynut was last observed in Washtenaw County in 1996 and in Wayne County in 2006; the hickorynut has not been reported from Monroe County (MNFI 2007g). Although streams with conditions suitable for the hickorynut are not present on the Fermi site, some nearshore areas in Lake Erie in the vicinity of the site could potentially provide suitable substrate. Since no large rivers will be crossed by the proposed transmission line ROW, it is unlikely that this species would be present in stream areas crossed by the transmission line corridor.

Northern Riffleshell (*Epioblasma torulosa rangiana*)

The northern riffleshell is a freshwater unionid mussel (see Section 2.4.2.1) that was Federally listed as an endangered species in 1993 and is also listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the northern riffleshell includes Illinois, Indiana, Kentucky, Michigan, Ohio, Pennsylvania, West Virginia, and western Ontario (Carman and Goforth 2000b). It was once widespread in the Ohio and Maumee River Basins and in tributaries of western Lake Erie (Carman and Goforth 2000b). In Michigan, the northern riffleshell is known to currently occur only in the Black River in Sanilac County and the Detroit River in Wayne County (Carman and Goforth 2000b). More than 100 individuals from the Detroit River population were relocated to the St. Clair River in 1992 as part of an effort to establish a new population, but the success of that effort is not known (Carman and Goforth 2000b).

The habitat for the northern riffleshell is fine to coarse gravel in riffles and runs of streams with swift currents (MNFI 2007g). The general life history of unionid mussels is described in Section 2.4.2.1. The northern riffleshell holds larvae over the winter and releases glochidia in the spring (Carman and Goforth 2000b). In the laboratory, glochidia developed with brown trout (*Salmo trutta*), bluebreast darter (*Etheostoma camurum*), banded darter (*Etheostoma zonale*), and banded sculpin (*Cottus carolinae*) as hosts; however, these fish species do not occur in the areas of Michigan that could harbor northern riffleshell populations, suggesting that there are also other hosts (Carman and Goforth 2000b). The age at maturity for northern riffleshells is not known, but this species may reach 15 years of age (Carman and Goforth 2000b). Like all freshwater mussels, the northern riffleshell is a filter feeder.

The survival of this species depends on the protection and preservation of suitable habitat and host fish species. Principal threats to survival of the species are similar to those described previously for the hickorynut. The northern riffleshell was last observed in Monroe County in 1977 and in Wayne County in 2006 (MNFI 2007g). The northern riffleshell has not been reported from Washtenaw County (MNFI 2007g). Streams with conditions suitable for the northern riffleshell are not present on the Fermi site; it is currently unknown if appropriate habitats are present in stream areas that are crossed by the proposed transmission line corridor. The portions of Lake Erie adjacent to the Fermi site do not offer suitable habitat for this species.

Purple Lilliput (*Toxolasma lividus*)

The purple lilliput is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the purple lilliput extends from Michigan south to Alabama and from Missouri and Arkansas eastward to Virginia (Carman 2002a). In Michigan, the purple lilliput is generally restricted to the southeastern portion of the State, and spent shells have been found from sites in the River Raisin in Monroe

Country (Carman 2002a). The purple lilliput occurs in small to medium-sized streams and occasionally in large rivers and lakes; the preferred substrate for this species is well-packed sand or gravel and a water depth of less than 1 m (MNFI 2007g).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid purple lilliputs have been known to retain the larvae internally for about a year, although populations in Michigan reportedly produce multiple broods in a single year (Carman 2002a). Fish hosts for the purple lilliput include green sunfish and longear sunfish (*Lepomis megalotis*) (Carman 2002a), both species that have been observed in aquatic habitats associated with the Fermi site (AECOM 2009b). Like all freshwater mussels, the purple lilliput is a filter feeder.

Principal threats to survival of the species are similar to those described previously for the hickorynut. The purple lilliput was last reported from Monroe County in 1977; it has not been reported from Wayne or Washtenaw County (MNFI 2007g). Streams with conditions suitable for the purple lilliput are not present on the Fermi site; it is currently unknown if appropriate habitats are present in stream areas that are crossed by the proposed transmission line corridor. The portions of Lake Erie adjacent to the Fermi site do not offer suitable habitat for this species.

<u>Purple Wartyback (*Cyclonaias tuberculata*)</u>

The purple wartyback is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as threatened by the State of Michigan (MNFI 2007g). The historic range for the purple wartyback includes eastern North America, from Ontario, Canada, south to Alabama, west to Oklahoma, and east to Pennsylvania (Badra 2004b). It is present in the Mississippi River, Ohio River, Lake Michigan, Lake St. Clair, and Lake Erie drainages (Badra 2004b). The purple wartyback is found in medium to large rivers with gravel or mixed sand and gravel substrates in areas with relatively fast current (Badra 2004b).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid individuals of the purple wartyback release glochidia during the same summer that they are fertilized (Badra 2004b). The yellow bullhead and channel catfish have been shown to be suitable hosts for the purple wartyback, and it is possible that additional species are used as hosts in natural environments (Badra 2004b). Like all freshwater mussels, the purple wartyback is a filter feeder.

Principal threats to survival of the species are similar to those described previously for the hickorynut. The purple wartyback was last reported from Monroe, Wayne, and Washtenaw Counties in 2000, 2006, and 2005, respectively (MNFI 2007g). Streams with conditions suitable for the purple wartyback are not present on the Fermi site, and Lake Erie adjacent to the Fermi site does not offer suitable habitat for this species. Since no large or medium rivers are crossed by the proposed transmission line corridor, it is unlikely that this species would be present in stream areas associated with the corridor.

Rayed Bean (*Villosa fabalis*)

The rayed bean is a freshwater unionid mussel (see Section 2.4.2.1) that has been proposed for Federal listing as endangered. This species is listed as endangered by the State of Michigan and has been recorded in Monroe and Wayne Counties (MNFI 2007g). The rayed bean is patchily distributed in the St. Lawrence, Ohio, and Tennessee River drainages (Carman 2001f). Although it was historically widespread from Ontario to Alabama and Illinois to New York, only a few populations are currently known to exist, and it is assumed to be extirpated throughout much of its former range (Carman 2001f). As of November 2010, extant populations were known from 28 streams in Indiana, Michigan, New York, Ohio, Pennsylvania, West Virginia, and the province of Ontario in Canada. In Michigan, existing rayed bean populations are known from the Black, Pine, Belle, and Clinton River systems.

The rayed bean is generally found in smaller headwater creeks, although it has also been found in larger rivers (FWS 2002). They usually are found in or near shoal or riffle areas; there are also records of rayed bean specimens from shallow, wave-washed areas of Lake Erie, generally associated with islands in the western portion of the lake (FWS 2002). Preferred substrates are gravel and sand, and it is oftentimes found among the roots of vegetation growing in riffles and shoals (FWS 2002).

The general life history of unionid mussels is described in Section 2.4.2.1. The rayed bean reportedly holds glochidia internally over the winter for release in the spring; female rayed beans bearing eggs have been found in May (Carman 2001f). Fish hosts for the glochidia could include the Tippecanoe darter (*Etheostoma tippecanoe*), greenside darter (*Etheostoma blennioides*), rainbow darter (*Etheostoma caeruleum*), mottled sculpin (*Cottus bairdi*), and largemouth bass (FWS 2002). The limited data available suggest that the lifespan for the rayed bean is less than 20 years (FWS 2002). As are other freshwater mussels, the rayed bean is a filter feeder.

The rayed bean has experienced a significant reduction in range, and most of its populations are isolated and appear to be declining (FWS 2002). The survival of the rayed bean is threatened by a variety of stressors, especially habitat destruction associated with siltation, dredging, and channelization and the introduction of alien species such as the Asian clam and zebra and quagga mussels (FWS 2002). The rayed bean was last observed in Monroe County in 1984 and in Wayne County in 2006 (MNFI 2007g), although these observations were based on the presence of shells, not living specimens (Carman 2001f). The rayed bean has not been reported from Washtenaw County (MNFI 2007g).

There are no streams on the Fermi site with conditions suitable for the rayed bean, and no extant populations are known to occur in the stream drainages that would be crossed by the proposed transmission line route. Although there are records of rayed bean specimens (valves, not live specimens) from shallow, wave-washed areas of western Lake Erie, information supplied by Detroit Edison suggests that it is unlikely that the species occurs in the vicinity of the Fermi site for a number of reasons, as follows. First, approximately 30 years of information on mussels in the western basin of Lake Erie (including in the vicinity of the Fermi site) have been collected and evaluated by the USGS, and no rayed bean specimens have been identified. Second, the USACE conducted mussel surveys in Lake Erie approximately 2 mi south of the Fermi site and found no live specimens or shells of the rayed bean. Third, the rayed bean was not observed in surveys conducted by the MNFI just north of the Fermi site near the mouth of Swan Creek. Fourth, observations made by divers during sediment sampling and buoy maintenance activities within the exclusion zone for the Fermi site indicate that the sediment is predominantly clay hardpan and not suitable for the rayed bean (Detroit Edison 2010c).

Round Hickorynut (*Obovaria subrotunda*)

The round hickorynut is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the round hickorynut includes much of eastern North America, from Ontario and New York southward to Arkansas, Mississippi, Alabama, and Georgia. It has historically been present in the Ohio, Tennessee, Cumberland, and Mississippi River systems, as well as the St. Lawrence and Lake Erie/Lake St. Clair drainages (Carman 2001g). In Michigan, the round hickorynut occurs in the Lake St. Clair and Lake Erie drainages, and it has historically been observed in Sanilac, St. Clair, Macomb, Wayne, Monroe, and Lenawee Counties (Carman 2001g). The round hickorynut is found in sand and gravel substrates of moderately flowing medium to large rivers and along the shores of Lake Erie and Lake St. Clair, near river mouths (Carman 2001g).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid individuals of the round hickorynut retain fertilized larvae over the winter and release glochidia during the early summer (Carman 2001g). The host fish species for the round hickorynut is unknown (Carman 2001g). Like all freshwater mussels, the round hickorynut is a filter feeder.

Principal threats to survival of the species are similar to those described previously for the hickorynut. The round hickorynut was last reported from Monroe and Wayne Counties in 1977 and 2000, respectively; there are no reports of this species from Washtenaw County (MNFI 2007g). Streams with conditions suitable for the round hickorynut are not present on the Fermi site, although areas in Lake Erie near the mouths of Swan Creek or Stony Creek could contain suitable substrates. Since no large or medium rivers are crossed by the proposed transmission line corridor, it is unlikely that this species would be present in stream areas associated with the corridor.

Salamander Mussel (*Simpsonaias ambigua*)

The salamander mussel is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the salamander mussel includes North America from Ontario southward to Tennessee, where it is found in the Great Lakes Basin in the Lake St. Clair, Lake Huron, and Lake Erie drainages. The salamander mussel is also found in the Ohio River, Cumberland River, and upper Mississippi River drainages (Carman 2002b). The salamander mussel is found in medium to large rivers and in lakes. It is usually found in silt or sand substrates under flat stones (MNFI 2007g).

The general life history of unionid mussels is described in Section 2.4.2.1. The biology of the salamander mussel is poorly understood. Gravid females release glochidia in the spring or summer (Carman 2002b). The host for the salamander mussel is the mudpuppy (*Necturus maculosus*) (Carman 2002b), a large (8 to 15 in. long) salamander species that inhabits many water bodies in Michigan. Like all freshwater mussels, the salamander mussel is a filter feeder.

Principal threats to survival of the salamander mussel are similar to those described previously for the hickorynut. The salamander mussel was last reported from Monroe and Wayne Counties in 1977 and 1998, respectively; there are no reports of this species from Washtenaw County (MNFI 2007g). Streams with conditions suitable for the salamander mussel are not present on the Fermi site. However, areas in Lake Erie near the site could contain suitable substrates as well as the mudpuppy host. Although the exact locations are not known, the nearest reported occurrence of the salamander mussel is from Macon Creek, a medium-sized tributary of Lake Erie, and La Plaisance Bay, located 6 to 9 mi southwest of the Fermi site (Carman 2002b). Since no large or medium rivers are crossed by the proposed transmission line corridor, it is unlikely that this species would be present in stream areas associated with the corridor.

<u>Slippershell (*Alasmidonta viridis*)</u>

The slippershell is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as threatened by the State of Michigan (MNFI 2007g). The historic range for this species extends from southern Ontario south to Alabama and from South Dakota and Kansas east to New York, Virginia, and North Carolina (Carman 2002c). It is found in the Lake Michigan, Lake Huron, Lake St. Clair, and Lake Erie drainages of the Great Lakes Basin and is also present in the Mississippi River system from the Ohio River drainage to the Tennessee River drainage (Carman 2002c). In Michigan, this species has been observed in a number of counties, including Monroe and Washtenaw Counties. The slippershell typically occurs in creeks and headwaters of rivers in sand or gravel substrates, although it can also be present in larger rivers and lakes and has occasionally been found in mud substrates (MNFI 2007g).

The general life history of unionid mussels is described in Section 2.4.2.1. The biology of the slippershell is poorly understood. The slippershell retains larvae internally for about a year. Fish species that are hosts for the slippershell include the johnny darter (*Etheostoma nigrum*) and mottled sculpin (Carman 2002c). Like all freshwater mussels, the slippershell is a filter feeder.

Principal threats to survival of the slippershell are similar to those described previously for the hickorynut (Carman 2002c). The slippershell was last reported from Monroe and Washtenaw Counties in 2000 and 2005, respectively; there are no reports of this species from Wayne County (MNFI 2007g). Streams with conditions suitable for the slippershell are not present on the Fermi site, and Lake Erie adjacent to the Fermi site does not offer suitable habitat for this species. It is currently unknown if appropriate habitats are present in any of the smaller streams that are crossed by the proposed transmission line corridor.

Snuffbox Mussel (*Epioblasma triquetra*)

The snuffbox mussel is a freshwater unionid mussel (see Section 2.4.2.1) that has been proposed for Federal listing as endangered. This species is listed as endangered by the State of Michigan and has been recorded in Monroe, Wayne, and Washtenaw Counties (MNFI 2007g). The historic range of the snuffbox mussel extends from Ontario southward to Mississippi and Alabama and eastward to New York and Virginia; extant populations are still present in Wisconsin, Illinois, Indiana, Kentucky, Michigan, Ohio, Pennsylvania, Tennessee, and West Virginia (NatureServe 2009). In Michigan, this species is found primarily in eastern and southeastern rivers, including Otter Creek in Monroe County and the Detroit River in Wayne County (Carman and Goforth 2000c). The snuffbox mussel primarily inhabits small and medium-sized rivers, although specimens have also been collected from Lake Erie and large rivers, such as the St. Clair River. Preferred habitat usually has clear water and sand, gravel, or cobble substrate with a swift current; individuals are often buried deep in the sediment (Carman and Goforth 2000c).

The general life history of unionid mussels is described in Section 2.4.2.1. The snuffbox mussel is a late summer spawner (Carman and Goforth 2000c). Gravid females retain larvae over the winter and release glochidia from May to July (Carman and Goforth 2000c). In Michigan, the only known fish host is the log perch (*Percina caprodes*), although the banded sculpin (*Cottus carolinae*) has been identified as a fish host in other portions of the range (Carman and Goforth 2000c). The snuffbox mussel can live to be approximately 10 years of age (Carman and Goforth 2000c). Like all freshwater mussels, the snuffbox mussel is a filter feeder.

Principal threats to survival of the snuffbox mussel are similar to those described previously for the hickorynut. The snuffbox mussel was last reported from Monroe, Wayne, and Washtenaw Counties in 1933, 2000, and 1977, respectively (MNFI 2007g). Streams with conditions suitable for the snuffbox mussel are not present on the Fermi site, although there is a possibility that shoreline areas of Lake Erie near the site could contain suitable substrates. The snuffbox mussel is unlikely to inhabit any of the smaller streams that are crossed by the proposed transmission line corridor.

<u>Wavyrayed Lampmussel (*Lampsilis fasciola*)</u>

The wavyrayed lampmussel is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as threatened by the State of Michigan (MNFI 2007g). The historic range for this species extended from Ontario to Alabama and Illinois to New York, and it is now discontinuously distributed in the Great Lakes tributaries of Lake Michigan, Lake Erie, Lake Huron, Lake St. Clair, and in the Ohio, Mississippi, and Tennessee River drainages (Stagliano 2001c). Historically, the wavyrayed lampmussel was found throughout the streams and rivers of southeastern Michigan, but the current distribution is more limited (Stagliano 2001c). It is currently known to occur in the Clinton River drainage in Macomb and Oakland Counties, the St. Joseph River in Hillsdale County, the Belle River in St. Clair County, the Huron River drainage in Washtenaw County, and the River Raisin drainage in Jackson, Lenawee, and Washtenaw Counties. It has also been reported in the past from the River Raisin in Monroe County, although the status of populations in that area is not known. The wavyrayed lampmussel occurs in small to medium-sized shallow streams, in and near riffles, with good current; it rarely occurs in medium or larger rivers (Stagliano 2001c). The preferred substrate is sand and gravel (Stagliano 2001c).

The general life history of unionid mussels is described in Section 2.4.2.1. The wavyrayed lampmussel breeding season extends from August of one year through July of the following year (Stagliano 2001c). Following fertilization, gravid females retain larvae over the winter and release glochidia during spring and summer (Stagliano 2001c; Carman and Goforth 2000c). The smallmouth bass is the only known fish host (Stagliano 2001c). After dropping off the fish host, this species reportedly does not move more than approximately 300 yd throughout its life (Stagliano 2001c). The life span of the wavyrayed lampmussel is unknown (Stagliano 2001c). Like all freshwater mussels, the wavyrayed lampmussel is a filter feeder.

Principal threats to survival of this species are similar to those described previously for the hickorynut. The wavyrayed lampmussel was last reported from Monroe, Wayne, and Washtenaw Counties in 2000, 1995, and 2005, respectively (MNFI 2007g). Streams with conditions suitable for the wavyrayed lampmussel are not present on the Fermi site, and Lake Erie adjacent to the Fermi site does not offer suitable habitat for this species. It is currently unknown if appropriate habitats are present in any of the smaller streams that are crossed by the proposed transmission line corridor.

<u>White Catspaw (*Epioblasma obliquata perobliqua*)</u>

The white catspaw is a freshwater unionid mussel (see Section 2.4.2.1) that is Federally listed as endangered and is also listed as endangered by the State of Michigan (MNFI 2007g). This species is considered extirpated from Michigan (MNFI 2007g). Catspaw mussels historically occurred throughout the Midwest and in eastern North America. The white catspaw is believed to have been widely distributed in the Great Lakes drainages; it has been reported from New York to Indiana and is confirmed to have once been present in several rivers in Ohio, Indiana, and southeastern Michigan (Carman 2001h). The white catspaw was also known to have been present in nearshore areas in Lake Erie (Carman 2001h). Currently, the white catspaw is a highly imperiled species, and the only known viable population remaining is in Fish Creek, Ohio (Carman 2001h).

The white catspaw is a medium-sized mussel up to 2 in. long. Little is known of its required habitat because this species is so rare, but it has historically been found in sand and gravel substrates in the riffles and runs of high-gradient streams. In Michigan, the white catspaw also occurred in large rivers (e.g., the Detroit River) and in nearshore areas of Lake Erie (Carman 2001h). The breeding season is unknown, but related mussel species typically release glochidia in late spring or early summer. It is considered likely that the host species for the white catspaw is a riffle-dwelling fish such as a darter or sculpin (FWS 1990). The lifespan is estimated to exceed 15 years (Carman 2001h).

The survival of the white catspaw mussel is currently in severe jeopardy (FWS 1990). Threats to the continued existence of the species include habitat destruction associated with siltation, dredging, and channelization (FWS 1990). The white catspaw was last observed in Monroe and Wayne Counties in 1930 and has not been reported from Washtenaw County (MNFI 2007g). High-gradient streams with conditions suitable for the white catspaw are not present at the Fermi site, although nearshore areas in Lake Erie adjacent to the site could provide suitable substrate. Given the rarity of this species and the absence of reports of individuals or other populations within the region surrounding the Fermi site, it is considered highly unlikely that this species would be present in the project area or in aquatic habitats crossed by the proposed transmission line corridor.

<u>Channel Darter (*Percina copelandi*)</u>

The channel darter is a small fish listed as endangered by the State of Michigan (MNFI 2007g). Its distribution extends from the upper St. Lawrence drainages, through the Great Lakes Basin, and into the Ohio River Basin. The darter is found primarily in the Ohio River Basin, but isolated populations occur southward to Louisiana (Carman and Goforth 2000a). In Michigan, the darter's range historically included nearshore areas of Lake Erie and Lake Huron, including some tributaries (Carman and Goforth 2000a). Since 1994, it has been recorded only in the Au Sable, Pine, and St. Clair Rivers in Michigan (Carman and Goforth 2000a). The channel darter's habitat includes rivers and large creeks with moderate current over sand and gravel substrate. It has also been recorded in wave-swept areas of Lake Huron and Lake Erie that have coarse-sand, fine-gravel beach and sandbar substrates (Carman and Goforth 2000a). The darter is usually found in deeper water but will move into shallow water (<3 ft) at night (Carman and Goforth 2000a).

The channel darter spawns in July in Michigan and requires flowing water conditions for successful spawning (Carman and Goforth 2000a). Spawning males maintain a territory with radius of approximately 1.6 ft around a large rock as a spawning female partially buries herself in gravel downstream of the rock and deposits her eggs (Carman and Goforth 2000a). Adults grow to be approximately 2 in. long. Channel darters are benthic feeders whose diet consists of small invertebrates, including mayfly and midge larvae, small crustaceans, and algae and organic debris (Carman and Goforth 2000a).

In Michigan, the range of the channel darter was severely reduced during the past century. Prior to 1957, this species was reported from 11 counties along Lake Huron, Lake St. Clair, the St. Clair River, and Lake Erie (Carman and Goforth 2000a). Declines in abundance and distribution have been attributed primarily to loss of suitable habitat (Carman and Goforth 2000a). The channel darter was last observed in Monroe County in 1941 and in Wayne County in 1952; there are no reports of this species from Washtenaw County (MNFI 2007g). No suitable stream habitat for the channel darter is present on the Fermi site, although there is a potential for this species to inhabit wave-swept shorelines in Lake Erie, such as that located along the eastern edge of the Fermi site. However, no channel darter individuals were collected during recent surveys of aquatic habitats on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No channel darter eggs or larvae were observed during entrainment and impingement studies conducted at the Fermi 2 intake in 2008 and 2009 (AECOM 2009b).

Creek Chubsucker (*Erimyzon oblongus claviformis*)

The creek chubsucker is listed as endangered by the State of Michigan and has been reported from Monroe County (MNFI 2007g). This fish occurs throughout most of the eastern United States but is becoming increasingly rare at the edges of its historic distribution. The northern extent of the range for the creek chubsucker terminates in Michigan, where it has been found in the Kalamazoo River, St. Joseph River, and River Raisin, and their tributaries. For the last two decades, it has been reported only in the Kalamazoo River, located west of Monroe County. The creek chubsucker inhabits headwaters and clear creeks with moderate currents over sand-gravel substrate. In Michigan, the creek chubsucker has been reported primarily from streams that are 3 to 5 ft deep with moderately swift currents and muddy bottoms (Carman 2001a).

The creek chubsucker migrates upstream to spawn in early spring. Eggs are usually scattered over substrates, although males have been observed building nests. Adults may produce up to 9000 eggs per year. Juveniles of this species often form schools in vegetated headwater areas with less current but migrate to deeper downstream areas as they become adults. Life expectancy of the creek chubsucker is approximately 5 years. The diet of the creek chubsucker is mostly small benthic invertebrates (Carman 2001a).

The preferred habitat type for this species (clear creeks with sandy substrates and moderate current) does not occur on the Fermi site. No creek chubsuckers were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) in the vicinity of the Fermi site.

<u>Eastern Sand Darter (*Ammocrypta pellucida*)</u>

The eastern sand darter is listed as threatened by the State of Michigan (MNFI 2007g). This fish occurs in the St. Lawrence River drainage, the Lake Champlain drainage in Vermont, south to West Virginia and Kentucky, and west through Ontario and Michigan (Derosier 2004a). Within Michigan, this darter was found historically in the Huron, Detroit, St. Joseph, Raisin, and Rouge Rivers, as well as Lake St. Clair. However, in the past two decades it has been recorded in the Lake St. Clair and Huron River drainages (Derosier 2004a). The preferred habitats of the eastern sand darter are streams and rivers with sandy substrates and lakes with sandy shoals. They frequently occur in slow-moving streams with deposits of fine sand, often just downstream of a bend (Derosier 2004a).

The spawning period for the eastern sand darter occurs from April through June. Eggs are buried singly in sandy sediments. These darters reach sexual maturity at age one and have a life expectancy of 2 to 3 years The eastern sand darter feeds mostly on chironomid larvae but will also prey upon aquatic worms and small crustaceans (Derosier 2004a).

Declines in Michigan populations of eastern sand darters have been attributed to siltation, modification of riparian areas, channel and flow alterations, and nutrient enrichment (Derosier 2004a). In the vicinity of the Fermi project, the eastern sand darter was last observed in Monroe County in 1929 and in Wayne County in 1936; it has not been reported from Washtenaw County (MNFI 2007g). Although suitable habitat for this species could be present in Stony Creek, no eastern sand darters were collected during recent surveys of aquatic habitats on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No eastern sand darter eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

<u>Lake Sturgeon (*Acipenser fulvescens*)</u>

The lake sturgeon is listed as threatened by the State of Michigan for Wayne County, although it is not listed for Monroe County (MNFI 2007g). This fish is also listed as endangered by the State of Ohio (ODNR 2009b). Historically, this species has been found in the Hudson Bay watershed, St. Lawrence estuary, and upper and middle Mississippi River and Great Lakes Basins, and scattered throughout Tennessee, Ohio, and lower Mississippi drainages (Goforth 2000a). It has become rare throughout its historic range, and population estimates indicate that about 1 percent of their original numbers remain. Michigan populations are among the largest at the current time and are scattered throughout most counties bordering the Great

Lakes, as well as in some inland lakes and rivers (Goforth 2000a). The lake sturgeon is a benthic organism that occurs in large rivers and the shallow areas of large lakes (Goforth 2000a). Lake sturgeon tend to avoid aquatic vegetation and prefer deep run and pool habitats of rivers, although habitat use varies among lakes, depending on what conditions are available (Goforth 2000a).

Lake sturgeon begin spawning migrations in May when the water temperature reaches 10–12°C, but they do not actually begin spawning until the water is between 13 and 18°C. Spawning occurs in areas with swift currents and clean rocky substrates and at depths of 2 to 15 ft. Large females lay hundreds of thousands of adhesive eggs but may spawn only once every 3 to 7 years. The eggs are fertilized as they are laid and hatch in approximately 5 days. Juveniles grow relatively quickly for the first 10 years, but growth slows considerably after that. Males become sexually mature at about 15 years of age, while females reach maturity at about 25 years of age. The lake sturgeon has the greatest life expectancy of any freshwater fish, with some individuals reaching 80 years old. Although a lake sturgeon spawning area was historically recorded along Michigan's Lake Erie shoreline near Stony Point in Monroe County, activity has diminished or ceased in this area since the 1970s. The lake sturgeon forages over gravel, sand, and mud substrates. The lake sturgeon feeds on snails, clams, crustaceans, fish, and aquatic insect larvae and may also prey on eggs of other species of fish during foraging (Goforth 2000a).

Lake Erie was formerly one of the most productive waters for lake sturgeon in North America (EPA 2009e). In the 1860s, the lake sturgeon population was greatly reduced in Lake Erie as a bycatch of the gill net fishery. In subsequent decades, overharvesting, limited reproduction, and destruction of spawning habitats nearly eliminated the lake sturgeon population in the lake (EPA 2009e). Threats to lake sturgeon populations include physical barriers to migration (e.g., construction of dams), loss of spawning and nursery areas, impacts on water quality, parasitism by sea lamprey, colonization of spawning habitats by zebra and quagga mussels, predation of eggs by round gobies, and the introduction of contaminants (Goforth 2000a). In addition, life history attributes, such as the late age at which sexual maturity is attained, infrequent reproduction, and lack of parental care for eggs or young, contribute to the decline of this species by offering a very low potential for population growth (Goforth 2000a).

Given the proximity of a previously documented spawning area for lake sturgeon in the vicinity of Lake Erie near Stony Point (Goforth 2000a), which is located approximately 1 mi south of the southern boundary for the Fermi site, there is a potential for lake sturgeon to occur in waters near the Fermi site. Although this species does not occur in Washtenaw County, it was last reported from Wayne County in 2006 (MNFI 2007g). No lake sturgeon individuals were collected during recent surveys of aquatic habitats in the vicinity of the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site.

No lake sturgeon eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

<u>Northern Madtom (*Noturus stigmosus*)</u>

The northern madtom is listed as endangered by the State of Michigan for Wayne County and Washtenaw County; it is not listed for Monroe County (MNFI 2007g). This fish species is found in Lake Erie and Ohio River Basins from western Pennsylvania, southern Ontario, and West Virginia, to the Ohio River in southern Illinois (Carman 2001b). The species is uncommon and is disappearing on the edges of its range. It is also protected in Canada as an endangered species. The northern madtom historically occurred in several large rivers in southeastern Michigan. Surveys in the late 1970s found the species to be present in the Detroit and Huron Rivers, although a survey conducted in the Huron River in 1983 found no northern madtom individuals; the species was observed in the St. Clair River as recently as 1995 (Carman 2001b).

The northern madtom inhabits riffles with sand and gravel substrates in swiftly flowing small to large rivers (Carman 2001b). This species is tolerant of elevated turbidity, although it apparently avoids heavily silted areas (Carman 2001b). Although knowledge of the life history characteristic of this species is limited, the northern madtom is probably sexually mature after 2 to 3 years. It spawns in small cavities in the substrate (Carman 2001b) from June to August (MNFI 2007g). It is believed to feed primarily on aquatic insect larvae and other small invertebrates (Carman 2001b).

The northern madtom is not known to occur in Monroe County, although it could be present in appropriate habitats in Wayne County and Washtenaw County (MNFI 2007g). No northern madtoms were collected during recent surveys on the Fermi site, although another madtom species (tadpole madtom, *Noturus gyrinus*) was observed in surveys conducted near the South Lagoon (AECOM 2009b). Similarly, no northern madtoms were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No northern madtom eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

<u>Pugnose Minnow (*Opsopoeodus emiliae*)</u>

The pugnose minnow is listed as endangered by the State of Michigan (MNFI 2007g). This fish species has been documented from the southern Great Lakes Basin, through the Mississippi River valley, to the Gulf of Mexico (Carman 2001c). Although common in the southeastern portion of its range, it is becoming rare at the northern edge of its range (Carman 2001c). Historically, the pugnose minnow occurred in Michigan tributaries and nearshore areas of Lake Erie and Lake St. Clair, located approximately 15 mi northeast of the Fermi site, although there is no recent record of occurrence (Carman 2001c). The pugnose minnow inhabits slow, clear waters of rivers and shallow regions of lakes and is found in greatest abundance in weedy areas over sand or organic substrate (Carman 2001c). Historically, it occurred in turbid areas of the Huron River that lacked aquatic vegetation, although it is believed that such conditions are not preferred (Carman 2001c).

The life history of the pugnose minnow is not well documented. Spawning occurs in June and July (MNFI 2007g). After hatching, the adult length of 2 in. is reached within 2 years (Carman 2001c). The pugnose minnow feeds on small crustaceans, fly larvae, and other aquatic invertebrates, as well as algae and plants (Carman 2001c).

In Michigan, the pugnose minnow has been observed in Monroe and Wayne Counties within the past 15 years (MNFI 2007g). Declines in Michigan populations have been attributed primarily to increased siltation and loss of weedy aquatic habitats (Carman 2001c). Although there is a potential for suitable habitat for the pugnose minnow to be present in the vicinity of the Fermi site, no individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No pugnose minnow eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

Pugnose Shiner (*Notropis anogenus*)

The pugnose shiner is listed as endangered by the State of Michigan (MNFI 2007g). The distribution of this fish species historically ranged from the Lake Ontario drainage of eastern Ontario and western New York to southeastern North Dakota and central Illinois (Derosier 2004b). The species is rare and declining in much of its former range (Derosier 2004b). Within Michigan, the pugnose shiner was historically found within at least 18 watersheds, including some within Wayne and Washtenaw Counties (MNFI 2007g). The pugnose shiner usually inhabits clear, vegetated lakes and vegetated pools and runs of low-gradient streams and rivers and appears to be extremely intolerant of increased levels of turbidity (MNFI 2007g). The species feeds on filamentous green algae, plant material, and small crustaceans (Derosier 2004b). There is little other information available about the life history of this species.

In Michigan, the pugnose shiner was last reported from Washtenaw County in 1938 and from Wayne County in 1894; it has not been reported from Monroe County (MNFI 2007g). No individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No pugnose shiner eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for this species does not occur on the Fermi site.

Redside Dace (*Clinostomus elongatus*)

The redside dace is listed as endangered by the State of Michigan (MNFI 2007g). This fish species was historically distributed in the Lake Erie and Lake Ontario drainages in southeastern Michigan, Ontario, Ohio, Pennsylvania, and New York; the upper Mississippi River Basin of Wisconsin and southeastern Minnesota; the upper Susquehanna River drainage of New York and Pennsylvania, and the upper Ohio River Basin (Goforth 2000b). In Michigan, the redside dace occurs in the River Rouge drainage of Oakland and Wayne Counties and in the Huron River drainage in Washtenaw County (Goforth 2000b). Redside dace occur in small headwater streams with moderate to high gradients, overhanging vegetation that provides shade, coarse woody structures, and clean rocky substrates (Goforth 2000b).

The redside dace spawns during late May in clean rocky riffles, and it inhabits pools during other periods of the year (MNFI 2007g). Redside dace generally mature at about 2 or 3 years of age and reach a length of about 3 in. (Goforth 2000b). This species feeds primarily on insects (Goforth 2000b).

The redside dace has not been reported to occur in Monroe County (MNFI 2007g). No individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No redside dace eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for this species does not occur on the Fermi site.

River Darter (*Percina shumardi*)

The river darter is listed as endangered by the State of Michigan (MNFI 2007g). The distribution of this fish species ranges from southern Canada to the Gulf of Mexico, including the Great Lakes Basin (Carman 2001d). The river darter is found in rivers and large streams with deep, fast-flowing riffles and cobble and boulder substrate. This species has also been observed at depths below 15 ft in nearshore areas of the Great Lakes and is tolerant of elevated levels of turbidity (Carman 2001d).

The river darter is believed to move upstream to spawn. Spawning occurs in late winter to early spring in southern areas, from April through May in the Midwest, and as late as June or July in Canada. The female river darter buries eggs in loose gravel or sand substrates during spawning, and neither males nor females provide parental care to the young. River darters grow to be 3 in. long, mostly within the first year of development, and sexual maturity is usually reached after 1 year. As juveniles, river darters primarily feed on small zooplankton; adults prey upon midge and caddisfly larvae, as well as some snail species (Carman 2001d).

Even though the river darter is relatively tolerant of elevated turbidity and other water quality changes, the species generally requires deep and swiftly flowing waters as habitat. Such habitats are becoming more limited as a result of flood control efforts and riverine impoundments. Within the project area, the river darter was last observed in Monroe and Wayne Counties in 1941; there are no reports of this species from Washtenaw County (MNFI 2007g). No suitable stream habitat for the river darter is present on the Fermi site. No river darters were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No river darter eggs or larvae were collected during entrainment and impingement studies in 2008 and 2009 (AECOM 2009b).

River Redhorse (*Moxostoma carinatum*)

The river redhorse is listed as threatened by the State of Michigan (MNFI 2007g). This fish species was historically distributed in rivers of the upper St. Lawrence River to the upper Mississippi River drainages, west to Nebraska, and south to Florida (west of the Appalachians); it is widespread in the central Mississippi Basin, including Missouri, Arkansas, Kentucky, Tennessee, and Alabama (Stagliano 2001a). The species reaches the northern extent of its historic range in Michigan, and few specimens have been documented in the State (Stagliano 2001a). In the vicinity of the Fermi site, the river redhorse has been documented only from the Detroit River in Wayne County. The species prefers medium to large rocky rivers with moderate to strong currents and is most often associated with long, deep run habitats up to 3 m deep (MNFI 2007g). This species is generally considered intolerant of increased levels of silt deposition and turbidity (MNFI 2007g).

Although most individuals average 10 to 20 in. in length, this species can be 30 in. long and weigh more than 10 lb. In Michigan, the river redhorse normally spawns in July or August, with adults often migrating upstream to medium-sized sections of rivers and tributary streams. Spawning occurs over gravel or rubble in nests constructed by males. After hatching, young fish generally remain in the spawning reaches until they are subadults. Sexual maturity is reached at approximately 3 years of age, and adults can live to be approximately 12 years old. River redhorse consume primarily benthic invertebrates, such as clams, crayfish, and aquatic stages of insects (Stagliano 2001a).

In Michigan, the river redhorse was last observed in Wayne County in 1984 and has not been reported from Monroe or Washtenaw Counties (MNFI 2007g). No river redhorse were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No river redhorse eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for river redhorse is not present on the Fermi site.

Sauger (*Sander canadensis*)

The sauger is listed as threatened by the State of Michigan (MNFI 2007g). The native range for this fish species includes the St. Lawrence, Great Lakes, Hudson Bay, and Mississippi River Basins, as well as the Tennessee River in Alabama and Louisiana; the sauger has also been introduced into the Atlantic, Gulf, and southern Mississippi River drainages (Derosier 2004c). This species was historically abundant in Lake Erie.

The sauger, which is closely related to the walleye, prefers turbid areas of lakes, reservoirs, and large rivers (MNFI 2007g). This species spawns over shallow areas with gravel and rubble substrates in May or June, when temperatures range from 4 to 6°C (Derosier 2004c). The sauger broadcasts demersal, adhesive eggs over shoals during the night. After hatching, young sauger spend up to 9 days on the bottom, absorbing yolk from their egg sacs. Males reach sexual maturity within 3 years, while females take 4 to 6 years to mature (Derosier 2004c). The life expectancy for the sauger is up to 13 years (Derosier 2004c), and it can attain lengths up to approximately 18 in. (NatureServe 2009). Saugers have a specialized structure in their eyes that makes them very sensitive to light, and they prefer to feed at night in clearer waters or during the day in turbid areas (Derosier 2004c). Juvenile sauger prey on zooplankton and aquatic insect larvae, whereas adults feed on fish and larger invertebrates, including gizzard shad, emerald shiner, crappie, bass, freshwater drum, leeches, crayfish, and insects (Derosier 2004c).

Within the project area, the sauger was last reported from Monroe County in 1996 and from Wayne County in 1993; there are no reports of this species from Washtenaw County (MNFI 2007g). Although there is no riverine habitat suitable for sauger on or adjacent to the Fermi site, suitable habitat could be present in Lake Erie near the Fermi site. However, no sauger individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No sauger eggs or larvae were collected during entrainment and impingement studies in 2008 and 2009 (AECOM 2009b).

Silver Shiner (*Notropis photogenis*)

The silver shiner is listed as endangered by the State of Michigan (MNFI 2007g). The distribution for this fish species ranges from the Great Lakes and their tributaries, through the Ohio River Basin and Tennessee drainage, to northern Alabama and Georgia. This shiner is fairly common within most of the Ohio River Basin but occurs more rarely in tributaries of the Great Lakes. Within Michigan, it is locally abundant in the St. Joseph River (Hillsdale County) and in the River Raisin (Washtenaw County). Historically, the silver shiner was also found in the River Raisin in Monroe County (Carman 2001e).

Preferred habitat for the silver shiner is medium to large streams with moderate to high gradients. This species is usually found in deeper water, such as pools or eddies directly below riffles. The species has been documented to prefer a variety of substrates, including gravel and boulder, pebble and cobble, and sand, mud, and clay, and is believed to avoid areas with dense vegetation and substantial siltation. In Michigan, the shiner has been found to inhabit areas of strong current with wooded banks (Carman 2001e).

Reproduction of the silver shiners is not well documented, but it is believed to spawn in June. Juvenile silver shiners exhibit rapid growth, reaching sexual maturity at age 2 and maximum size by age 3. Although the silver shiner primarily feeds at the surface, it will take mid-water prey as well. The majority of the silver shiner's prey are aquatic stages of insects, especially flies (Carman 2001e).

The silver shiner is relatively rare in Michigan, but populations appear to be stable (Carman 2001e). The species is fairly tolerant of human impact and poor water quality (Carman 2001e). The silver shiner prefers stream habitats with moderate to high gradient, and such habitat is not present on the Fermi site. No silver shiners were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) in the vicinity of the Fermi site. No silver shiner eggs or larvae were observed during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for this species does not occur on the Fermi site.

<u>Southern Redbelly Dace (*Phoxinus erythrogaster*)</u>

The southern redbelly dace is listed as endangered by the State of Michigan (MNFI 2007g). The distribution for this fish species ranges from the Lake Erie and Lake Michigan drainages, through the Mississippi River Basin south to Alabama, Arkansas, and Oklahoma. The northern limit of this species' range is in southeastern Michigan in the Huron River and River Raisin drainages that feed Lake Erie (Stagliano 2001b). The southern redbelly dace generally occurs in the clear and cool permanent headwaters of river systems, especially small moderate-gradient spring-fed and wooded streams that contain pools and are shaded (Stagliano 2001b). Preferred substrates include mud bottoms of pools and clean gravel of riffles (Stagliano 2001b).

In the northern portion of its range, the southern redbelly dace usually spawns in May and June. Spawning fish migrate from pools to riffles, where they use nests built by other fishes in the same family (*Cyprinidae*). Females generally release 700 to 1000 eggs during each spawning event. Southern redbelly dace reach sexual maturity within 1 year at a length of less than 2 in. This species is generally herbivorous, feeding on filamentous algae, diatoms, and drifting or benthic detritus; larger fish reportedly feed on chironomid and mayfly larvae, as well as other small invertebrates (Stagliano 2001b).

Within the project area, the southern redbelly dace was last reported from Monroe County in 1930 and from Washtenaw County in 1973; there are no reports of this species from Wayne County (MNFI 2007g). Although there is a potential for suitable habitat to be present in some of the small streams adjacent to the Fermi site or within the ROW for the proposed transmission line, the areas of Lake Erie near the Fermi site are not suitable habitat for this species. No southern redbelly dace were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No southern redbelly dace eggs or larvae were collected during entrainment and impingement studies in 2008 and 2009 (AECOM 2009b).

Critical Habitats

No critical habitat for aquatic species has been designated by the FWS in the vicinity of the Fermi site.

Non-Native and Nuisance Species

Aquatic nuisance species have the ability to cause large-scale ecological and economic problems when they have been introduced into an ecosystem that does not have the natural controls to keep them in check, such as pathogens, predators, and parasites. When new species are introduced into an area, 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 balance of the existing ecosystem. As a nuisance species proliferates, it may prey upon, out-compete, or cause disease in the existing inhabitants. Aquatic nuisance species that are known to occur on or near the Fermi site are discussed below.

<u>Asian Clam (*Corbicula fluminea*)</u>

The Asian clam was imported in the northwestern United States in 1938 as a food source and subsequently released to the environment. The species has since become widely distributed throughout the United States (Foster et al. 2011). Native to Asia and Africa, the first report of this species from Lake Erie was in 1981, and it has now become established in the Great Lakes. Cold water temperatures limit the potential for survival and reproduction of this species in the Great Lakes Region, where it is often found in areas influenced by the heated water discharged from power plants (French and Schloesser 1991). Asian clams can attach to intake pipes and other manmade structures, causing problems related to the operation and maintenance of power plants and industrial water systems. The cost of removing them from intake systems is estimated at about a billion dollars each year (Foster et al. 2011). Asian clams compete with other species, especially native freshwater mussels, by occupying benthic habitat and filtering phytoplankton and suspended matter from the water column. This species is also eaten by some aquatic species, such as fish and crayfish (Foster et al. 2011).

Fishhook Water Flea (*Cercopagis pengoi*)

The fishhook water flea is an invasive planktonic crustacean that is native to the Caspian Basin in southwest Asia. It is believed to have been introduced to the Great Lakes from the ballast water of a transoceanic ship in the late 1990s. It is now considered established in Lake Ontario and has substantial populations in all of the Great Lakes except Lake Superior and Lake Huron. The fishhook water flea consumes zooplankton and competes with other planktivores for food. Similar to the spiny water flea (described below), this species has a long spine that makes it less palatable to planktivorous fish, and it has a high reproductive rate. As a consequence, it is feared that the establishment of this species could result in substantial changes to plankton communities and could affect survival of planktivorous fish in affected lakes. The current distribution of this species in the vicinity of the Fermi site is unknown, although it was found in Lake Erie in 2002 (Benson et al. 2010a).

Lyngbya (*Lyngbya wollei*)

Lyngbya is an invasive filamentous cyanobacterial (blue-green algae) species that has become established in some areas of the western basin of Lake Erie. Lyngbya, which is common in some areas of the southeastern United States, was first observed in Maumee Bay (approximately 18 mi south-southwest of the Fermi site) in 2006. This species has been observed to form dense benthic and floating mats that can interfere with boating and other lake activities and may negatively affect other aquatic organisms. In addition, when the algal mats wash ashore, they can blanket extensive shoreline areas and become a nuisance as they decompose.

Bridgeman and Penamon (2010) conducted surveys of the western basin in 2008 and found that lyngbya was most prevalent along shorelines in the vicinity of Maumee Bay, becoming less prevalent with increasing distance from Maumee Bay. In addition, the biomass of benthic mats of lyngbya was found to be greatest in Maumee Bay and Bolles Harbor at water depths of 5 to 11 ft on substrates that contained mixtures of sand and fragmented shells from dreissenid mussels (i.e., zebra and quagga mussels). The closest record of occurrence of lyngbya is in the vicinity of Sterling State Park, approximately 5 mi south-southwest of the Fermi site (Bridgeman and Penamon 2010). Bridgeman and Penamon (2010) found no lyngbya in samples collected at Stony Point (approximately 2 mi southwest of the Fermi site) in 2008, and lyngbya has not been documented at the Fermi site. Overall, it appears that the potential for excessive growth of lyngbya is related to the amount of light penetration into the water column (a function of water turbidity), water depth, nutrient availability, and the type of substrate that is present (Bridgeman and Penamon 2010; LaMP Work Group 2008). Bridgeman and Penamon (2010) found that Lyngbya in the vicinity of Maumee Bay usually occurred at depths between 6.6 and 9.2 ft. Nutrient concentrations of nitrate, orthophosphate, and total phosphorus reported from Maumee Bay (Moorhead et al. 2008) were higher than those reported by the applicant in Lake Erie near the Fermi site (AECOM 2009a).

Quagga Mussel (*Dreissena rostriformis bugensis*)

The quagga mussel is a nuisance species believed to have been introduced to the United States through the ballast water discharge of transatlantic shipping vessels. Native to Ukraine, this species was first discovered in the Great Lakes region in 1989 and has now become well-established in Lake Erie. It has been reported in Lake Erie near the 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 (described below), the quagga mussel attaches to a wide variety of living and nonliving things, including intake pipes and structures, causing problems related to the operation and maintenance of these structures. By filtering phytoplankton and suspended matter from the water column, the quagga mussel consumes a large portion of the zooplankton food source, thus affecting 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 (Benson et al. 2010b).

Round Goby (*Neogobius melanostomus*)

The round goby is an invasive species abundant throughout the Great Lakes region, with origins in the Black and Caspian Seas. It is commonly believed that the round goby was introduced to the Great Lakes through ballast water. First encountered in the vicinity of the St. Clair River in 1990, the round goby has now spread to all of the Great Lakes. The largest populations are believed to be in Lake Erie and Lake Ontario. This small fish feeds primarily on bivalves (including zebra mussels), amphipods, small fish, and fish eggs. Thermal tolerance for this species ranges from 39 to 68°F. Known to compete with other fish for food and consume eggs and juvenile fish, the round goby is seen as a detriment to the Lake Erie ecosystem (Fuller et al. 2010a).

The round goby is present in habitats near the Fermi site and is likely present in Swan Creek and Stony Creek. During aquatic surveys conducted at the Fermi site in 2008 and 2009, a total of 22 round gobys were collected along the Lake Erie shoreline near the South Lagoon (AECOM 2009b). Round gobys were also observed in samples collected during impingement and entrainment studies during 2008 and 2009; it was estimated that 123 individuals would be impinged and that more than 1.7 million eggs and larvae would be entrained annually during normal operations of the water intake (AECOM 2009b).

Sea Lamprey (*Petromyzon marinus*)

The sea lamprey is a primitive jawless fish originating in the Atlantic Ocean. The sea lamprey is an invasive species and is larger and far more predacious than the lamprey species that are native to Lake Erie. During the adult stage, sea lampreys parasitize other fish by attaching to them with their suckerlike mouth and penetrate the body wall with sharp teeth in order to feed on body fluids; this often results in the death of the host fish (Great Lakes Fishery

Commission 2000). A single sea lamprey can kill as much as 40 lb of fish in its lifetime, and it is estimated that only one in seven fish survive an attack by a sea lamprey (Great Lakes Fishery Commission 2000). They have a strong advantage over the many species of fish native to Lake Erie because they have no natural predators in the lake. The sea lamprey has no economic value, and during its peak abundance, it is estimated that 85 percent of lake trout encountered that have not been killed by the lamprey will have scarring from their attacks (Great Lakes Fishery Commission 2000). Sea lampreys were first observed in Lake Erie (Fuller et al. 2010b). This species typically moves into tributaries to spawn, and many tributaries of Lake Erie are treated with chemicals, called lampricides, that kill the larval stages of sea lampreys in order to prevent further expansion of the species. Although Lake Erie and Swan Creek are the only waterways in the vicinity of the Fermi site where sea lampreys have been found, Stony Creek and the Detroit River could have individuals present during spawning runs.

Spiny Water Flea (*Bythotrephes longimanus*)

The spiny water flea is an invasive planktonic crustacean (cladoceran) that is native to Europe and northern Asia and believed to have arrived in the Great Lakes region via ballast water in the mid 1980s. Because of a preference for cooler waters, the spiny water flea is more abundant in the central basin of Lake Erie than in the western basin; however, it can be found throughout the lake (Berg 1992). There are populations found in inland lakes of the Great Lakes region, and it is presumed that the spiny water flea could also occur in tributaries of Lake Erie, such as Swan Creek, Stony Creek, and the Detroit River as well.

This is a large plankton species, about 0.5 in. long, that has a very high reproductive rate. The spiny water flea consumes small zooplankton, such as small cladocerans, copepods, and rotifers, and it is feared that the introduction of this species could result in changes to the zooplankton community structure in affected lakes. The spiny water flea also competes with juvenile fish, since they share many similar food sources, such as zooplankton, fish larvae, and eggs. This species is not an attractive prey to the native inhabitants of Lake Erie because of the sharp spines located on its tail. It is assumed that there will be few deterrents to the success of its rapidly growing population (Liebig and Benson 2010).

Zebra Mussel (*Dreissena polymorpha*)

The zebra mussel is considered a nuisance species throughout all of the Great Lakes region and is 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. Originally found primarily in Russia, it is believed that this species was transported to the Great Lakes region in the ballast water of a transatlantic freighter in 1988. Since that time, it has spread to more than 100 lakes and several major river systems, including the Mississippi River (USGS 2008).

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 attach to a wide variety of living and nonliving things, from boats, docks, piers, and water intake pipes to plants and even slow-moving animals. They can also attach to each other, creating dense blankets of mussels up to 1-ft thick. In 1989, the city of Monroe lost its water supply for 3 days when large amounts of zebra mussels clogged the city's water intake pipeline. The FWS 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 (USGS 2008).

In addition to the economic damage caused by this species, the invasion of the Great Lakes and other areas by this species has had important ecological effects. As identified in previous sections, zebra mussels have contributed to the decline of native freshwater mussels by competing for food and space and by preventing burrowing and other activities when they attach to the shells of freshwater mussels. In addition, the collective water-filtering ability of quagga and zebra mussels is believed to have had lakewide effects on nutrient levels, the abundance and composition of phytoplankton and zooplankton communities, and water clarity, resulting in large-scale ecological changes (USGS 2008).

2.4.2.4 Important Aquatic Species and Habitats – Transmission Lines

As identified in Section 2.4.2.2, aquatic habitats within or adjacent to the new transmission line corridor include several small streams and numerous small drainage ditches. The new transmission line corridor does not cross any lakes, ponds, or reservoirs. Stony Creek, which is located in the developed eastern portion of the assumed route, is the largest stream crossed by the transmission line route and is discussed in Section 2.4.2.1.

There are no known commercial fisheries occurring within surface water habitats that occur within the proposed transmission line corridor. While some species that support fisheries (e.g., largemouth or smallmouth bass, bluegill, or yellow perch) could be present in these habitats in low numbers, there are no important commercial or recreational fisheries present within the assumed 300-ft-wide ROW because of the small sizes of the drainages present.

Federally and State-listed species that have a potential to occur along the new transmission line route, on the basis of county-level records for Monroe, Wayne, and Washtenaw Counties, are identified in Table 2-16. The majority of the transmission line route falls within the Ottawa-Stony Watershed (Hydrologic Unit Code 04100001). However, it is not known whether suitable habitat or populations of species identified in Table 2-16 occur in portions of the drainage that would be crossed by the proposed transmission route. The FWS and MDEQ may require surveys of the proposed transmission line corridor to evaluate the presence of important species and habitat.

2.4.2.5 Aquatic Monitoring

No formal monitoring of the aquatic environment on the Fermi site has been conducted or is planned. The current NPDES permit for the Fermi site does not require monitoring of aquatic ecological resources, and there are no requirements in the license for Fermi 2 to conduct monitoring of aquatic resources, including specific aquatic ecological monitoring of the algal community, benthic invertebrates, or fish.

2.5 Socioeconomics

This section describes the socioeconomic baseline of the regional and local area around the Fermi plant site. The proposed Fermi 3 would be built at the site of the existing Fermi 1 and 2 that are owned and operated by Detroit Edison, located in Monroe County, Michigan, on the shore of Lake Erie. Section 2.5.1 describes the regional and local population, and Section 2.5.2 describes community characteristics of the population.

The review team considered the regional area to be the area within a 50-mi radius of Fermi 3, including portions of the metropolitan statistical areas that encompass the Cities of Detroit and Toledo and their surrounding metropolitan areas. Within a 50-mi radius of Fermi 3 are all or a portion of eight counties in Michigan (Jackson, Lenawee, Livingston, Macomb, Monroe, Oakland, Washtenaw, and Wayne); eight counties in Ohio (Erie, Fulton, Henry, Lucas, Ottawa, Sandusky, Seneca, and Wood); and three Canadian census divisions (Essex, Chatham-Kent, and Lamberton). The 2000 Census population and estimated 2008 population of counties and selected municipalities located within or partially within the 50-mi radius are shown in Table 2-17.[a]

Also within a 50-mi radius of Fermi 3 are the Cities of Detroit and Toledo and portions of their surrounding metropolitan statistical areas. The City of Detroit is part of the Detroit-Warren-Livonia Metropolitan Statistical Area (MSA), which encompasses 10 principal cities over a six-county area. The City of Toledo is part of an MSA that includes Lucas, Fulton, Ottawa, and Wood Counties. The 2000 Census population and estimated 2008 population of the Detroit-Warren-Livonia MSA and the Toledo MSA are shown in Table 2-18.

(a) During the preparation of this draft EIS, the results of the mandated U.S. decadal census for 2010 were being released in topical and regional data sets. Although the U.S. Census Bureau has not issued all of the data sets in final form, some of the preliminary information was considered by the review team. While some of the final data sets were released for national-scale information, most of the fine-scale information is still under review by the U.S. Department of Commerce and other Federal agencies. The review team is not aware of information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier census.

Table 2-17. Total Population of U.S. Counties and Municipalities and Canadian Census Divisions within or Partially within a 50-mi Radius of the Fermi Site in 2000 and 2008

County or Municipality	2000 (Actual)	2008 (Estimate)	Change in Population (percent)
Michigan			
Jackson County	158,422	160,180	1.1
Lenawee County	98,890	100,801	1.9
Livingston County	156,951	182,575	16.3
Macomb County	788,149	830,663	5.4
Monroe County[(a)]	145,945	152,949	4.8
City of Monroe	22,076	21,374	–3.2
Oakland County	1,194,156	1,202,174	0.7
Washtenaw County	322,895	347,376	7.6
Wayne County[(a)]	2,061,162	1,949,929	–5.4
City of Detroit	951,270	912,062	–4.1
Ohio			
Erie County	79,551	77,062	–3.1
Fulton County	42,084	42,485	1.0
Henry County	29,210	28,841	–1.3
Lucas County[(a)]	455,054	440,456	–3.2
City of Toledo	313,619	293,201	–6.5
Ottawa County	40,985	40,823	–0.4
Sandusky County	61,792	60,637	–1.9
Seneca County	58,683	56,461	–3.8
Wood County	121,065	125,340	3.5
Ontario, Canada[(b)(c)]			
Essex County	374,975[(d)]	393,402[(e)]	4.9
City of Windsor	209,218[(d)]	216,473[(e)]	3.5
City of Chatham-Kent	107,709[(d)]	108,589[(e)]	0.8

Sources: USCB 2009a, b; Statistics Canada 2007

(a) Counties that make up the three-county economic impact area.

(b) Canadian census divisions are counties or other legislated areas that are identified by provinces for the planning or provision of community services. Population data from 2000 and 2008 for Canadian census divisions are unavailable. Canadian 2001 and 2006 Census data are provided instead.

(c) The 50-mi radius around Fermi 3 encompasses a small portion of Lamberton County in Ontario; however, because of the small amount of land impacted, population statistics for Lamberton County have not been included in the analysis of the 50-mi radius area.

(d) 2001 data.

(e) 2006 data.

Table 2-18. Total Population of Detroit-Warren-Livonia MSA and Toledo MSA in 2000 and 2008

Metropolitan Statistical Area	2000 (Actual)	2008 (Estimate)	Change in Population (percent)
Detroit-Warren-Livonia[a]	4,452,557	4,425,110	–0.6
Toledo[b]	659,188	649.104	–1.5

Source: USCB 2008

(a) The Detroit-Warren-Livonia MSA encompasses the principal cities of Detroit, Warren, Livonia, Dearborn, Troy, Farmington Hills, Southfield, Pontiac, Taylor, and Novi. It encompasses Wayne, Lapeer, Livingston, Macomb, Oakland, and St. Clair Counties.

(b) The Toledo MSA encompasses the principal city of Toledo and Lucas, Fulton, Ottawa, and Wood Counties.

The review team expects most socioeconomic impacts to occur within a local area where most of the building and operations workforces for Fermi 3 are expected to reside. This local area would be Monroe and Wayne Counties in Michigan and Lucas County in Ohio, which the review team considers the economic impact area. The review team expects community services there to receive the majority of any benefits and stresses associated with building, maintenance, and operation of Fermi 3.

Table 2-19 shows the county of residence for the 2008 Detroit Edison workforce at the Fermi site. Approximately 57.5 percent of the plant's workforce resides in Monroe County, Michigan, where the plant is located. Approximately 23.1 percent reside within the Detroit-Warren-Livonia MSA, principally in Wayne County (19.0 percent of the workforce). Approximately 12.9 percent reside within the Toledo MSA, principally in Lucas County (10.7 percent of the workforce). The remaining 6.5 percent of the workers is distributed across 13 other counties in Michigan, Ohio, and Ontario. No more than 23 employees (3.2 percent of the total workforce) reside in any one county outside Monroe, Wayne, and Lucas Counties. Current employees at the Fermi site represent less than 1 percent of the total population in any of the counties or locations where these employees reside.

The review team determined that, on the basis of the analysis of the residential distribution of the Fermi site workforce, the economic impact area for analysis of the construction and operation of Fermi 3 would include Monroe and Wayne Counties in Michigan and Lucas County in Ohio. These three counties are where more than 87 percent of the current Fermi site workforce resides; therefore, the review team expects that most of the building and operations workforces for Fermi 3 would similarly reside in these three counties. Given the commute distance beyond this three-county area and the residential distribution pattern of the current Fermi site workforce, the review team expects few in-migrating workers to choose to reside outside these three counties, and the impact on any one community is not likely to be noticeable. The review team expects workers already residing in the 50-mi region will have no marginal impact on their communities due to Fermi 3 building or operations.

Table 2-19. Distribution of Fermi Site Employees in 2008 by County of Residence

County	Workforce in 2008	Percent of Workforce by County	Percent of Workforce Cumulative	Percent of 2008 County Population[(a)]
Monroe	418	57.5	57.5	0.3
Wayne	138	19.0	76.5	<0.1
Lucas	78	10.7	87.2	<0.1
Economic Impact Area	**634**		**87.2**	**0.02**
Washtenaw	23	3.2	90.4	<0.1
Oakland	21	2.9	93.3	<0.1
Lenawee	10	1.4	94.7	<0.1
Wood	8	1.1	95.8	<0.1
Macomb	6	0.8	96.6	<0.1
Ottawa	6	0.8	97.4	<0.1
Sandusky	3	0.4	97.8	<0.1
Livingston	2	0.3	98.1	<0.1
Fulton	2	0.3	98.4	<0.1
Windsor (Ontario)	2	0.3	98.7	<0.1
Jackson	1	0.1	98.8	<0.1
Branch[(b)]	1	0.1	98.9	<0.1
Berrien[(b)]	1	0.1	99.0	<0.1
Saint Clair[(b)]	1	0.1	99.1	<0.1
Van Buren[(b)]	1	0.1	99.2	<0.1
Presque Isle[(b)]	1	0.1	99.3	<0.1
Erie	1	0.1	99.4	<0.1
Seneca	1	0.1	99.5	<0.1
Stark[(b)]	1	0.1	99.6	<0.1
Clare	1	0.1	99.7	<0.1
Total	**727**			

Source: Detroit Edison 2008a
(a) County population data were from USCB 2009a, b; Statistics Canada 2007.
(b) Outside the 50-mi radius around Fermi 3.

The scope of the review of demographic and community characteristics is guided by the magnitude and nature of the expected impacts that may result from the building, maintenance, and operation of Fermi 3.

2.5.1 Demographics

This section provides population data within a 50-mi radius of Fermi 3 for two major groups: residents, who live permanently in the area, and transients, who may temporarily work or visit in the area but have a permanent residence elsewhere. Population data for residents are based on the 2000 U.S. Census and the 2001 Canada Census. Transient populations are not fully characterized by the U.S. Census Bureau (USCB), which generally documents only resident populations. Therefore, the transient population within a 50-mi radius of Fermi 3 is estimated as described in Section 2.5.1.2. Regional population projections in 10-year increments are provided through 2060 for the combined resident and transient populations within a 50-mi radius.

Data on the resident population, population change, and selected demographic characteristics also are provided for the local population (i.e., the population within the three-county economic impact area, including Monroe and Wayne Counties, Michigan, and Lucas County, Ohio). Included in this section is information on migrant workers (i.e., workers who reside in an area for a period of time to work and then leave after their jobs are done).

2.5.1.1 Resident Population

Data for the resident population within a 50-mi radius of Fermi 3 were estimated by Detroit Edison using LandView® 6 software, developed by the USCB in collaboration with other Federal agencies as a tool to estimate 2000 Census populations at prescribed distances within a specific geographic area. Detroit Edison used ArcGIS software, which can estimate the percentage of a population within a specified geographic area, to estimate the population in Canada.

On the basis of 2000 Census data, approximately 5.4 million persons reside within a 50-mi radius of Fermi 3. Table 2-20 provides the 2000 population as distributed among 10-mi circular segments within a 50-mi radius.

Table 2-20. Resident Population within a 50-mi Radius of Fermi 3 in 2000

0–10 mi	10–20 mi	20–30 mi	30–40 mi	40–50 mi	1–50 mi
89,198	336,170	1,725,503	1,939,797	1,287,597	5,378,266

Source: Detroit Edison 2011a

Figure 2-15 shows the distribution of this population in further detail, as each 10-mi circular segment within a 50-mi radius is subdivided into sectors to show the population distribution by radial direction.

The largest population center within a 50-mi radius of Fermi 3 is the portion of the Detroit-Warren-Livonia MSA within the 50-mi radius. This MSA had a population of more than 4 million persons in 2000. The Detroit-Warren-Livonia MSA encompasses 10 principal cities over a six-county area, the core of which is the City of Detroit, which is located approximately 30 mi northeast of the Fermi site. Toledo, which is approximately 24 mi southwest of the Fermi site, is part of an MSA that includes Lucas, Fulton, Ottawa, and Wood Counties, portions of which are within a 50-mi radius of the site. In 2000, the population of the Toledo MSA was

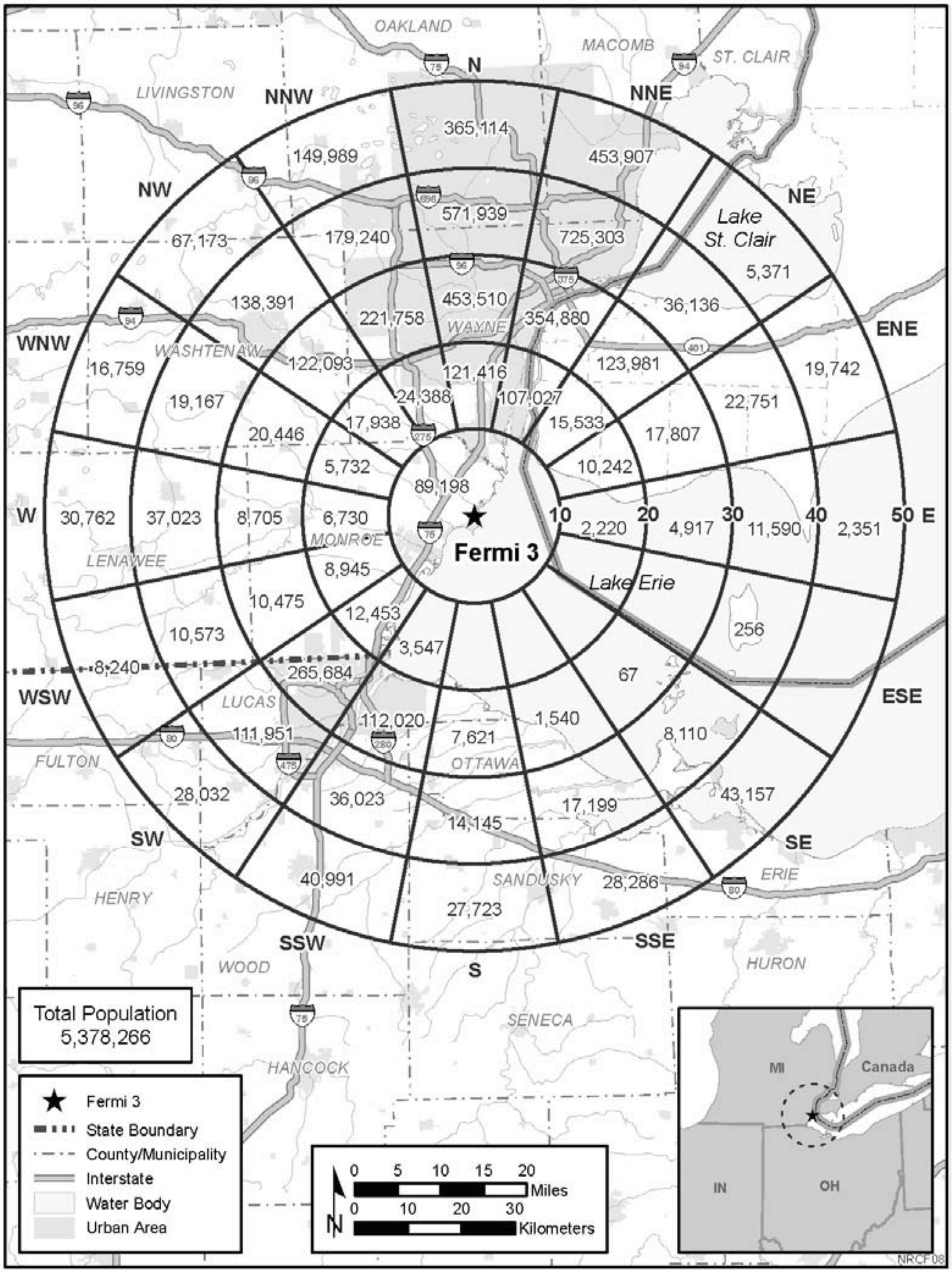


Figure 2-15. Resident Population Distribution in 2000 Located 0 to 50 mi from Fermi 3 as Shown by Segmented Concentric Circles (Detroit Edison 2011a)

659,188 persons. To the northeast, approximately 251,563 persons in Canada are within a 50-mi radius of Fermi 3.

An estimated 89,198 permanent residents are located within the emergency evacuation zone, which lies within a 10-mi radius around Fermi 3. The City of Monroe accounts for a large portion of this population. It is the largest city within a 10-mi radius of Fermi 3, with a population of 22,076 persons in 2000. Other population centers (and their corresponding 2000 Census populations) within the 10-mi radius include Woodland Beach (2179 persons), Carleton (2561 persons), Detroit Beach (2289 persons), Flat Rock (8488 persons), Gibraltar (4264 persons), Rockwood (4726 persons), and Stony Point (1175 persons). Much of the surrounding land use beyond the population centers is agricultural. Open water also accounts for a large portion of the area within the emergency evacuation zone because of the presence of Lake Erie directly east of the Fermi site.

Tables 2-21 and 2-22 present the historic and projected populations for Monroe, Wayne, and Lucas Counties compared with the respective State totals. In addition to the 1990 and 2000 Census populations, the USCB provides annual population estimates, which are included for 2008, and Statewide population projections. Projections at the county level are provided by SEMCOG for Monroe and Wayne Counties, Michigan, and by the Ohio Department of Development for Lucas County, Ohio.

Table 2-21. Historic and Projected Population Change in Monroe and Wayne Counties, Michigan, 2008–2030

	Michigan					
	Monroe County		Wayne County		State of Michigan	
Year	Population	Average Annual Growth (percent)	Population	Average Annual Growth (percent)	Population	Average Annual Growth (percent)
1990 actual	133,600	–[(a)]	2,111,687	–	9,295,297	–
2000 actual	145,945	0.9	2,061,162	–0.2	9,938,492	0.7
2008 estimate	152,949	0.6	1,949,929	–0.7	10,003,422	0.1
2020 projected	159,461	0.4	1,812,593	–0.6	10,695,993	0.6
2030 projected	167,588	0.5	1,824,113	0.1	10,694,172	0.0

Sources: Monroe and Wayne Counties 2020 and 2030 projections are provided by SEMCOG (2008a). 1990 and 2000 data for all areas are from the 1990 and 2000 Census of Population and Housing (USCB 1990a , 2000a). 2008 estimates are from the USCB Population Estimates Program (USCB 2009a). State projections for 2020 and 2030 are also provided by the USCB via its 2004 Interim Projections (USCB 2004).

(a) – = The average annual growth rate was calculated from 1990 through 2030 and is not presented for 1990 or any years prior to 1990.

Table 2-22. Historic and Projected Population Change in Lucas County, Ohio, 2008–2030

	Lucas County		State of Ohio	
Year	Population	Average Annual Growth (percent)	Population	Average Annual Growth (percent)
1990 actual	462,361	–[(a)]	10,847,115	–
2000 actual	455,054	–0.2	11,353,140	0.5
2008 estimate	440,456	–0.4	11,485,910	0.1
2020 projected	434,650	–0.1	11,644,058	0.1
2030 projected	417,870	–0.4	11,550,528	–0.1

Sources: For Lucas County, projections are provided by the Ohio Department of Development (2003). 1990 and 2000 data for all areas are from the 1990 and 2000 Census of Population and Housing (USCB 1990b, USCB 2000b). 2008 estimates are from the USCB Population Estimates Program (USCB 2009b). State projections for 2020 and 2030 are also provided by the USCB via its 2004 Interim Projections (USCB 2004).

(a) – = The average annual growth rate was calculated from 1990 through 2030 and is not presented for 1990 or any years prior to 1990.

Monroe County has 24 municipal jurisdictions, including 15 townships, 4 cities, and 5 villages. The county had modest growth between the 1990 and 2000 Census, and the population is expected to continue to grow through 2030, although at a slower rate than has occurred historically (SEMCOG 2008a). Most of the population growth has occurred around the City of Monroe, along the northern boundary toward Detroit and along the southern boundary toward Toledo (Monroe County Planning Department and Commission 2010).

Wayne County has 38 municipal jurisdictions. The population in Wayne County has declined between the 1990 and 2000 Census and is expected to continue to decline through 2020. Some of the population loss in Wayne County has been due to residents moving out of the City of Detroit into suburban communities in adjoining counties. However, SEMCOG forecasts modest growth in Wayne County between 2020 and 2030 (SEMCOG 2008a).

Lucas County has nine municipal jurisdictions, including three townships, three cities, and three villages. The county has experienced, and is projected to continue to experience, modest population loss through 2030 (Ohio Department of Development 2003).

Tables 2-23 and 2-24 present selected demographic characteristics for the resident population within Monroe, Wayne, and Lucas Counties.

2.5.1.2 Transient Population

Transient populations include people who do not reside permanently in the area but work in or visit schools, hospitals and nursing homes, correctional facilities, hotels and motels, and recreational areas or special events on a temporary basis. The transient population within a 50-mi radius of Fermi 3 was estimated by Detroit Edison on the basis of data on the following groups:

Table 2-23. Selected Demographic Characteristics of the Resident Population in Monroe and Wayne Counties, Michigan

Demographic Characteristic	Monroe County	Wayne County	State of Michigan	United States
Population Density				
Population, 2000	145,945	2,061,162	9,938,492	304,059,724
Population estimate, 2008	152,949	1,949,929	10,003,422	281,424,602
Land area (square miles)	551	614	56,804	3,537,438
Population per square mile, 2000	265	3357	175	86
Ethnic Composition, 2007 (percent of total)				
Caucasians	93.0	50.1	77.6	66.0
African-American	2.4	41.3	14.3	12.8
Hispanic	2.6	4.9	4.0	15.1
Other[(a)]	1.0	2.8	3.0	5.6
Two or more races	1.2	1.5	1.5	1.6
Income Characteristics, 2007				
Median household income	$47,931	$42,529	$47,931	$50,740
Persons below poverty (percent of total)	7.8	20.8	13.9	13.0

Sources: USCB 2009a, g

(a) Includes American Indian and Alaska Native persons, Asian persons, and Native Hawaiian and Other Pacific Islanders.

- workers who live permanently outside of the 50-mi radius and commute to a worksite within the 50-mi radius, an assumption based on 2000 Census commuter data for each county
- visitors who live outside of the 50-mi radius and travel to destinations within the 50-mi radius (e.g., campers, users of recreational facilities), an assumption based on 2000 Census data on recreational, seasonal, and occasional housing units
- residents of special facilities (correctional facilities, college dormitories, nursing homes, hospitals, religious group quarters, and others).

Detroit Edison estimated the transient population by using LandView® 6 software based on the 2000 Census population. Table 2-25 provides the estimated total transient population within a 50-mi radius of Fermi 3. An estimated 200,656 transient persons lived or visited within a 50-mi radius of Fermi 3 as of the 2000 Census.

2.5.1.3 Regional Population Projections

Table 2-26 shows the population growth projections for the region in 2020 (the projected first year of operation) and for four subsequent decades through the year 2060 (the projected end of the initial license period) by 10-mi increments. Detroit Edison based these projections on the average annual growth rate between the 1990 Census population and the estimated 2005

Table 2-24. Selected Demographic Characteristics of the Resident Population in Lucas County, Ohio

Demographic Characteristic	Lucas County	State of Ohio	United States
Population Density			
Population, 2000	455,054	11,353,160	304,059,724
Population estimate, 2008	444,456	11,485,910	281,424,602
Land area	340	40,948	3,537,438
Population per square mile, 2000	1338	277	86
Ethnic Composition, 2007 (percent of total)			
Caucasians	73.8	82.7	66.0
African-American	18.0	12.0	12.8
Hispanic	5.2	2.5	15.1
Other[(a)]	1.8	1.8	5.6
Two or more races	1.7	1.3	1.6
Income Characteristics, 2007			
Median household income	$44,618	$46,645	$50,740
Persons below poverty (percent)	16.9	13.1	13.0

Sources: USCB 2009b, g

(a) Includes American Indian and Alaska Native persons, Asian persons, and Native Hawaiian and Other Pacific Islanders.

Table 2-25. Transient Population within a 50-mi Radius of Fermi 3 in 2000

0–10 mi[(a)]	10–20 mi	20–30 mi	30–40 mi	40–50 mi	1–50 mi
17,538	10,906	44,433	70,601	57,178	200,656

Source: Detroit Edison 2011a

(a) Transient population within the emergency evacuation zone (e.g., 0–10 mi radius) was derived from KLD Associates, Inc. 2008.

population of each of the counties within the region and the average annual growth rate for populations in the Canadian census subdivisions between the Canadian 1996 Census and 2006 Census. Average annual growth rates were applied to the 2000 (United States) and 2001 (Canada) resident census population and the estimated transient population to project the growth through 2060. These growth rates were weighted by the applicant for the percentage of the county population within each 10-mi segment around Fermi 3. The review team reviewed the growth rates and concurred with this approach.

2.5.1.4 Agricultural, Seasonal, and Migrant Labor

Agricultural, seasonal, or migrant labor within Monroe, Wayne, and Lucas Counties includes:

- contract labor employed during outages at Fermi 2 and
- migrant labor on farms in Monroe, Wayne, and Lucas Counties.

Table 2-26. Resident and Transient Population Projections within a 50-mi Radius of Fermi 3 by 10-mi Increments, 2000-2060

Year	Distance					
	0–10 mi	10–20 mi	20–30 mi	30–40 mi	40–50 mi	Total
2000	106,736	347,077	1,769,937	2,010,398	1,344,775	5,578,923
2008	112,665	348,369	1,791,988	2,081,615	1,449,117	5,783,754
2020	123,378	351,302	1,831,686	2,198,894	1,624,796	6,130,056
2030	133,239	354,711	1,871,367	2,307,607	1,791,234	6,458,158
2040	144,031	359,060	1,917,634	2,427,916	1,978,702	6,827,343
2050	155,853	364,415	1,971,113	2,561,627	2,190,275	7,243,283
2060	168,849	370,858	2,032,503	2,810,898	2,429,542	7,812,650

Source: Detroit Edison 2011a

During Fermi 2 scheduled refueling outages, contract labor is hired by Detroit Edison to carry out fuel reloading activities, equipment maintenance, and other projects associated with the outage. Detroit Edison employs approximately 1200 to 1500 workers for 30 days during every refueling outage, which occurs every 18 months for Fermi 2.

A migrant worker is defined by the U.S. Department of Agriculture (USDA) as “a farm worker whose employment required travel that prevented the migrant worker from returning to his/place of residence the same day.” In the 2007 Census of Agriculture (USDA 2007), the USDA reports the number of farms with hired labor by county and State as well as the total number of hired workers. Migrant workers are a subset of total hired workers, but the number of migrant workers is not reported.

The review team concluded that the number of migrant workers within Monroe, Wayne, and Lucas Counties is low because the total number of hired workers in the 2007 Census was 3592, and between 7 percent to 15 percent of the farms in Monroe, Wayne, and Lucas Counties reported that migrant workers were employed there (Table 2-27).

Table 2-27. Migrant Labor within the Regional Area of Fermi 3 in 2007

County	Farms with Hired Labor (no. of farms)	Farms with Hired Labor (no. of workers)	Migrant Labor on Farms with Hired Labor (no. of farms)	Percentage of Farms with Migrant Labor
Monroe	222	1854	27	12
Wayne	86	894	6	7
Lucas	91	844	14	15

Source: USDA 2007

2.5.2 Community Characteristics

This section characterizes the communities that may be affected by the building, maintenance, and operation of Fermi 3. As noted in Section 2.5.1, most socioeconomic impacts are expected to occur within a three-county economic impact area, which includes Monroe and Wayne Counties in Michigan and Lucas County in Ohio. These three counties are where more than 87 percent of the current Fermi site workforce resides; therefore, the review team expects that most of the building and operations workforces for Fermi 3 would similarly reside in these three counties.

Since no more than 3.2 percent of the current workforce resides in any one county outside the local area of Monroe, Wayne, and Lucas Counties and since current employees at the Fermi site represent less than 1 percent of the total population in any of the counties or locations where these employees reside, the review team expects impacts beyond the three-county area to be minimal. Therefore, the following discussion focuses on the three-county economic impact area. Community characteristics evaluated in this section include the economy, taxes, transportation, aesthetics and recreation, housing, public services, and education, focusing on the three-county economic impact area of Monroe and Wayne Counties, Michigan, and Lucas County, Ohio.

2.5.2.1 Economy

An overview of the economy of Monroe, Wayne, and Lucas Counties is provided below. Tables 2-28 and 2-29 show employment by industry for 2000 and 2008 within each of the three counties, and Table 2-30 shows the labor force statistics.

Manufacturing, specifically automobile manufacturing, has been the major sector of the economy in southeast Michigan throughout most of the 20th century. This manufacturing base has affected the economies of Wayne and Monroe Counties in Michigan as well as Lucas County, Ohio. Southeast Michigan is 680 percent more concentrated in automobile manufacturing employment than the national economy overall (SEMCOG 2007). Since the 1940s, Lucas County has also supported the automotive industry, primarily as a supplier of automotive glass and automotive parts (Lucas County 2010).

Job growth in manufacturing was strong through the 1990s but has been in decline since 2000. Between 1999 and 2006, the State of Michigan lost 274,000 manufacturing jobs, primarily in the automobile and automobile parts manufacturing industries (Ivacko 2007). SEMCOG estimates that between 2000 and 2009, southeast Michigan lost 210,000 manufacturing jobs (SEMCOG 2009a). Domestic automobile manufacturers, heavily reliant on light trucks and sport utility vehicles (SUVs), were particularly hit by the increase in gasoline prices and loss of market share in light vehicles during this decade. Job losses in auto manufacturing have had a

Table 2-28. Area Employment by Industry – Monroe and Wayne Counties, Michigan, in 2000 and 2008

	Monroe County					Wayne County				
	2000		2008		Net Change	2000		2008		Net Change
Occupation	Persons	%	Persons	%		Persons	%	Persons	%	
Agriculture; forestry; fishing and hunting; mining	894	1	441	<1	–453	1044	<1	1467	<1	+423
Construction	5370	7.6	4816	6.6	–554	39,296	14.6	33,005	4.4	–6291
Manufacturing	18,120	25.8	15,449	21.3	–2671	185,856	21.8	129,811	18.5	–56,045
Wholesale trade	2307	3.3	2168	3.0	–139	26,904	3.2	21,769	2.8	–5135
Retail trade	8430	12	8286	11.4	–144	90,905	10.7	89,067	10.8	–1838
Transportation and warehousing; utilities	5112	7.3	6062	8.4	+950	54,387	6.4	49,740	5.9	–4647
Information	973	1.4	834	1.2	–139	21,231	2.5	16,561	2.4	–4670
Finance and insurance; real estate and rental and leasing	2669	3.8	3506	4.8	+837	50,591	5.9	47,520	6.9	–3071
Professional, scientific, and management; administrative and waste management services	4012	5.7	5058	7.0	+1046	77,890	9.2	78,525	9.6	+635
Educational services; healthcare; social assistance	12,891	18.3	14,815	20.4	+1924	158,342	18.6	173,671	21	+15,329
Arts, entertainment, and recreation; accommodation and food services	4894	7.0	5445	7.5	+551	68,026	8.0	82,517	9.2	+14,491
Other services, except public administration	3054	4.3	3932	5.4	+878	42,366	5.0	36,021	4.8	–6345
Public administration	1618	2.3	1706	2.4	+88	34,272	4.0	30,560	3.3	–3712
Total	**70,344**		**72,518**		**+2174 (3.1%)**	**851,110**		**790,234**		**–60,876 (–7.2%)**

Sources: USCB 2000a, 2009c

Table 2-29. Area Employment by Industry – Lucas County, Ohio, in 2000 and 2008

	Lucas County				
	2000		2008		
Occupation	**Persons**	**%**	**Persons**	**%**	**Net Change**
Agriculture; forestry; fishing and hunting; mining	866	<1	723	<1	–143
Construction	12,230	5.8	11,778	5.8	–452
Manufacturing	38,774	18.3	30,065	14.7	–8709
Wholesale trade	8411	4.8	6534	3.2	–1877
Retail trade	25,977	12.3	23,769	11.6	–2208
Transportation and warehousing; utilities	11,599	5.5	13,349	6.5	+1750
Information	4079	1.9	4205	2.1	+126
Finance and insurance; real estate and rental and leasing	10,258	4.8	9166	4.5	–1092
Professional, scientific, and management; administrative and waste management services	19,036	9.0	18,063	8.9	–973
Educational services; healthcare; social assistance	46,342	21.9	51,577	24.8	+5235
Arts, entertainment, and recreation; accommodation and food services	17,110	8.1	21,044	10.3	+3934
Other services, except public administration	10,226	4.8	7886	3.9	–2340
Public administration	7111	3.4	5909	2.0	–1202
Total	**212,019**		**204,068**		**–7951 (–3.8%)**

Sources: USCB 2000b; 2009d

Table 2-30. Labor Force Statistics for Monroe, Wayne, and Lucas Counties in 2000 and 2008

	Monroe County		Wayne County		Lucas County	
	2000	**2008**	**2000**	**2008**	**2000**	**2008**
Total labor force	77,194	76,285	952,300	866,827	227,304	222,647
Employed workers	74,756	69,471	911,069	780,704	217,049	204,204
Unemployed workers	2438	6814	41,231	86,123	10,255	18,443
Unemployment rate	3.2	8.9	4.3	9.9	4.5	8.3

Source: USBLS 2009a

ripple effect in other industries statewide, estimated as a loss of between one to three jobs in other sectors for every job lost in manufacturing (Ivacko 2007; SEMCOG 2009a).

Job losses accelerated with the automobile industry restructuring and the economic downturn of 2009, which affected the construction sector and consumer spending (Michigan Department of Energy, Labor, and Economic Growth 2010a). As the manufacturing sector has declined, the economy of southeast Michigan, including the Fermi 3 economic impact area, has moved toward a health care and services based economy. SEMCOG forecasts continued growth in the health care and services industries (SEMCOG 2008a).

Overall, with the decline in population as discussed in Section 2.5.1 and with the loss of jobs and transition from higher to lower wage and salary rates, the economy in southeast Michigan is in transition. Overall, the State of Michigan, and southeast Michigan in particular, have experienced a decline in average income, housing prices, and income and property tax revenues (Scorzone and Zin 2010). The decline in tax revenues, along with a declining population, has resulted in a lower level of investment in infrastructure (SEMCOG 2010b).

Monroe County

Monroe County employment was nearly 70,000 workers in 2008 (USBLS 2009a). Approximately 40 percent of the jobs in Monroe County are in two sectors: manufacturing sector and educational services/healthcare/social assistance sector. The four largest employers in Monroe County in 2007 were Detroit Edison, with approximately 1500 employees; Mercy Memorial Hospital, with approximately 1300 employees; the supermarket chain Meijer Inc., with approximately 1025 employees; and the Monroe Public Schools school district, with approximately 1000 employees (Monroe County Finance Department 2008). In 2007, Ford Motor Company closed Automotive Component Holdings, formerly named Visteon Corporation, causing a loss of 1200 jobs.

Detroit Edison's workforce of approximately 1500 workers is employed at the Fermi plant site and the coal-fired Monroe County Power Plant. During outages, an additional 1200 to 1500 outage workers are also employed at the Fermi plant site for a period of 30 days every 18 months. Between 2009 and 2010, Detroit Edison had a construction workforce at the Monroe County Power Plant to conduct capital improvements of the air emission control equipment (Detroit Edison 2011a). Future projects involving installation of air pollution control equipment will require a workforce ranging from 100 to 550 workers. Detroit Edison expects the work at the Monroe County Power Plant will be completed by 2014 (Detroit Edison 2011d).

Monroe County lost jobs in manufacturing, construction, and retail and wholesale trade but experienced growth in other sectors, for a net gain in jobs between 2000 and 2008. However, the U.S. Bureau of Labor Statistics (USBLS) reported a rise in unemployment from 3.2 percent in 2000 to 8.9 percent in 2008. The unemployment rate has continued to increase, with the

USBLS reporting an unemployment rate of 14.1 percent for Monroe County in 2009 (USBLS 2010).

Monroe County's economy benefits from an extensive transportation network, waterfront access, energy supplies, and agricultural production. Three major railroad lines and I-75 traverse Monroe County from north to south. Access to the waterfront of Lake Erie provides industrial, commercial, and recreation-based economic opportunities. The Port of Monroe provides a point of access for Great Lakes shipping and transport through the Great Lakes-Saint Lawrence Seaway. Thirty-seven other marinas are located within Monroe County, and the Lake Erie shoreline, with its beaches, boat launch facilities, and campgrounds, is attractive to tourists. Three major energy facilities are located in Monroe County, including Detroit Edison's Fermi 2 Plant and its coal-fired Monroe Power Plant and Consumer's Energy's J.R. Whiting Power Plant (Monroe County Planning Department and Commission 2010). Approximately 62 percent of Monroe County's land is in farmland. In 2007, the USDA reported that the value of agricultural products sold from Monroe County was $130 million (USDA 2007). Between 2006 and 2016, job growth is expected in the healthcare, service, professional, and farming occupations (Michigan Department of Energy, Labor and Economic Growth 2010a).

Wayne County

Employment in Wayne County was 780,704 workers in 2008 (USBLS 2009a). Approximately 40 percent of the jobs in Wayne County are in two sectors: manufacturing sector and educational services/healthcare/social assistance sector. In 2008, Wayne County had 129,811 manufacturing jobs and 173,671 jobs in educational services/healthcare/social assistance. The four largest employers in Wayne County in 2007 were Ford Motor Company, with approximately 42,309 employees; the Detroit School District, with approximately 17,329 employees; the City of Detroit, with approximately 13,593 employees; and the Henry Ford Health System, with approximately 11,475 employees (Wayne County Department of Management and Budget 2008).

Wayne County is part of a large urbanized area within the Detroit-Warren-Livonia MSA, which encompasses 10 principal cities in a six-county area and had a combined estimated population in 2008 of 4.5 million. In addition to Ford Motor Company, other large manufacturing businesses in the metropolitan area as of 2008 included General Motors Corporation (41,861 employees); Chrysler LLC (32,597 employees); Automotive Component Holdings, an automotive supplier (4497 employees); and Johnson Controls Automotive Experience, an automotive supplier (4205 employees). Several healthcare systems were also large employers in the metropolitan area as of 2008, in addition to Henry Ford Health System and including the University of Michigan Health System (16,551 employees), St. John Providence Health System (14,286 employees), Trinity Health (13,012 employees), Beaumont Hospitals (12,638), and Detroit Medical Center (11,003 employees) (Detroit Economic Growth Corporation 2010).

Wayne County is served by major transportation routes, including highway, air transport, rail, and waterway shipping routes, which support the economy of the area. International trade with Canada, which is conducted primarily by truck traffic across the Ambassador Bridge, contributes significantly to the local economy. Wayne County was the destination or origin for 11,987 cross-border trucks and 123,012 tons of cargo in 2006. Passenger trips across the border also contribute toward retail spending and tourism (SEMCOG 2009b). In addition, the Detroit/Wayne County Port Authority maintains freight transportation hubs for rail, trucking, and shipping. In 2005, the Port of Detroit imported and exported 17 million tons of cargo, with revenues of approximately $165 million (Detroit/Wayne County Port Authority 2010). The Detroit Metropolitan Wayne County Airport (DTW), located in Wayne County, served more than 36 million passengers in 2007 (DTW 2009).

Between 2000 and 2008, Wayne County lost approximately 61,000 jobs, primarily in the manufacturing and construction sectors. Some growth occurred in educational services, healthcare and social assistance, the arts, entertainment, recreation, and accommodation and food services, but it did not make up for the jobs lost. In addition to losses in manufacturing and construction, Wayne County also experienced job losses in other employment sectors, including wholesale and retail trade and transportation, indicating that its economy is closely linked to its manufacturing base. During this time period, Wayne County lost members of the labor force as well as population. These trends are attributed to workers leaving the area to pursue jobs elsewhere, production workers taking buyouts and early retirement in the restructuring process, and an aging population (SEMCOG 2007). In 2008, the USBLS reported the unemployment rate for Wayne County was 9.9 percent. Nationally, the unemployment rate in 2008 was 5.8 percent; and in the State of Michigan it was 8.4 percent. Wayne County's unemployment rate has continued to increase, with the USBLS reporting an unemployment rate of 16.0 percent in 2009 (USBLS 2010).

Between 2006 and 2016, job growth is expected in the healthcare, service, professional, and farming occupations (Michigan Department of Energy, Labor, and Economic Growth 2010a).

Lucas County

Lucas County had 204,204 employed workers in 2008 (USBLS 2009a). Approximately 25 percent of the workforce is employed in the educational services/healthcare/social assistance sector. Manufacturing and retail trade employ approximately 15 percent and 12 percent, respectively. The four largest employers in Lucas County in 2007 were Promedica Health Systems, with approximately 11,265 employees; Mercy Health Partners, with approximately 6723 employees; the University of Toledo, with approximately 4987 employees; and the Toledo School District, with approximately 4554 employees (Lucas County Auditor's Office 2008).

Lucas County is part of an urbanized area within the Toledo MSA, which encompasses the City of Toledo and three other counties. The economy of Lucas County is integrated with the economy of the City of Toledo and communities within the MSA. The economy has been supported by agricultural and industrial production, transportation, and warehousing (Regional Growth Partnership 2010). Approximately 49 percent of the land area in Lucas County is in farmland. In 2007, the USDA reported that the value of agricultural products sold from Lucas County was $47 million (USDA 2007). Large manufacturing businesses in the Toledo area as of 2009 included General Motors Corporation (2924 employees), Chrysler LLC (2261 employees), The Andersons (grain storage, process, and retail; 1793 employees), Libbey, Inc. (glass manufacturing; 1047 employees), Owens-Corning (glass manufacturing; 950 employees), and Dana Corporation (automotive parts manufacturing; 850 employees) (Regional Growth Partnership 2010). Other nonmanufacturing employers in the MSA, in addition to the four largest employers listed above, are Bowling Green State University (5400 employees), Lucas County (3934 employees), and Kroger, Inc. (retail grocery; 2747 employees) (Regional Growth Partnership 2010).

Transportation and warehousing also support the economy in Lucas County. The Toledo-Lucas County Port Authority maintains freight transportation hubs for rail, trucking, and shipping. Sixteen terminal operators are located at the Port of Toledo on Lake Erie, providing access to the Great Lakes Saint Lawrence Seaway; they involve grain and food storage (ADM Grain Company, The Andersons, Hansen Mueller), fuel storage (BP-Husky Refining, Seneca Petroleum, and Sunoco MidAmerica M&R), and other operations. Toledo is a major railroad hub for Canadian National (North American), CSX Transportation (CSX), and Norfolk Southern Railway (Regional Growth Partnership 2010).

Between 2000 and 2008, Lucas County lost 7951 jobs. Job losses occurred in manufacturing, retail, wholesale trade, and educational services/healthcare/social assistance sectors, with fewer job losses in other sectors of the economy. The county gained jobs in the arts, entertainment, recreation and accommodation, and food services sectors. Lucas County's construction workforce remained relatively stable, with 11,778 construction jobs in 2008. Between 2000 and 2008, the unemployment rate for the county increased from 4.5 percent to 8.3 percent. In the State of Ohio, the unemployment rate in 2008 was 6.5 percent. The unemployment rate has continued to increase, with the USBLS reporting an unemployment rate of 12.6 percent for Lucas County in 2009 (USBLS 2010).

Heavy Construction Workforce in Economic Impact Area

A portion of the existing construction workforce in Monroe, Wayne, and Lucas Counties is engaged in the type of heavy craft construction work that would be required for building a nuclear power plant facility. Detroit Edison identified the following types of heavy craft construction workers who would be employed for construction of Fermi 3: supervisors, boilermakers, brick and stone masons, carpenters, laborers, paving and surfacing workers, operating engineers, electricians, insulation workers, plumbers and steamfitters, rebar workers, sheet metal workers, and millwrights (Detroit Edison 2011a).

Table 2-31 provides an estimate of the size of the labor pool for the metropolitan areas that include Monroe and Wayne Counties in Michigan and Lucas County, Ohio, for the types of workers that would be needed for construction of Fermi 3. The review team notes that the total estimates do not equal the sum for detailed occupations because total estimates include occupations not shown separately. Included in the total are occupations within the extraction industry (e.g., drilling and mining) and other construction occupations that are not occupations that would be used for constructing Fermi 3. However, also included in the total are construction occupations that would be used by Detroit Edison to construct Fermi 3, but have not been reported by USBLS by construction type. Estimates do not include self-employed workers.

Table 2-32 provides the 2016 employment projections for the types of heavy craft construction workers who would be employed for building Fermi 3. The State of Michigan forecasts a modest growth in all of the major craft occupations; the State of Ohio also forecasts growth in the major craft occupations, except for sheet metal workers and millwrights (Michigan Department of Energy, Labor and Economic Growth 2010b; Ohio Department of Job and Family Services 2008).

Detroit Edison identified the following occupations specific to the operations workforce for Fermi 3: management, operations, engineering, maintenance, outage and planning, major modification and site support, organizational effectiveness, radiation protection, training, security, supply chain management, and telecommunications (Detroit Edison 2011a).

Table 2-33 lists the 2006 statewide labor force and the 2016 projections for the statewide labor force for occupational categories that correspond to the operations workforce that would be required for Fermi 3. The State of Michigan forecasts growth in most of the occupations that support operations, especially in the occupations with broad applications in multiple industries (Michigan Department of Energy, Labor, and Economic Growth 2010b). The State of Ohio also forecasts growth in the occupations with broad applications, but it also forecasts modest declines in general and operations managers, mechanical engineers, power distributors and dispatchers, power plant operators, and stationary engineers and boiler operators (Ohio Department of Job and Family Services 2008).

2.5.2.2 Taxes

This section describes the State and local tax structure and tax revenue for jurisdictions in the area of the proposed Fermi 3.

1 **Table 2-31**. Construction Industry Occupational Employment Estimates in the Economic Impact
2 Area[a] in 2008

Occupation Title[b]	Monroe, Michigan MSA	Detroit-Livonia-Dearborn, Michigan Metropolitan Division	Toledo, Ohio MSA
Boilermakers	–[c]	120	70
Brickmasons and blockmasons	–	550	160
Carpenters	160	2200	1850
Cement masons and concrete finishers	70	320	340
Stonemasons	–	–	–
Construction laborers	330	2380	1320
Paving, surfacing, and tamping equipment operators	–	120	50
Operating engineers and other construction equipment operators	130	1570	600
Electricians	210	3660	1340
Insulation workers: floor, ceiling, and wall	–	–	–
Insulation workers: mechanical	–	–	–
Painters, construction, and maintenance	–	790	420
Reinforcing iron and rebar workers	–	–	–
Plumbers, pipefitters, and steamfitters	210	1860	1120
Sheet metal workers	–	430	460
Structural iron and steel workers	100	190	150
Millwrights[d]	40	1140	–
Total construction and extraction occupations[e]	1850	19,430	11,410

Source: USBLS 2008

(a) Data are presented by the USBLS for metropolitan areas that include the counties identified as the economic impact area. The geographical area for the Monroe MSA is Monroe County, and the geographical area for the Detroit-Livonia-Dearborn Metropolitan Division is Wayne County. However, the geographical area for the Toledo MSA includes Fulton, Ottawa, and Wood Counties as well as Lucas County, Ohio.

(b) The occupational titles presented are those occupations that Detroit Edison plans to use for construction of Fermi 3.

(c) – = Data are not reported for this occupation type.

(d) Millwrights are classified by the USBLS under the Installation, Maintenance, and Repair Occupations.

(e) Included in the total are occupations within the extraction industry (e.g., drilling and mining) and other construction occupations, which are not occupations that would be used to construct Fermi 3. However, included in the total are construction occupations that would be used by Detroit Edison to construct Fermi 3 but have not been reported by USBLS by construction type. Therefore, total estimates do not equal the sum for detailed occupations because total estimates include occupations not shown separately. Estimates do not include self-employed workers.

3

Table 2-32. Michigan and Ohio Construction Labor Force by Major Craft Occupation

Construction Category	Michigan			Ohio		
	2006 Actual	2016 Projected	Net Change	2006 Actual	2016 Projected	Net Change
Construction and Extraction Occupations[(a)]	184,180	195,890	+11,710	246,120	263,130	+17,010
Boilermakers	520	580	+60	590	670	+80
Brickmasons and blockmasons	4,740	5,220	+480	6,510	7,180	+670
Carpenters	31,710	33,710	+2,000	41,220	44,930	+3,710
Cement masons and concrete finishers	4,140	4,490	+350	6,610	7,340	+730
Stonemasons	260	280	+20	440	490	+50
Construction laborers	27,240	29,330	+2,090	32,330	35,270	+2,940
Paving, surfacing, and tamping equipment operators	2,250	2,420	+170	1,810	1,930	+120
Operating engineers and other construction equipment operators	9,090	9,680	+590	12,080	12,950	+870
Electricians	24,000	25,070	+1,070	30,190	30,400	+210
Insulation workers: floor, ceiling, and wall	480	530	+50	1,160	1,230	+70
Insulation workers: mechanical	480	510	+30	560	600	+40
Painters, construction, and maintenance	8,580	9,090	+510	12,620	13,970	+1,350
Reinforcing iron and rebar workers	170	200	+30	900	1,020	+120
Plumbers, pipefitters, and steamfitters	15,060	15,760	+700	18,120	19,110	+990
Sheet metal workers	4,960	5,190	+230	5,770	5,750	–20
Structural iron and steel workers	1,600	1,650	+50	2,690	2,780	+90
Millwrights[(b)]	5,500	5,520	+20	5,410	4,550	–860

Sources: Michigan Department of Energy, Labor, and Economic Growth 2010b; Ohio Department of Job and Family Services 2008

(a) Total estimates do not equal the sum for detailed occupations because total estimates include occupations not shown separately. Estimates do not include self-employed workers.

(b) Millwrights are classified by the USBLS under the installation, maintenance, and repair occupations.

State

Income and sales taxes are the principal sources of tax revenues for the States of Michigan and Ohio, accounting for more than half of the tax receipts for fiscal year (FY) 2009 in both States (Table 2-34). Corporate taxes account for 12 percent of tax revenues in Michigan and Ohio. Most of the tax revenues go to a general fund that supports various State activities in both Michigan and Ohio, as defined in each State's budget. The State of Michigan also receives a portion of property tax revenue from a State education tax, which is collected at the local level. The State education tax supports the State School Aid Fund, which, along with 2 percent of the sales tax and contributions from other sources, allows the State to provide an equitable

Table 2-33. Michigan and Ohio Nuclear Operations Labor Force by Occupation

	Michigan			Ohio		
Occupation	**2006**	**2016 Projected**	**Net Change**	**2006**	**2016 Projected**	**Net Change**
General and operations managers	36,460	35,450	–1010	56,770	54,430	–2340
Accountants and auditors	34,290	38,230	+3940	49,080	54,050	+4970
Computer software engineers Applications and systems software	19,420	24,400	+4980	23,770	31,760	+7990
Network and computer system Administrators	7850	9270	+1420	12,020	14,510	+2490
Chemical engineers	1050	1160	+110	1530	1570	+40
Civil engineers	6190	6870	+680	5990	6460	+470
Electrical engineers	6370	6790	+420	4440	4500	+60
Mechanical engineers	24,730	25,970	+1240	11,350	10,630	–720
Nuclear technicians	90	90	0	400	400	0
Security guards	25,360	27,600	+2240	31,390	33,680	+2290
Office and administration support	699,660	723,590	+23,930	917,670	943,850	+26,180
Nuclear power reactor operators	–[(a)]	–	–	150	160	+10
Power distributors and dispatchers	490	470	–20	160	140	–20
Power plant operators	1640	1680	+40	1260	1220	–40
Stationary engineers and boiler operators	1310	1320	+10	2080	1970	–110

Sources: Michigan Department of Energy, Labor, and Economic Growth 2010b; Ohio Department of Job and Family Services 2008
(a) – = Data are not reported for this occupation type.

redistribution of school aid throughout the State. All local school districts are provided with a minimum allowance per pupil, which has lowered the spending gap between low- and high-spending school districts.

Tax rates for income, sales and use, corporate, and State education in the States of Michigan and Ohio are shown in Table 2-35.

Local

Table 2-36 presents the total revenue, property tax revenue, percent of total revenues, and millage rate for property taxes (property tax rate per $1000) for each county in Monroe, Wayne, and Lucas Counties.

Table 2-34. Tax Revenue for the States of Michigan and Ohio

	FY 2009[a] Net Receipts in 1000s (percent of total)			
	Michigan		Ohio	
Tax Source	**Dollars**	**Percent**	**Dollars**	**Percent**
Individual income	6,071,541	29	8,228,349	39
Sales and Use	7,417,881	35	7,276,288	34
Corporate	2,602,517	12	2,443,059	12
State education	2,145,886	10	–[b]	–
Cigarettes	984,028	5	924,764	4
Motor vehicle fuel	957,202	5	1,743,151	8
Other taxes and fees[c]	890,287	4	648,284	3
Total	**21,069,342**		**21,263,895**	

Sources: Michigan Department of Treasury 2010; Ohio Office of Management and Budget 2009

(a) FY 2009 for the State of Michigan is October 1, 2008, through September 30, 2009. FY 2009 for the State of Ohio is July 1, 2008, through June 30, 2009.

(b) – = The State of Ohio does not collect a State education tax.

(c) Includes real estate transfer tax, airport parking tax, convention center utility tax, and others.

Table 2-35. Tax Rates in the States of Michigan and Ohio

	2009 Tax Rates	
Tax Source	**Michigan**	**Ohio**
Individual income	4.35 percent[a]	0.618 percent on the first $5000 of income to 6.24 percent on the amount in excess of $200,000[b]
Sales and Use[c]	6 percent[d] [e]	5.5 percent
Corporate [f]	Income: 4.95 percent Modified gross receipts: 0.8 percent	Gross receipts: 0.26 percent
State education	$6 per $1000 of assessed value	–[g]

Sources: Citizen Research Council of Michigan 2011; Ohio Department of Taxation 2009

(a) Rate applies from 2007 through 2011, decreasing annually thereafter through 2015, at which time the rate is set at 3.9 percent.

(b) The State of Ohio enacted a 4.2 percent annual across-the-board tax rate reduction between 2005 and 2009. In 2010, the State Tax Commission is required to adjust the tax rate for each income bracket based on inflation.

(c) Michigan has no city, local, or county sales tax. The county sales tax rate for Lucas County, Ohio, is 1.25 percent, which is in addition to the 5.5 percent State sales tax.

(d) 2 percent of the sales and use tax is dedicated to the School State Aid Fund.

(e) Sales of electricity, natural gas, and home heating fuels for residential use are taxed at a rate of 4 percent; commercial and industrial users are taxed at a rate of 6 percent.

(f) For Michigan, this is the Michigan business tax. For Ohio, this is the commercial activity tax, which replaced the corporation franchise tax as of 2009.

(g) – = The State of Ohio does not collect a State education tax.

Table 2-36. Property Tax Revenue and Millage Rates for Monroe, Wayne, and Lucas Counties (FY 2009)

Rates and Revenues	Monroe County	Wayne County	Lucas County
Tax revenues			
Total revenue[(a)]	$64,974,874	$522,088,000	$248,270,000
Total property tax revenue	$32,028,207	$364,895,000	$102,305,000
Percent of total revenues	49	70	41
Millage rates			
Direct county millage rate[(a)]	4.8	6.6	2.0
Overlapping rates[(b)]			
Cities and village	10.33 to 18.96	11.43 to 38.95	0.80 to 7.00
Townships	0.70 to 9.66	2.36 to 14.04	4.80 to 24.25
School districts [(c)]	28.95 to 37.99	18.00 to 33.50	46.85 to 125.85
Intermediate school districts	3.46 to 7.28	3.37 to 4.75	–[(d)]

Sources Monroe County Finance Department 2009; Wayne County Department of Management and Budget 2009; Lucas County Auditor's Office 2009

(a) General Fund only.

(b) Millage rates for special districts, special authorities, and other community facilities (e.g., libraries, community colleges) are not shown.

(c) Millage rates for school districts in Monroe and Wayne Counties includes 6 mills for the State School Aid Fund.

(d) – = Lucas County does not have a separate tax rate for intermediate school districts.

In the State of Michigan, local jurisdictions have taxing authority for income (cities only), selected sales revenue (i.e., hotel accommodations and stadium and convention facilities), and various property taxes.

Under the Michigan Uniform City Income Tax Act, individual cities in Michigan may adopt a city uniform income tax. Generally, the rate is 1 percent for residents and corporations and 0.5 percent for nonresidents with earnings in the imposing city. Cities with populations larger than 750,000 may impose rates up to 2.5 percent on residents, 1.0 percent on corporations, and 1.25 percent on nonresidents (Citizen Research Council of Michigan 2011). Cities with income taxes in Wayne County include Detroit (2.5 percent for residents, 1.0 percent for corporations, and 1.25 percent for nonresidents); Hamtramck (1.0 percent for residents, 1.0 percent for corporations, and 0.5 percent for nonresidents); and Highland Park (2.0 percent for residents, 2.0 percent for corporations, and 1.0 percent for nonresidents). None of the cities in Monroe County impose income taxes (Citizen Research Council of Michigan 2011).

Property taxes are the primary source of revenue in Monroe and Wayne Counties. As shown in Table 2-36, property taxes represent 49 percent of total revenue in Monroe County. In Wayne County, property tax revenue represents 70 percent of total county revenue (Monroe County Finance Department 2009; Wayne County Department of Management and Budget 2009).

Millage for local school districts in Michigan is limited to the lesser of 18 mills or the 1993 millage rate (when the State School Aid Fund was established) because the State funds most of the operating expenses for schools. In addition, principal residences, industrial personal property, and qualified agricultural property are entirely exempt from school millages, and commercial personal property is partially exempt. However, if the per-pupil foundation allowance falls below the State minimum allowance, school districts may reduce the exemption on principal residence and qualified agricultural property or may levy additional mills on all property to generate the per-pupil allowance. School districts may also levy taxes to fund capital expenditures. In 2009, the State average millage rate, including the 6-mill State education tax, was 39.13 mills (Citizen Research Council of Michigan 2011).

Millage rates for county property tax revenue and revenue of overlapping jurisdictions in Monroe and Wayne Counties are shown in Table 2-36.

In the State of Ohio, only the State and counties may levy a general sales tax; however, cities, villages, and townships may also levy sales taxes on accommodations and admissions. In addition to the State, cities and villages in Ohio may levy income taxes. All local jurisdictions may levy property taxes, including schools and other special districts (i.e., fire, water, and sewer). Property taxes are the primary source of revenue in Lucas County.

As of 2006, 566 municipalities (235 cities and 331 villages) in the State of Ohio levied an income tax. The tax rates are flat rates, and the maximum rate allowed under State law is 1 percent without voter approval. In 2006, municipal income tax rates ranged from 0.30 percent to 3 percent (Ohio Department of Taxation 2009).

As shown in Table 2-36, property taxes represent 41 percent of total revenue in Lucas County (Lucas County Auditor’s Office 2009).

Fermi 2

The major State and local taxes paid by Detroit Edison are the Michigan business tax, property tax, and sales tax on purchases of goods and services for operation and maintenance of the plant. In addition, consumers of electricity pay a State sales tax on the electricity used, which is collected by Detroit Edison and paid to the State of Michigan.

Detroit Edison paid $149 million in combined Federal and State income tax in 2007 (Detroit Edison 2010e). Detroit Edison estimates that it paid, on average, $1.154 million per year in direct sales taxes (those taxes generated by direct expenditures for operation and maintenance of the plant site and capital expenditures) during the years 2002 through 2007. An additional $4.44 million in indirect sales tax revenues was generated, benefitting the States of both Michigan and Ohio (Detroit Edison 2011a). Indirect sales tax revenue is based on expenditures by workers as a portion of their take-home salary.

Table 2-37 shows the estimated State sales tax revenue based on electrical usage by consumers within the Detroit Edison service area in 2009.

Detroit Edison is also assessed property tax by local jurisdictions within Monroe County. Detroit Edison is the leading taxpayer in Monroe County. In 2009, its assessed value was $820 million, or 13.3 percent of the total county taxable assessed value, which includes the coal-fired Monroe Power Plant as well as Fermi 2. Over the past 9 years, Detroit Edison's assessed value has declined. In 2000, the assessed value of the Fermi plant was $1,146 million, or 25.4 percent of the total county taxable assessed value (Monroe County Finance Department 2009). In 2009, Detroit Edison paid a millage rate of approximately 47.33 mills, dispersed to the local jurisdictions outlined in Table 2-38. Total property taxes paid by Detroit Edison for the Fermi 2 plant site are shown in Table 2-38.

Table 2-37. Estimated Sales Tax Revenue from Electrical Usage by Consumers within the Detroit Edison Service Area in 2009[(a)]

Consumers	Usage[(b)] (MWh)	Total Revenue (in millions of $)	Sales Tax Rate[(c)]	Total Sales Tax Revenue (in millions of $)
Residential	14,625,206	1,754	0.04	70
Commercial	18,190,402	1,617	0.06	97
Industrial	9,932,275	687	0.06	41
Total				208

Source: U.S. Department of Energy, Energy Information Administration 2009

(a) Detroit Edison owns and operates eight fossil-fuel plants, one hydroelectric plant, and various oil or gas-fueled peaking units as well as Fermi 2 within the State of Michigan (Detroit Edison 2010e).

(b) Detroit Edison reports that approximately 14 percent of its power generation is nuclear (Detroit Edison 2010e).

(c) Detroit Edison reports that most of its customers are located within the State of Michigan (Detroit Edison 2010e). Therefore, the estimated sales tax revenue is based on the State of Michigan sales tax rate.

2.5.2.3 Transportation

This section provides an overview of the regional transportation facilities in the local area, including air, rail, and barge, that could provide service for the Fermi plant site. The discussion of the roads and highways in the local area focuses on the immediate vicinity of the Fermi site, where traffic impacts associated with the commute of the preconstruction, construction, and operational workforce to and from the Fermi site are more likely to occur. Commuter traffic beyond the immediate vicinity of the site would be dispersed and would not be expected to affect traffic patterns or level of service on more distant roadways.

Table 2-38. Estimated 2009 Property Tax for Detroit Edison

Jurisdiction	Millage in 2009	Total Estimated Tax in 2009 (in millions of $)
Monroe County – Operation	4.8	3.9
Monroe County – Senior Citizens	0.5	0.4
Monroe County Community College	2.18	1.8
Monroe County Library	1.0	0.8
Monroe Intermediate School District	4.75	3.9
Frenchtown Charter Township	6.8	5.6
Jefferson Schools	18.5	15.2
State Education Tax	6.0	4.9
Resort Authority	2.8	2.3
Total	47.33	38.8

Source: Monroe County Finance Department 2009

Air

The largest commercial airport in the Fermi site region is DTW, located approximately 19 mi north of the Fermi plant site. DTW serves domestic and international passenger carriers and air cargo flights. In 2007, more than 467,000 annual flight operations went through DTW, serving more than 36 million passengers. In 2007, it was the 10th largest airport in the country, based on number of passengers served (DTW 2009).

Willow Run Airport is located 7 mi west of DTW and serves cargo, corporate, and general aviation flights. It is one of the country's largest airports for handling cargo air freight. DTW and the Willow Run Airport are operated by the Wayne County Airport Authority. There are numerous other cargo, passenger, and private airports in the Fermi site region. Table 2-39 lists the public airports in the vicinity of the Fermi plant site.

Rail

Three major railway systems provide service to or at stations near the Fermi site because it is centrally located between Detroit and Toledo: Canadian National (CN), CSX, and Norfolk Southern Railway (NS) (Monroe County Planning Department and Commission 2010). A rail spur from the main line CN railway extends into the Fermi site parallel to Enrico Fermi Drive. This rail spur allows large and heavy equipment to be transported to the plant site (Detroit Edison 2011a).

Shipping

Barges, freighters, and bulk cargo ships use Lake Erie in the vicinity of the Fermi site. Most of the barge traffic on Lake Erie near the Fermi site occurs to and from the Ports of Toledo, Detroit,

Table 2-39. Public Use Airports in the Local Area

Name	Location	Type of Operation	Distance from Fermi Site (mi)	Direction from Fermi Site
Wickenheiser Airport	Carleton, Michigan	General aviation	7	NW
Custer Airport	Monroe, Michigan	General aviation	9	W
Grosse Ile Municipal Airport	Detroit/Grosse Ile, Michigan	General aviation	11	NNW
Erie Aerodrome	Erie, Michigan	General aviation	18	SW
Detroit Metropolitan Wayne County Airport	Detroit, Michigan	Commercial, air taxi, general aviation	19	NNW
Willow Run Airport	Ypsilanti, Michigan	Commercial, air taxi, general aviation	24	NNW
Toledo Suburban Airport	Lambertville, Michigan	General aviation	25	SW
Gradolph Field Airport	Petersburg, Michigan	General aviation	25	W
Toledo Express Airport	Toledo, Ohio	Commercial, air taxi, general aviation	>40	SW
Coleman A. Young Municipal Airport	Detroit, Michigan	General aviation, air taxi	33	NNE

Source: AirNav.com 2009

and Monroe, which are part of the Great Lakes-St. Lawrence Seaway system, which connects shipments from the Atlantic Ocean to the Midwest. In 2008, 4232 vessels traveled through the seaway. During that same year, the Toledo port received 138 shipments and exported 126 shipments, and the Port of Detroit received 140 shipments and exported 49 shipments (St. Lawrence Seaway Management Corporation 2009). The Port of Monroe is not considered a major port but has received heavy equipment for the Fermi 2 power plant in the past. A barge slip and offloading area is located at the Fermi plant site; it was used to offload equipment during Fermi 2 construction, but is no longer in use (Detroit Edison 2011a).

Roads/Highways

The region within a 50-mi radius surrounding the Fermi site has a highly developed roadway network. I-75, which extends through Monroe County and Frenchtown Charter Township, is 2 mi east of the Fermi plant site and provides access from the Fermi site north to Detroit and south to Toledo. I-275 splits from I-75 north of the Fermi plant site and continues in a northwesterly direction, providing a western bypass around the Detroit metropolitan area, and access to the DTW, western Wayne County, and Oakland County. It connects to I-94 and I-96, which are the primary Michigan east-west interstates.

The main entrance to the site is at Enrico Fermi Drive, which connects to N. Dixie Highway after crossing Toll Road and Leroux Road. N. Dixie Highway links the site to local communities north and south and connects to many other key local and regional highways. To the south, N. Dixie Highway provides access to I-75 at an interchange approximately 6.2 mi southwest of the site. It also intersects Nadeau Road south of the site, which provides another interchange with I-75 approximately 6 mi west of the site. To the north, N. Dixie Highway intersects with Swan Creek Road, which has an interchange with I-75 approximately 6 mi to the northwest of the Fermi site.

Existing roadways in the vicinity of the Fermi site are shown on Figure 2-16. The average daily traffic (ADT) volume for these roadways is shown on Table 2-40. Most of the roads in the area, excluding I-75 and N. Dixie Highway, are low-volume roads, with an ADT of fewer than 5000 vehicles per day. These traffic volumes are generally below the capacity of the roads (The Mannik & Smith Group, Inc. 2009).

In May 2009, Detroit Edison performed a level of service (LOS) analysis for the intersections of these roadways during the peak traffic periods associated with the arrival and departure of Fermi plant employees during normal operations. LOS is a designation of operational conditions on a roadway or intersection, ranging from A (best) to F (worst).LOS categories as defined in the *Highway Capacity Manual* are listed on Table 2-41. The LOS analysis was conducted in accordance with the Transportation Research Board's *Highway Capacity Manual* to evaluate the operational efficiency at each intersection and its approaching roadway(s). This analysis was conducted to determine the baseline conditions from which the traffic impacts associated with construction and operation of Fermi 3 could be compared. Table 2-42 provides the LOS at local intersections during the morning and afternoon commutes to and from the Fermi plant site. All intersections in the immediate vicinity of the Fermi plant site operated at acceptable LOSs. The Mannik & Smith Group identified deficiencies at three intersections associated with the I-75 interchanges (The Mannik & Smith Group, Inc. 2009):

- northbound I-75 ramp, left turn to westbound Nadeau Road
- northbound I-75 ramp, left turn to westbound Swan Creek Road
- southbound I-75 ramp, northbound approach at Swan Creek Road.

The Mannik & Smith Group, Inc., determined that beyond the immediate vicinity of Fermi 2, the traffic associated with the Fermi workforce would not be distinguishable from the ADT volumes on major commuting routes, such as I-75. Therefore, the traffic analysis did not encompass the entire economic impact area. The review team reviewed the traffic analysis prepared by The Mannik & Smith Group, Inc., and concurred with the findings.

SEMCOG is the region's designated metropolitan planning organization for regional transportation planning. Short-range (e.g., 2008 to 2011) priorities for funding by cities, county road commissions, transit agencies, and the Michigan Department of Transportation are

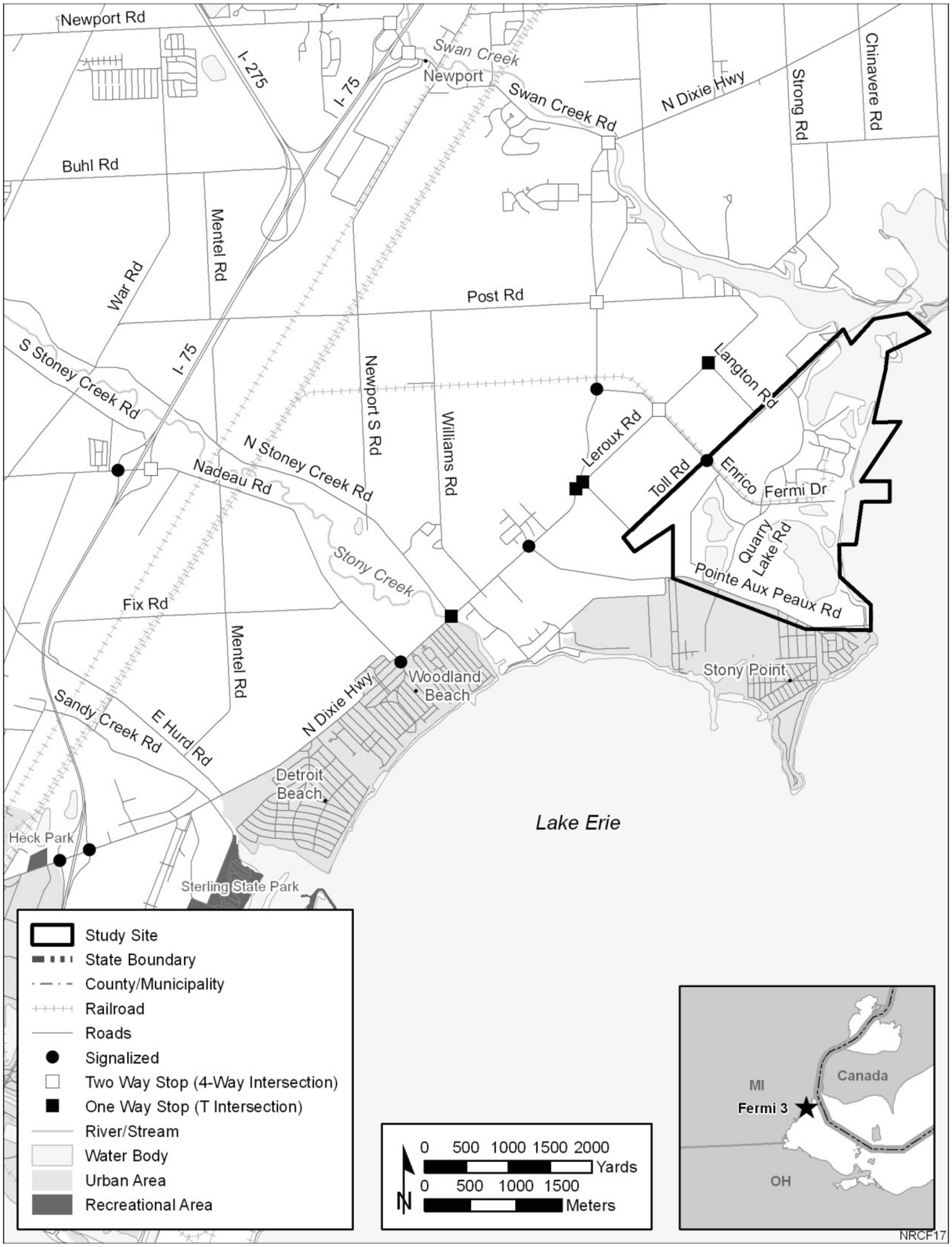


Figure 2-16. Local Roadways near the Fermi Site (The Mannik & Smith Group, Inc. 2009)

Table 2-40. Existing Average Daily Traffic Volumes on Local Roadways

Roadway	Weekday ADT	Weekend ADT
I-75, N. Dixie Highway to Nadeau Road	16,800	–[(a)]
I-75, I-275 to Newport/Swan Creek Road	31,200	–
N. Dixie Highway, I-75 to Nadeau Road	12,700	–
N. Dixie Highway, Stony Creek to Pointe Aux Peaux Road	8,494	7219
N. Dixie Highway, south of Enrico Fermi Drive	4,307	–
Nadeau Road	5,300	–
Pointe Aux Peaux Road	4,110	3766
Swan Creek Road	4,300	–
Enrico Fermi Drive	2,378	611
Post Road, east of N. Dixie Highway	275	260
Leroux Road	124	125

Source: The Mannik & Smith Group, Inc. 2009
(a) – = ADT volumes were not collected during the weekend for these roadways.

Table 2-41. Level of Service Categories

Level of Service	Definition
Intersections with signals	
A	Acceptable: little or no delay, few vehicles stopped at intersection
B	Acceptable: short traffic delays, progression is still good
C	Acceptable: average traffic delays, many vehicles go through intersection without stopping, but a significant amount are stopped
D	Acceptable (marginal): long traffic delays, unfavorable progression, more vehicles stopped at intersection, individual cycles may fail
E	Moderately deficient: very long traffic delays, individual cycles frequently fail
F	Deficient: extreme traffic delays, over-saturation
Intersections with no signals	
A	Acceptable: primarily free flow
B	Acceptable: reasonably free flow
C	Acceptable: stable flow
D	Acceptable (marginal): marginal congestion
E	Moderately deficient: unstable congestion
F	Deficient: very congested

1 **Table 2-42.** Existing Level of Service in 2009 on Area Roadway Intersections during Peak
2 Morning and Afternoon Workforce Commutes

Intersection	Approach/Movement	LOS Peak Morning	LOS Peak Afternoon
Northbound I-75 ramps and Dixie Hwy.	Northbound ramp	C	C
	N. Dixie Hwy./eastbound	A	A
	N. Dixie Hwy./westbound	A	A
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp/left turn	F	D
	Northbound ramp/right turn	Free	Free
	Nadeau Rd./eastbound/thru/left turn	A	A
	Nadeau Rd./westbound	Free	Free
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp/left turn	D	E
	Northbound ramp/right turn	B	B
	Swan Creek Rd./southeast-bound	Free	Free
	Swan Creek Rd./northwest-bound	A	A
Southbound I-75 ramps and Swan Creek Rd./ Newport Rd.	Southbound ramp (northbound approach)	C	E
	Newport Rd./northwest-bound	A	A
	Newport Rd./southeast-bound	A	A
	Swan Creek Rd./southbound	A	D
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd./eastbound	C	C
	North Dixie Hwy./northbound	A	A
	North Dixie Hwy./southbound	Free	Free
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy./northeast-bound	B	B
	North Dixie Hwy./southwest-bound	A	C
	Pointe Aux Peaux Rd./northwest-bound	B	B
N. Dixie Hwy. and Leroux Rd.	Leroux Rd./southwest-bound	B	B
	North Dixie Hwy./northbound	Free	Free
	North Dixie Hwy./southbound	A	A
N. Dixie Hwy. and Enrico Fermi Dr.	N. Dixie Hwy./northbound	A	A
	N. Dixie Hwy./southbound	A	B
	Enrico Fermi Dr./westbound	C	B
N. Dixie Hwy. and Post Rd.	Post Rd./eastbound	C	C
	Post Rd./westbound	B	B
	North Dixie Hwy./northbound	A	A
	North Dixie Hwy./southbound	B	A
Enrico Fermi Dr. and Leroux Rd.	Leroux Rd./northeast-bound	B	A
	Leroux Rd./southwest-bound	A	A
	Enrico Fermi Dr./southeast/northwest	Free	Free

3

included on a list called the Transportation Improvement Program (TIP), which is regularly updated (SEMCOG 2009c). Projects funded under the TIP are drawn from the long-range RTP, the latest version of which is the *Direction 2035 Regional Transportation Plan for Southeast Michigan* (SEMCOG 2009d). Included in the RTP are more than 1500 projects throughout southeast Michigan that address roadway congestion and safety, bridges, bicycling/walking, public transit, and freight transport.

Specific transportation projects in the vicinity of the Fermi site that are included in either the TIP or the RTP include adding a center left-turn lane on N. Dixie Highway. Improvements between Grand Boulevard and Stony Creek Road were completed in 2008; improvements between Stony Creek Road and Swan Creek Road are still pending (Brudzinski 2011). Other projects identified in the TIP were roadway resurfacing projects on some of the roadways in the vicinity of the Fermi site. None of the deficiencies identified in the LOS analysis are currently addressed by roadway improvements in the TIP or the RTP (SEMCOG 2009c, d).

Public transportation in Monroe County is provided by the Lake Erie Transportation Commission. The Lake Erie Transportation Commission operates a bus service called the Lake Erie Transit (LET). It has eight fixed routes serving the City of Monroe and Monroe Charter and Frenchtown Charter Townships. The Lake Erie Transportation Commission also provides a Dial-a-Ride program for residents in Frenchtown Charter and Bedford Townships; residents are transported from their homes to any destination within the township or to one of the LET fixed lines. Ridership is approximately 400,000 persons annually (LET undated). For the 2007 fiscal year, LET served 358,196 passengers (Michigan Department of Transportation 2009). None of the routes provided by LET directly access the Fermi plant site.

2.5.2.4 Aesthetics

The location of Fermi 3 would be within the existing Fermi site along the Lake Erie shoreline. Elevations at the site range from lake level to 25 ft above lake level. Existing plant structures include the decommissioned Fermi 1, Fermi 2 (operating), and two 400-ft-tall cooling towers. The cooling towers, neutral gray concrete in color, are the predominant visible structures on the site and are visible from outside the site property boundaries in all directions. Topography in the vicinity of the plant site is fairly flat, with some lower elevation wetland areas along the Lake Erie shoreline, including the Fermi site and the surrounding DRIWR.

Surrounding land use is predominantly agricultural, with some residential areas that are within the viewshed of the plant site. Several small beach communities are located along the Lake Erie shore within 5 mi of the Fermi plant site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. Several public and private beaches are located along the Lake Erie shoreline in Monroe and Wayne Counties. Many small marinas and docks are also located along the Lake Erie shoreline within the vicinity and viewshed of the Fermi site. Lake Erie provides a wide variety of water-related recreational opportunities, and recreational boating on

Lake Erie is an important resource to the State. The Fermi site and buildings are easly viewed by boaters in Lake Erie.

Recreational facilities and areas in Monroe, Wayne, and Lucas Counties offer a wide variety of active and passive recreational opportunities such as boating, swimming, hiking, camping, picnicking, and bird watching. The following discussion focuses on major parks and recreational facilities in the local area and their management and highlights prominent park features.

The DRIWR is one of the largest Federally managed recreational and conservation lands in the local area. It encompasses 656 ac of the Fermi site and is managed by the FWS. The DRIWR's acquisition boundary extends 48 mi along the Lake Erie shoreline from the Detroit River to the River Raisin, with lands that can be acquired as they become available. Although the portion of the DRIWR that is within the Fermi site is not open to the public, other portions are open and provide opportunities for hunting, fishing, and wildlife observation. The River Raisin National Battlefield Park, located in Monroe County, is also under Federal control. Located approximately 7 mi from the Fermi site, it is a recent addition to the National Park System. The park and visitor center had been operated previously by the Monroe County Historical Society and the Monroe County Historical Commission.

State recreational areas in Monroe County total 7413 ac and include Sterling State Park and three game areas – Point Mouille State, Petersburg State, and Erie State – as well as several boat access sites and road rest areas. The two Fermi 2 cooling towers are visible from Point Mouille State Game Area (3.1 mi to the northeast) and Sterling State Park (4.8 mi to the south-southwest). Point Mouille State Game Area (3466 ac) is one of the largest freshwater marsh restoration projects in the world. Waterfowl, shorebirds, and other wetland wildlife are the primary attraction at this site. Sterling State Park (1300 ac) is the only State Park on the Lake Erie shoreline of Michigan. It has campgrounds, beach access, a boat launch, a playground, and nature trails.

The Huron-Clinton Metropolitan Authority (HCMA) is a regional special park district encompassing Wayne, Oakland, Macomb, Washtenaw, and Livingston Counties. The HCMA operates 13 Metroparks totaling 23,630 ac. These Metroparks are located along the Huron and Clinton Rivers, providing a greenbelt around the Detroit metropolitan area. The parks are generally more than 1000 ac each, with Stony Creek and Kensington being more than 4300 ac.

Monroe County, Wayne County, and the City of Detroit also manage a number of parks and recreational facilities. Several regional recreational trail and greenway initiatives include the Detroit Heritage River Water Trail, Downriver Linked Greenways Initiative, and Southeast Michigan Greenways Initiative.

Lucas County contains many Federal, State, and local park and conservation lands. Along Lake Erie is the Ottawa National Wildlife Refuge (NWR) Complex, which consists of three

NWRs and a waterfowl production area. The Cedar Point NWR, West Sister Island NWR, and a portion of the Ottawa NWR are located in Lucas County. State lands include the 2202-ac Magee Marsh Wildlife Refuge, the 3101-ac Maumee State Forest, and the 1336-ac Maumee Bay State Park (ODNR 2009a).

The Metroparks in and around the Toledo area encompass 11 parks, totaling 10,500 ac. These parks provide a variety of passive and active recreational opportunities and preserve the natural and cultural features of the area.

2.5.2.5 Housing

This section provides an overview of the housing market in Monroe, Wayne, and Lucas Counties, including information on the housing stock, vacancy rates, house values, rental costs, and basic services. Also included is information about short-term accommodations, including hotels and motels, and sites for recreational vehicles (RVs), which could support the temporary construction workers as well as outage workers.

As shown in Table 2-43, the USCB estimates that more than 1.1 million housing units were located in Monroe, Wayne, and Lucas Counties in 2008. The vacancy rate within the three counties ranged between 1.8 and 6.4 percent for owner-occupied housing and 5.6 and 12.0 percent for rental units, with Wayne County having the highest vacancy rates and Monroe County the lowest. Most of the housing units are owner-occupied single-family units, with owner occupancy highest in Monroe County. Occupied units generally offer basic services, including plumbing, kitchens, and telephone service.

Estimated 2008 median housing costs for Monroe, Wayne, and Lucas Counties are provided in Table 2-44. Housing costs are comparable throughout the area, although the median housing values tend to be higher in Monroe County, whereas the rental cost is slightly higher in Wayne County.

SEMCOG provides regional housing information and trends for counties in southeast Michigan, including Monroe and Wayne Counties. SEMCOG reported that the number of mobile home parks and sites and amount of building permit activity in southeast Michigan as of 2008 indicated that Wayne County had 68 mobile home parks and 15,835 mobile home sites.

Monroe County had 29 mobile home parks and 7452 mobile home sites (SEMCOG 2008b). Monroe County reported that 17.2 percent of the surveyed sites were vacant in 2006 (Detroit Edison 2011a).

In 2008, Monroe County approved permits for the construction of 118 new housing units and the demolition of 44 housing units, resulting in a net increase of 74 new units. During the same year, permits for construction of 1062 new housing units and the demolition of 3498 housing

Table 2-43. Selected Housing Characteristics for Monroe, Wayne, and Lucas Counties, 2008 Estimate

Characteristics	Monroe County	Wayne County	Lucas County
Total Housing Units	63,729	837,894	203,843
Occupied	58,785	688,293	180,738
Owner-occupied (number of units)	46,849	462,844	118,032
Owner-occupied (percent)	80	67	65
Renter-occupied (number of units)	11,936	225,449	62,706
Renter-occupied (percent)	20	33	35
Vacant	4944	149,601	23,105
Vacancy Rate			
Homeowner (percent)	1.8	6.4	3.9
Rental (percent)	5.6	12.0	8.9
Units in Structure for Total Housing Units			
1 unit (number of units)	49,062	627,298	147,570
1 unit (percent)	77.0	74.9	72.3
2–4 units (number of units)	2708	68,176	18,123
2–4 units (percent)	4.2	8.1	8.9
5 or more units (number of units)	4984	127,599	33,479
5 or more units (percent)	7.8	15.2	16.4
Mobile homes (number of units)	6975	14,555	4671
Mobile homes (percent)	10.9	1.7	2.3
Other (boat, RV, van, etc.) (number of units)	0	266	0
Other (boat, RV, van, etc.) (percent)	0	<1	0
Lack of Services within Occupied Housing Units			
Lacking complete plumbing facilities (number of units)	576	5153	261
Lacking complete plumbing facilities (percent)	1	1	<1
Lacking complete kitchen facilities (number of units)	281	8968	2493
Lacking complete kitchen facilities (percent)	<1	1.3	1.4
No telephone service available (number of units)	1036	12,507	2260
No telephone service available (percent)	1.8	1.8	1.3
>1 occupant/room (number of units)	743	17,607	1903
>1 occupant/room (percent)	1.3	2.6	1.1

Sources USCB 2009e, f

Table 2-44. Housing Costs for Monroe, Wayne, and Lucas Counties, 2008 Estimate

Parameter	Monroe	Wayne	Lucas
Median Housing Value	$169,400	$128,100	$128,000
Median Monthly Cost			
Housing units with a mortgage	$1428	$1379	$1236
Housing units without a mortgage	$454	$478	$455
Median Monthly Rent	$709	$745	$632

Sources: USCB 2009e, f

units were approved in Detroit and the remainder of Wayne County, resulting in a net loss of 2436 units. Permits for residential construction have declined over the past few years in southeast Michigan. Data on building permit activity between 2005 and 2008 are provided in Table 2-45. These trends are continuing in 2009, with a net of 40 units approved in Monroe County and a loss of 101 units in Wayne County (SEMCOG 2010b).

Table 2-45. Housing Construction Trends in Monroe and Wayne Counties, 2005–2008

Parameter	Wayne County				Monroe County			
	2005	**2006**	**2007**	**2008**	**2005**	**2006**	**2007**	**2008**
New building units	4864	2789	1422	1062	919	583	351	118
Demolitions	2419	1897	1976	3498	43	64	59	44
Net units	**2445**	**892**	**–554**	**–2436**	**876**	**519**	**292**	**74**

Source: SEMCOG 2010b

The housing market has also been affected by foreclosures in southeast Michigan and in other areas of the country. The U.S. Department of Housing and Urban Development (HUD) has estimated housing foreclosures for each county in the country under its new Neighborhood Stabilization Program, which provides grants for State and local governments and nonprofit organizations to acquire and redevelop foreclosed properties that may otherwise lead to abandonment and neighborhood decline (HUD 2008). HUD estimated the number of housing foreclosures in 2007 and the first six months of 2008 throughout the country. In Monroe County, HUD estimated that 2398 properties were in foreclosure, representing a rate of 6.5 percent of the housing units with a mortgage. In Wayne County, HUD estimated that 48,944 properties were in foreclosure, a rate of 11.2 percent of the housing units with a mortgage (HUD 2008).

SEMCOG forecasts a slow increase in the number of occupied units in Monroe County through 2035 (see Table 2-46). Wayne County experienced a decline in the number of occupied units between 1990 and 2008, with growth occurring in the next decade and through 2035.

Table 2-46. Forecasted Number of Occupied Units, 2020–2035

	Historical			Forecast Period		
County	1990 Census	2000 Census	2008 (estimate)	2020	2030	2035
Monroe	46,508	53,772	58,785	63,307	67,709	69,388
Wayne	780,535	768,440	688,293	717,116	738,524	747,632

Source: SEMCOG 2008a

Assuming that the average vacancy rate for Monroe and Wayne Counties remains constant, an estimated 2342 units would be vacant in 2020 in Monroe County and an estimated 65,975 units would be vacant in 2020 in Wayne County.

An estimated 375 short-term accommodation establishments are located within 50 mi of the City of Monroe; they include hotels and motels, bed and breakfast inns, cabins, cottages, condos, historic inns, and campgrounds (Detroit Edison 2011a). Table 2-47 provides an estimate of the number of RV sites within Wayne, Monroe, and Lucas Counties. Although the number of units in other short-term accommodation establishments has not been estimated, the review team assumes that some units would be available during construction of Fermi 3.

Table 2-47. Campground/Recreational Vehicle Sites near Fermi Plant Site

Name	Location	Number of Sites
Monroe County		
Covered Wagon Camp Resort	Ottawa Lake	140
Harbortown RV Resort	Monroe Township	250
Monroe County/Toledo North KOA	Summerfield	NR[(a)]
River Raisin Canoe Livery Campground	Dundee	19
River Raisin Marine and Campground	Monroe	
Totem Pole Park LLC	Summerfield	130
Camp Lord Willing Management RV Park and Campground	Frenchtown Township	110
KC Campground	Milan	100
Pirolli Park Campground	Summerfield	NR

Sources: Michigan Association of RV Parks and Campgrounds 2011; Pure Michigan 2011; Monroe County Parks Commission 2008
(a) NR = Not reported.

2.5.2.6 Public Services

This section provides information about water supply and wastewater treatment and police, fire response, and healthcare services available to the residents of Monroe, Wayne, and Lucas Counties. Educational services are discussed in Section 2.5.2.7.

Water Supply Services

Residents of Monroe, Wayne, and Lucas Counties obtain potable water through wells or municipal water supplies. The capacities of the major water suppliers servicing the local area are provided below.

<u>Monroe County</u>

Several municipal water suppliers provide water to residents of Monroe County, including the City of Monroe; Frenchtown Charter Township; City of Toledo, Ohio; and the DWSD. Table 2-48 shows the total treatment capacity, average daily flow, and maximum daily flow for these municipal water suppliers. Residents outside areas supported by these municipal suppliers obtain water through private wells (Monroe County Planning Department and Commission 2010).

Table 2-48. Capacity of Municipal Water Suppliers in Monroe, Wayne, and Lucas Counties in 2005

Municipal Water Supplier	Treatment Capacity (MGD)	Average Daily Flow (MGD)	Maximum Daily Flow (MGD)
City of Monroe	18	7.8	10.9
Frenchtown Charter Township	8	2.1	3.9
City of Milan	2	1.2	NR[(a)]
Detroit Water and Sewage District[(b)]	1720	622	794
City of Toledo [(b)]	120	73	104

Sources: Monroe County Planning Department and Commission 2010; Ellenwood 2010; Leffler 2010
(a) NR = not reported.
(b) 2009 data.

The City of Monroe pumps and treats water from Lake Erie. It operates a joint intake and pumping facility with Frenchtown Charter Township. The city's water treatment and distribution system serves the City of Monroe and portions of the surrounding townships, including Monroe Charter, Raisinville, Exeter, Ida, and London. In addition, the City of Monroe supplies water in bulk to the Village of Dundee and the City of Petersburg, serving an estimated population of 53,000 residents. The City of Monroe treatment plant has an 18 MGD treatment capacity. The average daily and maximum daily water demands for the service area provided by the City of Monroe treatment plant were 7.8 MGD and 10.9 MGD, respectively, in 2005 (Monroe County Planning Department and Commission 2010).

Frenchtown Charter Township shares the water intake with the City of Monroe and operates a water treatment plant that services approximately 20,000 residents and other nonresidential customers within the township. Frenchtown Charter Township also provides the potable water supply for the Fermi plant site. The average daily and maximum daily water demands for Frenchtown Charter Township in 2005 were 2.1 MGD and 3.9 MGD, respectively. The plant doubled its capacity from 4 to 8 MGD in 2006, which was projected to be sufficient for a minimum of 20 years (Monroe County Planning Department and Commission 2010).

The southern portion of Monroe County, including Bedford, Erie, and LaSalle Townships, and the City of Luna Pier receive water supplies through the City of Toledo, Ohio, water treatment and distribution system. Northern portions of Monroe County, including Ash Township, Berlin Township, and the Villages of Carleton, Estral Beach, and South Rockwood, receive water supplies either directly through the DWSD treatment and distribution system via the township, which then distributes the water to the villages, or wholesale from DWSD.

The City of Milan in Monroe County has its own water treatment plant, drawing from groundwater wells located within the city limits. The plant has a 2.0 MGD capacity and treats an average daily demand of 1.2 MGD (Monroe County Planning Department and Commission 2010).

Wayne County

Residents of Wayne County receive water from the Detroit Water and Sewerage Department (DWSD), which also supplies water to residents in the City of Detroit and 126 neighboring communities in all or portions of Oakland, Macomb, St. Clair, Lapeer, Genesee, Washtenaw, and Monroe Counties. The DWSD maintains three intake facilities that draw water from Lake Huron and the Detroit River and five water treatment plants. The total capacity of the treatment plants is approximately 1720 MGD. The average daily and maximum daily water demands in 2009 were 622 MGD and 794 MGD, respectively (DWSD 2004; Ellenwood 2010).

Lucas County

Residents in Lucas County are served by two municipal water suppliers. Toledo's water treatment and distribution system serves the city residents and portions of Lucas County, including the Cities of Maumee, Sylvania, and Perrysburg, and portions of Monroe County, Michigan, and Wood County, Ohio. Within the Collins Park Treatment Plant are two facilities, one with an 80-MGD treatment capacity and a second with a 40-MGD treatment capacity. In 2009, the average daily demand was 73 MGD, and the maximum daily demand was 104 MGD (Leffler 2010)

The City of Oregon's water treatment and distribution system serves city residents and portions of eastern Lucas County. Because of its distance from the Fermi 3 site, this public facility is not expected to be impacted and is not discussed further.

Wastewater Treatment Services

Monroe County

Wastewater treatment services are provided by a number of townships and municipalities in Monroe County, which service residential, commercial, and industrial customers within the City of Monroe; in Frenchtown Charter, Monroe Charter, Raisinville, Bedford, Berlin, Ida, York, LaSalle and Ash Townships; in the Cities of Milan, Petersburg, and Luna Pier; and in the Villages of Dundee, Carleton, and Maybee. Other residents within the county are served by private, onsite wastewater disposal systems (Monroe County Planning Department and Commission 2010). Table 2-49 shows the design flow, average daily flow, and maximum daily flow for the municipal wastewater treatment facilities that service these areas.

The following discussion focuses on wastewater treatment system for the City of Monroe, where the largest concentration of the construction and operation workforces associated with Fermi 3 would be expected to reside.

The Monroe Metropolitan Water Pollution Control System serves approximately 52,000 residents within the City of Monroe, large portions of Monroe Charter and Frenchtown Charter Townships, and a small portion of Raisinville Township. The plant has a design capacity of 24 MGD and average daily flow of 16 MGD, for an available capacity of about 34 percent during normal flow periods. During heavy rain events, the treatment plant can be overloaded from excessive stormwater and groundwater. The maximum daily flow that has occurred is 67 MGD (MDEQ 2011).

Wayne County

Residents of Wayne County are served by two large municipal wastewater treatment systems (WWTPs) (DSWD and the Wayne County Downriver WWTP) and by three small municipal systems (Grosse Ile Township, and the Cities of Rockwood and Trenton).

The DWSD owns and operates one of the largest single-site WWTPs in the United States. It serves the northern portion of Wayne County, including Detroit and portions of Macomb and Oakland Counties, a service area covering 946 mi^2 and 76 communities. The system includes four principal regional interceptors, 14 pumping stations, 3383 mi of sewers in Detroit, and an estimated 8770 mi in the suburban communities served by DWSD. Currently, DWSD's WWTP has a design flow of 930 MGD. The plant currently treats an average of 727 MGD (DWSD 2003; Ellenwood 2010).

Wayne County operates the Downriver WWTP located in Wyandotte, Michigan, which serves 13 communities in the remaining portions of Wayne County that are not served by the DWSD. It

Table 2-49. Flows in Major Public Wastewater Treatment Facilities in Monroe, Wayne, and Lucas Counties

Municipal Wastewater Treatment Plant (WWTP)	NPDES Permit Date	Design Flow (MGD)[a]	Avg. Daily Flow (MGD)[b]	Max. Daily Flow (MGD)[b]
Monroe County				
City of Monroe (including Frenchtown Charter, Monroe Charter, and Raisinville Townships)	2010	24	15.9	67
Bedford Township	2007	6	–[c]	–
Berlin Township	2006	1.8	–	–
Ida and Raisinville Townships	2009	0.14	–	–
City of Milan (including York and Milan Townships)	2010	2.5	1.3	3.5
City of Petersburg	2010	0.2	0.12	0.85
City of Luna Pier (including LaSalle Township)	2011	0.35	0.24	0.58
Village of Dundee	2011	1.5	–	–
Village of Carlton (including Ash Township)	2010	0.74	0.39	0.95
Village of Maybee	2009	0.08	–	–
Wayne County				
Detroit Water and Sewage District	2008	930		
Grosse Ile Township	2008	2.5	2.5	10.5
City of Rockwood	2009	1.0	0.4	2.4
City of Trenton	2008	6.5	4.5	10.8
Wayne County Downriver WWTP	2008	125		
Lucas County				
Bayview WWTP		195	71	160

Sources: MDEQ 2011; McGibbeny 2010
(a) Basis of effluent limitations in NPDES permit.
(b) As reported in the NPDES application.
(c) – = Not available.

has a design flow of 125 MGD and treats an average daily flow of 52 MGD (MDEQ 2011; Hubbell, Roth, and Clark, Inc. 2009)

<u>Lucas County</u>

Lucas County residents are served by various wastewater treatment systems. The City of Toledo's Bayview WWTP is one of the largest wastewater treatment facilities in northwest Ohio. It provides treatment services to an area of approximately 120 mi^2 with a population of approximately 398,000 residents within the City of Toledo, City of Rossford, Villages of Walbridge and Ottawa Hills, and portions of Wood County, Lucas County, and the Village of Northwood. The total capacity of the system is 195 MGD. The average daily and maximum daily water demands in 2009 were 71 MGD and 160 MGD, respectively, for an available capacity of about 64 percent (Toledo Waterways Initiative 2009; McGibbeny 2010).

Police Services

Police jurisdictions operating in Monroe County include the City of Monroe Police Department, Monroe County Sheriff, and Michigan State Police. Municipal jurisdictions, including the Cities of Luna Pier and Milan, the Villages of Carleton and South Rockwood, and Erie Township also maintain police departments.

Police jurisdictions operating in Wayne County include the City of Detroit Police Department, the Wayne County Sheriff, and the Michigan State Police. More than 40 other jurisdictions within Wayne County also maintain police departments.

Police jurisdictions in Lucas County include the Lucas County Sheriff, the City of Toledo, the City of Oregon, and the City of Maumee. The Villages of Holland and Waterville and Sylvania Township also maintain police departments.

The number of law enforcement personnel employed in county and municipal governments in Ohio and Michigan is provided in Table 2-50. The ratio of law enforcement personnel per 1000 residents throughout the county (county and municipal jurisdictions combined) is provided in Table 2-51.

State police also serve populations within Monroe, Lucas, and Wayne Counties. The Michigan State Police organization is divided into seven districts. Monroe and Wayne Counties are within District 2, which also includes Washtenaw, Macomb, St. Clair, and Oakland Counties. In 2008, the total number of law enforcement personnel employed by the Michigan State Police was 2907 full-time employees, which included 1830 officers and1077 civilians (FBI 2009). In March 2011, the Michigan State Police announced a regional restructuring plan involving a reduction in the number of posts from 62 to 29 and the redesignation of 12 posts as

Table 2-50. Law Enforcement Personnel in Monroe, Wayne, and Lucas Counties

Jurisdiction(a)	Law Enforcement Personnel		
	Civilians(b)	Officers(c)	Total
County Sheriffs			
Monroe County	96	106	202
Wayne County	166	1064	1230
Lucas County	229	289	518
Municipal Police Departments			
Monroe County			
Carleton	1	3	4
Erie Township	1	5	6
Luna Pier	0	4	4
Milan	3	9	12
Monroe	5	40	45
South Rockwood	0	4	4
Wayne County			
Allen Park	4	44	48
Belleville	2	9	11
Brownstown Township	11	38	49
Canton Township	37	87	124
Dearborn	32	198	230
Dearborn Heights	25	85	110
Detroit	369	3032	3401
Ecorse	5	26	31
Flat Rock	3	24	27
Garden City	8	38	46
Gibralter	1	10	11
Grosse Ile Township	7	17	24
Grosse Pointe	2	25	27
Grosse Pointe Farms	13	35	48
Grosse Pointe Park	6	43	49
Grosse Pointe Shores	3	18	21
Grosse Pointe Woods	6	40	46
Hamtramck	0	44	44
Harper Woods	3	35	38
Huron Township	5	20	25
Inkster	10	58	68
Lincoln Park	10	51	61
Livonia	35	148	183
Melvindale	3	23	26
Northville	1	16	17

Table 2-50. (contd)

Jurisdiction[(a)]	Law Enforcement Personnel		
	Civilians[(b)]	Officers[(c)]	Total
Northville Township	12	34	46
Plymouth	1	15	16
Plymouth Township	15	31	46
Redford Township	17	64	81
River Rouge	1	19	20
Riverview	3	29	32
Rockwood	1	8	9
Romulus	18	55	73
Southgate	9	38	47
Sumpter Township	7	15	22
Taylor	15	92	107
Trenton	1	37	38
Van Buren Township	16	44	60
Wayne	10	39	49
Westland	25	100	125
Woodhaven	3	31	34
Wyandotte	10	38	48
Lucas County			
Holland	0	9	9
Maumee	15	45	60
Oregon	14	46	60
Sylvania Township	15	43	58
Toledo	134	639	773
Waterville	1	12	13
Total County Sheriff and Municipal Law Enforcement Personnel			
Monroe County			277
Wayne County			6957
Lucas County			973

Source: FBI 2009

(a) State police also serve populations within Monroe, Lucas, and Wayne Counties, but they are not included in these totals because they serve multiple jurisdictions.

(b) Civilians include personnel, such as clerks, radio dispatchers, meter attendants, jailers, correctional officers, and mechanics, who are full-time employees of the agency.

(c) Officers are individuals who ordinarily carry a firearm and a badge, hav e full a rrest powers, and are paid from governmental funds set aside specifically for sworn law enforcement representatives.

Table 2-51. Population Served by Law Enforcement Personnel in Monroe, Wayne, and Lucas Counties

County	Law Enforcement Personnel	Population Served[(a)]	Law Enforcement Personnel per 1000 Residents (2008 estimate)
Monroe	277	152,949	1.8
Wayne	6822	1,949,929	3.5
Lucas	973	440,456	2.2

Source: FBI 2009
(a) 2008 population estimate from the USCB (USCB 2009a, b).

detachments. Although the plan results in fewer facilities, the number of state troopers overall does not decrease (Michigan State Police 2011).

The Ohio State Highway Patrol is organized into nine districts. Lucas County is within District 1, which also includes Wood, Fulton, Henry, Defiance, Williams, Paulding, Putnam, Van Wert, Allen, and Hardin Counties. In 2008, the total number of law enforcement personnel employed by the Ohio State Highway Patrol was 2630 full-time employees, which included 1556 officers and 1074 civilians (FBI 2009).

Fire Response Services

Twenty-one jurisdictions within Monroe County have fire response services, primarily staffed by volunteer firefighters. Career firefighters staff the City of Monroe Fire Department and the Frenchtown Charter Township, with staffs of 37 and 33, respectively. Forty-five jurisdictions have fire response services within Wayne County, and 15 jurisdictions within Lucas County have fire response services. The largest fire departments within the economic impact area are in the City of Detroit, which has 48 stations and a staff of 1738, and in the City of Toledo, which has 17 stations and a staff of 508. Townships, cities, and villages in Monroe, Wayne, and Lucas Counties that maintain fire protection services are listed in Table 2-52. The number of fire response personnel per 1000 residents is provided in Table 2-53.

Healthcare Services

Mercy Memorial Hospital is staffed by 235 full-time physicians and 1100 full-time equivalent staff members and is the primary healthcare facility in Monroe County. It is also the primary treatment facility for any injury at the Fermi plant. There are 238 licensed beds in the hospital, and the daily average number of inpatients in 2010 was about 169. Mercy Memorial Hospital has recently undergone a major, $34 million renovation, which doubled the capacity of the emergency center from 25,000 to 60,000 patient visits per year and increased its capability to

Table 2-52. Fire Response Personnel in Monroe, Wayne, and Lucas Counties

Fire Department Name	Department Type	Number of Stations	Number of Personnel: Firefighters: Active (career)	Number of Personnel: Firefighters: Active (volunteer)	Number of Personnel: Firefighters: Active (paid per call)	Number of Personnel: Non-firefighting (civilian)	Number of Personnel: Non-firefighting (volunteer)	Total
Monroe County								
Ash Township Volunteer Fire Department	Volunteer	2	0	40	0	0	0	40
Bedford Fire Department	Volunteer	3	0	0	64	0	0	64
Bedford Fire Department 2	Volunteer	1	0	30	0	0	0	30
Berlin Charter Township Fire Department 1	Volunteer	1	0	0	28	0	0	28
Berlin Charter Township Fire Department 2	Volunteer	1	0	0	23	0	0	23
Dundee Township Fire Department	Volunteer	1	0	30	0	0	0	30
Erie Township Fire Department	Volunteer	1	0	22	0	0	0	22
Estral Beach Fire Department	Volunteer	1	0	8	0	0	6	14
Exeter Township Fire Department	Volunteer	1	0	0	26	0	0	26
Frenchtown Charter Township Fire Department	Mostly career	4	18	0	14	1	0	33
Ida Township Volunteer Fire Department	Volunteer	1	0	26	0	0	1	27
La Salle Volunteer Fire Department	Volunteer	1	0	24	0	0	0	24
London-Maybee-Raisinville	Volunteer	1	0	21	0	0	0	21
Luna Pier Volunteer Fire Department	Volunteer	1	0	0	21	0	2	23
Milan Area Fire Department	Volunteer	1	0	0	36	1	0	37
Monroe Charter Township Fire Department	Volunteer	3	0	0	25	0	0	25
Monroe Fire Department	Career	3	37	0	0	0	0	37
Morin Point Fire Department	Volunteer	1	0	29	0	0	3	32
Ottawa Lake Volunteer Fire Department	Volunteer	1	0	22	0	0	0	22
Summerfield TWP Volunteer Fire Department	Volunteer	1	0	0	26	0	0	26
Whiteford Township Volunteer Fire Department	Volunteer	1	0	22	0	0	0	22
Wayne County								
Allen Park Fire Department	Career	1	32	0	0	1	0	33
Belleville Fire Department	Volunteer	1	0	0	16	0	0	16
Brownstown Fire Department	Career	4	30	0	0	1	0	31
Canton Fire Department	Career	2	53	0	0	2	0	55
Charter Township of Redford Fire Department	Career	3	39	0	0	1	0	40
City of Detroit Fire Department	Career	48	1260	0	0	478	0	1738

Table 2-52. (contd)

Fire Department Name	Department Type	Number of Stations	Number of Personnel – Firefighters: Active (career)	Firefighters: Active (volunteer)	Firefighters: Active (paid per call)	Non-firefighting (civilian)	Non-firefighting (volunteer)	Total
City of Harper Woods Fire Department	Career	1	12	0	0	0	0	12
City of Inkster Fire Department	Career	1	18	0	0	6	0	24
City of Northville Fire Department	Mostly volunteer	1	1	0	28	0	0	29
Dearborn Fire Department	Career	4	121	0	0	2	0	123
Dearborn Heights Fire Department	Career	2	54	0	0	1	0	55
Ecorse Fire Department	Mostly career	1	14	0	10	0	0	24
Flat Rock Fire Department	Mostly volunteer	1	7	0	25	0	0	32
Garden City Fire Department	Career	1	20	0	0	1	0	21
Gibraltar Fire Department	Volunteer	1	0	0	30	0	0	30
Great Lakes Operations Fire Department	Career	2	15	0	0	0	0	15
Grosse Ile Fire Department	Mostly volunteer	1	2	32	0	1	0	35
Grosse Pointe City Fire Department	Career	1	25	0	0	6	0	31
Grosse Pointe Farms Public Safety	Career	1	35	0	0	0	0	35
Grosse Pointe Park Department of Public Safety	Career	1	44	0	0	8	0	52
Grosse Pointe Shores Department of Public Safety	Mostly career	1	19	8	0	0	0	27
Grosse Pointe Woods Department of Public Safety	Career	1	47	0	0	6	0	53
Hamtramck Fire Department	Career	1	25	0	0	0	0	25
Highland Park Department of Public Safety	Career	1	43	0	0	0	0	43
Huron Township Fire Department	Mostly volunteer	3	6	0	30	0	0	36
Lincoln Park Fire Department	Career	1	32	0	0	1	0	33
Livonia Fire and Rescue	Career	5	91	0	0	5	0	96
Melvindale Fire Department	Career	1	14	0	0	1	0	15
Metro Fire Department, Ltd.	Volunteer	2	0	5	2	0	10	17
Northville Township Fire/Rescue Department	Career	2	15	0	0	0	0	15
Plymouth Community Fire Department	Mostly career	3	31	0	7	1	0	39
River Rouge Fire Department	Career	1	27	0	0	0	0	27
Riverview Fire Department	Mostly volunteer	1	2	0	50	8	0	60
Rockwood Fire Department	Volunteer	1	0	0	21	5	0	26

Table 2-52. (contd)

Fire Department Name	Department Type	Number of Stations	Number of Personnel: Firefighters: Active (career)	Firefighters: Active (volunteer)	Firefighters: Active (paid per call)	Non-firefighting (civilian)	Non-firefighting (volunteer)	Total
Romulus Fire Department	Mostly volunteer	4	8	0	32	1	0	41
Southgate Fire Department	Career	1	27	0	0	1	0	28
Sumpter Township Fire Department	Volunteer	2	0	0	30	0	0	30
Taylor Fire Department	Career	3	66	0	0	3	0	69
Trenton Fire Department	Career	2	33	0	0	1	0	34
Van Buren Fire Department	Mostly volunteer	2	2	0	32	0	0	34
Wayne County Department of Airports	Career	3	65	0	0	2	0	67
Wayne Fire Department	Career	1	21	0	0	2	0	23
Westland Fire Department	Career	5	78	0	0	2	0	80
Woodhaven Fire Department	Mostly volunteer	2	7	0	20	0	1	28
Wyandotte Fire Department	Career	2	29	0	0	1	0	30
Lucas County								
180th Ohio Air National Guard Fire Department	Career	1	40	0	0	0	0	40
Jerusalem Township Fire Department	Volunteer	1	0	28	0	0	0	28
Maumee Fire Station 1	Mostly volunteer	2	20	0	55	1	0	76
Monclova Township Fire-Rescue Department	Mostly volunteer	1	2	0	33	0	0	35
Oregon Fire Department	Mostly volunteer	3	12	0	95	1	0	108
Ottawa Hills Fire Department	Career	1	10	0	0	0	0	10
Providence Township Fire and Rescue	Mostly volunteer	1	1	32	32	0	6	71
Richfield Township Fire Department	Volunteer	1	0	33	0	0	1	34
Spencer Township Fire-Rescue	Volunteer	1	0	26	0	0	0	26
Springfield Township Fire Department	Mostly career	3	40	0	36	5	0	81
Sylvania Township Fire Department	Mostly career	4	55	0	8	1	0	64
Toledo Fire Department	Career	17	494	0	0	14	0	508
Washington Township Fire Department	Volunteer	1	0	0	40	0	0	40
Waterville Fire Department	Mostly volunteer	1	6	0	26	1	0	33
Whitehouse Department	Mostly volunteer	1	11	0	30	0	0	41

Table 2-52. (contd)

Fire Department Name	Department Type	Number of Stations	Number of Personnel					
			Firefighters					
			Active (career)	Active (volunteer)	Active (paid per call)	Non-firefighting (civilian)	Non-firefighting (volunteer)	Total
Total Municipal Fire Department Personnel								
Monroe County		31	55	274	263	2	12	606
Wayne County		129	2470	45	333	548	11	3407
Lucas County		39	691	119	355	23	7	1195

Source: FEMA 2010

Table 2-53. Population Served by Firefighters in Monroe, Wayne, and Lucas Counties

County	Fire Protection Service Personnel	Population Served	Firefighters per 1000 Residents (2008 estimate)
Monroe	606	152,949	4.0
Wayne	3407	1,949,929	1.7
Lucas	1195	440,456	2.7

Source: FEMA 2010

respond to higher-level traumas (Kreiger 2011). In 2007, the emergency center accommodated 42,040 patient visits (Mercy Memorial Hospital 2009).

Thirty-two hospitals are located in Wayne County, 17 of which are located in Detroit (Wayne County 2009). The largest healthcare providers, which operate multiple facilities, include the Henry Ford Health System (11,475 employees), the Detroit Medical Center (10,150 employees), and Oakwood Healthcare, Inc. (7510 employees) (Wayne County Department of Management and Budget 2008).

The Toledo/Lucas County area has 12 hospitals. The largest healthcare provider is Promedica Health Systems (11,265 employees), which operates several of the hospitals in the Toledo area, including the Toledo Hospital, Toledo Children's Hospital, and Bay Park Community Hospital (City of Oregon). Another large healthcare provider in the Toledo area is Mercy Health Partners (6723), which operates the Mercy St. Vincent Medical Center, Mercy St. Charles Hospital (City of Oregon), Mercy St. Anne's Hospital, and Mercy Children's Hospital. The University of Toledo Medical Center is also located in Toledo.

Data on the number of healthcare workers employed in Monroe, Wayne, and Lucas Counties and the ratio of healthcare workers per 1000 residents are provided in Table 2-54. Healthcare workers are workers within the "healthcare practitioner and technical occupations," and "healthcare support occupations" as defined by the U.S. Bureau of Labor Statistics, Standard Occupational Classification System.

2.5.2.7 Education

Tables 2-55 through 2-57 list selected characteristics, including the number of schools, district enrollment, and the student-to-teacher ratio for the 2008–2009 school year for all public school districts in Monroe, Wayne, and Lucas Counties. Michigan does not mandate a student-to-teacher ratio, but some of the local school districts have adopted a standard student-to-teacher ratio. The student-to-teacher ratio in Ohio is prescribed under the Ohio Administrative Code as a districtwide average of 25 students to one full time equivalent (FTE) teacher for regular classrooms.

Table 2-54. Population Served by Healthcare Workers in Economic Impact Area

Jurisdiction(a)	Number of Healthcare Workers	Estimated Population Served(b)	Healthcare Workers per 1000 Residents (estimated 2008)
Monroe, Michigan MSA			
Healthcare practitioner and technical occupations(c)	1750		
Healthcare support occupations (d)	1020		
Total	2770	152,945	18.1
Detroit-Livonia-Dearborn Metropolitan Division			
Healthcare practitioner and technical occupations	45,640		
Healthcare support occupations	23,390		
Total	69,030	1,949,929	35.4
Toledo, Ohio MSA			
Healthcare practitioner and technical occupations	22,140		
Healthcare support occupations	12,460		
Total	34,600	649,104	53.3

Source: USBLS 2008

(a) Occupational employment is provided for the metropolitan area in which the county is located.

(b) 2008 population estimate from the USCB for metropolitan area.

(c) Includes physicians, dentists, registered nurses, therapists, medical and clinical laboratory technicians, emergency medical technicians and paramedics, and others as defined by the USBLS (2008).

(d) Includes home health aides; nursing aides, orderlies and attendants; and other healthcare assistants as defined by the USBLS (2008).

There are 9 public school districts (Table 2-55), 14 private or parochial schools, and 2 charter schools in Monroe County. Monroe County is also served by the Monroe County Intermediate School District (ISD), which provides specialized education services and resources to the schools. The Monroe County ISD operates specialized education facilities, including the Monroe County Educational Center for children with developmental disabilities, the Monroe County Transition Center for secondary students with disabilities, the Monroe County Hearing Impaired Program, the Holiday Camp, and academic programming for students in the juvenile justice system at the Monroe County Youth Center.

The total enrollment within the Monroe County public school districts during the 2008–2009 school year was 23,283 students. The Monroe public schools district is the largest district in Monroe County; it includes the City of Monroe and all or part of the five surrounding townships. School enrollment for the Monroe County public school district was 6683 students during the 2008–2009 school year.

The student-to-teacher ratio within the Monroe County public school districts ranged from 15.9:1 (Mason Consolidated Schools) to 20.0:1 (Monroe Public Schools); the nationwide ratio was 15.3 students to one teacher, and the statewide ratio was 17.5 students to one teacher.

Table 2-55. Monroe County Public School Districts

School District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
Public School District						
Airport Community School District	Carleton	K-12	6	2935	157	18.6
Bedford Public Schools	Temperance	K-12	8	5223	280	18.7
Dundee Community Schools	Dundee	K-12	4	1687	88	19.1
Ida Public School District	Ida	K-12	3	1674	100	16.7
Jefferson Schools (Monroe)	Monroe	K-12	7	2177	121	18.0
Mason Consolidated Schools (Monroe)	Erie	K-12	3	1374	86	15.9
Monroe Public Schools	Monroe	K-12	14	6683	334	20.0
Summerfield School District	Petersburg	K-12	3	790	43	18.6
Whiteford Agricultural Schools	Ottawa Lake	K-12	3	740	45	16.6
Total Public School District Enrollment				23,283		
Regional District						
Monroe ISD	Monroe	K-12	6	1006	101	10.0

Source: U.S. Department of Education 2010

Most of the districts were equal to or exceeded the State average student-to-teacher ratio, with the Monroe County public school district having the highest student-to-teacher ratio.

Wayne County has 35 school districts and 74 public school academies or charter schools. The county is also served by the Wayne County Regional Educational Service Agency (RESA), which provides specialized education services and resources to the schools. The total enrollment within the Wayne County public school districts was 276,862 students during the 2008–2009 school year. The largest district in Wayne County is the Detroit school district, with more than 97,000 students. Other large school districts include the Dearborn City school district, Plymouth-Canton community schools, Wayne Westland community schools, and Livonia public schools.

In March 2010, the Detroit school district announced plans to reduce approximately 4 million ft^2 of excess capacity (55 schools) to address declining enrollment. In 1994, kindergarten enrollment was 16,046 students; it declined to 6039 in 2009 (Detroit Public Schools 2010). In February 2011, the State mandated that with a budget deficit of $327 million, the Detroit Public Schools needed to close 70 schools between 2011 and 2012. After a series of town hall meetings, the Detroit Public Schools announced in May 2011 that it could reduce operating costs by $75 to $99 million by transferring 45 of the schools proposed for closure to local and national groups and charter school operators. In its Renaissance Plan 2012, 18 schools would

1 **Table 2-56**. Wayne County Public School Districts

School District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
Allen Park Public Schools	Allen Park	K-12	6	3737	175	21.3
City of Harper Woods Schools	Harper Woods	K-12	4	1264	60	21.1
Clarenceville School District	Livonia	K-12	4	1884	98	19.2
Crestwood School District	Dearborn Heights	K-12	5	3458	176	19.7
Dearborn City School District	Dearborn	K-12	36	18,478	1090	17.0
Dearborn Heights School District #7	Dearborn Heights	K-12	6	2859	146	19.5
Detroit School District	Detroit	PK-12	199	97,577	5953	16.4
Ecorse Public School District	Ecorse	K-12	4	1057	54	19.6
Flat Rock Community Schools	Flat Rock	PK-12	5	1917	90	21.3
Garden City School District	Garden City	K-12	10	5256	354	14.9
Gibraltar School District	Woodhaven	K-12	8	3705	190	19.5
Grosse Ile Township Schools	Grosse Ile	K-12	4	1875	104	18.0
Grosse Point Public Schools	Grosse Point	K-12	16	8606	540	16.0
Hamtramck Public Schools	Hamtramck	K-12	7	2936	159	18.5
Highland Park City Schools	Highland Park	K-12	5	3032	154	19.7
Huron School District	New Boston	K-12	5	287	126	19.8
Lincoln Park Public Schools	Lincoln Park	PK-12	13	4891	275	17.8
Livonia Public Schools	Livonia	K-12	28	16,864	931	18.1
Melvindale-North Allen Park Schools	Melvindale	K-12	4	2801	134	20.9
Northville Public Schools	Northville	K-12	12	7275	437	16.7
Plymouth-Canton Community Schools	Plymouth	PK-12	27	19,235	948	20.3
Redford Union School District	Redford	K-12	9	3565	218	16.4
River Rouge School District	River Rouge	K-12	4	1206	57	21.1
Riverview Community School District	Riverview	K-12	5	2631	127	20.7
Romulus Community Schools	Romulus	K-12	10	4090	201	20.4
School District of the City of Inkster	Inkster	K-12	5	3218	112	28.9
South Redford School District	Redford	K-12	7	3381	178	19.0
Southgate Community School District	Southgate	K-12	12	5689	297	19.2
Taylor School District	Taylor	K-12	17	9226	500	18.4
Trenton Public Schools	Trenton	K-12	5	2877	173	16.6
Van Buren Public Schools	Belleville	K-12	12	5944	352	16.9
Wayne-Westland Community School District	Westland	PK-12	27	13,654	741	18.4
Westwood Community Schools	Dearborn Heights	K-12	8	2013	129	15.6
Woodhaven-Brownstown School District	Brownstown	K-12	9	5390	289	18.7

Table 2-56. (contd)

School District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
Wyandotte City School District	Wyandotte	K-12	11	4984	285	17.5
Total Public School District Enrollment				276,862		
Regional District						
Wayne Regional District	Wayne	–[(a)]	2	107	NA[(b)]	

Source: U.S. Department of Education 2010
(a) – Data were not reported.
(b) NA = Not applicable.

Table 2-57. Lucas County Public School Districts

School District/ Charter School/ Regional District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
School District						
Anthony Wayne Local	Whitehouse	PK-12	6	4631	210	22.1
Maumee City	Maumee	PK-12	6	2844	171	16.7
Oregon City	Oregon	PK-12	7	3870	249	15.5
Ottawa Hills Local	Toledo	PK-12	2	996	71	14.0
Springfield Local	Holland	PK-12	6	4030	219	18.4
Sylvania City	Sylvania	PK-12	12	7640	489	15.6
Toledo City	Toledo	PK-12	67	26,516	1888	14.0
Washington Local	Toledo	PK-12	12	6736	419	16.1
Total Public School District Enrollment				57,263		
Regional District						
Lucas Regional District	Toledo	–[(a)]	5	NA[(b)]	54	

Source: U.S. Department of Education 2010
(a) – = Data were not reported.
(b) NA = Not applicable.

close during the summer of 2011 if a charter operator is not identified (Detroit Public Schools 2010).

The student-to-teacher ratio within the Wayne County public school districts ranged from 14.9 students per teacher (Garden City schools) to 28.9 students per teacher (City of Inkster schools); the nationwide ratio was 15.3 students per teacher, and the statewide ratio was 17.5 students per teacher. All but one school exceeded the national student-to-teacher ratio, and approximately 71 percent of the schools exceeded the State student-to-teacher ratio.

Lucas County has 8 school districts and 38 academies and alternative schools. The total enrollment within the Lucas County public school districts during the 2008–2009 school year was 57,263 students. The Toledo City School District is the largest district in Lucas County, with 26,516 students attending during the 2008–2009 school year.

The student-to-teacher ratio within the Lucas County public school districts ranged from 14.0 students per teacher (Ottawa Hills Local schools and Toledo City School District) to 22.1 students per teacher (Anthony Wayne Local schools); nationally, the ratio was 15.3 students per teacher, and within the State of Ohio, the ratio was 16.1 students per teacher. Fifty percent of the districts have fewer students per teacher than the statewide ratio, and all the school districts are below the State-mandated ratio of one teacher to 25 students.

Numerous colleges and universities are within the local area, including Monroe County Community College (MCCC), Wayne State University, University of Detroit, University of Michigan-Dearborn, and University of Toledo. Over the past few years, MCCC and Lakeland Community College, in Kirkland, Ohio, have developed a nuclear engineering technology program in anticipation of a forecasted need for workers in the nuclear energy industry. MCCC has also recently developed a new heavy and industrial construction technology certificate program that is designed to support the anticipated building workforce needed for Fermi 3.

2.6 Environmental Justice

Environmental justice refers to a Federal policy established by Executive Order 12898 (59 *Federal Register* [FR] 7629] under which each Federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations.[a] The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (69 FR 52040).

This section provides a general description of the minority and low-income populations within a 50-mi radius of the proposed Fermi 3 site. This geographic area covers all or a portion of eight counties in Michigan (Jackson, Lenawee, Livingston, Macomb, Monroe, Oakland, Washtenaw, and Wayne) and eight counties in Ohio (Erie, Fulton, Henry, Lucas, Ottawa, Sandusky, Seneca,

(a) Minority categories are defined as American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, Black races, or Hispanic ethnicity. "Other" may be considered a separate minority category. Low income refers to individuals living in households meeting the official poverty definition. To see the USCB definition and values for 2000, visit its Web site at http://ask.census.gov/.

Wood). Two Canadian census divisions (Essex, Chatham-Kent) are also located within a 50-mi radius of the Fermi 3 site.

The characterization of minority and low-income populations in this section forms the analytical baseline from which potential environmental justice effects would be determined. The characterization of populations of interest includes an assessment of "populations of particular interest or unusual circumstances" (e.g., minority or low-income communities exceptionally dependent on subsistence resources or identifiable in compact locations such as Native American settlements).

2.6.1 Methodology

The review team first examined the geographic distribution of minority and low-income populations within a 50-mi radius of Fermi 3 by using the ArcGIS 10 geographical information system (GIS) software. This software allows the user to map and analyze demographic information from the USCB's *2000 Census of Population and Housing* (USCB undated)[a] at the census block group level[b] for a defined geographic area. The review team verified its analysis by field inquiries to numerous agencies and groups (Appendix B).

The first step in the review team's environmental justice methodology is to examine each census block group that was fully or partially included within a 50-mi radius of Fermi 3 in order to determine for each block group whether the percentage of any minority or low-income population is great enough to identify that block group as a minority or low-income population of interest. If either of the two criteria discussed below are met for a census block group, that census block group is considered a minority or low-income population of interest warranting further investigation. The two criteria are whether:

- the minority or low-income population exceeds 50 percent of the total population for the census block group, and/or
- the percentage of the minority or low-income population is at least 20 percentage points greater than the same minority or low-income population's percentage in the respective State.

(a) During the preparation of this draft EIS, the results of the mandated U.S. decadal census for 2010 were being released in topical and regional data sets. While the U.S. Census Bureau has not issued all of the data sets in final form, some of the preliminary information was considered by the review team. While some of the final data sets were released for national scale information, most of the fine scale information is still under review by the DOC and other Federal agencies. The review team is not aware of information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier census.

(b) A census block is the smallest geographic area for which the USCB collects and tabulates decennial census data. A block group is the next level above census blocks in the geographic hierarchy and is a subdivision of a census tract or block numbering area.

The populations of minority groups in Michigan and Ohio are shown on Table 2-58.

Table 2-58. Population by Race in Michigan and Ohio, 2000

	Population by Race			
	Michigan		Ohio	
Category	Persons	%[(a)]	Persons	%
White	7,966,053	78.6	9,645,453	84.0
Black or African American	1,412,742	14.2	1,301,307	11.5
American Indian and Alaska Native	58,479	0.6	24,486	0.2
Asian	176,510	1.8	132,633	1.2
Native Hawaiian and other Pacific Islander	2,692	<0.1	2749	<0.1
Hispanic or Latino (of any race)	323,877	3.3	217,123	1.9
Some other race/two or more races	321,968	1.6	256,512	1.2
Total population	**9,938,444**		**11,353,140**	
Aggregate minority (percent)		21.4		16.0

Source: Detroit Edison 2011a
(a) Note: Percentages may not add to 100 percent due to rounding.

The identification of census block groups that met one or both of the two criteria noted above is not sufficient for the review team to conclude that a disproportionately high and adverse impact exists. Likewise, the lack of census block groups meeting the above criteria cannot be construed as evidence of no disproportionately high and adverse impacts upon minority or low-income populations. The review team must also conduct an active public outreach and on-the-ground investigation in the region of the plant to determine whether minority and low-income populations in the region that were not identified in the census mapping exercise may exist. To reach an environmental justice conclusion, the review team investigated all populations in greater detail to identify pathways by which environmental impacts could have disproportionately high and adverse effects on minority or low-income communities. To identify pathways to disproportionately high and adverse effects, the review team considered the following:

- Health considerations:
  - Are the radiological or other health effects significant or above generally accepted norms?
  - Is the risk or rate of hazard significant and appreciably in excess of the general population's?
  - Do the radiological or other health effects occur in groups that are affected by cumulative or multiple adverse exposure from environmental hazards?

- Environmental considerations:
  - Is there an impact on the natural or physical environment that significantly and adversely affects a particular group?
  - Are there any significant adverse impacts on a group that appreciably exceed or are likely to appreciably exceed those on the general population?
  - Do the environmental effects occur in groups affected by cumulative or multiple adverse exposure to environmental hazards?

Under NRC's methodology, if this more detailed investigation does not yield any potentially disproportionately high and adverse impacts on populations of interest, the review team could conclude that there are no environmental justice impacts from the proposed action. If, however, the review team found any potential disproportionately high and adverse effects and potential pathways by which those impacts could occur, the review team would then (1) determine there was the potential for a disproportionately high and adverse impact on minority or low-income populations, (2) fully characterize the nature and extent of that impact, and (3) identify possible mitigation measures that may be used to lessen that impact.

The remainder of this section discusses the results of the search for potentially affected populations of interest.

2.6.1.1 Minority Populations

The review team assessed the populations for each minority group, as well as for an "aggregate" minority population, which is the sum of all persons not identified by the Census as White. For each of the 4606 census block groups fully or partially within a 50-mi radius of Fermi 3, the percent of the census block group's population represented by each minority population was calculated separately and in aggregate and compared with the two criteria listed above. Table 2-59 displays the results of that Census search, indicating that:

- 1299 census block groups within the 50-mi radius met the criteria and are considered to have a Black or African-American population of interest.
- No census block groups within the 50-mi radius met the criteria, and none is considered to have an American Indian or Alaskan Native population of interest.
- 32 census block groups within the 50-mi radius met the criteria and are considered to have an Asian population of interest.
- No census block groups within the 50-mi radius met the criteria, and none is considered to have a Native Hawaiian or other Pacific Islander population of interest.
- 85 census block groups within the 50-mi radius met the criteria and are considered to have a Hispanic or Latino population of interest.

Table 2-59. Results of the Census Block Group Analysis for Minority Populations of Interest within the Region (50-mi radius)[(a)]

State/County	Total Census Block Groups	Number of Census Block Groups with Minority Populations of Interest					
		Black	American Indian	Asian	Pacific Islander	Hispanic	Aggregate
Michigan							
Jackson	7	0	0	0	0	0	0
Lenawee	72	1	0	0	0	5	1
Livingston	64	0	0	0	0	0	0
Macomb	541	8	0	0	0	0	9
Monroe	127	1	0	0	0	0	1
Oakland	724	110	0	7	0	8	119
St. Clair	2	0	0	0	0	0	0
Washtenaw	260	23	0	16	0	0	47
Wayne	2126	1050	0	9	0	61	1066
Ohio							
Erie	49	7	0	0	0	0	6
Fulton	18	0	0	0	0	0	0
Henry	3	0	0	0	0	0	0
Lucas	434	99	0	0	0	9	102
Ottawa	40	0	0	0	0	0	0
Sandusky	57	0	0	0	0	2	0
Seneca	6	0	0	0	0	0	0
Wood	76	0	0	0	0	0	0
Total	**4606**	**1299**	**0**	**32**	**0**	**85**	**1351**

Source: USCB 2011a
(a) Shaded rows indicate counties in the economic impact area.

- 1351 census block groups within the 50-mi radius met the criteria and are considered to have an aggregate minority population of interest.

Most of the census block groups classified as minority populations of interest lie to the north and south of the Fermi plant site in Wayne and Lucas Counties, respectively (Figures 2-17, 2-18, and 2-19). One census block group within Monroe County qualifies as a minority population of interest. This census block group is the closest minority population of interest to the proposed site, located in the City of Monroe, approximately 8 mi southwest of the Fermi 3.

Table 2-59 shows the results of the analysis to identify minority populations of interest within a 50-mi radius of Fermi 3. Figures 2-17, 2-18, and 2-19 show the geographic locations of the minority populations of interest within the 50-mi radius.

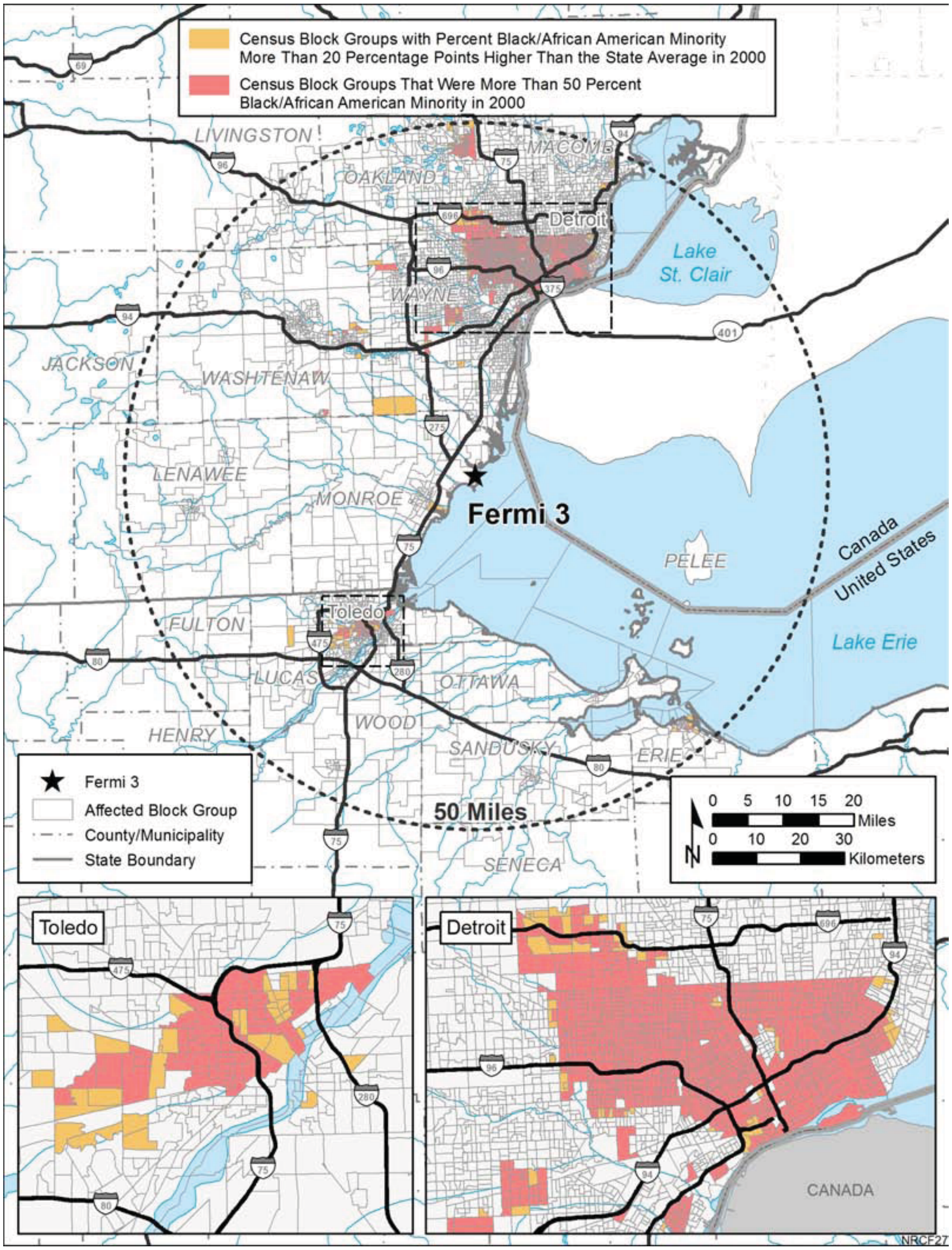
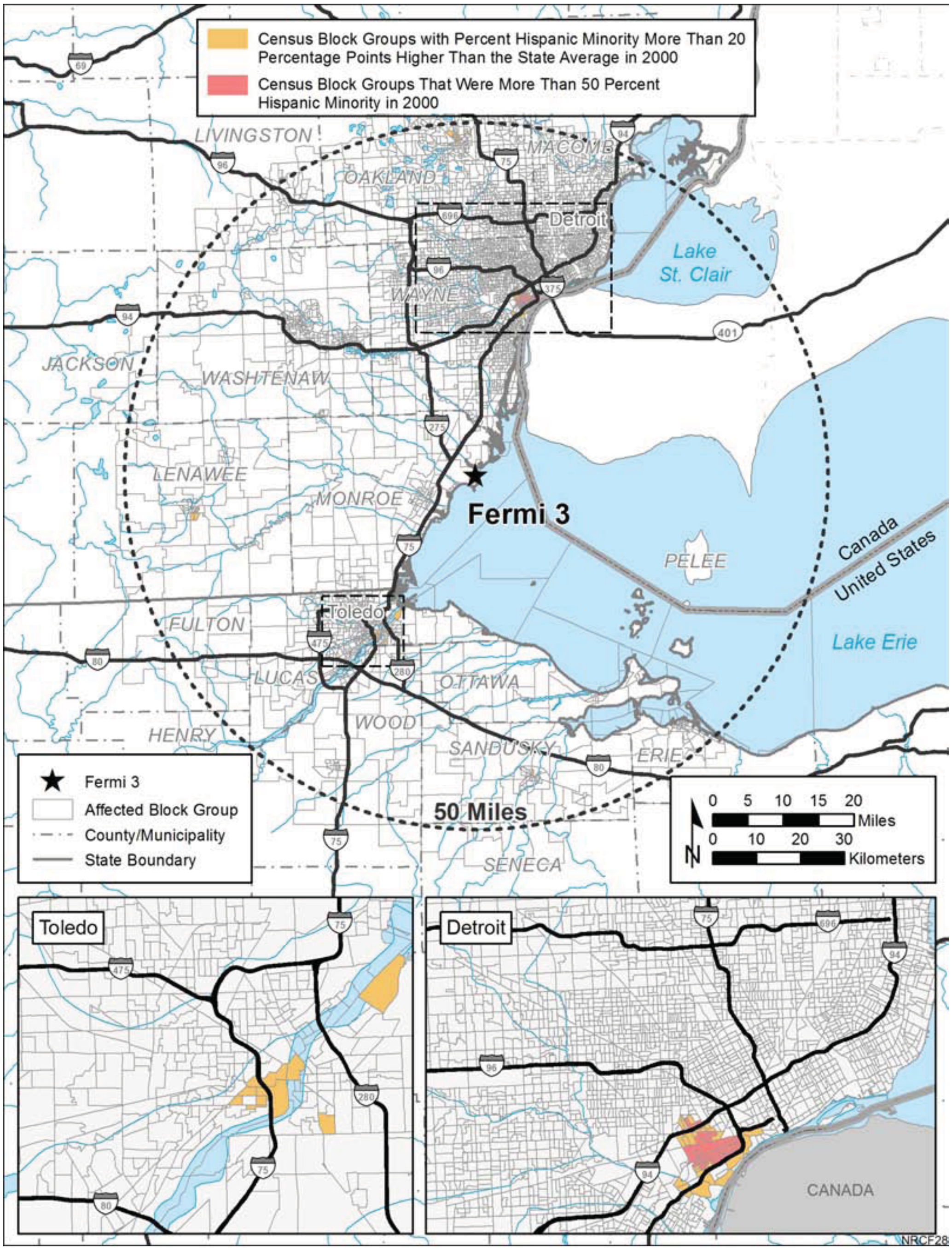


Figure 2-17. Black and African-American Minority Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2011a)

1



2 **Figure 2-18**. Hispanic Minority Census Block Group Populations of Interest
3 within a 50-mi Radius of Fermi 3 (USCB 2011a)

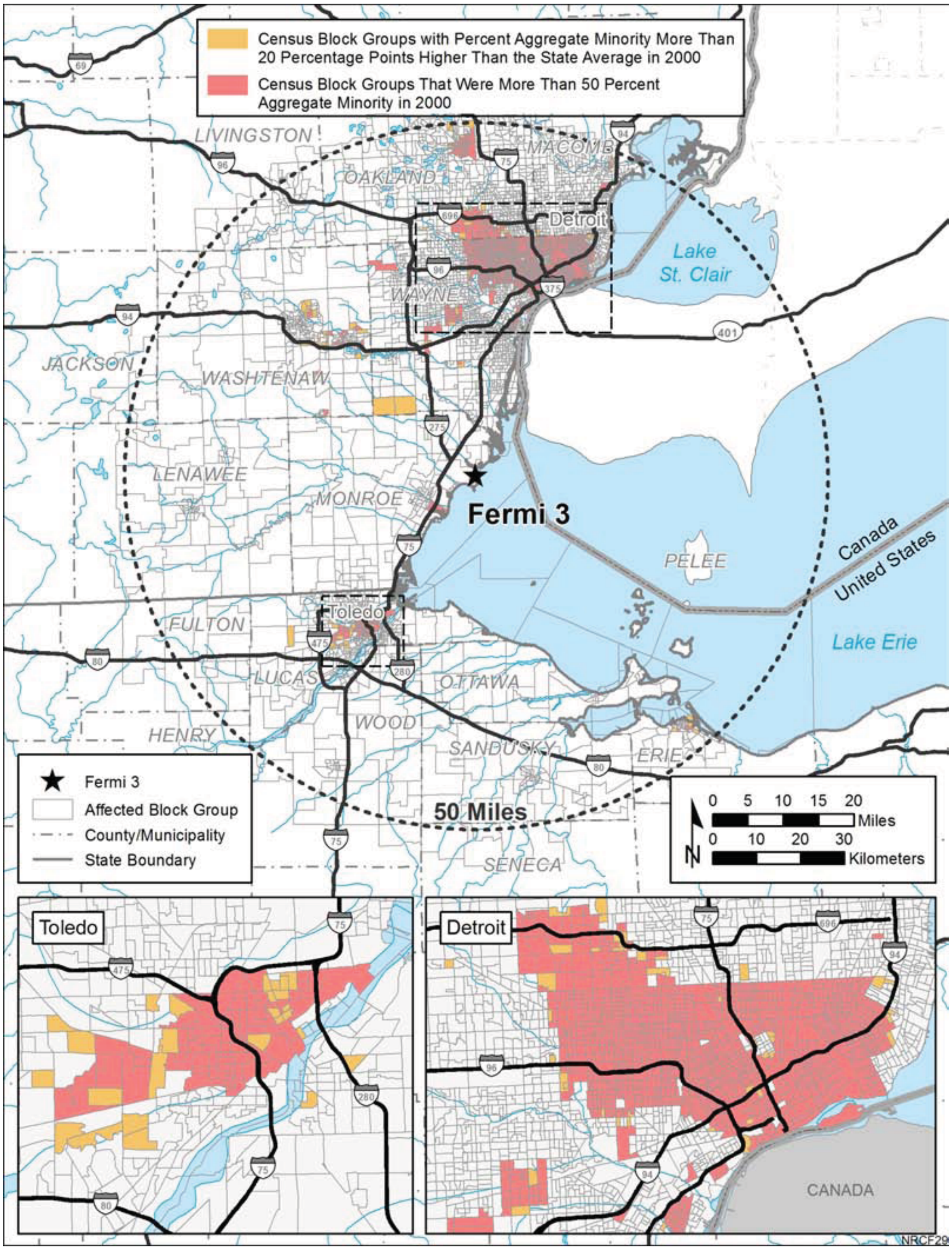


Figure 2-19. Aggregate Minority Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2011a)

There is one Native American population within a 50-mi radius of the proposed Fermi 3 plant site, located on Walpole Island, Canada, approximately 50 mi northeast of the site. The island is inhabited by the Chippewa, Potawatomi, and Ottawa peoples. In 2001, the population was 1841 persons (Detroit Edison 2011a). Because this Native American population of interest is at the limit of the 50-mi region, and because it is in Canada, the review team did not include it in its environmental justice investigation.

2.6.1.2 Low-Income Populations

The review team calculated the percent of households in each of the 4606 census block groups within a 50-mi radius of Fermi 3 and identified 572 census block groups that met the low-income measurement for being populations of interest (Table 2-60).

Table 2-60. Results of the Census Block Group Analysis for Low-Income Populations of Interest within the Region (50-mi radius)[(a)]

State and County	Total Number of Census Block Groups	Number of Census Block Groups with Low-Income Populations of Interest	Percent of Census Block Groups with Low-Income Populations of Interest
Michigan			
Jackson	7	0	0
Lenawee	72	1	1.4
Livingston	64	0	0
Macomb	541	5	0.9
Monroe	127	1	0.8
Oakland	724	20	2.8
St. Clair	2	0	0
Washtenaw	260	33	12.7
Wayne	2126	428	20.1
Ohio			
Erie	49	3	6.3
Fulton	18	0	0
Henry	3	0	0
Lucas	434	71	16.4
Ottawa	0	0	0
Sandusky	57	1	1.8
Seneca	6	0	0
Wood	76	9	11.7
Total	**4606**	**572**	**12.4**

Source: USCB 2011b
(a) Shaded rows indicate counties in the economic impact area.

Most of the census block groups classified as low-income populations of interest lie to the north and to the south of the Fermi site in Wayne and Lucas Counties, respectively (Figure 2-20).

One census block group within Monroe County also qualifies as a low-income population of interest. This census block group is the same minority population identified above as being the population of interest closest to the Fermi plant site (approximately 8 mi away).

2.6.2 Scoping and Outreach

The review team conducted interviews with community leaders within the 50-mi region to verify and supplement the list of populations of interest and to identify pathways by which a disproportionately high and adverse environmental or socioeconomic effect could be experienced by minority or low-income communities. The review team provided the region with an advanced notice of public scoping meeting in accordance with NRC guidance. In these scoping and outreach activities, the review team did not identify any additional groups of minority or low-income persons not already identified in the GIS analysis of census data.

2.6.3 Subsistence and Communities with Unique Characteristics

The next step in the review team's methodology is to examine whether or not any of the identified minority or low-income populations appear to have a unique characteristic that could lead to a disproportionately high and adverse affect. Examples of unique characteristics include lack of vehicles, sensitivity to noise, close proximity to the plant, or subsistence activities. Such unique characteristics must be demonstrably present in the population and relevant to the potential environmental impacts of the plant. If the impacts from the proposed action appear to adversely affect an identified minority or low-income population through a unique characteristic, then the review team makes a determination whether the adverse impact is disproportionately high when compared with that in the general population.

Subsistence uses of natural resources are often intended to supplement income by providing food or other resources that free up actual earnings for additional purchases. Common categories of subsistence uses include gathering plants, fishing, and hunting. Some subsistence use is undertaken for ceremonial and traditional cultural purposes. Subsistence use often involves using publicly held resources, such as rivers (subsistence fishing) or forests (hunting or gathering of vegetation), but it also includes the use of privately owned resources such as home vegetable gardens. Subsistence information is often site-specific and difficult to differentiate from the recreational uses of natural resources. Therefore, the review team presents subsistence information in a more qualitative manner on the basis of diverse sources of published and anecdotal information.

Approximately 206 ac of the 1260-ac Fermi site are currently developed. The general public is not allowed uncontrolled access to the site for safety and security reasons; thus, no ceremonial,

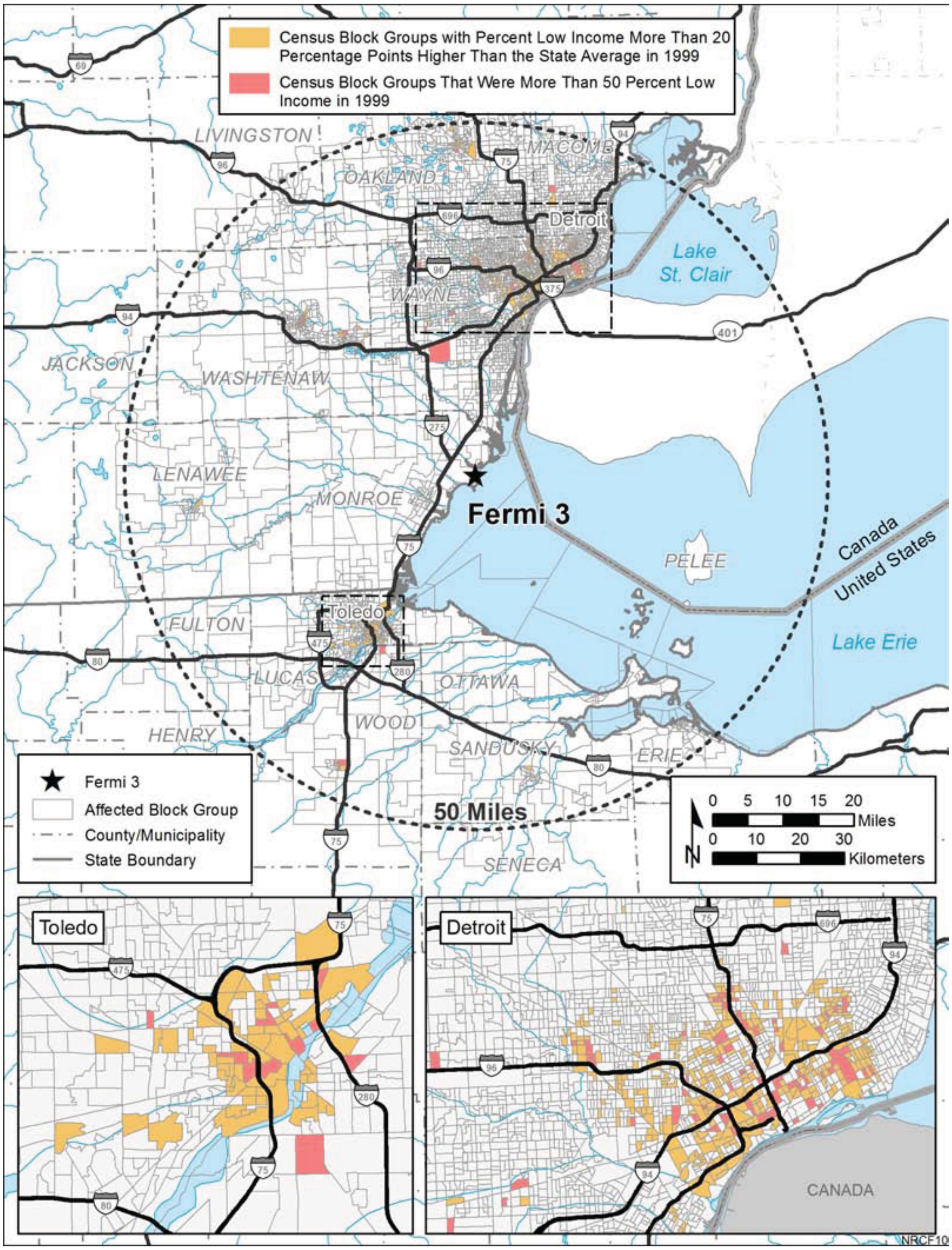


Figure 2-20. Low-Income Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2011b)

culturally significant, or subsistence gathering of vegetation occurs on the site. In addition, the DRIWR encompasses a 656-ac portion of the Fermi plant site that is not open to the public. The public is also prohibited from using the waters of Lake Erie for fishing, swimming, or boating within a 1-mi exclusion zone around the plant site.

During the development of the ER, Detroit Edison contacted several local persons with knowledge of the potential for subsistence activities in Monroe County. These persons included the Monroe County Sheriff, the Superintendent of the Monroe County Intermediate School District, two local church officials, and a landowner who has farmed more than 200 ac approximately 2 mi from the site for more than 30 years. The review team concluded from discussions with these contacts that no subsistence activities are occurring on or near the site (Detroit Edison 2011a).

2.6.4 Migrant Populations

Migrant labor or a migrant worker is defined by the USDA as a "farm worker whose employment required travel that prevented the migrant worker from returning to his/her place of residence the same day." From an environmental justice perspective, there is a potential for such groups in some circumstances to be disproportionately affected by emissions in the environment. However, as discussed in Section 2.5, only 27 of 222 farms employing hired labor reported that they use migrant labor. Even if all of the migrant workers were minority or low-income individuals, on the basis of the average number of hired workers per farm in Monroe County, the review team estimated that the total number of migrant workers is about 216 in the Monroe County. No information was available on their actual location of employment within the county.

2.6.5 Environmental Justice Summary

The review team found census block groups with aggregate minority or low-income populations that exceed the percentage criteria established for environmental justice analyses. Consequently, the review team performed additional analyses before making a final environmental justice determination. On the basis of the information in the Detroit Edison ER, public input, and its own outreach and analysis, the review team determined that because there are minority and low-income populations of interest in the region, impacts on these communities must be considered in greater detail, as discussed in Section 2.6.1. The result of the review team analyses of construction impacts can be found in Section 4.5 of this EIS. Analyses of operation impacts can be found in Section 5.5.

2.7 Historic Properties and Cultural Resources

In accordance with 36 CFR 800.8(c), the NRC and the USACE have elected to use the National Environmental Policy Act of 1969, as amended (NEPA), process to comply with the obligations found under Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA). As a cooperating agency, the USACE is part of the NRC review team, involved in all aspects of the environmental review. The USACE is the primary Federal agency that will review and authorize regulated activities in waters of the United States, including wetlands. The NRC will determine whether or not to issue a COL for Fermi 3. For the purposes of Section 106, the NRC is the lead Federal agency consulting with the State Historic Preservation Office/Officer (SHPO) for the COL permit.

This section discusses the cultural background of the Fermi 3 site region, including prehistoric and historic resources (Section 2.7.1). It also details the efforts that have been taken to identify cultural resources within the area of potential effects (APE) and the cultural resources and historic properties that were identified (Section 2.7.2). A description of the NHPA Section 106 consultation efforts accomplished to date is also provided (Section 2.7.4). The assessments of impacts of the proposed building and operation of Fermi 3 and its associated facilities on historic properties identified within the APE, pursuant to Section 106 of the NHPA, are found in Sections 4.6 and 5.6, respectively.

2.7.1 Cultural Background

The cultural background for the proposed Fermi 3 project location and the surrounding region was developed as part of the Phase I cultural resources investigations and the submerged sites sensitivity assessment that were conducted for the Fermi 3 project in support of the COL application ER (Demeter et al. 2008; Weir 2008a; Taylor 2009) and is summarized here.

The proposed Fermi 3 project location and the surrounding region show evidence of both prehistoric and historic occupation and/or settlement by Native Americans and Euroamericans that has continued through to the present. Archaeological records suggest that the Fermi 3 project location and the surrounding area have had the potential for occupation from the Paleo-Indian period (ca. 10,000 BC to 8000 BC), the Archaic Period (ca. 8000 BC to 550 BC), and the Woodland Period (ca. 600 BC to AD 1600). Native American groups that lived in the region at the time of contact with early European explorers and settlers were identified from historic written accounts, which indicated that these contact-period Native American groups were associated with the Erie, an Iroquoian group, and with the Wendat/Huron, Ottawa, Miami, and the allied Fox and Mouscatine, which are all Algonkian groups (Demeter et al. 2008).

According to the Michigan Department of Human Services and the Bureau of Indian Affairs, there are currently 12 Federally recognized Indian Tribes in the State of Michigan primarily associated with the Chippewa, Ottawa, and Potawatomi. None of these 12 Federally recognized Indian Tribes are located within the proposed Fermi 3 project area or its surrounding region in southeastern Michigan. However, the closest of these 12 Federally recognized Indian Tribes are three groups of Potawatomi Indians in southwestern Michigan and one group of Chippewa Indians in central Michigan: the Nottawaseppi Huron Band of Potawatomi Indians in

Calhoun County; the Pokagon Band of Potawatomi Indians in Cass County; the Gun Lake Potawatomi Tribe (also known as the Match-e-be-nash-she-wish Band of Potawatomi Indians of Michigan) in Allegan County; and the Saginaw Chippewa Indian Tribe, located on the Isabella Indian Reservation in Isabella County (Michigan Department of Human Services 2010; Michigan Department of Human Services undated; 73 FR 18553).

The National Park Service (NPS) Native American Consultation Database (NACD), developed as part of NPS's national program for compliance with the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), identified three Federally recognized Indian Tribes with judicially established land claims within Monroe County, Michigan. One is the Hannahville Indian Community in Menominee County, Michigan (northern Michigan). The other two are located outside the State of Michigan: the Forest County Potawatomi Community in Forest County, Wisconsin (northeastern Wisconsin), and the Ottawa Tribe of Oklahoma in Ottawa County, Oklahoma (northeastern Oklahoma) (NPS 2010b). Because judicially established land claims are based on proven ancestral or historic ties to lands (USGS 1993; NPS 2010a), these three Federally recognized Indian Tribes may also have been prehistorically or historically associated with the Fermi 3 project location or its surrounding region.

The regional historic cultural background begins with European exploration and settlement by the French in the 17th century, followed by British control of the area in the mid to late 18th century. After the War of 1812, the region came under American control and was reorganized into counties, including the establishment of Monroe County and the Village of Monroe in 1817. With the opening of a Federal Land Office in the area in 1824, increasing settlement occurred in the region through the remainder of the 19th century. However, because the Fermi 3 project area was historically a wetland environment, little settlement occurred in the project area in the 19th century, although the shoreline areas have been used for commercial fishing purposes and upland areas were used for vineyards and silica sand mining. By the early 20th century, wealthy Detroit residents began to purchase lots and build summer cottage communities or resorts to the south of the Fermi 3 project area, along the Lake Erie shoreline. These seasonal communities have been converted since the mid 20th century to year-round communities that are still occupied today, including the Stoney Point, Woodland Beach, and Detroit Beach communities located south/southwest of the Fermi 3 project area (Demeter et al. 2008).

Shoreline and offshore areas in the vicinity of the Fermi site may have been used prehistorically and historically by Native Americans for fishing, hunting, and gathering plant resources. Historic Euroamerican activities along the shoreline and in offshore areas in the region also have been associated with fishing, including the development of commercial fishing industries associated with lake herring (*Coregonus artedii*), lake sturgeon (*Acipenser fulvescens*), lake whitefish (*Coregonus clupeaformis*), and common carp (*Cyprinus carpio*) in the region from the mid-19th to the early 20th centuries (Demeter et al. 2008; Weir 2008a; University of Wisconsin Sea Grant

Institute 2002). The local commercial fishing industry was subsequently replaced in the early 20th century by the development of shoreline areas as seasonal (summer) communities or resorts, as described above. Currently, shoreline areas in the vicinity of the Fermi site support the Fermi 1 and 2 plant facilities and the year-round beach communities to the northeast and southwest of the Fermi 3 project area.

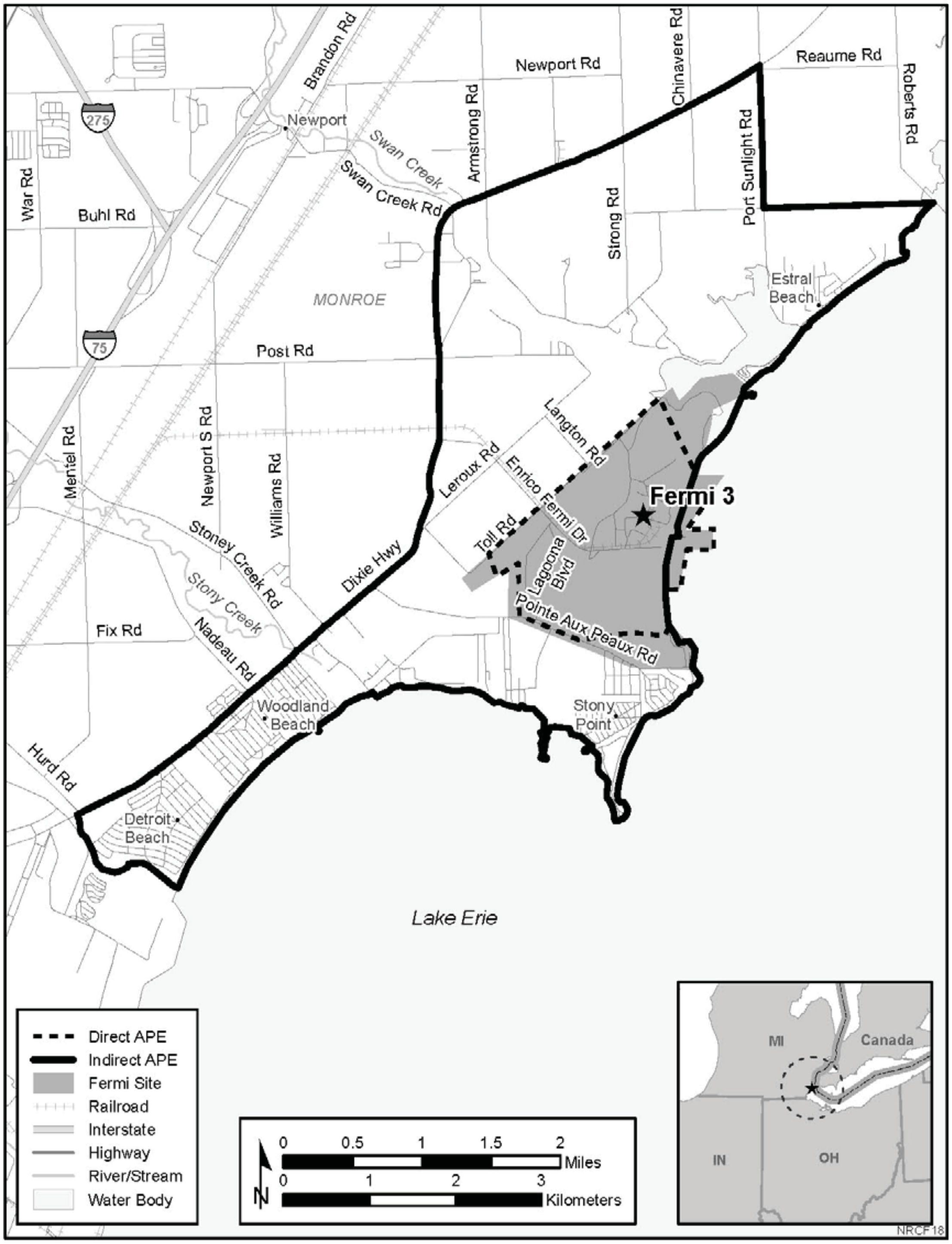
2.7.2 Historic and Cultural Resources at the Site

To identify the historic properties and cultural resources at the Fermi 3 site and along associated transmission line corridors, the review team reviewed the following information:

- Fermi 3 ER (Detroit Edison 2011a) – Detroit Edison's contractor, Black & Veatch Corporation (Black & Veatch), summarized the conclusions of investigations undertaken to identify and evaluate cultural resources and historic properties in the APE for the Fermi 3 project.
- NRC site audit, February 2009 – NRC staff consulted with the Michigan SHPO and also conducted an on-the-ground visit of the Fermi 3 site and the direct and indirect APEs for the Fermi 3 project.
- Detroit Edison's RAI responses – letters dated July 31, 2009; September 30, 2009; and November 23, 2009 (Detroit Edison 2009f, d, and e, respectively).
- Detroit Edison technical report – Fermi 3 Phase I cultural resources investigation, July 2008 (Demeter et al. 2008).
- Detroit Edison technical report – Fermi 3 submerged sites sensitivity study, December 2008 (Weir 2008a).
- Detroit Edison technical report – Fermi 1 preliminary *National Register of Historic Places* evaluation, March 2009 (Kuranda et al. 2009).
- Detroit Edison technical report – Fermi 3 archaeological survey, November 2009 (Taylor 2009).
- Detroit Edison technical report – Fermi 3 cultural resources review, March 2011 (Taylor 2011).

Determination of APE

The NRC has determined that the APE for the environmental review consists of the area containing the proposed Fermi 3 power plant site where ground-disturbing activities could potentially occur (the direct APE) and surrounding areas that may be indirectly (visually) affected by the building and operation of Fermi 3 and associated facilities (the indirect APE) (see Figure 2-21). Historic and cultural resources identified within the direct APE are

1 

2 **Figure 2-21**. Fermi 3 Cultural Resources Area of Potential Effects

considered onsite resources. Historic and cultural resources identified within the indirect APE are considered offsite resources.

The direct and indirect APEs identified by the NRC for the environmental review correspond to three APEs identified by Detroit Edison and Commonwealth Cultural Resources Group, Inc. (CCRG), in consultation with the Michigan SHPO for the Phase I cultural resources investigation, as follows: the direct APE, which corresponds to the archaeological APE discussed in Phase I reports; the indirect APE, which corresponds to that portion of the aboveground resources APE that is discussed in Phase I reports that is outside the archaeological APE; and a submerged sites APE, which the NRC considers in the offshore (aquatic) portions of the direct APE.

The direct APE consists of an area that is approximately 520 ac within which Fermi 3 and associated facilities would be constructed and that would include the area at the site that will be impacted by ground-disturbing activities associated with building and operating Fermi 3. Areas within the direct APE include the existing Fermi 1 and Fermi 2 plant sites, a series of interconnected roadway grades, a stone quarry, two spoils-disposal zones, and areas possibly affected by building the Fermi 3 cooling tower, laydown areas, and a new access road (Demeter et al. 2008). Additional areas were subsequently determined to be potentially affected by ground-disturbing activities associated with the use of a laydown area during the building phase and building of a meteorological tower and its associated access road, and they are considered part of the direct APE by the NRC review team. These additional areas, totaling 28.5 ac, were also subjected to additional Phase I archaeological investigations (Taylor 2009, 2011). One previously recorded cultural resource, an archaeological site, is located in the direct APE (Demeter et al. 2008) and is discussed in greater detail below.

The indirect APE consists of offsite areas surrounding the proposed Fermi 3 power plant site to address the potential for indirect visual impacts or effects on cultural resources and historic properties (buildings or structures) that may result from building and operating Fermi 3. The indirect APE consists of an area of about 6680 ac that extends approximately parallel to the shoreline of Lake Erie and includes the nearest shoreline settlements of Estral Beach to the northeast and Woodland Beach and Detroit Beach to the southwest of the Fermi 3 site (Detroit Edison 2011a; Conway 2007; Weir 2008b).

The indirect APE does not include the direct APE. One previously recorded NRHP-eligible historic property, a building at 5046 Williams Road, is located offsite in the indirect APE (Demeter et al. 2008) and is discussed in greater detail below. Two other previously recorded cultural resources, both archaeological sites that have not been evaluated for NRHP-eligibility, are also located in the indirect APE (Demeter et al. 2008).

The submerged sites APE was identified by CCRG to address the potential for impacts on offshore cultural resources or historic properties that might result from building and operating

Fermi 3 and its water intake and discharge structures. This approximately 130-ac area includes the existing discharge conduit and cooling water intake channel for the Fermi 1 and 2 units, as well as the existing barge dock and channel for the Fermi plant property (Weir 2008a). No previously identified shipwrecks or archaeological sites are located within the submerged sites APE (Weir 2008a; Demeter et al. 2008).

Phase I Cultural Resources Investigations

CCRG conducted Phase I cultural resources investigations within the terrestrial portions of the Fermi 3 APE between November 2007 and April 2008 and in October 2009 (Detroit Edison 2011a; Demeter et al. 2008; Taylor 2009). The purpose of these Phase I cultural resources investigations was to identify cultural resources and historic properties within the direct and indirect APEs and to evaluate the NRHP-eligibility of any newly identified cultural resources and any previously identified cultural resources that had not been evaluated for NRHP eligibility.

The archaeological survey conducted as part of the Phase I cultural resources investigation resulted in the identification of eight archaeological resources within the direct APE (one previously recorded prehistoric site location; four newly identified prehistoric find spots or isolated artifacts; two newly identified historic sites; and one newly identified multicomponent site [prehistoric and historic]). None of these eight archaeological resources were recommended eligible for listing in the NRHP (see Table 2-61). The aboveground resources survey conducted as part of the Phase I cultural resources investigation identified a total of 84 architectural resources within the direct and indirect APE (consisting of buildings or structures). Twenty-two of these architectural resources have been determined or recommended eligible for listing in the NRHP; the remaining architectural resources have been recommended not eligible for listing in the NRHP (see Table 2-62).

Archaeological Resources

Ten archaeological resources have been identified within the direct and indirect APEs: eight in the direct APE and two in the indirect APE. The eight archaeological resources identified in the direct APE consist of one previously recorded archaeological site location, four newly identified prehistoric archaeological find spots or isolated artifacts, two newly identified historic archaeological sites, and one newly identified multicomponent (prehistoric and historic) archaeological site (Detroit Edison 2011a). The one previously recorded onsite archaeological site location was revisited during the Phase I cultural resources investigation, but no evidence of this previously recorded site was observed. The site appears to have been destroyed by natural shoreline erosion due to wave action and/or landfilling and installation of riprap for erosion control, and no further archaeological investigations have been recommended for this previously recorded site.

Table 2-61. Fermi 3 Archaeological Resources Identified – Phase I Investigations

Site Number	Site Description	Site Age or Cultural Period	NRHP–Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
20MR702	Onsite Previously Recorded Prehistoric Archaeological Site	Unidentified Prehistoric	Not Eligible[a] – Site destroyed by natural erosion and/or installation of rip-rap for erosion control	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
20MR818	Onsite Multi-component (Prehistoric and Historic) Surface Artifact Scatter	Unidentified Prehistoric and Late 19th to Early 20th Century	Recommended Not Eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
20MR819	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
20MR820	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
20MR821	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
20MR822	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
20MR823	Onsite Historic Archaeological Site	Early to mid 20th Century	Recommended Not Eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
20MR825	Onsite Historic Surface Artifact Scatter and Pet Cemetery	20th Century	Recommended Not Eligible[b]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Sources: Demeter et al. 2008; Taylor 2009
(a) Demeter et al. 2008.
(b) Taylor 2009.
(c) Conway 2011.

Table 2-62. Fermi 3 Aboveground Resources Identified – Phase I Investigations

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
Fermi Drive (Enrico Fermi Atomic Power Plant [Fermi 1])	Onsite Nuclear Power Plant	1956	Recommended NRHP-eligible (Criterion A and C)[b]	Evaluation of NRHP-eligibility[a] [b]	Concurrence indicated in May 9, 2011, letter[c]
5046 Williams Rd.	Offsite Previously Recorded Front-Gabled-Style House	c. 1840	Determined NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2381 Hurd Rd.	Offsite New England One-and-a-Half-Style House	c. 1850	Recommended NRHP-eligible (Criteria A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2122 N. Dixie Hwy.	Offsite Gabled-Ell-Style House	c. 1875	Recommended NRHP-eligible (Criteria A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2430 N. Dixie Hwy. (St. Anne's Catholic Church Grotto)	Offsite Vernacular-style Ecclesiastical Structure (Grotto)	1956	Recommended NRHP-eligible (Criterion C, Exception A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Near 4973 N. Dixie Hwy.	Offsite Greek Revival-Style House	c. 1840	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5179 N. Dixie Hwy. (Dixie Skateland)	Offsite Vernacular-Style Skating Rink	1958	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6068 N. Dixie Hwy.	Offsite Farmstead Complex: Side-Gabled House and Vernacular-Style Barn and Other Outbuildings[d]	c. 1885	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
N. Dixie Hwy. (St. Charles Cemetery)	Offsite Late 19th Century Cemetery	1882	Recommended NRHP-eligible (Criterion A and Exception D)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
N. Dixie Hwy. (Old St. Charles [White or LaDue] Cemetery)	Offsite Mid 19th Century Cemetery	1851	Recommended NRHP-eligible (Criterion A and Exception D)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8109 Swan Creek Rd. (St. Charles [Borromeo] Church Complex)	Offsite Victorian Gothic-Style Church and Outbuildings[d]	1882-1886	Recommended NRHP-eligible (Criterion C and Exception A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6344 Trombley Road (Jacob Masserant Farmstead Complex)	Offsite Farmstead Complex: Hall-and-Parlor-style House, Three-Bay Threshing Barn and Associated Outbuildings[d]	c. 1853	Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6511 Leroux Road (Joseph Fix Farmstead Complex)	Offsite Farmstead Complex: Gabled-Ell-style House, Three-Bay Threshing Barn and Associated Outbuildings[d]	1878	Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
3684 Brest Rd. (Frenchtown Township District No. 13 School)	Offsite Standardized School Plan-Style School	1926-1927	Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3738 Brest Rd. (Dewey House)	Offsite Greek Revival-Style House	c. 1840	Recommended NRHP-eligible (Criterion A, B and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Pearl Drive Historic District			Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3535 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3555 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3575 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3595 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2983 Third St.	Offsite Tudor Revival-Style House (Cotswold Cottage/ Storybook substyle)	c. 1940	Recommended NRHP-eligible (Criterion C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3677 Lakeview Dr.	Offsite Contemporary Folk-Style House	c. 1945	Recommended NRHP-eligible (Criterion C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3360 Elmwood St.	Offsite Mediterranean-Style House	c. 1940	Recommended NRHP-eligible (Criterion C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3390 Lawndale St.	Offsite Queen Anne-style House	c. 1910	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3518 Nippising St. (Indian Trails Clubhouse)	Offsite Vernacular-style Civic Building	c. 1930-1940	Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3606 Lakeshore Dr.	Offsite Mediterranean-Style House	c. 1940	Recommended NRHP-eligible (Criterion C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3351 N. Dixie Hwy. (Joey's Frenchtown Bar)	Offsite Commercial Building with American Foursquare-Style Base	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3979 N. Dixie Hwy.	Offsite T-Plan-Style Farmstead[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5163 N. Dixie Hwy.	Offsite Gabled-Ell-Style House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5795 N. Dixie Hwy.	Offsite T-Plan-Style House and Farmstead Complex[d]	c. 1870	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
6175 N. Dixie Hwy.	Offsite Gabled-Ell-Style House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7180 N. Dixie Hwy.	Offsite Upright and Wing-Style House	c. 1850	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7858 N. Dixie Hwy.	Offsite Vernacular-Style Commercial Building	c. 1920	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8106 N. Dixie Hwy.	Offsite Gabled-Ell-style House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8145 N. Dixie Hwy.	Offsite Cross-gabled-style House and Farmstead Complex[d]	c. 1870	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8207 N. Dixie Hwy. (F. Bondy or Masserant House)	Offsite Gabled-ell-style House	1887	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8527 N. Dixie Hwy.	Offsite Vernacular Side-Gabled-Style House	c. 1840	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8563 N. Dixie Hwy.	Offsite Upright and Wing-Style House	c. 1850	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8570 N. Dixie Hwy.	Gabled-Ell-Style House	c. 1900	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7781 Swan Creek Rd.	Offsite Foursquare-Style House	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8038 Swan Creek Rd.	Offsite Side-Gabled-Style House	c. 1850	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7705 Strong Rd.	Offsite Gabled-Ell-Style House and Farmstead Complex[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7831 Strong Rd.	Offsite Gabled-Ell-Style House and Farmstead Complex[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8180 Chinaware Rd.	Offsite Gabled-Ell-Style House and Farmstead Complex[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8594 Port Sunlight Rd.	Offsite Cross-Gabled-Style House and Farmstead Complex[d]	c. 1890	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Lakeshore Dr.	Offsite Art Moderne-Style House	c. 1925	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
6771 Lakeshore Dr.	Offsite Minimal Traditional-style House	c. 1940	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6771 Lakeshore Dr.	Offsite Vernacular-Style Fire Pit	c. 1945	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6708 Lakeshore Dr.	Offsite Vernacular-Style House	c. 1920	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7497 Lakeshore Dr. (Estral Beach Hotel)	Offsite Neoclassical Revival-Style Commercial Building	1922	Recommended Not NRHP-Eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7194 Lakeview Blvd. (Estral Beach Fire Station 58 and Village Hall)	Offsite Vernacular Civic Buildings[d]	1968	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5603 Post Rd.	Offsite Foursquare-Style House	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5701 Post Rd.	Offsite Queen Anne-Style House	c. 1895	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6994 Post Rd.	Offsite Gabled-ell House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
4610 Burke Rd.	Offsite Colonial Revival-Style House	c. 1915	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3880 Lakeshore Dr.	Offsite Tudor Revival-Style House	c. 1942	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3195 Brest Rd.	Offsite Foursquare-Style House	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Lakeshore Dr. (between 6771 and 3689)	Offsite Vernacular-Style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3704 Lakeshore Dr.	Offsite Contemporary Folk-Style House	c. 1925	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3019 Second St.	Offsite Tudor Revival-Style House	c. 1940	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3013 Tenth St.	Offsite Side-gabled Vernacular-style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3260 Eleventh St.	Offsite Side-Gabled Vernacular-Style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3028 Harborview (Detroit Beach Boat Club)	Offsite Side-Gabled Vernacular-Style Civic Building	Mid 20th Century	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Harborview (Substation)	Offsite Vernacular-Style Industrial Building	c. 1960	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
2112 Grand Blvd.	Offsite Foursquare-Style House	c. 1920	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Grand Blvd. (next to 2015)	Offsite Front-Gabled (clipped) Vernacular-Style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Sources: Demeter et al. 2008; Kuranda et al. 2009

(a) Demeter et al. 2008.

(b) Kuranda et al. 2009.

(c) Conway 2011.

(d) Two or more architectural resources were evaluated at this location.

The remaining seven newly identified archaeological resources within the direct APE were evaluated for NRHP eligibility under Criterion D. The four prehistoric archaeological find spots or isolated artifacts and the single prehistoric artifact identified at the multicomponent archaeological site are nondiagnostic (i.e., the artifact cannot be interpreted for function and/or cannot be dated to a specific prehistoric cultural period), are not associated with any other prehistoric materials or features, and would not contribute information beyond what is already known of the prehistoric context for the Fermi 3 site. The lack of diagnostic information renders these prehistoric archaeological resources minimally important with regard to their research value. The two newly identified historic archaeological sites and the historic component of the one multicomponent archaeological site have been evaluated as possessing limited interpretive value such that none are likely to contribute significant information relative to past regional historic land use patterns (Demeter et al. 2008). As such, none of the seven newly identified archaeological resources in the direct APE have been recommended as being eligible for listing in the NRHP under Criterion D, and no further archaeological investigations have been recommended for any of these seven onsite archaeological resources (Detroit Edison 2011a; Demeter et al. 2008; Taylor 2009).

The two previously recorded archaeological resources identified within the indirect APE consist of a prehistoric site and a historic (19th century) site. Neither of these offsite archaeological resources has been evaluated for NRHP eligibility (Demeter et al. 2008).

Architectural Resources

The 84 architectural resources identified within the direct and indirect APEs consist of historic buildings or structures. The NRHP-eligibility status of the 84 architectural resources is as follows:

- One offsite previously recorded historic property, a house at 5046 Williams Road in the indirect APE, was determined NRHP-eligible by the Michigan SHPO in 1995 (Detroit Edison 2011a; Demeter et al. 2008).
- One onsite architectural resource, the Enrico Fermi Atomic Power Plant Unit 1 (Fermi 1), is located within the direct APE. Fermi 1 was evaluated for NRHP eligibility as part of a separate project and appears to meet the criteria for NRHP eligibility (Detroit Edison 2011a; Kuranda et al. 2009; Conway 2011). Fermi 1 was also designated a Nuclear Historic Landmark by the American Nuclear Society in October 1986 (American Nuclear Society 2010).
- One offsite proposed historic district, the Pearl Drive Historic District in the indirect APE, composed of four houses, has been recommended as NRHP eligible as a result of cultural resource investigations for this project (Detroit Edison 2011a; Demeter et al. 2008).

- Nineteen offsite individual buildings or structures in the indirect APE (consisting of houses, farmstead complexes, cemeteries, ecclesiastical complexes or structures, civic buildings, and miscellaneous community or recreational buildings) have been recommended as NRHP eligible as a result of cultural resource investigations for this project (Detroit Edison 2011a; Demeter et al. 2008).
- Sixty-two offsite architectural resources in the indirect APE (consisting of individual houses, farmstead complexes, ecclesiastical complexes or structures, civic buildings, industrial and commercial buildings, and miscellaneous community or recreational buildings) have been recommended as not eligible for listing in the NRHP as a result of cultural resources investigations for this project (Detroit Edison 2011a; Demeter et al. 2008).

Historic Properties

One offsite previously recorded historic property is located within the indirect APE: a house at 5046 Williams Road, which was determined to be NRHP eligible by the Michigan SHPO in 1995 (Detroit Edison 2011a; Demeter et al. 2008).

One onsite property is located within the direct APE: Fermi 1, which was evaluated for NRHP eligibility as part of a separate project and appears to meet the criteria for NRHP eligibility. The Michigan SHPO indicated concurrence with this finding per the letter dated May 9, 2011 (Detroit Edison 2011a; Kuranda et al. 2009; Conway 2011).

Twenty additional offsite properties within the indirect APE have been recommended to be NRHP eligible. These resources include:

- the proposed Pearl Drive Historic District, composed of four houses (Detroit Edison 2011a; Demeter et al. 2008), and
- nineteen individual buildings or structures (Detroit Edison 2011a; Demeter et al. 2008).

The Phase I cultural resources investigations did not discover any human remains in the terrestrial portions of the APE (Demeter et al. 2008; Taylor 2009).

The proposed new approximately 11-mi transmission line route from the Sumpter-Post Road junction to the Milan Substation has been assessed as having a moderate to high potential for encountering archaeological resources; however, no Phase I cultural resource investigations were conducted (Detroit Edison 2011a |ER Rev. 2|).

Submerged Sites Sensitivity Study

CCRG reported the results of the submerged sites sensitivity study in December 2008 (Weir 2008a). The purpose of the submerged sites sensitivity study was to identify previously recorded submerged sites and maritime-related resources within the submerged sites APE and to determine the likelihood that previously unidentified submerged sites and maritime-related resources would be located within the submerged sites APE. On the basis of the presence of known resources in areas outside the submerged sites APE, the lack of research on submerged sites within the general project area, and the shallow water environment within the submerged sites APE, CCRG concluded that the submerged sites APE has a moderate to high sensitivity for containing previously unidentified maritime-related resources. However, no previously recorded submerged sites or maritime-related resources (including archaeological sites, structures such as docks, or shipwrecks) were identified within the submerged sites APE and portions of the APE along the shoreline and in the vicinity of the current outfall pipes, water intake pipes, dock, and channel were assessed as having been previously disturbed by landfilling and dredging during the building and operation of Fermi 1 and 2 (Weir 2008a).

The results of the Phase I cultural resource investigations conducted for the Fermi 3 project (Demeter et al. 2008; Taylor 2009, 2011), including the results of the submerged sites sensitivity assessment (Weir 2008a), have been submitted to the Michigan SHPO for review and comment under Section 106 of the NHPA.

Traditional Cultural Properties

Detroit Edison contacted six Native American groups in an effort to identify any traditional cultural properties in the area of the Fermi 3 site and/or to determine whether the Fermi 3 site is an area that is otherwise sensitive to these groups with respect to cultural resources. Five of the six Native American groups are Federally recognized Indian Tribes: the Match-e-be-nash-she-wish Band of Potawatomi Indians of Michigan; the Huron Potawatomi, Inc.; the Forest County Potawatomi Community of Wisconsin; the Hannahville Indian Community; and the Saginaw Chippewa Indian Tribe of Michigan (Detroit Edison 2009d). The NRC also contacted these five Federally recognized Indian Tribes as part of consultation under NEPA and Section 106 of the NHPA (see Section 2.7.4). The remaining Native American group contacted by Detroit Edison was the non-Federally recognized Native American group (the Wyandot of Anderdon Nation) (Detroit Edison 2009d).

None of the five Federally recognized Indian Tribes responded to Detroit Edison. The non-Federally recognized Native American group responded to Detroit Edison’s contact but did not identify any traditional cultural properties in the area of the Fermi 3 site or indicate that the Fermi 3 site is an area that is sensitive to this group with respect to cultural resources (Detroit Edison 2011a; Gronda 2008). Responses from Federally recognized Indian Tribes that the NRC has received to date are discussed in Section 2.7.4.

2.7.3 Historic and Cultural Resources within the Transmission Line Corridor

The proposed transmission line route will extend from the Fermi 3 site in Monroe County north and west to the existing Milan Substation in Washtenaw County. The majority of the proposed transmission line route, from the Fermi 3 project area in Monroe County north to the Sumpter-Post Road junction in Wayne County, will utilize an existing transmission line route. The remaining portion of the proposed transmission line route, from the Sumpter-Post Road junction in Wayne County west to the existing Milan substation in Washtenaw County, will utilize a new, undeveloped transmission line route.

Efforts to identify cultural resources along the proposed transmission line route were limited, consisting of site file research for the entire proposed transmission line route and a field view of the proposed new portion of the route. The APE for the site file search for the entire proposed transmission line route was defined as a 1.5-mi area around the proposed route from the Fermi 3 site in Monroe County to the existing Milan Substation in Washtenaw County. Site file searches identified a total of 77 previously recorded archaeological resources within the proposed transmission line route APE; no previously recorded architectural resources or NRHP-listed or NRHP-eligible historic properties were identified (Detroit Edison Corporation 2011a). Six of the 77 archaeological resources would be crossed by that portion of the proposed transmission line route that would require a new corridor. These six archaeological resources, which consist of five prehistoric archaeological sites and one historic archaeological site, were previously determined to not be NRHP eligible (see Table 2-63).

Table 2-63. Identified Transmission Line Corridor Archaeological Resources

Site Number	Site Description	Site Age or Cultural Period	NRHP–Eligibility Status
20WN928	Previously Recorded Prehistoric Archaeological Site	Unidentified Prehistoric	Determined Not Eligible
20WN927	Previously Recorded Prehistoric Archaeological Site	Woodland	Determined Not Eligible
20WN972	Previously Recorded Prehistoric Archaeological Site	Late Woodland	Determined Not Eligible
20WN 973	Previously Recorded Prehistoric	Unidentified Prehistoric	Determined Not Eligible
20WN976	Previously Recorded Prehistoric	Late Woodland	Determined Not Eligible
20WN1043	Historic Archaeological Site	19th and 20th Century	lDetermined Not Eligible

Source: Detroit Edison 2011a

The preliminary field view of the APE for both archaeological and aboveground resources was limited to the portion of the proposed transmission line route that would require a new corridor, and it extended 1.5 mi on either side of an assumed 300-ft-wide corridor centerline (Detroit Edison 2011a). Results of this field view of the proposed new transmission line route indicated a moderate to high potential for encountering archaeological resources and the few aboveground resources that meet the minimum age requirement or retain sufficient integrity to be considered for NRHP eligibility (Detroit Edison 2011a).

2.7.4 Section 106 Consultation

In December 2008, the NRC initiated Section 106 consultation for the proposed Fermi 3 project with the Michigan SHPO and the Advisory Council on Historic Preservation (ACHP) as part of the scoping process for the review of the Fermi 3 COL application under NEPA, consistent with 36 CFR 800.8(c) (Hatchett 2008a, b) (see Appendix C). In December 2008, the NRC also initiated Section 106 consultation for the proposed Fermi 3 project with a total of 17 Federally recognized Indian Tribes, in accordance with 36 CFR 800.2(c)(2)(ii) and 36 CFR 800.3(c), (see Appendix C for complete listing). Twelve of the Indian Tribes contacted as part of the scoping process are located in the State of Michigan. The remaining five Indian Tribes are located outside the State of Michigan but are either within a 50-mi radius of the Fermi 3 project or have a judicially established land claim in Monroe County, Michigan. In these letters, the NRC provided information about the proposed action and indicated that Section 106 consultation would be integrated with the NEPA process in accordance with 36 CFR 800.8 and would include participation in the scoping process; the identification of cultural resources and historic properties, including those historic properties of traditional religious or cultural importance to Federally recognized Indian Tribes; the assessment of effects of the proposed action on any historic properties; and the resolution of any adverse effects on historic properties.

The USACE would issue a public notice upon receipt of a complete permit application that initiates consultation and solicits comments from the public; Federal, State, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of regulated activities associated with the Fermi 3 project. Any comments received would be considered by the USACE to determine whether to issue, modify, condition, or deny a permit and to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors.

The ACHP responded to the NRC, indicating that the NRC must notify the Michigan SHPO and meet the standards in 36 CFR 800(c)(1)(i) through (v); and that it should notify the ACHP in the event that the NRC determines, in consultation with the SHPO/Tribal Historic Preservation Office (THPO) and other consulting parties, that the proposed undertaking may adversely affect properties listed, or eligible for listing, on the NRHP, and submit to the ACHP any EIS that is prepared pursuant to 36 CFR 800.8(c)(2)(i) (Vaughn 2009). The NRC will also notify the ACHP of the finding of any adverse effect on Fermi 1 and invite the ACHP to participate in the consultation to resolve the adverse effects, in accordance with 36 CFR 800.6.

In a December 21, 2009, phone conversation, Mr. Brian Grennell of the Michigan SHPO suggested that the NRC provide him with a completed Michigan SHPO's *Application for Section 106 Review* form to facilitate his Section 106 review of the Fermi 3 COL application. This form was further discussed in a phone conference with Mr. Grennell on August 5, 2010. The NRC sent the completed form to the Michigan SHPO in a letter dated December 17, 2010. In a response letter dated May 9, 2011 (that was received on May 10, 2011), the Michigan

SHPO stated that Fermi 1 appeared to meet the criteria for listing in the NRHP and that it concurred with the NRC's determination that demolition would have an adverse effect on Fermi 1 Conway 2011). Consultation to resolve the adverse effect in accordance with 36 CFR 800.6 is ongoing. To date, none of the 17 Federally recognized Indian Tribes have responded to the NRC.

On January 14, 2009, the NRC conducted two public scoping meetings (an afternoon session and an evening session) in Monroe, Michigan, at the Monroe County Community College's La-Z-Boy Center Meyer Theater. Comments made during the scoping meetings identified five additional historic or cultural resources in the vicinity of the Fermi 3 site (NRC 2009a). The five historic or cultural resources identified during the scoping meetings are as follows:

- Monroe Harbor.
- River Raisin Battlefield, an NRHP-listed historic property and a Congressionally authorized addition to the NPS.
- a portion of the existing Motor Cities National Heritage Area, a Congressionally designated area that is collaboratively managed by Federal, State, and local public and private agencies and groups to promote natural, cultural, historic, and scenic resources that combine to form a cohesive, nationally important landscape arising from patterns of human activity shaped by geography (in this case, the development of the automotive industry and the relationship between labor and industry).
- A proposed War of 1812 Bicentennial Legacy Commission project, developed under the auspices of the Michigan Commission on the Commemoration of the Bicentennial of the War of 1812 by the Experiential Tourism Task Group, War of 1812 Bicentennial Steering Committee in Monroe County, and consisting of the proposed reestablishment of wild rice (*Zizania aquatica*), with the help of the Native American Community, in unspecified areas suitable for its propagation.
- A proposed War of 1812 Bicentennial Legacy Commission project consisting of the proposed development of a nonmotorized trail, Hull's Road Coastal Heritage Trail along North Dixie Highway, in part in the vicinity of the Fermi 3 site, as part of the Downriver Greenways Initiative (NRC 2009a).

Two of the five historic or cultural resources identified during the scoping meetings, Monroe Harbor and the River Raisin Battlefield, are outside the Fermi 3 APE. Another two of the five resources, the Motor Cities National Heritage Area and the proposed reestablishment of wild rice as a proposed War of 1812 Bicentennial Legacy Commission project, overlap but do not have specific or identified locations within the Fermi 3 APE. The fifth resource, the proposed development of Hull's Road Coastal Heritage Trail along North Dixie Highway, would be located along or immediately adjacent to the western boundary of the indirect APE. No other comments or concerns regarding historic and cultural resources were made at the scoping meetings.

According to 10 CFR 50.10(a)(2)(vii) the building of transmission lines is not considered an NRC-authorized activity. Therefore, the NRC considers the offsite proposed transmission lines to be outside the NRC's APE and therefore not part of the NRC's consultation.

2.8 Geology

The geology and associated seismological and geotechnical conditions at the proposed Fermi Unit 3 site are described in Section 2.5 of the FSAR, which is part of the COL application (Detroit Edison 2011b). A summary of the geology of the Fermi site is provided in Section 2.6 of the ER (Detroit Edison 2011a). Both the FSAR and the ER were informed by the characterization conducted for the now decommissioned Fermi 1 and the operating Fermi 2 and the results of subsurface investigations performed recently to support the COL application. The staff's descriptions of the geological features of the site and the vicinity and its detailed analyses and evaluations of geological, seismological, and geotechnical data, as required for an assessment of the site-safety issues related to Fermi 3, are, or will be, included in the staff's Safety Evaluation Report.

The Fermi site is in the Eastern Lake section of the Central Lowland physiographic province (USGS 2010a). The geologic setting is described in detail in the FSAR (Detroit Edison 2011b). In summary, the site is in a relatively tectonically stable region, with glacial and glaciolacustrine Pleistocene deposits underlain by a thick succession of Paleozoic sedimentary bedrock. The near-surface units are summarized in Table 2-64. Excavation for some site buildings extends through the surficial unconsolidated materials and into the Bass Islands Group bedrock.

Table 2-64. Geologic Units at the Fermi 3 Site

Formation	Geologic Age	Description	Approx. Thickness (ft)	Approx. Depth to Upper Contact (ft)
Fill	Recent	Various gravel-cobble fill and fine-grained fill	Up to 15	0
Lacustrine deposits	Pleistocene	Mainly clay and silty clay	0 to 8.7	Up to 15
Glacial deposits	Pleistocene	Clay with sand or gravel, silt with sand or gravel, clayey gravel	6 to 19	15 to 20
Bass Islands Group	Silurian	Dolomite	Up to 99	28
Salina Group	Silurian	Shale, halite, dolomite, anhydrite	Hundreds	119

Source: Detroit Edison 2011b

The Fermi site is fairly flat, with site elevations mainly in a range of approximately 575 to 595 ft. Most existing Fermi facilities, including Fermi 2, are located at elevation 583.0 ft plant grade datum (581.8 ft NAVD 88), and Fermi 3 would be located on an area elevated to 590.0 ft plant grade datum (587.8 NAVD 88), with safety-related facilities at a minimum of 590.5 ft plant grade datum (589.3 NAVD 88).

The average water elevation for Lake Erie is estimated to be 571.6 ft NAVD 88 (NOAA 2009a). A rock barrier is present east of Fermi 2 at the shoreline to protect against high water levels of Lake Erie. The rock barrier crest elevation is at 581.8 ft NAVD 88. Over the past 30 years, the Lake Erie shoreline at the Fermi site has remained fairly stable. Additional hydrologic information, including information on lake level and site drainage, is in Section 2.3.1.1.

Soils adjacent to the developed portion of the Fermi site are primarily Lenawee silty clay loam, a very poorly drained soil developed on till-floored lake plains (USDA 2010).

Mineral resources in Monroe County are summarized in a USGS (2010b) database of locations and deposit types. The resources include active and inactive quarries, sand and gravel pits, and clay pits. The nearest extraction site to the Fermi property is a clay pit 6 mi to the north. Several additional quarries in the county, including the Fermi quarries that were used to support the building of Fermi 2, are described by Reeves et al. (2004) and Detroit Edison (2011a). The nearest offsite quarry is about 3 mi north-northwest of the Fermi site. In Monroe County, bedrock aquifers are the main groundwater resource; glacial drift generally provides water only in small to moderate quantities (Reeves et al. 2004). Further hydrogeologic information is in Section 2.3.1.2.

2.9 Meteorology and Air Quality

The following sections describe the climate and air quality of the Fermi 3 site. Section 2.9.1 describes the climate of the region and area in the immediate vicinity of the Fermi 3 site, Section 2.9.2 describes the air quality of the region, Section 2.9.3 describes atmospheric dispersion at the site, and Section 2.9.4 describes the meteorological monitoring program at the site.

2.9.1 Climate

The Fermi 3 site is located in Monroe County in the southeastern corner of Michigan. Its climate is influenced by Lake Erie and its location with respect to major storm tracks. The Fermi 3 site has a humid continental climate that is marked by variable weather patterns and that features cold winters with frequent snowfalls and warm and humid summers with frequent thunderstorms. Because of its proximity to Lake Erie, the site experiences relatively small diurnal and seasonal temperature ranges compared with those at comparable latitudes. Air masses approach the region mostly from the southwest, except when they come from the northwest during spring months. The closest first-order weather stations with long periods of record are Detroit Metropolitan Airport, about 17 mi north-northwest of the site; Toledo Express Airport, about 38 mi southwest of the site; and Flint Bishop International Airport, about 74 mi north-northwest of the site. These stations provide a good indication of the general climate at the site because of their proximity. The general area surrounding the site is relatively flat, with no topographic features that would cause the local climate to deviate significantly from the regional climate.

The following statistics are derived from local climatological data for Detroit Metropolitan Airport (NCDC 2010a). Temperatures are more variable in the winter than in the summer because of the differences in air mass source regions. Mean daytime maximum temperatures range from about 31.1°F in January to about 83.1°F in July, while mean nighttime minimum temperatures range from about 17.0°F in January to about 62.1°F in July. Monthly average wind speeds range from about 7.6 miles per hour (mph) in August to about 11.4 mph in January. Precipitation varies slightly from season to season, with the highest of 9.81 in. in summer and the lowest of 6.30 in. in winter. Snow generally occurs from October to April, with an annual total of 44.0 in., of which about 90 percent falls from December to March.

On a larger scale, climate change is a subject of national and international interest. The recent compilation of the state of knowledge in this area by the U.S. Global Change Research Program (USGCRP), a Federal Advisory Committee (USGCRP 2009) has been considered in preparation of this EIS. The USGCRP has provided valuable insights regarding the state of knowledge of climate change. The projected change in temperature from the “recent past” (1961–1979) over the period encompassing the licensing action (i.e., to the period 2040 to 2059 in the USGCRP report) in the vicinity of the Fermi site is an increase of between 3 to 5°F. While the USGCRP has not incrementally forecast the change in precipitation by decade to align with the licensing action, the projected change in precipitation from the “recent past” (1961–1979) to the period 2080 to 2099 was presented. The USGCRP report forecasts that northern areas will become wetter as a result of more northward incursions of storm tracks: about a 15 to 20 percent increase in winter and spring, a 5 to 10 percent decrease in summer, and a 0 to 5 percent increase in fall around the Fermi site (USGCRP 2009).

On the basis of the assessments of the USGCRP and the National Academy of Sciences’ National Research Council, the EPA determined that potential changes in climate caused by greenhouse gas (GHG) emissions endanger public health and welfare (74 FR 66496). The EPA indicated that although ambient concentrations of GHGs do not cause direct adverse health effects (such as respiratory or toxic effects), public health risks and impacts can result indirectly from changes in climate. As a result of the determination by the EPA and the recognition that mitigative actions are necessary to reduce impacts, the review team concludes that the effect of GHG emissions on climate and the environment is already noticeable but not yet destabilizing. The Commission has provided guidance to the NRC staff to consider carbon dioxide and other GHG emissions in its NEPA reviews and has directed that such considerations should encompass emissions from constructing and operating a facility as well as from the fuel cycle (NRC 2009b). The review team characterized the affected environment and the potential GHG impacts of the proposed action and alternatives in this EIS. Consideration of GHG emissions was treated as an element of the existing air quality assessment that is essential in a NEPA analysis. In addition, in situations in which it was important to do so, the review team considered the effects of the changing environment during the period of the proposed action on other resource assessments.

2.9.1.1 Wind

To examine regional wind patterns around the Fermi site, the staff reviewed wind roses from the three nearby first-order weather stations (Detroit, Toledo, and Flint) for the years 2005 through 2009 (NCDC 2010b). Overall wind patterns among the three nearby first-order weather stations show some similarity, but monthly wind patterns are somewhat different, and these differences are primarily attributable to the position of storm tracks. The wind rose from the closest first-order weather station, Detroit Metropolitan Airport, is presented in Figure 2-22.

As shown in Figure 2-22, the average annual wind speed at Detroit Metropolitan Airport is about 8.6 mph. For the same period, average annual wind speeds at Toledo (8.1 mph) are lower than those at Flint and Detroit (8.6 mph). The Detroit seasonal lowest wind speed of 7.2 mph occurs in summer, while the Detroit seasonal highest wind speed of 10.0 mph occurs in winter. Although not prominent, the prevailing wind direction is from the southwest (about 8.9 percent of the time). Prevailing winds are from the west-southwest for Toledo and from the south-southwest for Flint. About 25 percent of the time, winds at Detroit blow from southwesterly directions, including south-southwest, southwest, and west-southwest. Typically, when the Bermuda High sits over the southeastern United States and storm tracks move north of the Fermi site, southwesterly winds dominate. During winter months when a storm track is situated near the Fermi site, westerly and northwesterly winds become more frequent.

Figure 2-23 presents the 33-ft height wind rose at the Fermi site based on 2001 to 2007 onsite wind data (Detroit Edison 2010c). Average annual wind speed is about 6.6 mph, which is approximately three-fourths of that at the Detroit Metropolitan Airport. The reason for differences in wind speeds is that the meteorological tower at the Fermi site is surrounded by forest and existing Fermi 2 facilities, while the tower at the airport is exposed to open areas. The prevailing wind direction is from the southwest (about 11.2 percent of the time). Similar to Detroit, winds blow from southwesterly directions, including south-southwest, southwest, and west-southwest, about 30.2 percent of the time. Overall, annual and monthly wind direction patterns of the two stations are quite similar. The exception is higher frequencies of occurrence of the southeast components for the Fermi site, which are attributable to onshore lake breezes that develop most often during late spring through early fall.

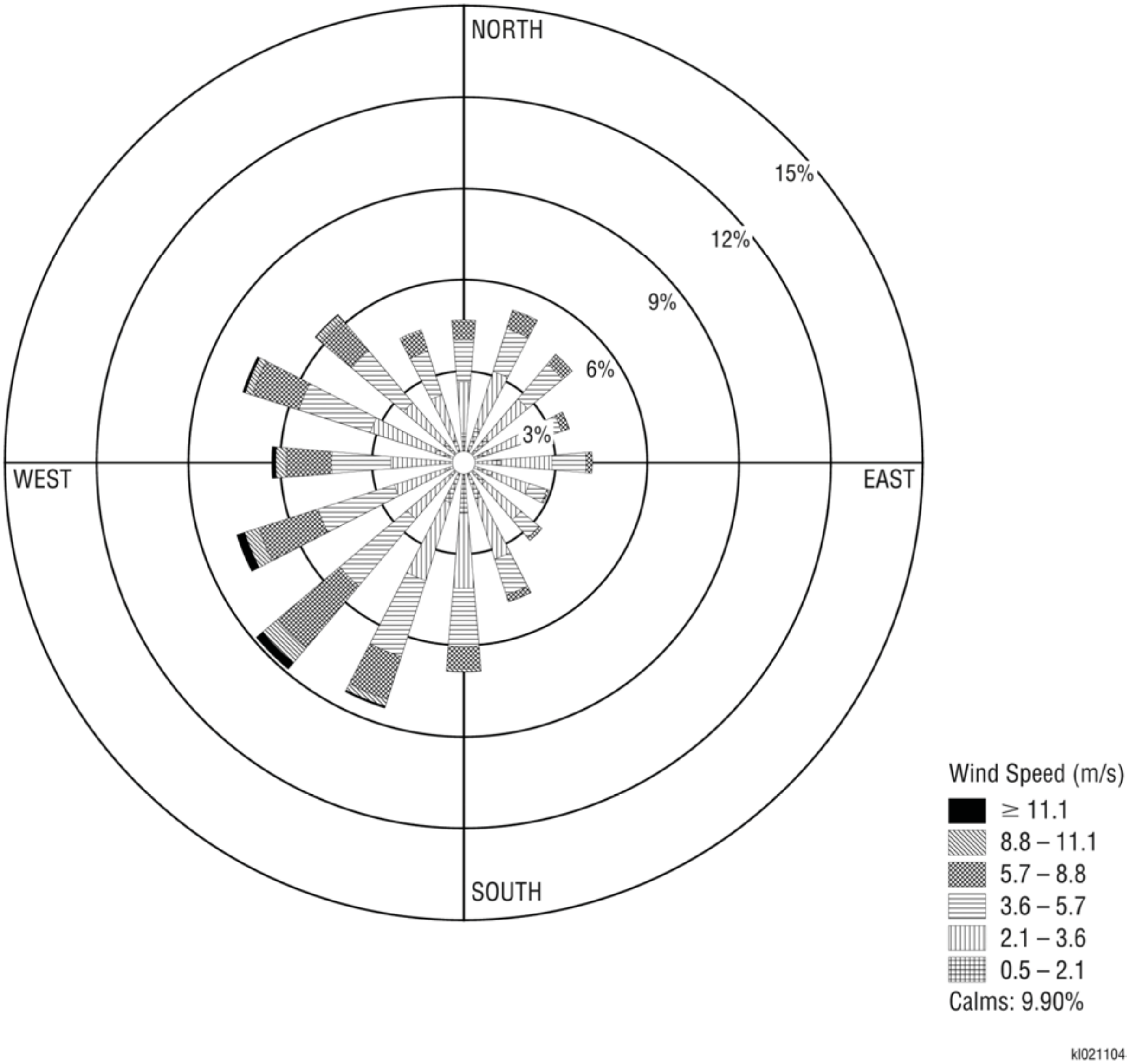
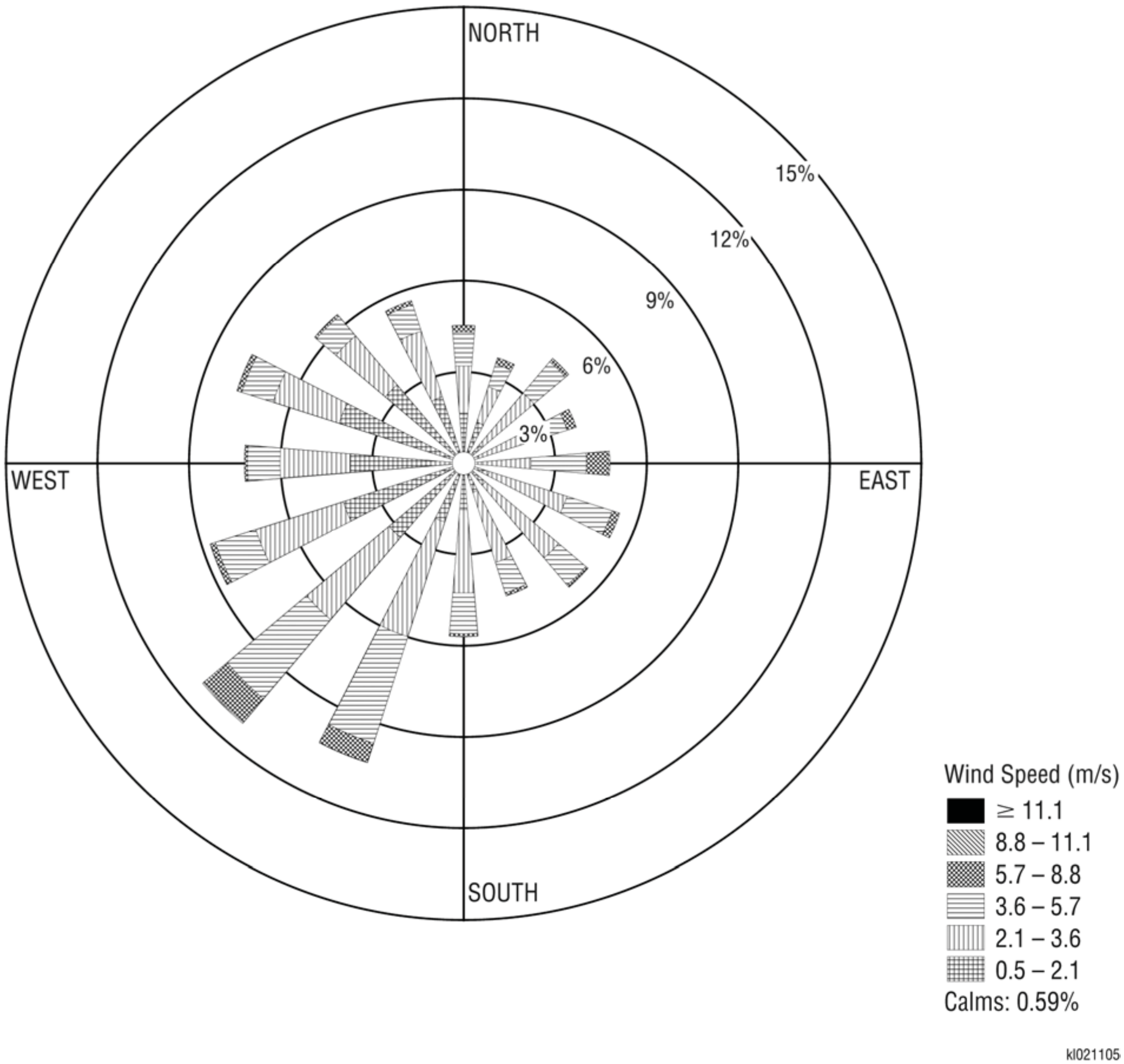


Figure 2-22. Wind Rose at 33-ft (10-m) Height at the Detroit Metropolitan Airport, Detroit, Michigan, 2005 to 2009 (Data source: NCDC 2010b)

1 

2 **Figure 2-23**. Wind Rose at 33-ft (10-m) Height at the Fermi Site, Monroe County,
3 Michigan, 2001 to 2007 (Data source: Detroit Edison 2010c)
4

2.9.1.2 Temperature

The temperature measured at the 33-ft level of the Fermi meteorological tower is considered to be representative of the Fermi 3 site. Temperature data from the tower for the 2001 through 2007 time period show that the annual average temperature is 50.6°F, with the lowest monthly average temperature of 27.3°F occurring in January and the highest monthly average temperature of 73.5°F occurring in July. During this 7-year period, the absolute minimum temperature was –3.8°F, and the absolute maximum temperature was 94.3°F. These temperatures are consistent with long-term values for Detroit Metropolitan Airport, with a monthly minimum of 24.5°F in January and a monthly maximum of 73.5°F in July during climate normal years (1971–2000). About 12.0 days per year have a maximum temperature that is higher than or equal to 90°F, while about 130 days per year have a minimum temperature that is lower than or equal to 32°F (NCDC 2010a).

2.9.1.3 Atmospheric Moisture

The moisture content of the atmosphere can be represented in a variety of ways. The most common are in terms of relative humidity, precipitation, and fog. The atmospheric moisture measurements at the Fermi site include precipitation and dew-point temperature. Wet-bulb temperature, relative humidity, fog, and visibility data are not collected at the Fermi site.

For precipitation, historic measurement data at the Detroit Metropolitan Airport are presented because of frequent malfunctions of the precipitation sensor at the Fermi site during the 2003–2007 period. Annual precipitation averaged about 32.9 in. during climate normal years (1971–2000) (NCDC 2010a). Measurable precipitation of 0.01 in. or more occurred about 137 days per year. Wintertime storm tracks are typically positioned south of Detroit, which could bring combinations of rain, snow, freezing rain, and sleet, along with heavy snowfall accumulations on occasion.

The area surrounding the Fermi site experiences abundant precipitation, and about 38 percent of the days have precipitation levels of at least 0.01 in., but droughts still occur at times. According to the Palmer Drought Index (NCDC 2010c), which determines the severity of drought conditions, more than 10 droughts have occurred in Michigan since 1900, and a recent drought was recorded in the late 1990s. Overall, the frequency of extreme drought conditions has been decreasing, and more wet years have been prevalent since 1940.

The annual average relative humidity at the Detroit Metropolitan Airport is about 71 percent. Relative humidity remains relatively uniform throughout the year, with the lowest monthly average of 65 percent occurring in April and May and the highest monthly average of 77 percent occurring in December (NCDC 2010a). Relative humidity is lowest during the day (the annual average relative humidity at 1 p.m. local standard time is 60 percent) and highest during early morning (the annual average relative humidity at 7 a.m. local standard time is 81 percent). Because of its proximity to Lake Erie, the Fermi site is expected to experience higher relative humidity and smaller monthly variations than locations that are farther inland but at a comparable latitude (e.g., Detroit Metropolitan Airport).

Fog occurs when horizontal visibility is less than or equal to 7 mi. On the basis of this criterion, fog occurred about 12.7 percent of the time (1114 hours per year) at the Detroit Metropolitan Airport during the period 1961–1995 (NCDC 1993; NCDC 1997). Fog occurs more frequently in winter than in summer, with the highest frequency of 17.5 percent of the time occurring in December and the lowest frequency of 9.0 percent of the time occurring in June. For the same period, heavy fog that restricts visibility to less than or equal to 0.25 mi is reported about 0.7 percent of the time (62.4 hours per year) on an annual basis. Monthly variations for heavy fog are almost the same as those for fog. Heavy fog occurred about 17.8 days per year, with about 2 to 3 days occurring in winter and less than 1 day occurring in summer (NCDC 2010a).

2.9.1.4 Atmospheric Stability

Atmospheric stability is a meteorological parameter that describes the dispersion characteristics of the atmosphere. It can be determined by the difference in temperature between two heights. A seven-category atmospheric stability classification scheme (ranging from A for extremely unstable to G for extremely stable) based on temperature differences is set forth in NRC’s Regulatory Guide 1.23, Revision 1 (NRC 2007). When the temperature decreases rapidly with height (typically during the day, when the sun is heating the ground), the atmosphere is unstable, and atmospheric dispersion is greater. Conversely, when temperature increases with height (typically during the night as a result of the radiative cooling of the ground), the atmosphere is stable, and dispersion is more limited. The stability category between unstable and stable conditions is D (neutral), which would occur typically with higher wind speeds and/or higher cloud cover, irrespective of day or night.

Onsite temperature measurement data at the 10-m and 60-m levels of the Fermi meteorological tower for the years 2001 through 2007 are used to determine the stability classes for the site. On an annual basis, D stability (neutral) is the most prevalent single stability class, accounting for about 28.2 percent of the time. The unstable conditions (A to C) occur approximately 31.6 percent of the time, while the stable conditions (E to G) occur about 40.2 percent of the time. Stability patterns vary from season to season. Stabilities A (extremely unstable), D (neutral), and E (slightly stable) are most frequent and can occur throughout the year. Stability A occurs more frequently from mid-spring to early fall when solar radiation is the strongest, and Stability D peaks in winter months. However, frequencies of Stability E remain fairly constant throughout the year.

The temperature contrast at the coastal boundary, due to uneven heating rates of land and water, can cause local lake/land breeze circulation. Around the Fermi site, a lake/land breeze occurs primarily in the warmer months (May to October), with its peak strength happening in the summer. When cooler air over a large water body (i.e., Lake Erie) advances inland during lake breeze conditions, a thermal internal boundary layer begins to develop because of the mechanical and thermal effects at the land-water interface. Typically, a lake breeze begins around late morning and peaks around mid-afternoon. As the sun sets, the land-lake temperature difference decreases and the lake breeze disappears. At night, the land cools off more quickly than the water, and this temperature contrast causes a land breeze, blowing from land to water. The strength of the land breeze is usually weaker than that of its daytime counterpart, the lake breeze.

On the basis of 2001–2007 onsite hourly temperature difference data, extremely unstable conditions (Stability A) occurred about 29 percent of the time when onshore winds blew from Lake Erie, in wind directions ranging from east-northeast to south. These wind conditions can occur during onshore flow conditions, either as local lake breezes or synoptic winds blowing from Lake Erie toward the land. In particular, an autoconvective condition with a lapse rate of –3.4°C per 100 m was frequently exceeded with onshore wind flows (the autoconvective lapse rate represents severe extremely unstable conditions when the density of the atmosphere increases with height). Autoconvective conditions account for about 31 percent of extremely unstable conditions under onshore wind flow conditions. Colder lake air affects temperatures at the 60-m height more than those at the 10-m height because the lower portion of the onshore flow is heated first by the land surface as it comes ashore. The existing meteorological tower is located about 0.5 mi from Lake Erie. At night, the Fermi site has air with relatively more moisture than the air at an inland site at a comparable latitude, and less radiative cooling occurs, which can lead to more neutral conditions than stable conditions. About 70 percent of extremely stable conditions (Stability G) occurred when offshore winds with drier air prevailed (i.e., blowing from the land toward Lake Erie). As a consequence, atmospheric stability and its attendant dispersion characteristics are affected considerably by Lake Erie.

2.9.1.5 Severe Weather

The site can experience severe weather in the form of thunderstorms, lightning, hail, ice storms, waterspouts, and tornadoes.

Thunderstorms occur about 32 days per year at the Detroit Metropolitan Airport (NCDC 2010a). Thunderstorms are most active during the summer months: on about 1 of 5 days from June through August. The Detroit area experiences about 5 days per year of damaging severe thunderstorms with straight winds greater than 50 knots (57.5 mph) (NSSL 2009). Another hazard of thunderstorms is lightning, which can strike up to 10 mi away from the rain. Some lightning strikes have caused injuries, including fatalities, or property damage, including that from disruptions of electrical circuits and wildfires. The Detroit area experienced about two to four flashes of lightning per square kilometer per year from 1996 through 2005 (NOAA 2009b).

On the basis of 1955–2002 data, the 1°-latitude-by-1°-longitude area around the Fermi site experienced about 16.5 hail events per year when hail diameters were 0.75 in. or more and fewer than one hail event per year when hail diameters were 2 in. or more (Schaefer et al. 2004). Seventy-two hail events have been reported for Monroe County (which encompasses the Fermi site) since 1963, eleven of which involved hail diameters of 1.75 in. or more (NCDC 2010d). The event with the largest hail diameter reported for Monroe County occurred on March 27, 1991; the diameter was 4 in. The majority of hail events occurred in April through July, and no hail was reported from November through February.

The Fermi site and surrounding region can experience wintry precipitation such as ice storms mostly during winter and early spring. Data for 1976 to 1990 indicate that freezing rain occurred on about 5 days/year around the Fermi site, while ice pellets occurred on about 4 days/year (Cortinas et al. 2004). Freezing rain and ice pellets occur mostly from November through April, peaking during the winter months. Thirty-seven snow and ice storms have been reported in Monroe County since 1993 (NCDC 2010d). A total of nine freezing rain events were reported in Monroe County, and ice accumulation during most events was 0.5 in. or lower. The highest ice accumulation, ranging from 1.5 to 2.5 in., occurred on March 13 and 14, 1997, when a major ice storm hit southeastern Michigan.

On occasion, tornadoes occur in the area surrounding the Fermi site, but they are less frequent and destructive than those in the “tornado alley” of the central United States. For the period 1950 to 2009, 28 tornadoes were reported in Monroe County, with an average frequency of one every two years (NCDC 2010d). More than 75 percent of the tornadoes occurring in Monroe County were relatively weak (less than or equal to F2 on the Fujita tornado scale). However, two F3 and four F4 tornadoes were reported in Monroe County; the combined F4 tornadoes caused 17 fatalities, 57 injuries, and considerable property damage. On the basis of tornado statistics for the Fermi site vicinity, the review team estimates the probability of a tornado striking the proposed Fermi 3 reactor building to be about 5 in 10,000 (5×10^{-4}) per year (Ramsdell and Rishel 2007).

Around 2:30 a.m. on June 6, 2010, a tornado touched down in Detroit Beach, Michigan, traveled about 5 mi northeast, and entered Lake Erie at Estral Beach six minutes later (AnnArbor.com 2010). On the basis of the observed damage, the tornado can be classified as an EF1 tornado. The tornado’s track had a width of 500 yd and an estimated top wind speed of 90 mph. Fermi 2, which was along the tornado’s path, automatically shut down as a precaution. Although the reactor building was undamaged, the storm tore a 20- by 30-ft hole in the roof of the building housing the steam turbines, blew off siding from the auxiliary building, and damaged the cooling fins at the twin natural draft cooling towers (MonroeNews.com 2010). The Fermi 2 reactor was safely shut down and kept in standby mode for more than a week as repairs to associated facilities were made.

Waterspouts, which are considered to be tornadoes on water but with weaker strength, were reported twice in 1997 and 1998 along Monroe County's shoreline. On July 26, 1998, one waterspout was reported off the shoreline of Stony Point, which is located a couple of miles south of the Fermi site.

2.9.2 Air Quality

The discussion on air quality includes six common criteria air pollutants for which the EPA has established National Ambient Air Quality Standards (NAAQS): sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$; particles with an aerodynamic diameter of less than or equal to 10 micrometers (μm) and 2.5 μm, respectively), and lead (Pb). The air quality discussion also covers heat-trapping GHGs (primarily carbon dioxide [CO_2]), which have been the principal factor causing climate change over the last 50 years (USGCRP 2009).

The Fermi 3 site is in Monroe County, Michigan, which, with Lucas and Wood Counties in Ohio, is in the Metropolitan Toledo Interstate Air Quality Control Region (AQCR) (40 CFR 81.43). However, nonattainment status for $PM_{2.5}$ is reported as a part of the Detroit-Ann Arbor Designated Area in 40 CFR 81.323. Surrounding AQCRs include the Metropolitan Detroit-Port Huron Intrastate AQCR to the north and the South Central Michigan Intrastate AQCR to the west. Monroe County and its neighboring counties are designated as an attainment area for all criteria pollutants except $PM_{2.5}$ (EPA 2010b). Monroe County is designated as a nonattainment area for $PM_{2.5}$, as are six other southeastern counties, including the Detroit metropolitan area and its downwind areas. In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). This request is based, in part, on air quality monitoring data collected in the 2007–2010 period showing all seven counties in southeast Michigan in attainment for the $PM_{2.5}$ NAAQS. The EPA has 18 months to respond to this request. On June 29, 2009, Monroe County, with seven other southeastern counties including the Detroit metropolitan area, was redesignated from a nonattainment area to a maintenance area for the 8-hour ozone standard, and, on August 9, 2007, Lucas and Wood Counties in Ohio were redesignated (EPA 2010b).

Class I Areas as defined by the Clean Air Act are national parks larger than 6,000 ac, wilderness areas, national memorial parks larger than 5,000 ac, and international parks that have stringent protection from air pollution damage. There are no mandatory Class I Federal areas where visibility is an important value in the lower peninsula of Michigan. The nearest Class I area is Otter Creek Wilderness Area in West Virginia, which is located about 275 mi southeast of the Fermi site.

Air emission sources from the Fermi 3 site would include standby diesel generators and diesel fire pumps operating on an intermittent basis, an auxiliary boiler, and cooling towers. Only small amounts of air pollutant emissions from the Fermi 3 site would be released, because there is no primary combustion involved in generating power from nuclear energy. Considering the distance to the Class I areas and the minor nature of air emissions from the Fermi 3 site, there is little likelihood that activities at the Fermi 3 site could adversely affect air quality and air-quality-related values (e.g., visibility or acid deposition) in any of the Class I areas. However, a new air operating permit would be required for the proposed Fermi 3 site.

Climate changes are under way in the United States and globally, and their extent is projected to continue to grow substantially over next several decades unless intense concerted measures are taken to reverse this trend. Climate-related changes include rising temperatures and sea levels; increased frequency and intensity of extreme weather (e.g., heavy downpours, floods, and droughts); earlier snowmelts and associated frequent wildfires; and reduced snow cover, glaciers, permafrost, and sea ice. Climate changes are closely linked to increases in GHGs (USGCRP 2009). GHGs are transparent to incoming short-wave radiation from the sun but opaque to outgoing long-wave (infrared) radiation from the earth's surface. The net effect over time is a trapping of absorbed radiation and a tendency to warm the earth's atmosphere, which together constitute the "greenhouse effect." Since the onset of the Industrial Revolution in the mid 1700s, human activities have contributed to the production of GHGs, primarily through deforestation and the combustion of fossil fuels such as coal, oil, and natural gas. The principal GHGs that enter the atmosphere due to human activities include CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). However, some GHGs such as CO_2, CH_4, and N_2O are emitted to the atmosphere through natural processes as well.

2.9.3 Atmospheric Dispersion

Atmospheric dispersion factors (χ/Q values) are used to evaluate the potential consequences of accidental and routine releases at the Fermi 3 site. Onsite meteorological data from the 6-year period 2002–2007 were used by Detroit Edison to develop the atmospheric dispersion factors presented in the ER (Detroit Edison 2011a).

Detroit Edison provided the review team with hourly meteorological data recorded for the 6-year period from January 2002 through December 2007 (Detroit Edison 2011a). The staff viewed the meteorological site and instrumentation, reviewed the available information on the meteorological measurement program, and evaluated data collected by the program.

Visual inspection during a site audit conducted on February 2 to 6, 2009, indicated that the distance from the meteorological tower to the nearest obstruction (i.e., the wooded area located west of the tower) was less than 10 obstruction heights. This distance is not consistent with Revision1 of Regulatory Guide 1.23 (NRC 2007), which states wind sensors should be located over level, open terrain at a distance of at least 10 times the height of any nearby obstruction, if the height of the obstruction exceeds one-half of the height of the wind measurement. In a response to a series of Requests for Additional Information (RAIs) from the staff, Detroit Edison performed a review of wind data ranging from 1975 through 2003 and concluded that the nearby trees could be affecting the 10-m wind speed measurements during the period 2002–2007; that is, the potential exists for the wind measurements at the 10-m elevation to be lower than the actual wind speed at the 10-m elevation. Detroit Edison assessed the effect of lower measured wind speeds at the 10-m level on its short-term (accident) atmospheric dispersion estimates (χ/Q values) and concluded that it was conservative to determine these dispersion estimates by using the lower measured wind speed at the 10-m elevation. Detroit Edison also assessed the effects of lower measured wind speed at the 10-m level on its long-term (routine) atmospheric dispersion estimates and concluded that the higher (more conservative) χ/Q and deposition (D/Q) values from either the 1985–1989 period (when trees to the west of the meteorological tower were lower) or 2002–2007 period should be used in the routine release dose analysis.

2.9.3.1 Short-Term Dispersion Estimates

Acceptable methods of calculating short-term (accident) χ/Q values for design-basis accidents (DBAs) from meteorological data are set forth in Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants* (NRC 1983). The short-term χ/Q values were estimated using the PAVAN computer program (Bander 1982), which implements the methodology of Regulatory Guide 1.145.

For environmental reviews, Section 7.1 of NUREG-1555 (NRC 2000) states that DBA consequences should be evaluated by assuming realistic meteorological conditions (i.e., 50-percentile χ/Q values) at the Exclusion Area Boundary (EAB) and outer boundary of the Low Population Zone (LPZ). The EAB and LPZ at the Fermi 3 site are circles centered at the Reactor Building with radii of 2928 ft and 3 mi, respectively. For conservatism, Detroit Edison defined dose calculation EAB and LPZ distances of 2428 ft and 2.9 mi, respectively, which were derived by using the distance from the outer edge of a circle centered on the Reactor Building that encompassed all possible release points. A 6-year (2002–2007) composite joint frequency distribution of wind speed, wind direction, and atmospheric stability was used to evaluate a ground-level (10-m level) release. The PAVAN model estimates 50-percentile overall site (i.e., non-direction-specific) 1-hour χ/Q values (which are assumed to persist for 2 hours) at the dose calculation EAB and LPZ distances. Atmospheric dispersion factors for intermediate periods at the dose calculation LPZ distance were estimated by logarithmic interpolation between the 50-percentile 1-hour χ/Q value and the corresponding annual average χ/Q value. Table 2-65 presents χ/Q results at dose calculation EAB and LPZ distances as a function of averaging time.

The review team independently ran the PAVAN model by using the 2002–2007 meteorological data and obtained results similar to those of Detroit Edison. The team also independently ran the PAVAN model by using a composite joint frequency distribution derived from the 1985–1989 Fermi 2 onsite meteorological database submitted by Detroit Edison in response to a staff RAI.

Table 2-65. Atmospheric Dispersion Factors for Design Basis Accidents at Fermi 3 Site

	χ/Q (s/m^3) by Averaging Time					
Location	**0–2 Hours**	**0–8 Hours**	**8–24 Hours**	**1–4 Days**	**4–30 Days**	**Annual Average**
Dose Calculation EAB	5.675×10^{-5}	–[(a)]	–	–	–	4.09×10^{-5}
Dose Calculation LPZ	4.026×10^{-6}	3.057×10^{-6}	2.664×10^{-6}	1.977×10^{-6}	1.287×10^{-6}	7.62×10^{-7}

Source: Detroit Edison 2011a
(a) A dash denotes "not applicable."

Detroit Edison stated that aerial photographs of the area surrounding the Fermi meteorological tower during this time period confirmed the absence of significant air flow obstructions to wind measurements at the 10-m elevation. The staff found that its short-term atmospheric dispersion estimates that resulted from using the 1985–1989 composite joint frequency distribution were less conservative than Detroit Edison's values from using the 2002–2007 composite joint frequency distribution. The staff therefore concluded that Detroit Edison has identified a conservative set of 50-percentile EAB and LPZ short-term atmospheric dispersion factors by using the 2002–2007 composite joint frequency distribution.

2.9.3.2 Long-Term Dispersion Estimates

Long-term dispersion estimates for use in evaluation of the radiological impacts of normal operations were calculated by Detroit Edison by using the XOQDOQ computer code (Sagendorf et al. 1982). This code implements the guidance set forth in Regulatory Guide 1.111 (NRC 1977) for estimation of atmospheric dispersion (χ/Q) and deposition factors (D/Q) for use in evaluation of the consequences of normal reactor operations.

Three release pathways were considered: ground-level releases from the Radwaste Building stack and mixed-mode releases (part-time elevated and part-time ground-level) from the Reactor Building/Fuel Building stack and the Turbine Building stack. As it did with PAVAN, Detroit Edison initially used a 6-year (2002–2007) composite joint frequency distribution of wind speed, wind direction, and atmospheric stability to evaluate potential impacts from routine releases at the Fermi 3 site. Distances from the release point to the site boundary, nearest residence, garden, sheep, goat, meat cow, and milk cow for all sectors were considered. These distances were computed by using distances from the outer edge of a circle, centered on the Reactor Building, which encompassed all three release pathways. Dry deposition and site and regional topography were considered for the dispersion analysis.

The NRC staff independently ran the XOQDOQ model by using the 2002–2007 meteorological data and obtained results similar to those of the Detroit Edison. The staff also independently ran the XOQDOQ model by using a composite joint frequency distribution derived from the 1985–1989 Fermi 2 onsite meteorological database submitted in Detroit Edison's response to an RAI. The staff found that in several cases, its long-term atmospheric dispersion estimates that resulted from using the 1985–1989 composite joint frequency distribution were more conservative than Detroit Edison's values from using the 2002–2007 composite joint frequency distribution. Accordingly, the applicant eventually used the higher χ/Q and D/Q values from either the 1985–1989 period or the 2002–2007 period in its routine release dose analyses. The maximum annual average χ/Q values for three plume depletion scenarios (i.e., no decay and the default half-life decay periods of 2.26 and 8 days) and annual average relative D/Q values are presented in Table 2-66. The long-term atmospheric dispersion and deposition estimates presented in the Table 2-66 are the higher values from either the 1985–1989 period or the 2002–2007 period.

2.9.4 Meteorological Monitoring

There has been a meteorological monitoring program at the Fermi site since June 1975. The initial instrumentation was installed to provide the onsite meteorological information required for licensing of Fermi 2. The Fermi 2 meteorological monitoring program provides the basis for the Fermi 3 preapplication meteorological monitoring program. The instrumentation is described briefly in the Fermi 3 ER (Detroit Edison 2011a). However, the natural draft cooling tower for Fermi 3 would be built prior to the building of Fermi 3 in the approximate location of the current meteorological tower; thus, the meteorological tower would be relocated to the southeast corner of the Fermi site, which is located about 0.9 mi south-southeast of the current meteorological tower.

The current meteorological tower is located about 1113 ft west-southwest of the proposed location of the Fermi 3 containment building and has a height of 197 ft above plant grade. The primary instrumentation on the open-latticed tower consists of 10-m and 60-m wind speed and direction sensors; a 10-m vertical wind speed sensor; a 10-m air temperature sensor; a 10- to 60-m vertical air temperature difference system; a 10-m dew point sensor; and a 1.5-m (ground level) heated tipping bucket rain gauge. The sensor types, heights, and locations relative to buildings conform to *Proposed Revision 1 of NRC Regulatory Guide 1.23* (NRC 1980), except for the proximity of the trees to the meteorological tower, as discussed below. There are secondary sensors for all parameters except dew point and precipitation.

Data from the sensors are routed through signal conditioning equipment and then sent to digital data recorders. An analog backup record of the outputs is also maintained. Sensors, electronics, and recording equipment are calibrated on a six-month basis or more frequently if

Table 2-66. Maximum Annual Average Atmospheric Dispersion and Deposition Factors from Routine Releases at Selected Receptors

Receptor	Downwind Sector	Distance (mi)	Emission Source Stack	Mode of Release	χ/Q (s/m^{-3})[a] No Decay Undepleted	χ/Q (s/m^{-3})[a] 2.26-Day Decay Undepleted	χ/Q (s/m^{-3})[a] 8-Day Decay Depleted	D/Q (m^{-2})
Site boundary	SSE	0.61	Radwaste Bldg.	Ground level	1.1×10^{-5}	1.1×10^{-5}	1.0×10^{-5}	–[b]
Site boundary	NW	0.48	Radwaste Bldg.	Ground level	–	–	–	4.9×10^{-8}
Site boundary	WNW	0.48	Reactor Bldg./ Fuel Bldg.	Mixed	–	–	–	1.7×10^{-8}
Site boundary	NW	0.48	Reactor Bldg. Fuel Bldg.	Mixed	8.7×10^{-7}	8.7×10^{-7}	8.1×10^{-7}	–
Site boundary	WNW	0.48	Turbine Bldg.	Mixed	–	–	–	1.5×10^{-8}
Site Boundary	NW	0.48	Turbine Bldg.	Mixed	9.6×10^{-7}	9.6×10^{-7}	8.9×10^{-7}	1.5×10^{-8}
Residence	NW	059	Radwaste Bldg.	Ground level	7.0×10^{-6}	7.0×10^{-6}	6.3×10^{-6}	3.4×10^{-8}
Residence	NW	0.59	Reactor Bldg./ Fuel Bldg.	Mixed	6.8×10^{-7}	6.8×10^{-7}	6.3×10^{-7}	1.2×10^{-8}
Residence	NW	0.59	Turbine Bldg.	Mixed	7.2×10^{-7}	7.2×10^{-7}	6.6×10^{-7}	1.2×10^{-8}
Vegetable garden	NW	0.60	Radwaste Bldg.	Ground level	7.0×10^{-6}	7.0×10^{-6}	6.3×10^{-6}	3.4×10^{-8}
Vegetable garden	NW	0.60	Reactor Bldg./ Fuel Bldg.	Mixed	6.8×10^{-7}	6.8×10^{-7}	6.3×10^{-7}	1.2×10^{-8}
Vegetable garden	NW	0.60	Turbine Bldg.	Mixed	7.1×10^{-7}	7.1×10^{-7}	6.5×10^{-7}	1.1×10^{-8}
Sheep	NNE	4.41	Radwaste Bldg.	Ground level	1.9×10^{-7}	1.8×10^{-7}	1.4×10^{-7}	5.7×10^{-10}
Sheep	NNE	4.41	Reactor Bldg./ Fuel Bldg.	Mixed	4.8×10^{-8}	4.8×10^{-8}	4.3×10^{-8}	2.8×10^{-10}
Sheep	NNE	4.41	Turbine Bldg.	Mixed	4.3×10^{-8}	4.3×10^{-8}	3.8×10^{-8}	2.8×10^{-10}
Goat	WNW	2.21	Radwaste Bldg.	Ground level	3.0×10^{-7}	3.0×10^{-7}	2.4×10^{-7}	1.5×10^{-9}
Goat	WNW	2.21	Reactor Bldg./ Fuel Bldg.	Mixed	7.7×10^{-8}	7.7×10^{-8}	7.0×10^{-8}	8.4×10^{-10}
Goat	WNW	2.21	Turbine Bldg.	Mixed	6.9×10^{-8}	6.9×10^{-8}	6.1×10^{-8}	7.9×10^{-10}

Table 2-66. (contd)

Receptor	Downwind Sector	Distance (mi)	Emission Source Stack	Mode of Release	χ/Q (s/m^{-3}) No Decay Undepleted	2.26-Day Decay Undepleted	8-Day Decay Depleted	D/Q (m^{-2})
Meat cow	NNE	4.41	Radwaste Bldg.	Ground level	1.9×10^{-7}	1.8×10^{-7}	1.4×10^{-7}	–
Meat cow	NNW	2.95	Radwaste Bldg.	Ground level	–	1.8×10^{-7}	1.4×10^{-7}	6.4×10^{-10}
Meat cow	NNE	4.41	Reactor Bldg./ Fuel Bldg.	Mixed	4.8×10^{-8}	4.8×10^{-8}	4.3×10^{-8}	–
Meat cow	NNW	2.95	Reactor Bldg./ Fuel Bldg.	Mixed	4.8×10^{-8}	–	4.3×10^{-8}	3.4×10^{-10}
Meat cow	NNE	4.41	Turbine Bldg.	Mixed	4.3×10^{-8}	4.3×10^{-8}	3.8×10^{-8}	–
Meat cow	NNW	2.95	Turbine Bldg.	Mixed	4.3×10^{-8}	–	3.8×10^{-8}	3.3×10^{-10}
Milk cow	WNW	2.09	Radwaste Bldg.	Ground level	3.4×10^{-7}	3.3×10^{-7}	2.8×10^{-7}	1.7×10^{-9}
Milk cow	WNW	2.09	Reactor Bldg./ Fuel Bldg.	Mixed	8.4×10^{-8}	8.4×10^{-8}	7.7×10^{-8}	9.5×10^{-10}
Milk cow	WNW	2.09	Turbine Bldg.	Mixed	7.6×10^{-8}	7.5×10^{-8}	6.8×10^{-8}	8.9×10^{-10}

Source: Detroit Edison 2011a
(a) Atmospheric dispersion and deposition factors presented in the table are the higher values from either the 1985–1989 period or the 2002–2007 period.
(b) A dash denotes "not applicable."

indicated by operating history. Visits are made to the tower twice a week for collection of data and visual inspection of the sensors and recording equipment.

Data from the primary and secondary sensors are fed independently to data acquisition equipment of the Integrated Plant Computer System (IPCS) in the Fermi 2 Control Room. The IPCS screens data for validity and quality, performs meteorological calculations, updates archives, and displays data. The data are available in five formats: instantaneous values, 1-minute blocked averages, 15-minute rolling averages, 15-minute blocked averages, and 1-hour blocked averages. Routine data summaries are generated for each day, calendar month, and calendar year. In addition, joint frequency distributions of wind speed and direction by Pasquill stability class are created from the 1-hour blocked averages.

The new meteorological tower will be located about 4750 ft south-southeast of the Fermi 3 reactor building; it will be a guyed open-latticed tower that is 197 ft high. The site is wooded, and trees will need to be trimmed to heights less than 16 ft out to a distance satisfying the 10 times building-height distance specified in Revision 1 of Regulatory Guide 1.23 (NRC 2007). A climate-controlled instrument shelter will be installed at the base of the tower. Primary and secondary sensors on the new tower will monitor the same parameters as do those on the existing Fermi 2 tower. The new tower will be operational for at least one and possibly two years prior to decommissioning of the existing tower.

The data recording process for the new program will mirror the process for the existing tower, except for the replacement of signal conditioning equipment that is no longer available. Instrument calibration, service, and maintenance procedures currently in use will be continued for the new program. Data reduction, transmission, acquisition, and processing used in the preapplication program will continue to be used for the construction, preoperational, and operational programs.

Detroit Edison provided the review team with meteorological data for the 6-year period from January 2002 through December 2007 (Detroit Edison 2010c). The staff used these data to independently estimate atmospheric dispersion factors for the site. The staff viewed the meteorological site and instrumentation, reviewed the available information on the meteorological measurement program, and evaluated data collected by the program.

As stated previously, visual inspection during the site audit in February 2009 indicated that the distance from the meteorological tower to the nearest obstruction (i.e., the wooded area located west of the tower) is less than the guidance provided in the proposed Revision 1 of Regulatory Guide 1.23 (NRC 1980), which states that the height of natural or manmade obstructions to air movement should ideally be lower than the measuring level to a horizontal distance of ten times the measuring level height. Revision 1 of Regulatory Guide 1.23 (NRC 2007) provides further guidance regarding the tower's proximity to obstructions to air movement, stating that wind sensors should be located over level, open terrain at a distance of at least 10 times the height of any nearby obstruction, if the height of the obstruction exceeds one-half of the height of the wind measurement. In a response to a series of RAIs from the staff, Detroit Edison performed a review of wind data ranging from 1975 through 2003 and concluded that the nearby trees could be affecting the 10-m wind speed measurements during the period 2002–2007; that is, the potential exists for the wind measurements at the 10-m elevation to be lower than the actual wind speed at the 10-m elevation. Detroit Edison provided a copy of the 1985–1989 data from the Fermi 2 meteorological tower in a response to a staff RAI. The staff found that the 1985–1989 data had a lower frequency of (1) low wind speeds at the 10-m elevation and (2) extremely unstable (stability class A) conditions. Discrepancies in wind speed and stability class frequency distributions between the two databases create uncertainty as to which one of the two datasets (1985–1989 versus 2002–2007) is most representative of site conditions for the purposes of performing atmospheric dispersion analyses. Given the uncertainty in the data, the dispersion estimates should be evaluated by using both sets of data, and the more conservative (bounding) dispersion estimates should be used. This topic is discussed in more detail in EIS Section 2.9.3.

2.10 Nonradiological Health

This section describes aspects of the environment at the Fermi site and vicinity associated with nonradiological human health impacts. The section provides the basis for evaluating impacts to human health from building and operating the proposed Fermi 3. Building activities have the potential to affect public and occupational health, create impacts from noise, and impact the health of the public and workers from the transportation of construction materials and personnel to the Fermi site. Operation of Fermi 3 has the potential to impact the public and workers at the Fermi site from operation of the cooling system, noise generated by operations, electromagnetic fields (EMFs) generated by transmission systems, and transportation of operations and outage workers to and from the Fermi site.

2.10.1 Public and Occupational Health

This section describes public and occupational health at the Fermi site and vicinity associated with air quality, occupational injuries, and etiological agents (i.e., disease-causing microorganisms).

2.10.1.1 Air Quality

Public and occupational health can be affected by changes in air quality from activities that contribute to fugitive dust, vehicle and equipment exhaust emissions, and automobile exhaust from commuter traffic (NRC 1996). Air quality for Monroe County and the Fermi site vicinity is discussed in Section 2.9.2. As discussed in that section, this area is designated as an attainment area for all criteria pollutants except $PM_{2.5}$ (EPA 2010b). Monroe County, as well as six other southeastern counties including the Detroit metropolitan area, are designated as nonattainment areas for the $PM_{2.5}$ standard. In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). This request was based, in part, on air quality monitoring data collected in the 2007–2010 period showing all seven counties in southeast Michigan being in attainment for the $PM_{2.5}$ NAAQS. Recently, Monroe County, as well as seven other southeastern counties in Michigan and Lucas and Wood Counties in Ohio, was redesignated from nonattainment areas to maintenance areas for the 8-hour ozone standard (EPA 2010b).

2.10.1.2 Occupational Injuries

In general, occupational health risks to workers and onsite personnel engaged in activities such as building, maintenance, testing, excavation, and modifications are expected to be dominated by occupational injuries (e.g., falls, electric shock, asphyxiation) or occupational illnesses. Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates, with a 2008 average incidence rate of 0.7 per 100 workers (USBLS 2009b). The annual incidence rates (the number of injuries and illnesses per 100 full-time workers) for the State of Michigan and the United States for electrical power generation, transmission, and distribution workers are 3.7 and 3.2, respectively (USBLS 2009b, c). These statistics are used to estimate the likely number of occupational injuries and illnesses for operation of the existing Fermi 2 and predict the likely number of cases for the proposed Fermi 3.

Occupational injury and fatality risks are reduced by strict adherence to NRC and Occupational Safety and Health Administration (OSHA) safety standards, practices, and procedures to minimize worker exposures. Appropriate State and local statues also must be considered when assessing the occupational hazards and health risks associated with the Fermi site. Currently, the Fermi site has programs and personnel to promote safe work practices and respond to occupational injuries and illnesses for Fermi 2. Procedures are in place with the objective of providing personnel who work at the Fermi site with an effective means of preventing accidents due to unsafe conditions and unsafe acts. They include safe work practices to address hearing protection; personal protective equipment; electrical safety; chemical handling, storage, and use; and other industrial hazards. Personnel are provided with training on safety procedures (Detroit Edison 2011a).

2.10.1.3 Etiological Agents

Public and occupational health can be compromised by activities at the Fermi site that encourage the growth of disease-causing microorganisms (etiological agents). Thermal discharges from Fermi 2 into the circulating water system and Lake Erie (Detroit Edison 2011a) have the potential to increase the growth of thermophilic microorganisms. The types of organisms of concern for public and occupational health include enteric pathogens (such as

Salmonella spp. and *Pseudomonas aeruginosa*), thermophilic fungi, bacteria (such as *Legionella* spp.), and free-living amoeba (such as *Naegleria fowleri* and *Acanthamoeba* spp.). These microorganisms could give rise to potentially serious human health concerns, particularly at high exposure levels.

Available data assembled by the Centers for Disease Control and Prevention (CDC) for the years 2000 to 2008 (CDC 2002, 2003, 2004, 2005, 2006, 2007, 2008a, 2009, 2010) were reviewed for outbreaks of *Legionellosis*, *Salmonellosis*, or *Shigellosis*. Outbreaks that occurred in Michigan from 2000 to 2008 were within the range of national trends in terms of cases per 100,000 population or total cases per year, and the outbreaks were associated with pools, spas, or lakes. According to the Detroit Edison correspondence with Michigan Department of Community Health (MDCH) in April 2008, it was noted that the department did not record any major waterborne disease outbreaks within Michigan in the last 10 years (Detroit Edison 2010a). The CDC Council of State Territorial Epidemiologists Naegleria Work Group, after reviewing the data from different sources, identified 121 fatal cases of primary amebic meningoencephalitis (a disease caused by *Naegleria fowleri*) in the United States from 1937 to 2007; most cases occurred in southern States during the months of July and September (CDC 2008b).

2.10.2 Noise

Any pressure variation that the human ear can detect is considered as sound, and noise is defined as unwanted sound. Sound is described in terms of amplitude (perceived as loudness) and frequency (perceived as pitch). Sound pressure levels are typically measured by using the logarithmic decibel (dB) scale. A-weighting (denoted by dBA) (Acoustical Society of America 1983, 1985) is widely used to account for human sensitivity to frequencies of sound (i.e., less sensitive to lower and higher frequencies and most sensitive to sounds between 1 and 5 kHz), which correlates well with a human's subjective reaction to sound. Several sound descriptors have been developed to account for variations of sound with time. L_{90} is the sound level exceeded 90 percent of the time, called the residual sound level (or background level) or fairly steady lower sound level on which discrete single sound events are superimposed. The equivalent continuous sound level (L_{eq}) is a sound level that, if it were continuous during a specific time period, would contain the same total energy as a time-varying sound. (Unless designated otherwise, all sound levels are instantaneous or L_{eq} values measured over short [e.g., 1- to 5-minute] time periods.) In addition, human responses to noise differ depending on the time of the day (e.g., higher sensitivity to noise during nighttime hours because of lower background noise levels). The day-night average sound level (L_{dn} or DNL) is a single dBA value calculated from hourly L_{eq} over a 24-hour period, with the addition of 10 dBA to sound levels from 10 p.m. to 7 a.m. to account for the greater sensitivity of most people to nighttime noise. Generally, a 3-dBA change over existing noise levels is considered to be a "just noticeable" difference, and a 10-dBA increase is subjectively perceived as a doubling in loudness and almost always causes an adverse community response.

There are no State or county noise regulations for Michigan or Monroe County. The only local noise regulation applicable to the Fermi site is Frenchtown Charter Township Noise Ordinance No. 184, which generally prohibits construction noise "unreasonably annoying to other persons, other than between the hours of 7:00 a.m. and 7:00 p.m." Section 5.3.4 of NUREG-1555 (NRC 2000) states that noise levels are acceptable if the L_{dn} outside a residence is less than 65 dBA, which is consistent with HUD regulations for exterior noise standards (24 CFR 51.101(a)(8)). For context, the sound level of a quiet office is 50 dBA, a normal conversation is 60 dBA, busy traffic is 70 dBA, and a noisy office with machines or an average factory is 80 dBA.

An ambient sound level survey was conducted November 26–28, 2007, with Fermi 2 in operation, at seven noise monitoring locations (NMLs) that were selected on the basis of the locations of the nearest noise-sensitive receptors in various directions within 1.5 mi of the Fermi 2 site (Detroit Edison 2011a). Weather conditions were conducive to the measurement of sound levels except during a period with a high average wind speed (10 a.m. to 3 p.m. on November 27, 2007). The noises observed were typical of suburban locations and included local and distant traffic, trains, birds, and dogs barking. Some intermittent gunshot noise from the Fermi firing range and noise from the Fermi cooling towers were faintly audible at five of the seven NMLs. At two NMLs, noise related to transmission lines was heard. Manned 10-minute L_{eq} measurements were collected at all seven NMLs, and continuous 24-hour noise monitoring was conducted at three NMLs. L_{dn} values were derived on the basis of 10-minute L_{eq} values measured every hour over a 24-hour period.

The highest and lowest sound levels occurred between 10 a.m. and 2 p.m. and between 11 p.m. and 3 a.m., respectively, which are typical times for suburban areas due to local and highway traffic volume. Measured L_{90} values at all NMLs ranged from 32 to 42 dBA, which are typical of suburban areas (Bishop and Schomer 1991). Measured L_{dn} values at three NMLs ranged from 54 to 63 dBA. Even including the period of higher wind speed, which could increase sound levels by several dB, the measured L_{dn} values were below 65 dBA.

2.10.3 Transportation

The Fermi site is accessible by roadways, water, and rail for transport of equipment, materials, and supplies. Construction, operations, and outage workers would access the site by roadway. No public transportation system to the site is available. The regional transportation system is described in Section 2.5.2.3. Existing roadways in the vicinity of the Fermi site are shown on Figure 2-16.

The main entrance to the site is at Enrico Fermi Drive, which connects to N. Dixie Highway after crossing Toll Road and Leroux Road. Enrico Fermi Drive is primarily a private drive for Fermi plant site ingress and egress. There is a signalized intersection at N. Dixie Highway, a four-way stop at Leroux Road, and a one-way stop (T-intersection) at Toll Road (The Mannik & Smith Group, Inc. 2009). Most of the roads in the area, excluding I-75 and N. Dixie Highway, are low-volume roads, with an average daily traffic (ADT) volume of less than 5000 vehicles per day. These traffic volumes are generally below the capacity of the roads (The Mannik & Smith Group, Inc. 2009).

Roadway accident data for roadway segments and intersections in southeast Michigan are maintained by the SEMCOG. In Monroe County, 3689 accidents occurred in 2009 (SEMCOG 2010c). Approximately 79 percent of the accidents involved property damage only. Approximately 20 percent involved injury, of which 2.5 percent were considered incapacitating injuries. Less than 1 percent of the accidents involved a fatality (SEMCOG 2010c).

Table 2-67 provides the intersections and roadway segments near the Fermi plant site that have a high frequency of accidents. Accident data are evaluated by local jurisdictions, SEMCOG, and the Michigan Department of Transportation to identify problem areas and to develop solutions – such as signalization, roadway improvements, public education, or enforcement – to reduce the number of accidents.

Table 2-67. High-Frequency Accident Intersections and Roadway Segments in Frenchtown Charter Township, 2005–2009

Roadway	Intersection or Roadway Segment	2008 Average Daily Traffic Volume	Total No. of Accidents (2005–2009)	Average Annual No. of Accidents (2005–2009)
Intersection				
N. Dixie Hwy.	Southbound I-75 ramp	NA[(a)]	25	5
Roadway Segments				
N. Dixie Hwy.	Sandy Creek Rd. to Nadeau Rd.	12,700	99	20
Southbound I-75	I-75/Nadeau Rd. ramp to southbound I-275 and northbound I-75 split	21,200	62	12
Nadeau Rd.	I-75/Nadeau Rd. ramp and N. Dixie Hwy.	5300	56	11
Northbound I-75	Sandy Creek Rd. to I-75/Nadeau Rd. ramp	16,800	55	11
Northbound I-75	I-75/N. Dixie Hwy. ramp to Sandy Creek Rd.	16,800	55	10
Southbound I-75	N. Dixie Hwy. to I-75/N. Dixie Hwy. ramp	16,800	48	10

Source: SEMCOG 2010d, e
(a) NA = Not applicable.

SEMCOG is the region's designated metropolitan planning organization for regional transportation planning. The latest version of SEMCOG's long-range RTP is *Direction 2035 Regional Transportation Plan for Southeast Michigan* (SEMCOG 2009d). Short-range (e.g., 2008 to 2011) priorities for funding by cities, county road commissions, transit agencies, and the Michigan Department of Transportation are included on a list called the TIP, which is regularly updated. Projects funded under the TIP are drawn from the long-range RTP. Included in the RTP are more than 1500 projects throughout southeast Michigan that address roadway congestion and safety, as well as bridges, bicycling/walking, public transit, and freight transport.

2.10.4 Electromagnetic Fields

Transmission lines generate both electric and magnetic fields, referred to collectively as EMFs. Public and worker health can be compromised by acute and chronic exposure to EMFs from power transmission systems, including switching stations (or substations) onsite and transmission lines connecting the plant to the regional electrical distribution grid. Transmission lines operate at a frequency of 60 Hz (60 cycles per second), which is considered to be extremely low frequency (ELF). In comparison, television transmitters have frequencies of 55 to 890 MHz, and microwaves have frequencies of 1000 MHz and greater (NRC 1996).

Electric shock resulting from direct access to energized conductors or from induced charges in metallic structures is an example of an acute effect from EMFs associated with transmission lines (NRC 1996). Objects near transmission lines can become electrically charged by close proximity to the electric field of the line. An induced current can be generated in such cases; it can flow from the line through the object into the ground. Capacitive charges can occur in objects that are in the electric field of a line, storing the electric charge while they are electrically isolated from the ground. A person standing on the ground can receive an electric shock by coming into contact with such an object because of the sudden discharge of the capacitive charge through the person's body to the ground. Such acute effects are controlled and minimized by conformance with National Electrical Safety Code (NESC) criteria.

Onsite transmission lines that would connect Fermi 3 to the proposed new Fermi 3 switchyard would be constructed and owned by Detroit Edison (Detroit Edison 2011a). Transmission lines that serve Fermi 3 offsite would be created and operated by ITC*Transmission* (Detroit Edison 2011a), which also operates and manages the transmission system of existing Fermi 2 at the Fermi site (Detroit Edison 2011a). The existing ITC*Transmission* system meets NESC criteria for induced currents (Detroit Edison 2011a). Detroit Edison stated that all transmission lines would comply with applicable regulatory standards and that the design and construction of the proposed Fermi 3 substation and transmission circuits would comply with NESC provisions (Detroit Edison 2011a). ITC*Transmission* would ensure that the electric field strength under the new transmission lines would conform to NESC guidelines (maximum of less than 7.5 kV/m within the ROW and maximum of less than 2.6 kV/m at the edge of the ROW) (Detroit Edison 2011a).

Long-term or chronic exposure to power transmission lines has been studied for a number of years. These health effects were evaluated in NUREG 1437 (NRC 1996) and are discussed in the ER (Detroit Edison 2011a). NUREG 1437 reviewed human health and EMFs and concluded:

> The chronic effects of electromagnetic fields (EMFs) associated with nuclear plants and associated transmission lines are uncertain. Studies of 60-Hz EMFs have not uncovered consistent evidence linking harmful effects with field exposures. EMFs are unlike other agents that have a toxic effect (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be forced and longer-term effects, if real, are subtle. Because the state of the science is currently inadequate, no generic conclusion on human health impacts is possible.

2.11 Radiological Environment

A REMP has been conducted around the Fermi site since 1978. This program measures radiation and radioactive materials from all sources, including the existing units at the Fermi site. The REMP includes the following pathways: direct radiation; atmospheric, aquatic, and terrestrial environments; groundwater; and surface water. A preoperational surveillance program was established to determine baseline conditions and quantify the radioactivity, and its variability, in the area prior to the operation of Fermi 2. After routine operation of Fermi 2 started in 1985, the monitoring program continued to assess the radiological impacts to workers, the public, and the environment.

The results of this monitoring are documented in annual reports entitled *Fermi 2 – [Year] Radioactive Effluent Release and Radiological Environmental Operating Report for the Period January 1, [Year], through December 31, [Year]*. The NRC staff reviewed these annual reports for calendar years 2004 through 2010 (Detroit Edison 2005, 2006, 2007, 2008b, 2009g, 2010d, 2011c). These reports show that exposures or concentrations in air, water, and vegetation are comparable to, if not statistically indiscernible from, preoperational levels, with the exception of tritium, as described below.

NRC's Lessons Learned Task Force Report (NRC 2006) made recommendations regarding potential unmonitored groundwater contamination at U.S. nuclear plants. In response to that report, the Nuclear Energy Institute (NEI) developed the Ground Water Protection Initiative (NEI 2007). Detroit Edison implemented the initiative and began additional groundwater sampling in various locations that may be a source of groundwater contamination around the Fermi site in the fourth quarter of 2007. The changes to the groundwater monitoring program based on the NEI initiative and results of this additional groundwater sampling are summarized in Appendix B of the Radioactive Effluent Release Report for 2008 (Detroit Edison 2009g). The sporadic and variable trace quantities of tritium (maximum concentration observed was

1950 pCi/L) were detected in the few shallow groundwater wells downwind from the Fermi 2 stack. Detroit Edison attributed this to the recapture of tritium in precipitation from the plant's gaseous effluent (Detroit Edison 2009a). The detected tritium concentrations were far below the EPA drinking water standard of 20,000 pCi/L (41 FR 28402).

2.12 Related Federal Projects and Consultations

The staff reviewed the possibility that activities of other Federal agencies might affect the issuance of a COL to Detroit Edison for the proposed Fermi 3. Any such activities could result in cumulative environmental impacts and the possible need for another Federal agency to become a cooperating agency for preparation of the EIS (10 CFR 51.10(b)(2)).

Fermi 3 would be sited on existing land owned by Detroit Edison. There is a Cooperative Agreement between Detroit Edison and the FWS that authorizes the FWS to include land on parts of the Fermi site within the DRIWR. Under the agreement, Detroit Edison and the FWS may end the agreement either in whole or in part, meaning that lands currently included as part of the DRIWR could be removed from the refuge. While approximately 2 ac would be removed during the construction of Fermi 3, Detroit Edison has stated that it intends to return all undisturbed wetlands to the DRIWR after construction of Fermi 3 is complete (Detroit Edison 2011a).

The 345-kV transmission system and associated corridors are currently owned and operated by ITC*Transmission*. The majority of the length of the three new transmission lines required for Fermi 3 would be located within existing transmission corridors. Although construction of the new transmission lines may require the acquisition of new ROWs (Detroit Edison 2011a), it is not expected that these activities will require any Federal action.

There is very little Federal land within 50 mi of the site. The majority of a 480-ac former U.S. Department of Defense (DOD) property about 4 mi northwest of the Fermi 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 (Detroit Edison 2011a). No plans for future use of this site have been specified by the DOD. The Cedar Point National Wildlife Refuge and the Ottawa National Wildlife Refuge, both located to the east of Toledo, Ohio, are approximately 25 mi and 30 mi from the site, respectively (National Atlas.gov 2010). There are no wilderness areas or rivers included in the national wild and scenic rivers system within 50 mi of the site, and the closest Native American Tribal reservations are more than 50 mi from the site (National Atlas.gov 2010).

After reviewing the Federal activities in the region surrounding the Fermi site, particularly with regard to their potential of having impacts on wetlands associated with the construction and operation of the Fermi 3 intake and discharge structures and other related facilities that are not under NRC's jurisdictional authority, the staff determined that it would be advantageous for USACE to become a cooperating agency for preparation of the EIS.

The NRC is required under section 102(2)(C) of NEPA to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the EIS. During the course of preparing this EIS, the NRC consulted with the USACE, FWS, EPA, and the NOAA Fisheries Service. Related correspondence is included in Appendix F.

2.13 References

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3.0 Site Layout and Plant Description

The proposed Enrico Fermi Unit 3 (Fermi 3) would be located in Monroe County in rural southeastern Michigan. Detroit Edison Company (Detroit Edison) applied to the U.S. Nuclear Regulatory Commission (NRC) for a combined license (COL) for Fermi 3. The proposed new unit would be situated wholly within the existing Enrico Fermi Atomic Power Plant (Fermi) site and adjacent to the existing Enrico Fermi Unit 2 (Fermi 2). Enrico Fermi Unit 1 (Fermi 1), also located on the Fermi site, is in the process of being decommissioned. The Fermi site is located on the western shore of Lake Erie approximately 30 mi southwest of Detroit, Michigan, and 7 mi from the United States–Canada international border.

In addition to the COL application, Detroit Edison must obtain a Department of Army permit from the U.S. Army Corps of Engineers (USACE) to conduct activities that affect waters of the United States, including wetlands. As a first step, Detroit Edison initiated coordination with USACE through preapplication and jurisdictional determination meetings. Then, on June 17, 2011, Detroit Edison submitted a Joint Permit Application (Detroit Edison 2011a) to the Michigan Department of Environmental Quality (MDEQ) for activities associated with the proposed Fermi 3 project. On September 9, 2011, Detroit Edison subsequently submitted a permit application to the USACE.

This chapter describes the key characteristics of the proposed plant that must be understood to assess the environmental impacts of the proposed action; the characteristics are drawn primarily from Detroit Edison's Environmental Report (ER) (Detroit Edison 2011b), its Final Safety Analysis Report (FSAR) (Detroit Edison 2011c), and supplemental information provided by Detroit Edison in response to requests for additional information.

Whereas Chapter 2 of this environmental impact statement (EIS) describes the existing environment at the proposed site and its vicinity, this chapter describes the physical layout of the proposed plant. This chapter also describes the physical activities involved in building and operating the plant and associated transmission lines. The environmental impacts of constructing and operating the plant are discussed in Chapters 4 and 5, respectively. This chapter is divided into four sections: Section 3.1 describes the external appearance and layout of the proposed plant; Section 3.2 describes the major plant structures and distinguishes structures that interface with the environment from those that do not interface with the environment, or that interface with the environment temporarily; Section 3.3 describes the activities involved in building or installing each of the plant structures; and Section 3.4 describes the operational activities of the plant that interface with the environment. Full citations for references are listed in Section 3.5.

3.1 External Appearance and Plant Layout

The 1260-ac Fermi site is located on the western shore of Lake Erie at a grade of approximately 581.8 ft North American Vertical Datum of 1988 (NAVD 88). The grade at the power block area where Category I structures are located is approximately 589.3 ft NAVD 88. The site contains one operating boiling water reactor (BWR), Fermi 2, and one fast breeder reactor, Fermi 1, and their associated facilities. Fermi 1 is no longer operational, and the unit has been defueled in preparation for dismantling. Full decommissioning of Fermi 1 is expected to be complete prior to initiation of Fermi 3 construction. Fermi 2 currently is in operation and, if its license is renewed, the unit will continue to operate when Fermi 3 comes online in 2020.

Figures 3-1 and 3-2 show aerial views of the Fermi site layout, including the location of existing and proposed buildings, and the site property boundary. Fermi 1 is shown in these figures, although, as discussed above, Detroit Edison plans to remove this unit as part of a separate action prior to construction of Fermi 3. Figure 3-3 is an aerial view of the current configuration of the Fermi site; Figure 3-4 is an aerial view with the proposed site layout and Fermi 3 structures superimposed.

Fermi 2 uses two 400-ft-tall concrete natural draft cooling towers for heat dissipation (Figure 3-3). Each tower is approximately 450 ft in diameter at the base. As can be seen in Figure 3-3, the natural draft cooling towers for Fermi 2 are the dominant visible structures on the site and are visible from outside the site property boundaries.

The normal power heat sink (NPHS) for Fermi 3 would be provided by an additional concrete natural draft cooling tower. Water from Lake Erie would be used for makeup water for the Circulating Water System (CIRC), the Plant Service Water System (PSWS), and the Fire Protection System (FPS). The intake for Fermi 3 would be adjacent to the existing intake for Fermi 2, which is located between the two groins that project into Lake Erie (Figure 3-1). An offshore underwater discharge pipe would serve as the outfall from the Fermi 3 CIRC and PSWS. The proposed natural draft cooling tower for Fermi 3 would be located to the southwest of the two existing Fermi 2 cooling towers (Figure 3-4).

Fermi 3 would share some facilities with Fermi 2, including office buildings, potable water supply, and sanitary discharge structures (Detroit Edison 2011b). Paved onsite roadways would connect Fermi 3 to the remainder of the Fermi site, providing routine and nonroutine access.

Some of the existing infrastructure on the Fermi site would be modified to integrate Fermi 3 with Fermi 2. None of the Fermi 2 structures or facilities that directly support power generation at that unit would be shared. The electrical switchyard for Fermi 3 would be separate from the existing Fermi 2 switchyard, but the transmission lines from the two switchyards would share common transmission towers as the lines leave the site. The existing Fermi 2 protected area

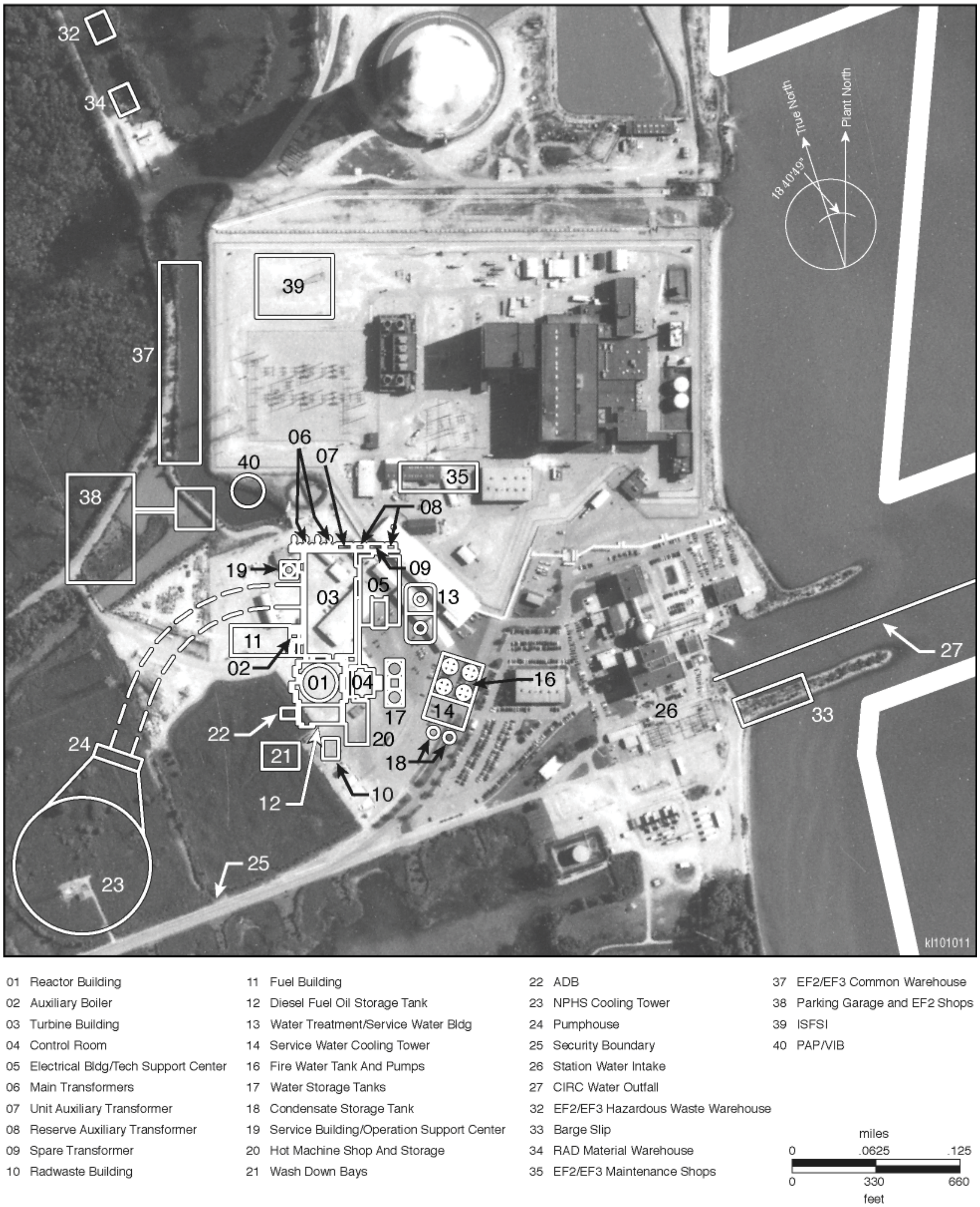

Figure 3-1. Fermi Site Layout Showing Existing and Proposed Facilities: Power Block and Adjacent Facilities (Detroit Edison 2011b)

Figure 3-2. Fermi Site Layout Showing Existing and Proposed Facilities: Ancillary Facilities (Detroit Edison 2011b)

Figure 3-3. Aerial View of the Existing Fermi Site Looking North (Detroit Edison 2011b)

would be expanded to include Fermi 3. Existing administrative buildings, warehouses, and other minor support facilities would be used, expanded, or replaced, based on economic considerations and operational requirements.

As shown in Figures 3-1 and 3-2, Fermi 3 would be located in close proximity to Fermi 2. Major proposed plant structures would be located, for the most part, on areas that were disturbed during construction and operation of Fermi 1 and Fermi 2. In designing the site layout for Fermi 3, Detroit Edison attempted to minimize offsite visual intrusion and other impacts by locating major plant structures away from the Lake Erie shoreline, placing new structures in relatively close proximity to Fermi 2 facilities, and placing the intake structure in the existing developed section of shoreline (Detroit Edison 2011b).

Land use within 5 mi of the Fermi site is primarily for agriculture, although there are several small beach communities (Estral Beach, Stony Point, Detroit Beach, and Woodland Beach) and the small Newport-Oldport residential area to the northwest. The nearest of these communities is Stony Point, located about 2 mi south of the Fermi site. Visual impacts from the site are limited to the closest residents and traffic on the Dixie Highway and other nearby roads. The

Figure 3-4. Aerial View of the Fermi Site Looking North with Proposed Fermi 3 Structures Superimposed (Detroit Edison 2011b)

site is not visible from any nearby recreational areas or other areas that have frequent visitor use.

Figure 3-5 provides a view of the Fermi site from outside the site boundary. As can be seen, the most obviously visible existing structures are the natural draft cooling towers. Although vegetation blocks public view of many of the power plant structures, the cooling towers and their plumes are prominently visible from all directions. Because Fermi 3 would be located in the same general vicinity as Fermi 2, the same vegetation would block views of some Fermi 3 facilities. However, similar to Fermi 2, the proposed natural draft cooling tower and its plume would be visible from offsite (Figure 3-5), including by recreational boaters on Lake Erie. The height of the proposed Fermi 3 natural draft cooling tower would be approximately 600 ft.

Figure 3-5. View of the Fermi Site from Post Road Looking Southeast: Existing Fermi 2 Cooling Towers Are Shown on the Left; the Proposed Fermi 3 Cooling Tower Is on the Right (Detroit Edison 2011b)

3.2 Plant Structures

This section describes each of the major plant structures and is divided into three categories: the reactor power system, structures that would have an interface with the environment during operation, and the balance of plant structures. All of these structures are relevant in the discussion of building impacts in Chapter 4. Only those structures that interface with the environment are relevant to the operational impacts discussed in Chapter 5.

3.2.1 Reactor Power Conversion System

Detroit Edison has proposed the construction and operation of an Economic Simplified Boiling Water Reactor (ESBWR) designed by GE-Hitachi Nuclear Energy Americas, LLC (GEH), at the Fermi site. GEH submitted the Standard Design Certification Application for the ESBWR on August 24, 2005, to the U.S. Nuclear Regulatory Commission (NRC), and it was accepted for review on December 1, 2005 (Detroit Edison 2011b). The NRC staff is performing a detailed review of that certification application.

The ESBWR design is a single-cycle, natural circulation, BWR, and has passive safety features. The reactor is rated at 4500 MW(t), with a design gross electrical output of approximately 1605 MW(e) and a net output of 1535 MW(e) (Detroit Edison 2011b). Figure 3-6 provides an

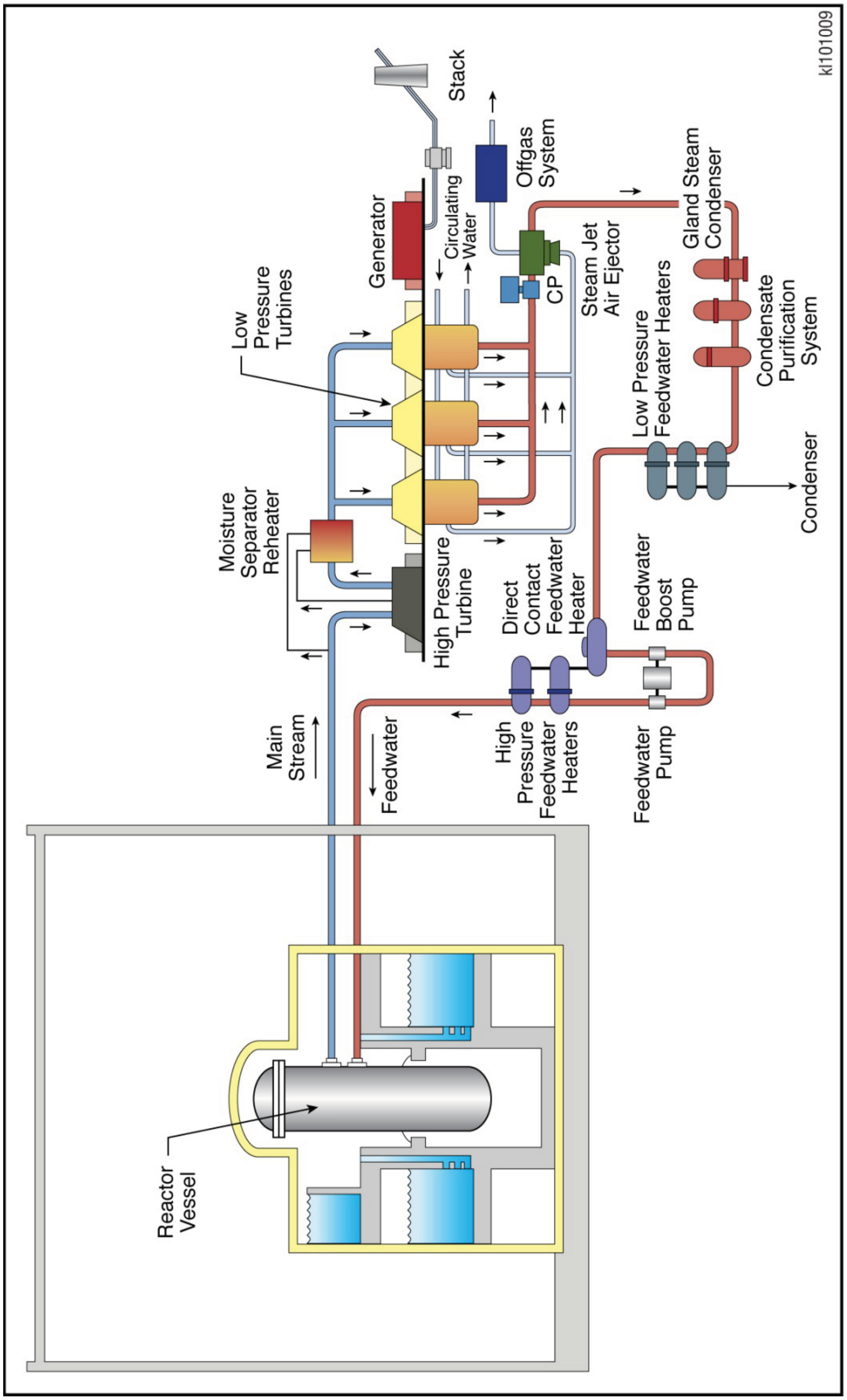

Figure 3-6. Simplified Flow Diagram of the ESBWR Power Conversion System (Detroit Edison 2011b)

illustration of the reactor power conversion system. Steam generated in the reactor vessel drives high-pressure and low-pressure turbines to create electricity. Steam that has passed through the low-pressure turbines is condensed and pumped back to the reactor vessel as water. The heat rejected from the plant to the environment, principally the atmosphere, is calculated to be 9.883×10^9 Btu/hr (Detroit Edison 2011b).

3.2.2 Structures with Major Plant-Environment Interfaces

For assessment purposes, the review team divided the plant structures into two primary groups: (1) those that interface with the environment and (2) those that are internal to the reactor and associated facilities but without environmental intakes or releases. Examples of environmental interfaces are withdrawal of water from the environment at the intake structures, release of water to the environment at the discharge structure, and release of excess heat to the atmosphere. Structures with environmental interfaces are those that the review team considers in its environmental review of the operational impacts of the facility in Chapter 5. The processes that occur within the plant itself and that do not affect the environment are not relevant to a National Environmental Policy Act (NEPA) review and are not discussed further in this EIS. However, such internal processes are considered in the ESBWR design certification documentation and in NRC plant safety reviews. This section discusses the plant structures that would interface with the environment. The remaining structures are discussed in Section 3.2.3, inasmuch as they may alter the landscape and are relevant in the review team's consideration of construction impacts, which are discussed in Chapter 4 of this EIS.

3.2.2.1 Landscape and Stormwater Drainage

Landscapes and stormwater drainage systems affect the rates and routing of rainfall-generated runoff and affect the infiltration of rainfall into the groundwater as recharge. Impervious areas eliminate recharge to aquifers beneath the site. Pervious areas managed to reduce runoff and maintained free of vegetation will experience considerably higher recharge rates than adjacent area with local vegetation. Landscaping at the Fermi site would be managed to reduce runoff and erosion. The Fermi 3 power block area would be mostly impervious. The proposed Fermi 3 stormwater drainage patterns are discussed in the FSAR (Detroit Edison 2011c), because the stormwater drainage system performs a safety-related function by preventing flooding of the safety structures. The grading of the surface topography would direct water away from the safety structures and into drop inlets, and stormwater runoff would be routed through storm drains to the North Lagoon. If the storm drains were blocked, stormwater would drain off the power block area in all directions and drain to the North Lagoon, the South Lagoon, or directly to Lake Erie (Detroit Edison 2011c). The land surrounding the Fermi 3 power block would be gently sloped away to allow drainage of stormwater runoff toward the North Lagoon, the South Lagoon, or Lake Erie.

3.2.2.2 Cooling System

The following sections provide detailed descriptions of the components of the cooling water systems for the proposed Fermi 3. These descriptions were determined from the *Economic Simplified Boiling Water Reactor Design Control Document* (GEH 2010) and include site-specific characteristics as described in the Fermi 3 ER (Detroit Edison 2011b).

The cooling system would represent the largest interface between the plant and the environment. Makeup water would be provided to Fermi 3 through the intake structure on Lake Erie. A portion of this makeup water would be returned to Lake Erie as blowdown via the discharge pipe. The remaining portion of this water would be lost to the atmosphere through evaporation or drift from the natural draft cooling tower. These three components represent interfaces between the plant and the environment, and are described next.

Cooling-Water Intake Structures

Water would be withdrawn from Lake Erie for use in Fermi 3 systems through an intake bay. The intake from Lake Erie for Fermi 3 would be located near the intake for Fermi 2, between the two rock groins that extend into Lake Erie. The proposed location of the intake for Fermi 3 is shown in Figure 3-1. Section 3.4.2.1 of the ER (Detroit Edison 2011b) describes the intake system for Fermi 3 in detail.

The intake structure would provide water for the nonsafety-related cooling for the Station Water System (SWS), which would supply makeup water for both the CIRC and the PSWS. The cooling water in the CIRC provides heat dissipation from the main condensers to the normal plant heat sink (NPHS). The NPHS for Fermi 3 would be a natural draft cooling tower. The cooling water in the PSWS would provide head dissipation from the heat exchangers of both the Turbine Component Cooling Water System and the Reactor Component Cooling Water System. The heat from the PSWS would be dissipated to the NPHS and/or the Auxiliary Heat Sink (AHS). The AHS would consist of two mechanical draft cooling towers and would be housed adjacent to the Water Treatment/Service Water on the southeast side of the Fermi 3 power block. The SWS would supply makeup water to the NPHS and AHS cooling tower basins and would consist of two subsystems: the Plant Cooling Tower Makeup System (PCTMS) and the Pretreated Water Supply System (PWSS). The PCTMS would provide makeup water from Lake Erie for evaporation, drift, and blowdown losses. The PWSS would provide water for the FPS and would serve as an alternate to the PCTMS for supplying PSWS makeup water to the cooling towers. The FPS would consist of onsite storage tanks and would be available for fire protection needs for Fermi 3.

At the interface with Lake Erie, there would be a pump house equipped with trash racks to screen out large objects from the pump system and three traveling screens with a 3/8-in. mesh arranged side by side to further screen out litter from the water entering the pump house. Trash collected on the rack and screens would then be disposed of. After water entered the pump house, it would be treated using sodium hypochlorite, a biocide/algaecide, before it entered the pumps at the location of the biocide injection diffuser. There would be two groups of pumps in the intake bay: three PCTMS pumps, each equipped to pump at 50 percent capacity for makeup water to the cooling tower basins, and two PWSS pumps, each designed to pump at 100 percent capacity for makeup water to the AHS and FPS during shutdown.

The maximum flow rate at the intake would be 34,264 gallons per minute (gpm) (Figure 3-7, Table 3-1; Detroit Edison 2011b). Detroit Edison (2011b) stated that the water velocity at the intake would be no more than 0.5 ft/s under all operating conditions to minimize the number of fish being impinged onto the screens.

The cooling water intake for Fermi 3 would include a trash rack, traveling screens, and a fish return system. The trash rack, equipped with a trash rake, would be positioned at the inlet to the pump house structure to capture larger debris; trash collected from the trash racks would be disposed of. Three dual-flow traveling screens (mesh size 3/8 in.) would be arranged side-by-side behind the trash rack to further prevent debris from entering the pump house and to collect aquatic organisms large enough to be caught on the screens. Aquatic organisms would first be washed from the traveling screens using a low-pressure water spray followed by a high-pressure wash to remove remaining debris. Strainers would be in place to collect the organisms washed from the screens, and a strainer backwash would then be used to direct those organisms back to Lake Erie via a fish return system in a manner compatible with the limits of the applicable NPDES permit (Detroit Edison 2011b). The point of return for the fish return system would be outside the zone of influence of the intake bay (Detroit Edison 2011b).

The elevation of the bottom of the planned intake bay is 559.0 ft NAVD 88, and the location of pump suction would be at 553.0 ft NAVD 88 inside the pump house. The record low water elevation of Lake Erie at the Fermi site (NOAA gage 9063090) is 563.9 ft NAVD 88. Low water levels in Lake Erie should not affect pump suction because the suction would be located at over 10 ft below the lowest recorded water level (Detroit Edison 2011b).

Cooling Towers

A natural draft cooling tower (NDCT) would be built for the proposed Fermi 3 as the NPHS. The location of the cooling tower is shown in Figure 3-1. The concrete cooling tower would be approximately 600 ft tall and 480 ft in diameter at the base. The cooling tower would be a part of the CIRC, and the cooling water in the CIRC would provide heat dissipation from the main condensers to the NPHS. The CIRC would have four pumps that circulate water from the intake to the condenser during startup, shutdown, and normal operation of Fermi 3. The four CIRC pumps (each 25 percent capacity) would be able to pump a total of 744,000 gpm. The NPHS would be located 2200 ft from the intake structure on Lake Erie and 1100 ft from the main condenser. Consumptive use of water (NDCT drift and evaporation) for cooling would average

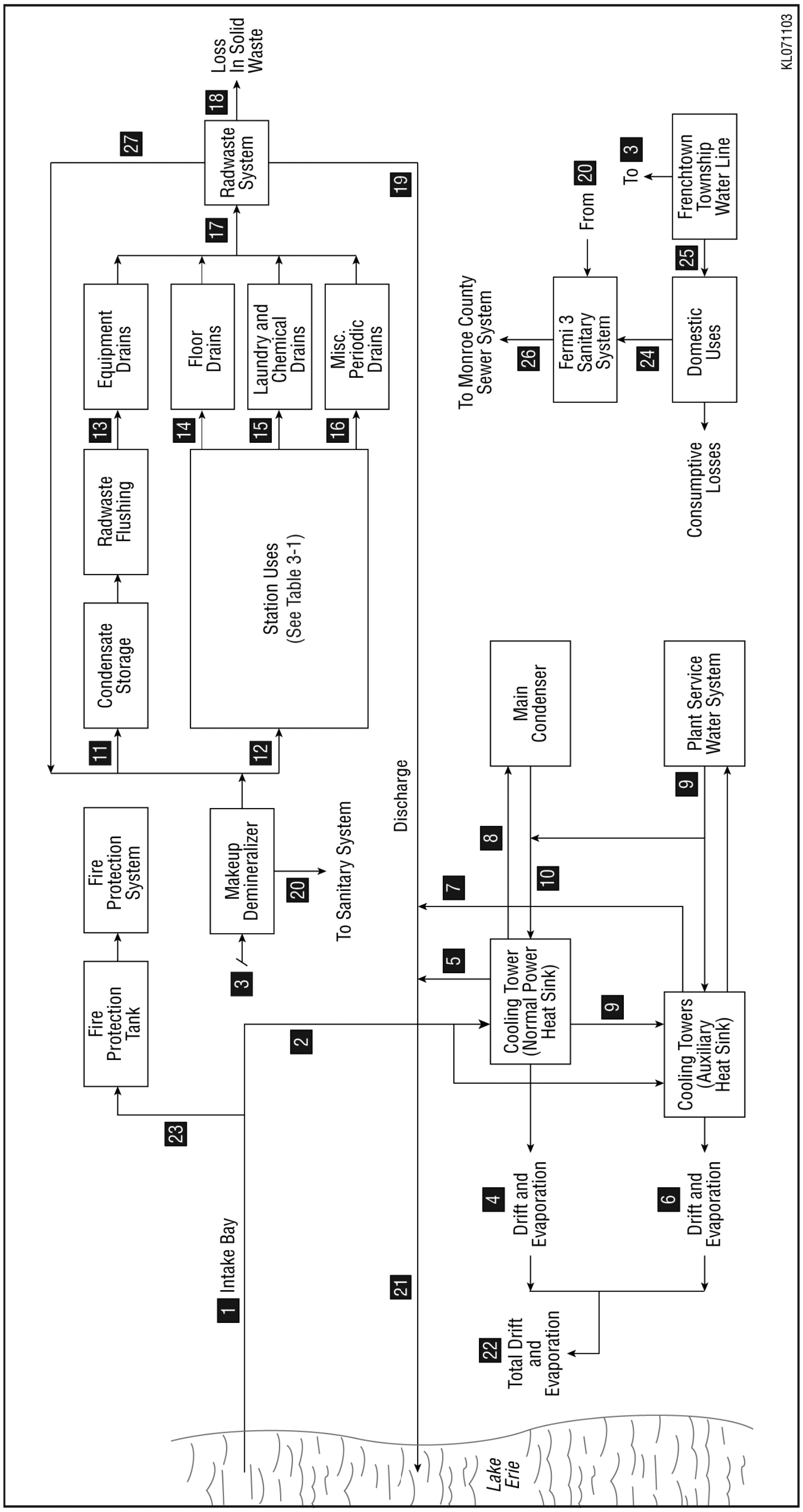

Figure 3-7. Water Use Flow Diagram for Fermi 3 Operations (flow values that correspond to the numbers shown in the figure are provided in Table 3-1) (Detroit Edison 2011b)

Table 3-1. Water Use During Fermi 3 Operations

Flow[a]	Description	Value (gpm) Maximum Normal Power Operation[b]	Value (gpm) Minimum Normal Power Operation[c]	Value (gpm) Average Normal Power Operation[d]	Value (gpm) Average Shutdown Operation
1	Total makeup water intake	34,264	23,780	28,993	1,166
2	Cooling tower makeup water	34,234	23,750	28,963	1,136
3	Demineralizer makeup water	160	160	160	639
4	Normal power heat sink drift and evaporation	17,124	11,882	14,488	0
5	Normal power heat sink discharge (blowdown)	17,110	11,868	14,474	0
6	Auxiliary heat sink drift and evaporation	0	0	0	569
7	Auxiliary heat sink discharge	0	0	0	567
8	Inflow to main condenser	684,000	684,000	684,000	0
9	Total plant service water system flow	40,000	40,000	40,000	40,000
10	Total circulating water system flow	724,000	724,000	724,000	0
11	Inflow to condensate storage	58	58	58	232
12	Inflow to station uses[e]	49	49	49	196
13	Outflow to equipment drains	58	58	58	232
14	Outflow to floor drains	8	8	8	30
15	Outflow to laundry and chemical drains	24	24	24	95
16	Outflow to miscellaneous periodic drains	18	18	18	71
17	Inflow to the radwaste system	107	107	107	428
18	Solid radwaste	2	2	2	9
19	Liquid radwaste discharge[f]	105 (0)	105 (0)	105 (0)	419 (0)
20	Makeup demineralizer blowdown	53	53	53	211
21	Total discharge	17,215	11,973	14,579	987
22	Total drift and evaporation	17,124	11,882	14,488	569
23	Fire protection uses	30	30	30	30
24	Potable water discharge to sewer	200	35	35	47
25	Domestic uses	200	35	35	47
26	Total discharge to Monroe County sewer system	253	88	88	258
27	Liquid radwaste recycled[e]	0 (105)	0 (105)	0 (105)	0 (419)

Source: Detroit Edison 2011b
(a) Numbers correspond to flow arrows shown in Figure 3-7.
(b) Summer months (design/maximum).
(c) Winter months (January/minimum).
(d) Spring and fall months (average).
(e) Station uses include: Standby Liquid Control System, Reactor Component Cooling Water System, Process Sampling System process use, HVAC System, Liquid Waste System chemical addition and line flushing, Turbine Component Cooling Water System, Auxiliary Boiler System, Isolation Condenser/Passive Containment Cooling Pool, Solid Waste System for line flushing, Chilled Water System, and Post Accident Sampling station flushing.
(f) 105 gpm of liquid radwaste is normally recycled for station uses, but system design allows for discharge to Lake Erie.

14,488 gpm and vary between 11,882 and 17,124 gpm (Figure 3-7 and Table 3-1). Blowdown water from the NDCT would be transported to the discharge pipe to be discharged to Lake Erie at an annual average rate of 14,474 gpm (range 11,868 and 17,110 gpm) (Figure 3-7 and Table 3-1). The NDCT would be designed to dissipate heat at a rate of 1.07×10^{10} Btu/hr to the atmosphere.

The heat from the PSWS would be dissipated to the NPHS and/or the AHS. Two mechanical draft cooling towers would serve as the AHS and would be located adjacent to the Water Treatment/Service Water Building (Figure 3-1). The AHS would have the capacity to dissipate heat at a rate of 2.98×10^{8} Btu/hr (Detroit Edison 2011b).

Discharge Structure

After the water is cooled in the cooling towers, some water would be discharged to Lake Erie. Additional discharges to Lake Erie could include treated liquid radwaste. The proposed location of the discharge pipe is shown on Figure 3-1 as the CIRC water outfall (shown as "27" in figure). The discharge pipe would extend approximately 1300 ft into Lake Erie and would be 4 ft in diameter. For thermal plume simulations (see Section 5.3), Detroit Edison (2011b) assumed that the discharge pipe would be buried in the Lake Erie lake bed and consist of a 3-port diffuser system. This preliminary design assumed that ports would be elevated 1.6 ft above the lake bed and be angled at 20 degrees above horizontal, pointing to the east (away from the shore).

3.2.2.3 Other Permanent Structures that Interface with the Environment

Roads, rail lines, and buildings are additional permanent plant-environment interfacing structures that would be built on the proposed site. These are discussed in this section.

Roads

Enrico Fermi Drive is the main existing site access point from North Dixie Highway into the Fermi site. Fermi Drive crosses Leroux Road and Toll Road before reaching the main entrance. Pointe Aux Peaux Road parallels the southern boundary of the site. Onsite roads include Quarry Lake Road, Fox Road, Boomerang Road, Doxy Road, and Bullit Road. Construction traffic would use existing onsite roads, but a new access road (new Fermi Drive) would be constructed parallel to and just north of the existing Fermi Drive from Dixie Highway to the west Fermi property boundary, and would continue through the site to the new personnel access gate (Detroit Edison 2011b). The new Fermi Drive would provide separation between Fermi 2 operations traffic and Fermi 3 construction traffic. Construction of the new Fermi Drive would occur during the early stages of Fermi 3 construction. After construction of Fermi 3 is complete, the new Fermi Drive would be used as the main access to the site, and the existing Fermi Drive may be retained as a secondary access road or abandoned (Detroit Edison 2011b).

To reduce the potential for erosion and siltation from road use by heavy construction vehicles, existing paved roads may be widened or additional surface layers added to roads to support construction traffic (Detroit Edison 2011b). Otherwise, roads are not expected to need reconditioning to handle the loads from Fermi 3 construction.

Rail Lines

Four rail lines occur in the immediate vicinity of the Fermi site, and there are no plans to expand the current level of rail service in the area (Detroit Edison 2011b). Rail transport is available for the construction of Fermi 3 as needed, and no construction or modification of rail lines is anticipated. A single spur track off the Canadian National main rail line crosses the Fermi site parallel to the route of Fermi Drive.

Excavation Water Infiltration Barriers

During construction of Fermi 3, Detroit Edison would use barriers to minimize the flow of water entering the excavation. Water in the shallow fill layer would be excluded from the excavation by barriers such as reinforced diaphragm concrete walls, sheet piles, grout curtains, or freeze walls extending through the fill to the top of the glacial till. The approach to be used has not yet been determined by Detroit Edison. If diaphragm concrete walls, sheet piles, or grout curtains are used, they would remain in place and continue to reduce the permeability of the affected areas.

Spoils Disposal Area

Excavated material from the power block and circulating water pipe runs would be used as backfill and structural fill for the cooling tower and circulating water pipe run area (Detroit Edison 2011b). No onsite borrow pit is anticipated to be used for Fermi 3 construction. About 500,000 yd^3 of excess excavated material will be disposed of in an onsite area. This onsite disposal area may be an expansion of one of the areas used for Fermi 2 spoils disposal (Figure 3-2), or a new spoils disposal area may be designated onsite. Under either condition, an updated USACE authorization would be required for handling of Fermi 3 material. The use of an onsite construction landfill is not anticipated.

Diesel Generators, Auxiliary Boiler, Diesel Fire Pumps

Two 17.1-MW standby diesel generators, a 33-MW auxiliary boiler, and two 200-kW diesel fire pumps will be installed on the site to provide auxiliary and backup systems. Infrequent testing and operations of these units would result in combustion emissions to the atmosphere. Standby diesel generators would operate about 4 hr per month, the auxiliary boiler is expected to operate a maximum of 30 days each year, and the fire pumps would operate approximately 48 hr annually.

Barge Slip

Dredging of a barge slip within the existing Lake Erie intake embayment may be conducted to allow delivery of heavy construction equipment and building materials during Fermi 3 construction and for removal of construction debris (shown as "33" in Figure 3-1) (Detroit Edison 2011b). No new roads or other transportation facilities would be required to accommodate Fermi 3 barge traffic. Dredge spoils would be placed in the Spoils Disposal Pond that drains to Lake Erie through Outfall 013, as designated in the Fermi 2 National Pollutant Discharge Elimination System (NPDES) permit.

Based on an evaluation of the size and draft of the barge that would be needed to transport the reactor vessel and other heavy equipment to the site, dredging to the navigation channel in Lake Erie does not appear to be necessary (Detroit Edison 2011a). If it is later determined that dredging to the navigation channel is needed, Detroit Edison would apply for USACE and MDEQ permits, impacts would be assessed, and any necessary mitigative measures determined through the respective permit evaluation processes.

Radwaste Facility

Liquid, gaseous, and solid radioactive waste-management systems collect the radioactive materials produced as byproducts of operating the proposed Fermi 3. The radioactive waste management systems are designed to maintain releases of radioactive materials in effluents to "as low as reasonably achievable" levels in conformance with 10 CFR Parts 20 and 50, including the design objectives of 10 CFR 50, Appendix I (Detroit Edison 2011b). These systems would process radioactive liquid, gaseous, and solid effluents to maintain releases within regulatory limits, as described in Section 3.4.3. The Radwaste Building would be located adjacent to the Turbine Building (shown as "03" in Figure 3-1).

Sanitary Waste Treatment Plant

Sanitary waste systems needed at Fermi 3 during construction activities would consist of portable toilets supplied and serviced by an offsite vendor; there would be no sanitary waste system discharge into the effluent stream. During operations, the Fermi 3 wastewater treatment system would collect sewage and wastewater generated from portions of the plant that are outside radiological control areas. The system would use mechanical, chemical, and biological treatment processes. Sanitary effluent would be gathered and discharged to the Frenchtown Township Sewage Treatment Facility and would be required to meet applicable NPDES permit requirements, health standards, regulations, and total maximum daily loads (TMDLs) set by the Michigan Department of Environmental Quality (MDEQ) and the U.S. Environmental Protection Agency (EPA).

Wastewater treatment operations for Fermi 3 would be similar to those for the existing Fermi 2 and those that are commonly used in wastewater treatment plants throughout the United States. 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 would be those within the Frenchtown Township Sewage Treatment Facility, in keeping with municipal sewage treatment standards.

Power Transmission System

Transmission lines and corridors are considered to interface with the environment during operation, because there are potential continuing impacts from electric fields, noise, and corridor maintenance.

A system impact study conducted for Fermi 3 identified the need for a new onsite 345-kV switchyard and three new 345-kV transmission lines to connect Fermi 3 to the regional electrical grid (Detroit Edison 2011b). The new switchyard would be separate from the existing Fermi 2 switchyard and the onsite 120-kV transmission system.

A new 170-ft-wide transmission corridor (Figure 3-2) is planned on the Fermi site to service Fermi 3 (Detroit Edison 2011b). This transmission corridor would include two sets of towers that would carry both rerouted 345-kV lines that serve Fermi 2 and the new 345-kV lines that serve Fermi 3. The new transmission lines would transmit power from the Fermi 3 generator to the Fermi 3 switchyard at the intersection of Toll Road and Fermi Drive (Figure 3-2). Onsite 120-kV support for Fermi 2 would be routed underground along the Fermi Drive corridor.

The offsite route for the new lines will traverse approximately 30 mi within a 300-ft transmission line corridor along mostly existing corridors to the Milan Substation (Figure 3-8). The first 18.6 mi of transmission lines (going west and north from Fermi) would be installed alongside the 345-kV lines that are already in place (Figure 3-8). By reconfiguring conductors, new lines in this portion of the route could use existing towers, but placement of additional transmission infrastructure may be necessary. The remaining 10.8 mi of transmission lines to the Milan Substation would be located in an undeveloped portion of the transmission line corridor that was previously authorized for transmission use (Figure 3-8). Some transmission tower footings were installed as part of the original Fermi 3 plan, but the corridor has been minimally maintained. The 350-ft-by-500-ft Milan Substation may be expanded to an area about 1000 ft by 1000 ft to accommodate the Fermi 3 expansion (Detroit Edison 2011b).

Most of the 18.6-mi portion of the route crosses agricultural land, but the undeveloped 10.8-mi portion crosses a variety of land cover types including forest, agricultural lands, rural residential areas, and a golf course.

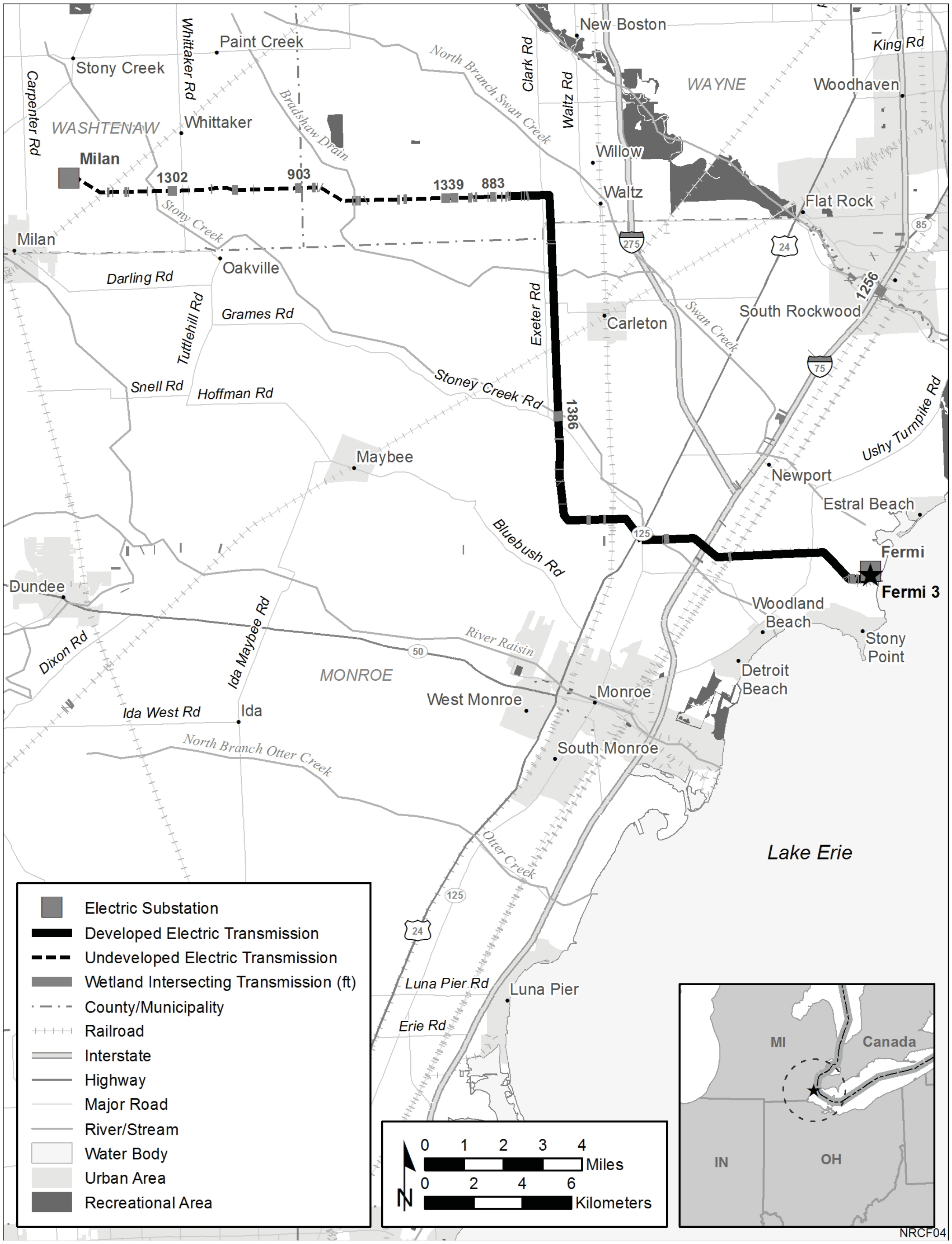

Figure 3-8. Proposed Transmission Line Corridor from Fermi 3 to Milan Substation (Detroit Edison 2011b)

ITC*Transmission* owns and operates the transmission system in southeastern Michigan. This system transfers power from regional power plants to local distribution systems, and carries power transfers from power plants to loads across the Eastern Interconnection (Detroit Edison 2011b). The offsite portions of the proposed Fermi 3 transmission system and associated corridors would be owned and operated by ITC*Transmission*. Detroit Edison has no control over the construction or operation of the transmission system and is not involved in the evaluation or decision making for proposed changes to or design of the transmission system. The two 345-kV transmission lines that would exit Fermi 3 would be owned by Detroit Edison up to the proposed new Fermi 3 switchyard. Detroit Edison would continue to own the onsite transmission corridor, but expects to contract with ITC*Transmission* to maintain these transmission lines and towers (Detroit Edison 2011b).

In addition to the new transmission lines and switchyard, upgrades to existing transmission lines would be needed to facilitate the new generation on the system (Detroit Edison 2011b). Transmission line and switchyard design would meet or exceed the requirements established in the National Electrical Safety Code (NESC) (IEEE 2007), which provides standards for electrical safety, electrical clearances, structural design loadings, and material strength factors. Modifications to the existing system would comply with relevant local, State, and industry standards, including NESC and various American National Standards Institute/Institute of Electrical and Electronic Engineers, Inc. (ANSI/IEEE) standards.

3.2.2.4 Other Temporary Plant-Environment Interfacing Structures

Temporary plant–environment interfacing structures include a concrete batch plant, construction laydown, a construction parking area, and groundwater dewatering systems.

Concrete Batch Plant

An onsite concrete batch plant would be used to produce concrete during Fermi 3 construction. Lake Erie water would be used for concrete production. The plant would be equipped with a dust-control system that would be checked and maintained on a routine basis. The location of the concrete batch plant onsite is expected to result in fewer offsite dust impacts than if concrete were produced offsite and trucked to the construction area.

Construction Laydown Areas and Temporary Parking

Portions of the Fermi site would be used for temporary construction parking and construction laydown (Figure 4-1). These areas would occupy a total of 143 ac (Detroit Edison 2011b). On completion of construction, these areas would be rehabilitated by removing gravel, replacing stocked topsoil, regrading, and revegetating.

Groundwater Wells and Dewatering Systems

Groundwater is not used for Fermi 2 operations, and has not been proposed for use during construction or operation of Fermi 3. However, it is possible that groundwater may be supplied to certain outbuildings as potable water during the construction period (Detroit Edison 2011b). This water use would be expected to be minimal. Groundwater wells or sumps are planned to dewater deep excavations during construction; however, no permanent dewatering systems would be required for Fermi 3.

3.2.3 Structures with Minimal Plant-Environmental Interface

The structures described in the following sections would have minimal interface with the environment during plant operation.

3.2.3.1 Power Block

Buildings and facilities within the power block would include the Reactor Building, Fuel Building, Control Building, Turbine Building, Radwaste Building, and several service buildings (e.g., Electrical Building, Service Water Building) (Figure 3-1).

The Reactor Building (shown as “01” in Figure 3-1) would house the reactor system, reactor support and safety systems, concrete containment, safety-related power supplies and equipment, steam tunnel, and refueling area (GEH 2010). The Fuel Building (shown as “11” in Figure 3-1) would house the spent fuel pool, cask loading area, fuel equipment and storage areas, lower connection to the inclined fuel transfer system, and other plant systems and equipment. The Reactor and Fuel Buildings would share a common wall and a large common foundation mat.

The Control Building (shown as “04” in Figure 3-1) would house safety-related electrical, control, and instrumentation equipment and the control room for the Reactor and Turbine Buildings (GEH 2010). The Turbine Building (shown as “03” in Figure 3-1) would be the tallest building within the power block (171 ft tall and with a 234 ft ventilation stack) and would house the turbine generator, main condenser, condensate and feedwater systems, condensate purification system, offgas system, turbine-generator support systems, and bridge crane.

The Radwaste Building (shown as “10” in Figure 3-1) would house the equipment and floor drain tank(s), sludge phase separator(s), resin hold-up tank(s), detergent drain collection tank(s), concentrated waste tank(s), chemical drain collection tank(s), and associated pumps and systems for the radioactive liquid and solid waste treatment systems (GEH 2010). Tunnels would connect the Radwaste Building to the reactor and Fuel and Turbine Buildings. The radwaste facility is discussed in Section 3.2.2.

3.2.3.2 Cranes and Crane Footings

Mobile cranes and a stationary crane would be used to facilitate the construction of the Fermi 3 power block. The stationary crane would require that footings be fabricated and cranes be erected on the site.

3.2.3.3 Ultimate Heat Sink

The ESBWR design has no separate emergency water cooling system. The ultimate heat sink function would be provided by safety systems integral and interior to the reactor plant. These systems would ultimately use the atmosphere as the heat sink. The ultimate heat sink would not rely on cooling towers, basins, or cooling water intake/discharge structures external to the reactor plant. In the event of an accident, the ultimate heat sink would be provided by the Isolation Condenser/Passive Containment Cooling Pools, which would provide the heat transfer mechanism for the reactor and containment to the atmosphere.

3.2.3.4 Pipelines

New pipelines would be needed to provide makeup water from Lake Erie for the CIRC, PSWS, and FPS. Cooling tower blowdown water would be discharged via a new pipeline and discharge structure within Lake Erie. The review team assumed that pipelines would follow existing roads or roads created when building Fermi 3. Therefore, the installation of pipelines would be limited to areas already disturbed.

3.2.3.5 Permanent Parking

Two new multiple-level parking garages would be built to accommodate Fermi 2 and 3 operational workers (shown as “38” on Figure 3-1 and “31” on Figure 3-2). The two parking garages are sized to accommodate Fermi 2 and Fermi 3 operational parking.

3.2.3.6 New Meteorological Tower

A new meteorological tower would be built for the Fermi site and would be located near the southeastern boundary of the property (shown as “42” in Figure 3-2) (Detroit Edison 2011b). Relocating the existing meteorological tower would be necessary because the Fermi 3 cooling tower would interfere with the current meteorological tower location. The new meteorological tower would be a guyed open-latticed tower and would have a height of 197 ft.

3.2.3.7 Miscellaneous Buildings

Several small buildings would be built on the site to support worker, construction, and operational needs (e.g., shop buildings, construction support offices, warehouses, guard houses). Some buildings may be temporary and would be removed after the plant begins operation.

3.3 Preconstruction and Construction Activities

Although nuclear-plant construction activities are similar to those for other large industrial facilities, the NRC's authority is limited to only those construction activities that have a "reasonable nexus to radiological health and safety or common defense and security" (72 FR 57432). This definition of "construction" includes placement of fill, mud mat, concrete, or permanent retaining walls within an excavation for safety-related structures, systems, or components (SSCs) (but not the excavation activity itself); installation of foundations; or in-place assembly, erection, fabrication, or testing of any safety-related SSC. This definition also extends to SSCs needed to mitigate accidents that are used in plant emergency operating procedures or whose failure could cause a safety-related problem. Activities fitting this definition of "construction" can only occur after the NRC issues a COL or a Limited Work Authorization.

Construction activities associated with structures that do not provide a safety function are called "preconstruction" by the NRC in 10 CFR 51.45(c). Preconstruction activities are not within the NRC's regulatory authority; they are typically regulated by other local, State, and Federal agencies. Preconstruction includes activities such as clearing and grading, excavating, and erection of buildings or facilities that do not support the reactor or associated safety structures. Examples of such facilities are parking lots, rail spurs, potable water systems, and sanitary waste treatment facilities. Activities associated with transmission line corridors are also considered preconstruction. Preconstruction activities can occur before, during, or after the construction of safety-related structures, but require the appropriate permits and authorizations from regulating agencies. Further information about the delineation of construction and preconstruction activities in this EIS is presented in Section 4.0.

In this section, those structures and activities that are associated with building a nuclear power plant are described without distinguishing whether those structures and activities are construction or preconstruction. Table 3-2 provides general definitions and examples of construction and preconstruction activities that would be performed in building the new unit. This section is not a comprehensive discussion of all activities or a detailed engineering plan for construction and preconstruction activities. Rather, this section provides an overall characterization of the major activities for the major structures to provide a framework for the activities involved in building the proposed nuclear power plants.

1 **Table 3-2**. Definitions and Examples of Activities Associated with Building Fermi 3

Activity	Definition	Examples
Clearing	Removing vegetation or existing structures from the land surface.	Cutting trees from an area to be used for construction laydown.
Grubbing	Removing roots and stumps by digging.	Removing stumps and roots of trees logged from the construction laydown area.
Grading	Reforming the elevation of the land surface to facilitate operation of the plant and drainage of precipitation.	Leveling the site of the reactors and cooling towers.
Hauling	Transporting material and workforce along established roadways.	Construction workers driving on new access road.
Paving	Laying impervious surfaces, such as asphalt and concrete, to provide roadways, walkways, parking areas, and site drainage.	Paving the new Fermi Drive.
Shallow excavation	Digging holes or trenches to a depth reachable with a backhoe. Shallow excavation may not require dewatering.	Pipelines; foundations for small buildings.
Deep excavation	Digging an open hole in the ground. Deep excavation requires equipment with greater vertical reach than a backhoe. Deep excavation generally requires dewatering systems to keep the hole from flooding.	Excavation of the basemat for the reactor.
Excavation dewatering	Pumping water from wells or pumping water directly to keep excavations from flooding with groundwater or surface runoff.	Pumping water from deep excavation for reactor building.
Dredging	Removing substrates and sediment in navigable waters or wetlands.	Enlargement of the barge slip.
Spoils placement	Placing construction (earthwork) or dredged material in an upland location.	Placing dredge spoils into a designated spoils disposal area.
Structure erection	Assembling structures into their final positions, including all connections between structures.	Using a crane to assemble structures.
Fabrication	Creating an engineered material from the assembly of a variety of standardized parts. Fabrication can include conforming native soils to some engineered specification (e.g., compacting soil to meet some engineered fill specification).	Preparing concrete for pouring; laying rebar for basemat.
Well drilling	Drilling and completing wells.	Drilling wells for dewatering or water supply.
Vegetation management	Thinning, planting, trimming, and clearing vegetation.	Maintaining the construction parking lots and laydown areas free of vegetation.
Filling a wetland or waterbody	Discharging dredge and/or fill material into waters of the United States, including wetlands.	Placing fill material into wetlands to bring it to grade with the adjacent land surface.

3.3.1 Areas Affected by Preconstruction and Construction Activities

Detroit Edison has stated (Detroit Edison 2011d) that construction and preconstruction activities for Fermi 3 would occur on approximately 301 ac of the Fermi property; however, previously developed areas account for 112 ac; thus, only 189 ac would be considered new disturbance. Approximately 154 ac of the Fermi site would be occupied by permanent Fermi 3 facilities. Areas that do not contain permanent structures would be reclaimed after construction to the maximum extent possible and, where practicable, would be replanted or allowed to revegetate naturally.

3.3.1.1 Landscape and Stormwater Drainage

During building of Fermi 3, parts of the Bass Islands aquifer below the site would be excavated, dewatered, and potentially grouted to facilitate construction of the plant. Fluids from dewatering activities would be discharged through stormwater outfalls, as regulated by an NPDES permit (Detroit Edison 2011b). Additional grading and land clearing would be done for activities such as preparing construction laydown areas. Stormwater runoff would be managed according to the required soil erosion and sedimentation control (SESC) plan; the NPDES construction permit, including EPA (2009) effluent limitations; and any other permits required for such activities.

Land would be graded and stormwater pipes would be installed to facilitate stormwater drainage from Fermi 3. The existing site grade would be raised to 589.3 ft NAVD 88 in the vicinity of safety-related structures, approximately 7.5 ft above the current Fermi plant grade. The power block would contain drop inlets connected to a stormwater collection system that would route stormwater to the North Lagoon, which drains to Swan Creek.

3.3.1.2 Power Block and Cooling Tower

Building the Fermi 3 power block is anticipated to affect 87 ac including the natural draft cooling tower, fabrication area, construction offices, and the concrete batch plant (Detroit Edison 2011b). Deep excavations would be required for certain Fermi 3 building foundations including approximately 50 ft for the Reactor Building, 46 ft for the Radwaste Building, 43 ft for the Control Building, and 31 ft for the Turbine Building. Dewatering would be necessary during excavation and foundation building and could be accomplished using sumps within the excavation and, if necessary, groundwater extraction wells. Portions of the subsurface could be injected with grout to reduce inflow of groundwater to the excavation areas (Detroit Edison 2011b). Grouting was done during construction of Fermi 2, resulting in a reduction in hydraulic conductivity and less inflow of water into the excavation area (Detroit Edison 2011b).

3.3.1.3 Intake Structure

The new intake structure would involve building a pump house near the intake structure for Fermi 2. The intake structure itself would be built on previously developed portions of the Lake Erie shore. Additional hydraulic dredging of the intake bay would be required for building of the intake structure. Material that is dredged from the intake bay would be disposed of in the Fermi Spoils Disposal Pond.

3.3.1.4 Discharge Structures

A portion of Lake Erie would be affected by building the Fermi 3 cooling water discharge pipe. Flow would exit to Lake Erie through three ports in a multi-port diffuser approximately 1300 ft east of the Lake Erie shoreline at the Fermi site. The ports would be at an elevation of approximately 1.6 ft above the lake bed. A 1300-ft line at least 5 ft deep and 5 ft wide at the bottom would be mechanically dredged into Lake Erie for the discharge pipe. The pipe would be installed within the bottom of Lake Erie in a bed of structural fill. Installation of the discharge structure would require USACE and MDEQ permits. Material that is dredged for the discharge pipe installation would be disposed of in the Fermi Spoils Disposal Pond (Figure 3-2) in conjunction with the NPDES permit.

3.3.1.5 Barge Slip

The barge slip that was used to offload equipment during Fermi 2 construction would be reconfigured to allow delivery of certain equipment and supplies during construction of Fermi 3. The barge slip and offloading area are cleared gravel with some trees and weedy vegetation along a sandy inlet area having no permanent structures. The facility would require substantial dredging and other preparation work before it could be used for equipment delivery, but dredging activities are expected to be similar to those associated with ongoing operations and maintenance dredging of the existing intake embayment.

3.3.1.6 Roads

New onsite roads would be graded and paved. Temporary access roads may need to be constructed. A road is planned to be constructed parallel to the current Fermi Drive, to accommodate construction traffic associated with Fermi 3 (Detroit Edison 2011b).

3.3.1.7 Pipelines

Pipelines would be installed for the CIRC, stormwater collection systems, intake structures, and discharge structures. Shallow excavation (trenching) would be necessary to install the subsurface pipelines, with the exception of the aforementioned discharge pipeline, which would require permitted dredging as mentioned in Section 3.3.1.4.

3.3.1.8 Transmission Line Corridors

Installing transmission lines would require the removal of trees and shrubs along portions of the transmission line corridor, movement of construction equipment, and shallow excavation for the foundations of the transmission line towers. It is assumed that development of the first 18.6 mi of transmission line from the Fermi 3 switchyard would require minimal land disturbance because the lines would be placed in an existing developed corridor. The 10.8 mi corridor to the Milan substation is currently undeveloped, and building this portion of the line could disturb 393 ac of mostly forested and agricultural lands. A total of 1069 ac of land would be occupied by the 29.4 mi long transmission line corridor.

A new 170-ft-wide transmission corridor (Figure 3-2) is planned on the Fermi site to service Fermi 3 (Detroit Edison 2011b). This transmission corridor would include two sets of towers that would carry both rerouted 345-kV lines that serve Fermi 2 and the new 345-kV lines that serve Fermi 3. Clearing of vegetation and land disturbance for this transmission line would be limited to the location of transmission towers because the wetland area traversed by the line could be spanned without clearing.

3.3.1.9 Switchyard

Detroit Edison would build a new switchyard containing three 345-kV transmission lines to transport to power generated by Fermi 3. The Fermi 3 switchyard would be constructed on 10 ac of the prairie restoration area at the intersection of Fermi Drive and Toll Road (shown as “28” on Figure 3-2). The offsite Milan Substation may be expanded in size, and this expansion would affect an additional 19 ac.

3.3.1.10 Construction Support and Laydown Areas

A total of 143 ac have been identified for possible construction laydown areas (Detroit Edison 2011b): 60 ac in an agricultural field next to the proposed Fermi 3 switchyard, 20.5 ac north and west of the intersection of Fermi Drive and Doxy Road, and 61 ac located in separate parcels around the Quarry Lakes (Figure 3-2). Existing topsoil would be removed, geofabric would be laid down, and the areas would be surfaced with rock. It is anticipated that construction laydown areas would be used during construction and then restored following project completion.

3.3.1.11 Parking and Warehouse

A parking structure and a warehouse would be built in the area to the west and north of the Fermi 3 power block, and about 7 ac of open water (the entire central canal and parts of the north and south canals) would be filled in to facilitate building a parking structure and a warehouse on a total of 5 ac (Figure 3-1).

3.3.1.12 Miscellaneous Buildings

The construction of the meteorological tower and its access road is anticipated to affect approximately 6 ac in the southeast portion of the Fermi site (Figure 3-2). In the southeast corner of the site, the Fermi 3 Simulator, the EF2/EF3 Administrative Building, and the parking garage would affect approximately 7 ac in an area that was previously impacted by construction activities. Shallow excavation and land clearing would likely be required prior to building activities.

3.3.1.13 Cranes and Crane Footings

Mobile cranes and a stationary crane would be used during building installation. The impact of these cranes is included in the area of impact within the Fermi 3 power block.

3.3.2 Summary of Resource Commitments Resulting from the Building of Fermi 3

Table 3-3 provides a list of the resource commitments resulting from the building of Fermi 3. The values in the table combined with the affected environment described in Chapter 2 provide the basis for the construction and preconstruction impacts assessed in Chapter 4. The sources of the values are provided, and the review team has confirmed that each of the values is not unreasonable.

3.4 Operational Activities

The operational activities considered in the review team's environmental review are those associated with structures that interface with the environment, as described in Section 3.2.2. Examples of operational activities are withdrawing water for the cooling system, discharging blowdown water and sanitary effluent, and discharging waste heat to the atmosphere. Activities within the proposed ESBWR plant are discussed by Detroit Edison in the Fermi 3 FSAR (Detroit Edison 2011c) and are reviewed by the NRC in its Safety Evaluation Report (final expected in September 2012). Structures that interface with the environment and related operational activities are listed in Table 3-4.

The following sections describe the operational activities, including operational modes (Section 3.4.1), plant-environment interfaces during operations (Section 3.4.2), and the radioactive and nonradioactive waste management systems (Sections 3.4.3 and 3.4.4); the values of resource parameters likely to be experienced during operations are summarized in Section 3.4.5.

1 **Table 3-3**. Summary of Parameters and Resource Commitments Associated with Building
2 the Proposed Fermi 3

Resource	Value	Description and References
Disturbed land area footprint onsite	301 ac total; of that 154 ac would be permanently occupied; of the 301 ac, 189 ac consists of currently undeveloped land	ER Section 4.1.1.1, p. 4-5 and Table 10.1-2, p. 10-8
Length of new transmission line corridors	Onsite: less than 1 mi from Fermi 3 to switchyard	ER Section 2.2.2.2, p. 2-22
	Offsite: 29.4 mi (18.6 mi of currently developed corridor; 10.8 mi of undeveloped corridor)	ER Section 2.2.2.2, p. 2-23
Width of new transmission line corridors	Onsite: 170 ft	ER Section 2.2.2.2, p. 2-22
	Offsite: 300 ft	ER Section 2.2.2.2, p. 2-23
Disturbed land area in new onsite transmission corridor	20 ac	Calculated from information in ER Section 2.2.2.2, p. 2-22
Disturbed land area for Milan Substation expansion	19 ac	ER Section 2.2.2.2, p. 2-23
Land area permanently occupied by 29.4 mi offsite transmission corridor	1069 ac; 393 ac in new corridor	ER Section 2.2.2.2, p. 2-23; Table 4.1-1, p. 4-23
Excavation depth to which dewatering would be required	40 ft to 50 ft below grade	Design Control Document, Rev. 6, Section 1.2.2.16; ER Section 4.2.1.5
Water use	350,000 to 600,000 gpd	Obtained from Lake Erie; ER Section 4.2.1.3, p. 4-26
Water discharge	200 gpm (288,000 gpd) dredge effluent discharge; no discharge of sanitary waste	Permitted discharge to Spoils Disposal Pond; ER Section 4.2.1.4, p. 4-24
Workforce	Increase from 150 workers in first 2 years to maximum 2900 workers	ER Section 4.4.2, p. 4-71
Duration of preconstruction and construction activities	9 to 12 years	ER Section 4.4.2, p. 4-71
Noise	89 dBA maximum construction noise level at 50 ft from activity; 63 dBA 1000 ft from activity	ER Section 4.4.1.1.3, Table 4.4-1, p. 4-90

Table 3-4. Operational Activities Associated with Major Structures

Structure Interfacing with Environment	Water Withdrawal from Lake Erie	Traveling Screen Operations	Cooling Tower Blowdown	Heat Dissipation to Atmosphere	Electricity Generation	Solid or Liquid Nonradioactive Waste Export	Gaseous Nonradioactive Effluent Discharge	Liquid Nonradioactive Effluent Discharge	Solid Radioactive Waste Export	Gaseous Radioactive Effluent Discharge	Liquid Radwaste Discharge	Stormwater Discharge	Personnel into and out of Site	Maintenance Dredging Spoils	Vegetation Management
Stormwater management system												x			x
Intake structure	x	x													
Discharge structure			x					x			x				
Cooling towers				x											
Diesel generators, auxiliary boiler, diesel fire pumps					x		x								
Roads						x	x						x		x
Rail lines						x	x								x
Barge slip														x	
Radwaste facility						x	x			x	x				
Sanitary waste treatment plant								x							
Power transmission system					x										x

3.4.1 Description of Operational Modes

The following sections describe the operational systems for the proposed Fermi 3 under normal operating conditions and under emergency shutdown conditions. Design basis accidents and severe accidents are not considered to be normal plant operations. Modes of operation can be divided into six categories: power operation, startup, hot shutdown, safe shutdown, cold shutdown, and refueling. Lake Erie would be the water source for all normal cooling and shutdown conditions. There is no separate emergency cooling water system. Fermi 3 would have its own supply of cooling water for safety-related cooling in the ultimate heat sink. Effluent discharges during normal plant operations at full capacity would be at their highest levels.

Therefore, impacts discussed in subsequent sections exclusively consider discharges during normal operations at full capacity.

3.4.2 Plant-Environment Interfaces during Operations

Fermi 3 operational activities as they relate to structures or systems with an interface to the environment are discussed in this section.

3.4.2.1 Station Water System – Intakes, Discharges, Cooling Towers

Lake Erie would supply the nonsafety-related cooling at Fermi 3 for the SWS, which would supply the CIRC and the PSWS. The cooling water in the CIRC provides heat dissipation from the main condensers to the NPHS. The NPHS for Fermi 3 would be a natural draft cooling tower as shown in Figures 3-1 and 3-3. The cooling water in the PSWS would provide heat dissipation from the heat exchangers of both the Turbine Component Cooling Water System and the Reactor Component Cooling Water System.

The SWS would supply makeup water to the NPHS and AHS cooling tower basins and would consist of two subsystems: the PCTMS and the PWSS. The PCTMS would provide makeup water from Lake Erie for evaporation, drift, and blowdown losses. During normal power operations, the NPHS would reject heat from the plant at a rate of 1.07×10^{10} Btu/hr (Detroit Edison 2011b). It is anticipated that Fermi 3 will be in normal mode 96 percent of the time and will shut down for refueling every 2 years for 30 days (Detroit Edison 2011b).

The heat from the PSWS would be dissipated to the NPHS and/or the AHS. The AHS would reject heat during startup, hot shutdown, stable shutdown, cold shutdown, and refueling at a rate of 2.98×10^{8} Btu/hr (Detroit Edison 2011b). The AHS could also be used during normal power operations. The AHS would consist of mechanical draft cooling towers and would be housed in the Water Treatment/Service Water Building (Figure 3-1) on the southeast side of the Fermi 3 power block. The PWSS would provide water for the FPS and serve as an alternate to the PCTMS for supplying PSWS makeup water to the cooling towers.

During normal plant operations, the only variable quantity of water use would be the amount of water that would be consumed by evaporation and drift from the cooling towers, which would vary based on the ambient temperature conditions (Detroit Edison 2011b). The monthly average anticipated water intake from Lake Erie would vary between approximately 23,750 and 33,500 gpm (Table 3-5). Monthly average consumptive use of water for cooling (drift plus evaporation) would vary between 11,882 and 16,757 gpm, and monthly discharge to Lake Erie (blowdown) would vary between 11,868 and 16,743 gpm.

- The maximum discharge to Lake Erie would be 17,110 gpm (Table 3-1).

Table 3-5. Monthly Fermi 3 Cooling Water Discharge Temperature and Flow Rates

Month	Discharge Temperature (°F)	Blowdown Flow Rate (gpm)	Drift Flow Rate (gpm)	Evaporation Flow Rate (gpm)	Makeup Flow Rate (gpm)
January	53.8	11,868	7.2	11,875	23,750
February	55.3	12,193	7.2	12,200	24,400
March	59.4	13,093	7.2	13,100	26,200
April	66.0	14,293	7.2	14,300	28,600
May	72.7	15,393	7.2	15,400	30,800
June	78.4	16,293	7.2	16,300	32,600
July	81.5	16,743	7.2	16,750	33,500
August	80.8	16,693	7.2	16,700	33,400
September	76.3	16,093	7.2	16,100	32,200
October	68.8	14,793	7.2	14,800	29,600
November	62.7	13,743	7.2	13,750	27,500
December	56.6	12,493	7.2	12,500	25,000

Source: Detroit Edison 2011b

- The maximum consumptive water use rate (evaporation and drift) would be 17,124 gpm (Table 3-1).
- The maximum makeup water flow rate would be 34,264 gpm (Table 3-1).

During shutdown conditions, less than 1166 gpm would be needed for makeup water to the plant (Table 3-1). Approximately 639 gpm of water would be consumed by evaporation and drift from cooling, and 569 gpm would be discharged back to Lake Erie. Periodic dredging of the intake canal would be required. Potential radwaste discharges from the plant are discussed in Section 3.4.2.3. Any discharges from Fermi 3 would require a NPDES permit, similar to the one already regulating Fermi 2 discharges.

The atmosphere would receive heat and water in the form of cooling tower vapor and drift.

3.4.2.2 Power Transmission System

During operation of Fermi 3, the power transmission line system would need to be maintained free of vegetation by ITC*Transmission*. Vegetation removal activities would include trimming and application of herbicides periodically and on an as-needed basis along the transmission line corridor.

3.4.2.3 Radioactive Waste-Management Systems

Liquid, gaseous, and solid radioactive waste management systems would be used to collect and treat the radioactive materials produced as byproducts of operating Fermi 3. These systems would process radioactive liquid, gaseous, and solid effluents to maintain releases within regulatory limits and to levels as low as reasonably achievable before releasing them to the environment. Waste-processing systems would be designed to meet the design objectives of 10 CFR Part 50, Appendix I ("Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents"). Radioactive material in the reactor coolant would be the primary source of gaseous, liquid, and solid radioactive wastes in light-water reactors. Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products would be contained in the sealed fuel rods, but small quantities would escape the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system would also be responsible for coolant contamination.

The Offsite Dose Calculation Manual (ODCM) for the operating Fermi 2 was revised in 2010 and is attached as Appendix C to the 2010 radioactive effluent and monitoring report for Fermi 2 (Detroit Edison 2011e). It describes the methods and parameters used for calculating offsite radiological doses from liquid and gaseous effluents. The ODCM also describes the methodology for calculation of gaseous and liquid monitoring alarm/trip set points for release of effluents from Fermi 2. Operational limits for releasing liquid and gaseous effluents are also specified in the ODCM to ensure compliance with NRC regulations. This ODCM will be revised to include operation of Fermi 3 or a similar ODCM will be developed for Fermi 3.

Summary descriptions of the liquid, gaseous, and solid radioactive waste management systems for the proposed Fermi 3 are presented in the following sections. A more detailed description of these systems can be found in Chapter 11 of the ESBWR Design Control Document (DCD) (GEH 2010).

Liquid Radioactive Waste Management System

The liquid radioactive waste management system (LWMS) would function to collect, monitor, process, store, and dispose of liquids containing radioactive material. The LWMS consists of four subsystems: equipment drain system, floor drain system, chemical drain system, and detergent drain system. The LWMS process flow diagram is provided in Figure 11.2-1 of the DCD (GEH 2010). Processing would be managed using evaporation, centrifugal separation, demineralization, and filtration in several process trains consisting of tanks, pumps, reverse osmosis, ion-exchanger, and filters. The system is designed to handle both normal and anticipated operational occurrences. Normal operations would include processing of (1) reactor coolant system effluents, (2) floor drains and other wastes with potentially high suspended solid contents, (3) chemical wastes, and (4) detergent wastes.

All liquid effluent discharges from the tanks to the environment are monitored so that the radioactivity release levels do not exceed the levels specified in 10 CFR Part 20, Appendix B, Table 2. The total liquid radioactive source term for liquid effluents can be found in

Table 12.2-19b of the DCD (GEH 2010). Calculated doses to the maximally exposed individual (MEI) and the population within 50 mi are presented in Section 5.9.2.

Gaseous Radioactive Waste Management System

The gaseous radioactive waste management system would function to collect, process, and discharge gaseous radioactive effluents. Gaseous radionuclides generated during normal operation of Fermi 3 include gaseous fission products and gaseous radionuclides formed by neutron activation of the reactor coolant and contained gases. These gases would be retained in the plant systems and removed in a controlled fashion through the gaseous waste management system. The building heating, ventilating, and air-conditioning (HVAC) systems and power cycle off-gas system (OGS) are the two main sources of the plant gaseous effluent. The gaseous waste management system, or OGS, collects waste from multiple sources and delays its release to allow short-lived radionuclides to decay. In the off-gas process, the OGS would use activated charcoal absorber beds for holdup and decay of radioactive gases containing radioactive isotopes of krypton, xenon, iodine, nitrogen, and oxygen.

All gaseous effluents from the gaseous waste processing system, the containment ventilation purge system, the main condenser exhaust, and ventilation from the Radwaste Building, the Fuel Pool Building, Reactor Building, Turbine Building, and the safeguards and access-controlled areas would be released via the plant stacks. Gaseous effluents would be monitored upon discharge so that radioactivity release levels are not exceeded. The total gaseous radioactive source term for gaseous effluents can be found in Table 12.2-16 of the DCD (GEH 2010) and FSAR Table 12.2-206 (Detroit Edison 2011c). Calculated doses to the MEI are presented in Section 5.9.2.

Solid Radioactive Waste Management System

The solid radioactive waste management system (SWMS) for Fermi 3 would function to control, collect, handle, process, package, and temporarily store dry or wet solid radioactive waste before shipment offsite. The SWMS located in the Radwaste Building is a four-part system, including the waste collection system, the waste processing system, the dry waste accumulation and conditioning system, and the container storage system. The SWMS process flow diagram is provided in Figure 11.4-1 of the DCD (GEH 2010). Solid radioactive wastes include filter backwash sludge, reverse-osmosis concentrates, bead resins generated by the LWMS, the reactor water cleanup/shutdown cooling system, the fuel and auxiliary pools cooling systems, the high-efficiency particulate air (HEPA) and cartridge filters, and rags, plastic, paper, protective clothing, tools, and equipment. The SWMS is designed to handle both normal and anticipated operational occurrences. There are no onsite facilities for permanent disposal of solid wastes, so the packaged wastes would be temporarily stored in the Auxiliary and Radwaste Buildings prior to being shipped to a licensed disposal facility.

The estimated annual solid radwaste volumes of dry active solids, wet solids, and mixed waste generated by an ESBWR are estimated to be 363, 110.8, and 0.416 m^3/yr, respectively (GEH 2010).

3.4.2.4 Nonradioactive Waste Systems

The following sections provide descriptions of the nonradioactive waste systems proposed for Fermi 3, including systems for chemical or biocide, sanitary, and other effluents. This category of effluent includes nonradioactive gaseous emissions, liquids, hazardous waste, mixed wastes, and solids.

Effluents Containing Chemicals or Biocides

Water chemistry for various plant water uses would be controlled with the addition of biocides, algaecides, corrosion inhibitors, scale inhibitors, and dehalogenators. Fermi 3 would use chemicals and biocides similar to those currently used for the existing Fermi 2 including sodium hypochlorite, sodium silicate, and sodium bisulfite. Cooling water effluents from Fermi 3 would be discharged to Lake Erie and may be subject to the limitations of the Fermi site's existing NPDES permitted outfalls. Estimated concentrations of chemicals in Fermi 3 discharge are presented in Table 3-6 (Detroit Edison 2011b).

Table 3-6. Estimated Concentrations of Chemicals in Fermi 3 Cooling Water Discharges[(a)]

Chemical	Maximum Concentration (ppm)	Mean Concentration (ppm)
Sodium (Na)	46.6	34.3
Calcium (Ca)	71.9	71.9
Magnesium (Mg)	17.4	17.4
Silica (SiO_2)	19.9	19.5
Chloride (Cl)	61.3	42.5
Sulfate (SO_4)	38.5	38.5
Potassium (K)	3.6	3.6
Scale inhibitor/dispersant	11.6	11.6
Bicarbonate alkalinity ($CaCO_3$)	167.8	167.7
Total dissolved solids (TDS)	428.5	397.4
Total suspended solids (TSS)	16.0	16.0

Source: Detroit Edison 2011b
(a) Based on two cycles of concentration.

Makeup water to the SWS would be treated with the biocide/algaecide sodium hypochlorite before it enters the pumps at the intake from Lake Erie. The SWS would supply water to the CIRC, the PSWS, and the FPS. Biocide injection is an important step to remove plant and animal life from the water, including invasive zebra mussels. If mussels do make it into the SWS, they could be killed through either chlorination or thermal shock treatment.

Both the influent to and the effluent from the CIRC would be treated. A biocide, a corrosion inhibitor, and a scale inhibitor would be injected into the CIRC at the inlet to the condenser. Before the CIRC water is discharged to Lake Erie, the water would be treated using sodium bisulfite for dehalogenation and maintenance of oxidant water quality standards. Water entering the PSWS also would be treated with biocide, corrosion inhibitor, and scale inhibitor. When the water from Lake Erie has high turbidity, an additional chemical to reduce sediment would be injected into the PSWS.

Water discharge temperatures would vary monthly as shown in Table 3-5 (Detroit Edison 2011b). The discharge temperature at times could reach a maximum of 86°F (Detroit Edison 2011b). When the Turbine Bypass System is in operation, the temperature of the discharge could reach up to 96°F. Impacts presented in subsequent sections consider discharges during normal operations and at full capacity.

Sanitary System Effluents

Sanitary waste effluent would first be mechanically treated at Fermi 3 using an onsite treatment system consisting of a waste basin, wet well, septic tank, settling tank, wet well pumps, sewage discharge pumps, and associated piping and controls. After onsite treatment, sanitary waste water would be discharged to the Frenchtown Township Sewage Treatment Facility. In addition to wastes generated by domestic uses, Detroit Edison would discharge the demineralized water effluent from the auxiliary boiler to the Sanitary Waste Discharge System. Detroit Edison projected that the maximum volume of sanitary effluent would be 253 gpm during normal operations. During shutdown operations, Detroit Edison projected that the average volume of sanitary effluent would be 258 gpm (Figure 3.3-1 of the ER) (Detroit Edison 2011b).

Other Effluents

Fermi 3 would have two standby diesel generators, two ancillary diesel generators, two diesel-driven fire pumps, and one package auxiliary boiler system. The gaseous and particulate emissions from the operation of the standby and ancillary diesel generators, fire pumps, and the auxiliary boiler would be in compliance with all applicable standards (Detroit Edison 2011b).

Fermi 3 would have nonradioactive liquid discharges from stormwater runoff and various plant drains. The potential release of nonradioactive liquid effluents to Lake Erie would be controlled to meet restrictions of the Fermi 3 NPDES permit and Section 401 Water Quality Certification (Detroit Edison 2011b).

The location of Fermi 3 is within the Swan Creek watershed, and water running off of the Fermi 3 developed area would drain primarily to Swan Creek before entering Lake Erie. Drop inlets on the power block would collect the stormwater runoff resulting from storm events and route it to Swan Creek. If storm drains were blocked, runoff would drain off the elevated area in all directions and flow into the North Lagoon, the South Lagoon, or Lake Erie. Stormwater drainage patterns are shown in Figures 2.4-215 and 2.4-217 of the FSAR (Detroit Edison 2011c).

Fermi 3 would produce effluents from various plant drains including equipment drains, floor drains, laundry and chemical drains, and other miscellaneous periodic drains. Effluent from these drains would be treated, combined with the cooling water discharge, and then discharged into Lake Erie through the discharge pipe.

Table 3-7 lists the types of hazardous wastes generated by the existing Fermi 2, including laboratory solvents, paint wastes, and aerosol residues; similar wastes are expected from operation of proposed Fermi 3 (Detroit Edison 2011b). The generation, treatment, storage, and disposal of hazardous wastes are governed by the Federal Resource Conservation and Recovery Act (RCRA) regulations. Detroit Edison addresses RCRA requirements for Fermi 2 and would manage hazardous wastes from Fermi 3 in the same manner.

Table 3-7. Quantities of Hazardous Wastes Generated during Fermi 2 Operations

Hazardous Waste Type	2007 (lb)	2006 (lb)	2005 (lb)
Paint – related materials	43	1782	387
Oil/solvent waste	103	20	506
Fiber wound parts – cleaner filters	7	0	309
Vehicle antifreeze – used	600	0	20
Munge-Blanchard and surfacegrinder/marble saw	180	0	210
Lead paint/contaminated mat	0	80	120
Lead contaminated rags/debris	45	0	405
Aerosol cans	692	70	1167
Leaking lead-acid batteries	0	75	0
Cutting fluids	0	80	0
Sand blast grit	0	1222	0
Parts cleaner solvent	0	32	0
Total	**1670**	**3361**	**3136**

Source: Detroit Edison 2011b

Mixed waste is a combination of hazardous waste and low-level radioactive material, special nuclear material, or byproduct materials. Mixed waste could be created during activities such as routine maintenance, refueling, and radiochemical laboratory work. NRC (10 CFR) and EPA (40 CFR) regulations govern generation, management, handling, storage, treatment, disposal, and protection requirements associated with these wastes. Management of these wastes would conform to applicable Federal and State requirements in a similar manner as that for Fermi 2. The quantities expected from Fermi 3 would be small (Detroit Edison 2011b), as they are from other nuclear power plants.

During construction of Fermi 3, solid effluents that could be disposed of in a landfill include clays, sand, gravels, silts, topsoil, tree stumps, root mats, brush and limbs, vegetation, and rocks. Such a landfill for land clearing debris does not require a permit but must comply with regulations issued by the state of Michigan for solid waste facilities.

During operation of Fermi 3, solid waste would be generated from periodic plant maintenance projects. Nonradioactive solid waste would be reused or recycled according to existing Fermi 2 plans to the extent practicable, and the rest would be disposed of at an approved and licensed offsite commercial waste disposal facility.

3.4.3 Summary of Resource Parameters during Operation

Table 3-8 summarizes the operational parameters that are relevant to assessing the environmental impacts of operating Fermi 3.

Table 3-8. Resource Parameters Associated with Operation of Proposed Fermi 3

Item	Value	Description and References
Project footprint	Commitment of approximately 154 ac onsite, and 1069 ac for offsite transmission corridor	ER Table 10.1-2
Operations workforce	900 workers	ER Section 5.8.2.1, p. 5-158
Total makeup water intake	Minimum: 23,780 gpm; average: 28,993 gpm; maximum: 34,264 gpm	ER Figure 3.3-1, p. 3-22
NPHS makeup water intake	Minimum: 23,750 gpm; average: 28,963 gpm; maximum: 34,234 gpm	ER Figure 3.3-1, p. 3-22
NPHS drift and evaporation	Minimum: 11,882 gpm; average: 14,488 gpm; maximum: 17,124 gpm	ER Figure 3.3-1, p. 3-22
NPHS discharge	Minimum: 11,868 gpm; average: 14,474 gpm; maximum: 17,110 gpm	ER Figure 3.3-1, p. 3-22
Waste heat to atmosphere	1.07×10^{10} BTU/h	ER Section 3.4.1.6, p. 3-26
Blowdown temperature	Monthly discharge temperatures range from 53.8 to 81.5°F	ER Table 3.4-1, p. 3-30
Solid radwaste volume	Dry active: 363 m^3/yr; wet solid: 110.8 m^3/yr; mixed: 0.416 m^3/yr	DCD Table 11.4-2
Sanitary system discharge	Average: 88 gpm; maximum normal operations: 253 gpm; average shutdown operations: 258 gpm	ER Figure 3.3-1, p. 3-22
Power transmission system	Vegetation management on 1069 ac	ER Section 2.2.2.2, p. 2-22; Table 4.1-1, p. 4-20
NPHS sound level at 1000 ft	55 to 60 dBA at 1000 ft	ER Section 3.4.1.6, p. 3-26
AHS sound level at 1000 ft	55 to 60 dBA at 1000 ft	ER Section 3.4.1.6, p. 3-26

3.5 References

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10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

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4.0 Construction Impacts at the Proposed Site

This chapter examines the environmental issues associated with the construction of a proposed new Enrico Fermi Unit 3 (Fermi 3), at the Enrico Fermi Atomic Power Plant (Fermi) site, as described in the application for a combined license (COL) submitted by Detroit Edison Company (Detroit Edison). As part of its application, Detroit Edison submitted an Environmental Report (ER) (Detroit Edison 2011a), which discusses the environmental impacts of building, operating, and decommissioning the proposed Fermi 3, and a Final Safety Analysis Report (FSAR) (Detroit Edison 2011b), which addresses safety aspects of construction and operation.

In addition to the COL application, Detroit Edison plans to apply for a Department of Army permit from the U.S. Army Corps of Engineers (USACE) to conduct activities in or affecting waters of the United States, including wetlands. In addition, Detroit Edison will be required to submit a number of other applications for permits and certifications related to construction to the USACE and the Michigan Department of Environmental Quality (MDEQ). At the time of this draft environmental impact statement (EIS), Detroit Edison had not yet applied for these permits and certifications.

As discussed in Section 3.3 of this EIS, the U.S. Nuclear Regulatory Commission's (NRC's) authority is limited to "construction activities that have a reasonable nexus to radiological health and safety and/or common defense and security" (72 FR 57416). Many of the activities required to build a nuclear power plant do not fall within the NRC's regulatory authority and therefore are not "construction" as defined by the NRC; such activities are referred to as "preconstruction" activities in Title 10 of the Code of Federal Regulations (CFR) 51.45(c). The NRC staff evaluates the direct, indirect, and cumulative impacts of the construction activities that would be authorized with the issuance of a COL. The environmental effects of preconstruction activities (e.g., clearing and grading, excavation, and erection of support buildings) will be included in the evaluation of cumulative impacts.

As described in Section 1.1.3 of this EIS, the USACE is a cooperating agency on this EIS consistent with the updated Memorandum of Understanding (MOU) signed with the NRC (USACE and NRC 2008). The NRC and USACE established this cooperative agreement because both agencies have concluded it is the most effective and efficient use of Federal resources in the environmental review of a proposed new nuclear power plant. The goal of this cooperative agreement is the development of one EIS that provides all the environmental information and analyses needed by the NRC to make a license decision and all the information needed by the USACE to perform analyses, draw conclusions, and make a permit decision in the USACE's regulatory permit decision document. In an effort to accomplish this goal, the environmental review described in this EIS was conducted by a joint NRC/USACE team. The review team was composed of NRC staff and its contractors and staff from the USACE.

The USACE is responsible for ensuring that the information presented in this EIS is adequate to fulfill the requirements of USACE regulations; the Clean Water Act (CWA) Section 404(b)(1) “Guidelines,” which contain the substantive environmental criteria used by the USACE in evaluating discharges of dredged or fill material into waters of the United States; and the USACE public interest review process. The USACE will decide whether to issue a permit on the basis of an evaluation of the probable impact, including the cumulative impacts of the proposed activity on the public interest. In accordance with the Guidelines, no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have a less adverse impact on the aquatic ecosystem, provided the alternative does not have other significant adverse consequences. The USACE permit decision will reflect the national concern for both protection and utilization of important resources. The benefit that reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. Factors that may be relevant to the proposal, including its cumulative effects, will be considered; among those factors are conservation, economics, aesthetics, general environmental concerns, wetlands, historic resources, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and in general, the needs and welfare of the people (see Appendix J of this EIS for a summary of the USACE public interest factors and Detroit Edison’s analysis of the impacts of alternative site layouts on waters of the United States, including wetlands).

Many of the impacts that the USACE must address in its analysis are the result of preconstruction activities. In addition, most of the activities conducted by a COL applicant that would require a permit from the USACE would be preconstruction activities.

While both the NRC and the USACE must meet the requirements of the National Environmental Policy Act of 1969, as amended (NEPA), both agencies have mission requirements that must be met in addition to the NEPA requirements. The NRC’s regulatory authority is based on the Atomic Energy Act of 1954, as amended (42 USC 2011 *et seq.*). The USACE’s regulatory authority that is related to the proposed action is based on Section 10 of the Rivers and Harbors Appropriation Act of 1899 (RHAA) (33 USC 403 *et seq.*), which prohibits the obstruction or alteration of navigable waters of the United States without a permit from the USACE, and Section 404 of the Clean Water Act (33 USC 1344), which prohibits the discharge of dredged or fill material into waters of the United States without a permit from the USACE. Therefore, the applicant may not commence preconstruction or construction activities in jurisdictional waters, including wetlands, without a USACE permit.

The USACE will complete its evaluation of the proposed project after it fully considers the recommendations of Federal, State, and local resource agencies and members of the public, and after the following consultations and coordination efforts are completed, if applicable:

Section 106 of the National Historic Preservation Act (NHPA), including, as appropriate, development and implementation of any Memorandum of Agreement (MOA); Section 7 of the Endangered Species Act; essential fish habitat coordination; State forest conservation plans; State water quality certifications; and State coastal zone consistency determinations. Because the USACE is a cooperating agency under the MOU for this EIS, the USACE's decision of whether to issue a permit will not be made until after public comments have been received on this draft EIS and the final EIS is issued.

The collaborative effort between the NRC and the USACE in presenting their discussion of the environmental effects of building the proposed project, in this chapter and elsewhere, must serve the needs of both agencies. Consistent with the MOU, the staffs of the NRC and the USACE collaborated (1) in the review of the COL application and information provided in response to requests for additional information (developed by the NRC and the USACE) and (2) in the development of the EIS. 10 CFR 51.45(c) requires that the impacts of preconstruction activities be addressed by the applicant as cumulative impacts in its ER. Similarly, the NRC's analysis of the environmental effects of preconstruction activities on each resource area would be addressed as cumulative impacts normally presented in Chapter 7. However, because of the collaborative effort between the NRC and the USACE in the environmental review, the combined impacts of the preconstruction and construction activities that would be authorized by the NRC with its issuance of a COL are presented in this chapter. For each resource area, the NRC also provides an impact analysis solely for construction activities that meet the NRC's definition of construction in 10 CFR 50.10(a). Thereafter, both the assessment of the impacts of 10 CFR 50.10(a) construction activities and the assessment of the combined impacts of preconstruction and construction are used in the description and assessment of cumulative impacts in Chapter 7 of this EIS.

In addition to guidance provided in NUREG-1555, staff used guidance provided in the NRC Staff Memorandum *Addressing Construction and Preconstruction Activities, Greenhouse Gas Issues, General Conformity Determinations, Environmental Justice, Need for Power, Cumulative Impact Analysis, and Cultural/Historical Resources Analysis Issues in Environmental Impact Statements* (NRC 2011). For most environmental resource areas (e.g., aquatic ecology), the environmental impacts are not the result of either only the preconstruction activities or only the construction activities. Rather, the impacts are attributable to a combination of preconstruction and construction activities. For most resource areas, the majority of the impacts would occur as a result of preconstruction activities.

This chapter is divided into 13 sections. In Sections 4.1 through 4.10, the review team evaluates the potential impacts on land use, water use and quality, terrestrial and aquatic ecosystems, socioeconomics, environmental justice, historic and cultural resources, meteorology and air quality, nonradiological and radiological health effects, and nonradioactive waste impacts of building Fermi 3.

In accordance with 10 CFR Part 51, impacts were analyzed and an impact category level (SMALL, MODERATE, or LARGE) of potential adverse impacts was assigned for each resource area by the review team on the basis of the definitions for these terms established in Chapter 1 of this EIS. The impacts on some resource areas (e.g., the impacts on taxes under the socioeconomic resource area) may be considered beneficial and are stated as such. The review team's determination of an impact category level was based on the assumption that the mitigation measures identified in the ER or the activities planned by various State and county governments, such as infrastructure upgrades (discussed throughout this chapter), would be implemented. Failure to implement these upgrades might result in a change in the impact category level. Possible mitigation of adverse impacts, where appropriate, is discussed in Section 4.11. A summary of the construction impacts is presented in Section 4.12. Citations for the references cited in this chapter are listed in Section 4.13. Cumulative impacts of construction and operation are discussed in Chapter 7. The technical analyses provided in this chapter support the results, conclusions, and recommendations presented in Chapters 7, 9, and 10 of this EIS.

The review team's assessment of the impacts from the construction of proposed Fermi 3 draws on information presented in Detroit Edison's ER Revision 2 (Detroit Edison 2011a) and supplemental documents, as well as other government and independent sources.

4.1 Land Use Impacts

This section provides information on land use impacts associated with site-preparation activities and the building of Fermi 3 at the Fermi site. Topics discussed include land use impacts at the Fermi site and in the vicinity of the site, and land use impacts in the transmission line corridor and offsite areas. For the purposes of the analysis, the site vicinity is defined as the area encompassed by a 7.5-mi radius around the site.

4.1.1 The Site and Vicinity

Approximately 301 ac of land on the Fermi site would be used to build Fermi 3 and associated facilities (Detroit Edison 2011a). Land would be used for an equipment and materials laydown and access area (143 ac); a new power block, including nuclear containment structure, turbine building, cooling towers and batch plant (87 ac); parking, warehouse, and access roads (22 ac); and a switchyard and onsite transmission line corridor (18 ac). An administrative building and meteorological tower would occupy 13 ac (Detroit Edison 2011a). An additional 18 ac would be used, but Detroit Edison has not indicated the specific use of this land. Approximately 189 ac of the land required for Fermi 3 would be land previously undisturbed by urban development, and 112 ac would be land that had been previously disturbed when building Fermi 1 or 2. The footprint of Fermi 3 and an exclusion area extending 2927 ft out from the center of the reactor building would overlap part of the exclusion area of Fermi 2, which is defined as an area extending 2001 ft from the center of the Fermi 2 containment structure (Detroit Edison 2011a). This overlap would not constitute a land use conflict.

Land preparation and building activities for Fermi 3 would involve clearing, grading, excavation, and draining land, resulting in the alteration of existing vegetation, topography, and drainage patterns. Mitigation measures implemented to reduce preconstruction and construction activity impacts would include erosion control, controlled access roads, and restricted construction zones. Surface features and soils would be stabilized and restored after completion of construction activities, and permanently disturbed locations would be stabilized and contoured to blend with the surrounding area. Vegetation stabilization and restoration methods would comply with applicable laws, regulations, permit requirements and conditions, good engineering and construction practices, and recognized environmental best management practices (BMPs).

Excavated material from the power block and cooling system would be used as backfill for building the cooling tower and cooling water system. Detroit Edison expects to use the remaining excavated material (265,000 cubic yards [yd^3]) as fill for onsite road improvements and in building the parking and laydown areas, (Detroit Edison 2011a). No onsite borrow pits or landfills are anticipated. Material dredged while building the water-intake structure, barge slip, and associated facilities would be disposed of in the existing onsite spoils disposal pond, (Detroit Edison 2011a).

Approximately 34.5 ac of wetlands and 5.2 ac of open water on the Fermi site would be disturbed. Of that, approximately 23.7 ac of wetlands would be only temporarily disturbed and would be restored to wetlands once construction is complete. Approximately 8.3 ac of wetlands and the 5.2 ac of open water would be permanently lost. Most wetland impacts on or close to the Fermi site would require a permit from the USACE and the MDEQ. Detroit Edison has developed a conceptual aquatic resource mitigation strategy proposed to offset all wetland impacts (see Appendix K of this EIS). Wetland impacts are discussed further in Section 4.3.1.3.

Approximately 10 ac of prime farmland would be permanently occupied by the proposed new Fermi 3 switchyard, and approximately 54 ac of additional prime farmland would be temporarily disturbed to establish an equipment and material laydown area (Detroit Edison 2011a). Although the temporarily disturbed farmland would ultimately become available for possible future agricultural use after the construction period, compaction or removal of topsoil during the use of the land for laydown could permanently alter the soil properties responsible for its designation as prime farmland. Although forested areas would be cleared to accommodate new facilities, Detroit Edison does not manage any land on the Fermi site for timber production and has no plans to do so in the future (Detroit Edison 2009a).

Approximately 45 ac of land managed as part of the Detroit River International Wildlife Refuge (DRIWR) would be disturbed during development of Fermi 3, of which approximately 26 ac would be only temporarily used, while approximately 19 ac would be permanently occupied

(Detroit Edison 2011a). Detroit Edison currently has a Cooperative Agreement with the U.S. Fish and Wildlife Service (FWS) for management of the onsite portion of the DRIWR, and a reduction of this size is consistent with the 2003 Cooperative Agreement and the FWS Comprehensive Conservation Plan for the Refuge (see Section 2.1.1).

The Fermi site and some adjoining areas lie within the Coastal Zone defined by the State of Michigan under the Coastal Zone Management Act, which is designed to ensure the reasonable use of coastal areas (see Section 3.1). Before ground disturbance, Detroit Edison would obtain a coastal zone consistency determination from the MDEQ, in conjunction with other permits and authorizations from the MDEQ (Detroit Edison 2011a) (see Section 2.1.1). Temporarily disturbed areas would be restored to their existing topographic and hydrological conditions and be planted with natural vegetation once no longer needed, to assist in protecting coastal lands from erosion and pollution (Detroit Edison 2011a). Because the public is already excluded from lands where Fermi 3 would be built and from areas of Lake Erie within the offshore portions of the security zone, Fermi 3 is not expected to interfere with public recreation in or enjoyment of the Coastal Zone. The project would be situated in an area already zoned as Industrial and dedicated to energy production; it would therefore not alter general land use patterns already established in the Coastal Zone. The aesthetics of the surrounding landscape and adjoining waters of Lake Erie have already been influenced by existing Fermi facilities, and the addition of Fermi 3 would not alter the general aesthetic character.

As stated in Section 2.2.1, Detroit Edison owns the mineral rights to the entire Fermi site, except for approximately 0.88 ac in southeastern part of the site. Development of Fermi 3 would not affect that 0.88 ac.

The majority of the proposed Fermi 3 buildings and structures would be situated outside the 100-year and 500-year floodplains (Detroit Edison 2011a). Detroit Edison designed the proposed layout to minimize floodplain encroachment. The majority of the floodplain impacts would be temporary, and the small number of permanent impacts would not noticeably reduce floodplain capacity. Additional description of floodplain impacts is provided in Section 4.2. Development in floodplain areas requires review and approval by Frenchtown Charter Township. A barge slip, water intake, and cooling tower outfall would be built on the Lake Erie shoreline, in an area subject to coastal flooding.

Some dredging in Lake Erie would be needed for a passage from the main channel of the Lake to the barge slip, to accommodate movement of heavy equipment and components to the site by barge. Dredged material would be removed and transported to an existing onsite spoils disposal pond area for treatment prior to disposal (Detroit Edison 2011a). All dredging would be performed in compliance with permits from the USACE under Section 10 of the RHAA and Section 404 of the CWA.

Fermi 3 construction traffic would use existing onsite roads, as well as a new access road designated as New Fermi Drive, which would extend from Dixie Highway to Fermi 3 (Detroit Edison 2011a). Installation of the new road is not expected to interfere with existing land use on the Fermi site. In addition to the new road, existing roadways onsite might be widened or additional surface layers added to roads used by heavy construction equipment, in order to reduce the potential for erosion and siltation. Traffic increases would be localized and occur mainly during shift changes. Rail access to the Fermi site currently exists, and would be available for Fermi 3 if necessary (see Section 3.1), with no new or modified rail lines required (Detroit Edison 2011a).

Fermi 3 and associated facilities (other than offsite transmission lines) would be situated entirely within the existing Fermi site. Land on the entire site is zoned as Industrial by Monroe County and as Public Service by Frenchtown Township (Monroe County Planning Department and Commission 2010; James D. Anulewicz Associates, Inc., and McKenna Associates, Inc. 2003). The new facilities would be consistent with these zoning designations. No impacts on land use planning in Monroe County or Frenchtown Township would be expected as a result of Fermi 3, as the facility would comply with all applicable land use and zoning regulations of Monroe County and Frenchtown Township. Regional and State land use plans do not contain designations that apply specifically to the Fermi site, and these plans would therefore not be affected by Fermi 3. Development of Fermi 3 would, therefore, be in compliance with all local, regional, and State land use plans.

The existing onsite 120-kilovolt (kV) and 345-kV transmission lines serving Fermi 2 would be rerouted to cross mostly emergent wetland and uplands in the DRIWR. New 345 kV transmission lines serving Fermi 3 would be built within the relocated corridor alongside the rerouted Fermi 2 lines. As stated previously, a proposed new switchyard for Fermi 3 would occupy about 10 ac of agricultural land (Detroit Edison 2011a).

Some offsite land use changes could indirectly result from the development of Fermi 3. Possible impacts include the conversion of some land in surrounding areas to housing developments (e.g., recreational vehicle parks, apartment buildings, single-family condominiums and homes, and manufactured home parks) and retail development to accommodate workers. Property tax revenue from the addition of Fermi 3 could induce additional growth in Monroe County as a result of infrastructure improvements (e.g., new roads and utility services). Additional information on roads, housing, and construction-related infrastructure impacts is discussed in Section 4.4, with operations-related infrastructure impacts presented in Section 5.4.

Based on information provided by Detroit Edison, and the review team's independent evaluation, the review team concluded that the land use impacts of preconstruction and construction activities would be SMALL and that mitigation measures beyond those required by the USACE under the Clean Water Act would not be warranted. This conclusion recognizes that the impacts on the DRIWR are consistent with Detroit Edison's Cooperative Agreement with the FWS for management of the DRIWR, that Detroit Edison would ensure that the Fermi 3 project is consistent with Michigan's objectives for managing its coastal zone, and that Detroit Edison would perform mitigation required by the USACE for impacts to wetlands. It also recognizes that ITC*Transmission* would seek a USACE permit for, and obtain a coastal zone consistency determination for, that part of the proposed transmission line to be built off the Fermi site. Because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concluded that the land use impacts of NRC-authorized construction activities would also be SMALL. As previously noted, the project would require certification from the State of Michigan that it would be consistent with Michigan's coastal zone management program.

4.1.2 Transmission Line Corridors and Other Offsite Facilities

Three new 345-kV transmission lines have been proposed to serve Fermi 3, and would extend offsite along a 29.4-mi route in Monroe, southwest Wayne County, and southeast Washtenaw County. Within the required corridor, approximately 18.6 mi of lines would be sited along established transmission line rights-of-way, and approximately 10.8 mi of the corridor would be sited along new undeveloped right-of-way (Detroit Edison 2011a). The lines would be connected to the ITC*Transmission* Milan Substation for distribution to the grid. New towers would require foundation excavations, and the new lines would be constructed, owned, and operated by ITC*Transmission*. The Milan Substation currently occupies 4 ac; it is likely that the substation footprint would be expanded to an area of approximately 23 ac to accommodate the three new transmission lines from Fermi 3 (Detroit Edison 2011a).

Approximately 1069 ac would be used for the proposed lines, assuming that a 300-ft-wide right-of-way (ROW) would be required for a distance of 29.4 mi (Detroit Edison 2011a). Additional acreage for laydown and other activities, located outside the corridors, might also be required. No new roadway access would be anticipated, with existing roads used for access and construction traffic. While the new lines are being built, the corridor areas might be fenced to prevent impacts on other land uses. Once the lines are installed, a small amount of land around the transmission tower bases would be lost from productive use in agricultural areas, while in forested areas, the corridor would remain cleared. Clearance of new corridor would result in vegetation removal and brush piles, disturbance of soils and soil erosion, and damage to culverts and roadways. Within the 300-ft corridor, there would be impacts on forest, agricultural lands, wetlands and streams, residences, undeveloped land, and recreational uses.

Practices used for extending the new transmission lines to the Milan Substation would be expected to comply with the requirements of local, State, and Federal environmental regulations. It is assumed that industry standards for best environmental practices would be observed, including (1) continual and responsible management of wastes and chemicals to prevent and avoid pollution, (2) use of environmentally preferable materials, (3) reduction or elimination of wastes at the source, (4) appropriate storage and handling of wastes, (5) recycling and reuse of waste materials, and (6) sediment and erosion control (ITC 2010). Once the new transmission structures are installed, existing land uses, other than forest, in the transmission line corridor would be largely restored (Detroit Edison 2011a).

Land use in each section of the corridor for the proposed new transmission lines is shown in local Township and County future use plans as being utility use, while land for the new corridor is shown as agricultural (Monroe County Planning Department and Commission 2010; James D. Anulewicz Associates, Inc., and McKenna Associates, Inc. 2003). Sections 460.551–460.575 of the Michigan Compiled Laws (MCL) authorize the Public Service Commission to regulate electric transmission lines. In siting the new transmission line, Detroit Edison would contact the State Historic Preservation Office (SHPO), FWS, MDEQ, and USACE.

Based on information provided by Detroit Edison, ITC*Transmission*, and the review team's own independent review, the review team concluded that the land use impacts of building the new transmission line would be SMALL, and no additional mitigation beyond that required by other environmental permits would be warranted. None of the impacts related to transmission lines would result from NRC-authorized activities.

4.2 Water-Related Impacts

Water-related impacts involved in building a nuclear power plant are similar to impacts associated with building any large industrial facility development project and to the impacts that occurred during the construction of Fermi 2. Prior to initiating onsite activities, including any site preparation work, Detroit Edison is required to obtain the appropriate authorizations that regulate alterations to the hydrological environment. These authorizations would likely include:

- <u>Clean Water Act Section 404 Permit</u>. This permit is required for the discharge of dredged and/or fill material into waters of the U.S.

- <u>Clean Water Act Section 401 Water Quality Certification</u>. This certification would be issued by the MDEQ to ensure that the project does not conflict with State and Federal water-quality management programs.

- <u>Clean Water Act Section 402(p) National Pollutant Discharge Elimination System (NPDES)</u>. The MDEQ administers the NPDES program for the U.S. Environmental Protection Agency (EPA) Construction General Permit and industrial discharge permits. These permits regulate point source stormwater and wastewater discharges. Discharge of excavation dewatering water would require an additional permit under Section 402(p). Discharges from hydrostatic pressure testing of new and existing piping, tanks, and other equipment would be regulated under an NPDES General Hydrostatic Pressure Test Water permit.

- Section 10 of the Rivers and Harbors Appropriations Act of 1899 Permit. This permit would be issued by the USACE to regulate any structure or work in or affecting waters of the United States, such as Lake Erie.
- Federal Coastal Zone Management Act of 1972. This concurrence of consistency with the policies of the State coastal program would be issued by the MDEQ. It applies to any activity that is in land, water, or any natural resource in the coastal zone or any activity that affects land use, water use, or any natural resource in the coastal zone, if the activity requires a Federal license or permit.
- MDEQ Soil Erosion and Sedimentation Control (SESC) Permit. This permit regulates controls on soil and sediment at construction sites. The authority for this permit is assigned to the Monroe County Drain Commissioner.
- MDEQ Permit Under Act 451, Natural Resources and Environmental Protection Act, Part 325, "Great Lakes Submerged Lands." This Michigan law regulates dredging activities in the Great Lakes.
- Monroe County Environmental Health/Sanitary Code Well Permit. Well permit is required for construction of wells, including dewatering and monitoring wells.

Hydrological alterations are discussed in Section 4.2.1; water use impacts are discussed in Section 4.2.2; water-quality impacts are discussed in Section 4.2.3; and water monitoring is discussed in Section 4.2.4.

4.2.1 Hydrological Alterations

Building the proposed Fermi 3 facility would affect several surface water bodies, site drainage patterns, and groundwater underlying the site.

4.2.1.1 Surface Water Bodies

Surface water bodies that would be altered by site preparation and building activities include Lake Erie, Swan Creek, and several onsite water bodies.

As part of building Fermi 3, Detroit Edison plans to construct a water intake structure and a water discharge pipe in Lake Erie. The intake structure would be located between two rock groins that extend 600 ft from the facilities' shoreline into the lake. The discharge pipe will extend 1300 ft from the shoreline in the plant vicinity and into Lake Erie. Dredging, bedding placement, and cover material would be required between the intake rock groins and along the discharge pipe pathway and outfall structures. Maintenance dredging for the intake canal would also be required for ongoing Fermi 2 operations during building activities for Fermi 3. Maintenance dredging activities for Fermi 2 are currently authorized by (1) USACE Permit Number 88-001-040-8 under Section 10 of the RHAA and Section 404 of the CWA and

(2) MDEQ Permit Number 04-58-0009-P under Act 451, Natural Resources and Environmental Protection Act, Part 325, "Great Lakes Submerged Lands."

Swan Creek could receive increased stormwater runoff from construction areas. In addition, the water removed from the subsurface during construction dewatering would likely be discharged into stormwater outfalls that flow to the mouth of Swan Creek.

During the building of Fermi 3, the north canal (overflow canal) and the small pond (the central canal) would be dewatered and backfilled, and the south canal (discharge canal) would be partially dewatered and backfilled (Detroit Edison 2011a; Figure 4-1). It is estimated that a total of 5.26 ac of open water would be permanently impacted (Detroit Edison 2011e). In addition, some onsite wetlands would be temporarily or permanently affected by building activities. Approximately 30.37 ac of wetlands would be permanently affected (Detroit Edison 2011e). Impacts on waters of the U.S. and jurisdictional wetlands areas would be regulated by the USACE and the MDEQ. The jurisdictional determinations are discussed in Section 2.7.1. The USACE and MDEQ permitting processes would ensure that construction and preconstruction impacts are avoided as practicable, then reduced as practicable by implementation of BMPs or other appropriate measures, and then mitigated by compensation and/or other appropriate means.

Building activities would decrease the available area of floodplain at the site, due to the emplacement of fill and building of new facilities that will occupy land which is currently available to accommodate flood waters. However, the majority of impacts on areas within the floodplain will be temporary, and the small amount of permanently impacted area is not anticipated to cause noticeable impacts on the floodplain capacity at the Fermi site. In addition, Detroit Edison's proposed compensatory mitigation of anticipated aquatic resource losses would restore and provide additional capacity to accommodate flood waters in coastal areas of Monroe County (Detroit Edison 2011e).

4.2.1.2 Landscape and Drainage Patterns

It is anticipated that a total of 189 ac of previously undeveloped land at the Fermi site would be affected by building activities related to the Fermi 3 power block, new parking structures, a warehouse, construction and preconstruction parking, construction and preconstruction laydown, a new switchyard, a new meteorological tower, and administrative buildings (Figure 3-2). Stormwater runoff from all building and site preparation activities would be regulated by an NPDES Construction General Permit under Section 402(p) of the Clean Water Act (EPA 2009). Before commencing any building activities, Detroit Edison would be required to develop an SESC plan to obtain an SESC permit. The SESC plan would include descriptions of the BMPs used during preconstruction and construction activities to prevent and manage erosion and offsite sedimentation. The SESC permit is needed to obtain the NPDES Construction General Permit.

Figure 4-1. Areas Affected by Building Activities for Fermi 3 (Detroit Edison 2011a)

During preconstruction and construction activities, the site stormwater drainage patterns and runoff quantities would be affected. Construction of the power block area would require excavation and alteration of the land surface in the vicinity of Fermi 3 in order to build an elevated area for the safety structures and to install a stormwater drainage system for the site. The existing site grade would be raised to 589.3 ft North American Vertical Datum of 1988 (NAVD 88) in the vicinity of the safety-related structures. Stormwater drainage patterns would be altered during clearing and grading activities for the new buildings, transmission lines, a substation, laydown areas, and the meteorological tower. The site clearing and building activities for the proposed Fermi 3 would also convert some land that is currently available for drainage to an impervious surface, so the quantity of stormwater runoff would increase compared to current conditions.

Offsite areas would be affected by the installation of the new 345-kV transmission lines along a 29.4-mi route to the Milan Substation, 10.8 mi of which is currently not developed. It is estimated that the undeveloped portion of the transmission line corridor would be approximately 393 ac, assuming the width along the 10.8-mi transmission line corridor would be 300 ft (Detroit Edison 2011a). Development of the new transmission lines would also take place along an existing 18.6 mi of ROW currently used for transmission structures and lines (Detroit Edison 2011a). The 10.8-mi undeveloped portion of the transmission line corridor would cross nine drains or streams, and these water bodies could be affected by building the line. The previously developed transmission line ROW crosses 12 drains or streams and eight wetland areas that could be affected by activities associated with upgrading the transmission lines (Detroit Edison 2011a).

4.2.1.3 Groundwater

Groundwater would not be used during the building of Fermi 3, but it would be affected during building activities. Building activities and conditions that could affect groundwater levels and alter groundwater flow around Fermi 3 include the following: excavation of portions of site aquifers (overburden and Bass Islands Group) and emplacement of the high-conductivity structural fill, filling in of the onsite water bodies, changes in recharge due to impervious surfaces and stormwater routing, and dewatering during excavation. Excavation dewatering would lower the water levels locally, in the overburden and in the Bass Islands Group bedrock aquifer. The impacts of excavation dewatering are discussed more fully in Section 4.2.2.2. Water produced during excavation dewatering would likely be discharged to Swan Creek via the North Lagoon by using the NPDES stormwater outfalls.

A drop in the groundwater elevation as a result of dewatering would not affect water levels in the onsite wetlands because the wetlands are hydraulically connected to Lake Erie. This means that any loss of wetland inflow due to dewatering would be quickly replaced by inflow from the lake. Detroit Edison (2011a) estimates that the water levels in the Quarry Lakes would drop between 1 and 2 feet as a result of dewatering operations for preconstruction and construction activities. Impacts on groundwater systems during dewatering would be reduced by installing flow barriers at the edges of the excavation area (Detroit Edison 2011a). Methods such as the (1) emplacement of a concrete wall extending from the surface to below the base of the excavation around the perimeter of the deep excavation area or (2) installation of a grout curtain at the perimeter of excavation would be used. Detroit Edison (2011a) also states that grouting in the bottom of the excavation could also be used to reduce groundwater inflows into the excavation area. These steps would limit the impacts of dewatering on offsite groundwater systems and groundwater users.

4.2.1.4 Summary of Hydrological Alterations

In summary, the hydrological alterations associated with building on and near the Fermi site would be limited to dredging for the intake and discharge structures and barge slip, altering the surface topography and hydrology (e.g., site grading, laydown areas, filling of onsite water bodies), and dewatering the excavation for construction of the nuclear facilities. Offsite hydrological alterations are associated with the proposed new or expanded transmission line corridors where the lines cross wetlands and drainages. The impacts of hydrological alterations resulting from both onsite and offsite construction activities would be localized and reduced with the implementation of BMPs and mitigation measures required by the necessary permits and certifications. Any impacts on water resources associated with the compensatory mitigation proposed by Detroit Edison would be evaluated by the USACE and MDEQ as part of the permitting process for that activity. It is anticipated that this process will be completed prior to issuance of the final Fermi 3 EIS.

4.2.2 Water Use Impacts

This section describes, analyzes, and assesses the impacts of proposed project preconstruction and construction activities on the use of both groundwater and surface water resources. It identifies the proposed preconstruction and construction activities that could have impacts on water use and analyzes and evaluates proposed practices designed to minimize adverse impacts on water use. The impacts of building a nuclear power plant on water use are similar to impacts associated with building any large industrial construction project.

4.2.2.1 Surface Water Use Impacts

Surface water obtained directly from Lake Erie would be used to support building activities at the site. Potable water to support preconstruction and construction would be obtained from Frenchtown Township, which also uses water from Lake Erie. Fermi 3 building activities are anticipated to require between 350,000 and 600,000 gallons per day (gpd) for concrete batch plant operation, temporary fire protection, dust control, and sanitary needs (Detroit Edison 2011a). Since this water withdrawn from Lake Erie would be for consumptive use (apart from the sanitary water returned to the system) no runoff is anticipated to be generated from these building activities. The usage rate of water for preconstruction and construction activities would be approximately 2 percent of the usage rate of water consumed for operation of Fermi 3, which is 0.1 percent of average consumptive use rate in Lake Erie basin between 2000 and 2006 and 0.001 percent of the average rate of Lake Erie water withdrawn between 2000 and 2006. In addition, annual water use during preconstruction and construction activities would be minute (approximately 0.00017 percent of the total volume of Lake Erie). The Great Lakes Compact of 2008 requires any new water use of more than 5 million gallons per day (MGD) to be subjected to a regional review. Water use during the building of Fermi 3 would be less than this amount, so water use for building activities would not be subject to review.

Detroit Edison (2011a) states that the only user of surface water near Fermi 3 preconstruction and construction activities would be the Fermi 2 power plant. Figure 4-1 shows the area of Lake Erie that would be impacted by withdrawals of water from Lake Erie for use as construction water. Though the intake area for Fermi 3 and Fermi 2 would be shared, Detroit Edison (2011a) states that water withdrawals for operations at Fermi 2 would not be affected by Fermi 3 building activities.

On the basis of information provided by Detroit Edison (2011a) and the review team's independent evaluation, the review team concludes that surface water use impacts of preconstruction and construction activities would be SMALL and that no mitigation would be warranted. On the basis of the above analysis, the NRC staff concludes that the impacts of NRC-authorized construction activities would be SMALL. The NRC staff also concludes that no further mitigation measures would be warranted.

4.2.2.2 Groundwater Use Impacts

Excavation dewatering is the only anticipated use of groundwater during building and site clearing activities for Fermi 3. Excavation will occur in the power block area and a barrier would be installed around the edge of the excavation area to limit flow into the excavation. This barrier would extend from the ground surface to below the maximum depth of excavation, into the Bass Islands Group bedrock aquifer (Detroit Edison 2011a). The barrier would be a concrete wall or a grout curtain extending from the ground surface to below the excavation at the perimeter of excavation. Grouting could also be done in the bottom of the excavation. Installing a barrier would reduce the groundwater flow into the excavation area, especially from the water in the overburden (Detroit Edison 2011a). Dewatering would occur from the bedrock aquifer, but groundwater in the site overburden drains down into the bedrock aquifer. Because the units are hydraulically connected, groundwater would also be drained from the overburden. Detroit Edison (2011a) anticipates that the proposed barriers around the excavation areas would minimize groundwater inflow, such that using sumps at the bottom of the excavation would be sufficient for dewatering the area of interest.

Construction Impacts at the Proposed Site

Detroit Edison (2011a) modeled the effects of excavation dewatering at the Fermi site by using a modified version of a published U.S. Geological Survey (USGS) MODFLOW model of Monroe County (Reeves et al. 2004). The review team performed an independent evaluation of the model and found the methods, parameters, and conclusions to be satisfactory. Detroit Edison (2011a) determined that construction and preconstruction dewatering activities could affect the groundwater table of the bedrock aquifer in the vicinity of the site and also that users in the vicinity could be affected by the lower water levels. Two alternative estimates of drawdown caused by construction and preconstruction dewatering activities are presented in the ER:

- In Scenario 1, Detroit Edison assumed there would be a reinforced diaphragm concrete wall in the subsurface to reduce the water drainage from the aquifer for dewatering.
- In Scenario 2, Detroit Edison assumed that there would be a grout curtain or freeze wall to reduce the water drainage from the aquifer during dewatering.

Both scenarios assumed that the bottom of the excavation would be grouted to reduce groundwater inflows. Based on the results of the model scenarios, the reinforced diaphragm concrete wall would be a better flow barrier and result in smaller drawdown in the groundwater system in the area of the site, although the differences offsite were not significant (Detroit Edison 2011a).

Groundwater wells that could be affected by drawdown from dewatering during the building of Fermi 3 are nearby household wells, irrigation wells, and other wells (Detroit Edison 2011a). The model results indicate that the reinforced diaphragm concrete (Scenario 1) wall could limit offsite impacts due to dewatering somewhat better than the grout curtain or freeze wall (Scenario 2). The nearest well to the site is a domestic water supply well located approximately 3800 ft from the center of the power block area where both modeling scenarios predict that drawdown would be highest. In Scenario 1, a drawdown of 1 ft or greater is confined within site boundary and is estimated to be less than 1 ft at the nearest offsite well (Figure 4-2). In Scenario 2, a drawdown of 2 ft or greater is confined within the site boundary and is estimated to be slightly less than 2 ft at the nearest offsite well (Figure 4-3). These drawdowns are the modeled maximum amounts associated with long-term dewatering to arrive at steady-state conditions.

The predicted impact of excavation dewatering is less than the observed seasonal fluctuation in local bedrock wells. Water levels in Fermi site wells screened in the Bass Islands Group aquifer have been observed to fluctuate an average of 4 ft within a year (Detroit Edison 2011a). Groundwater elevations in the vicinity of the Fermi site have declined between approximately 10 and 15 ft since the early 1990s as a result of dewatering for offsite quarry operations elsewhere in Monroe County (Reeves et al. 2004). Onsite dewatering during construction is temporary and may result in an additional decrease of 2 ft or less to nearby users; therefore, their water source is not expected to be affected. As a result, dewatering would not create

Figure 4-2. Modeled Drawdown of Groundwater in the Bass Islands Group as a Result of Dewatering for Fermi 3 Construction – Scenario 1 (Detroit Edison 2011a)

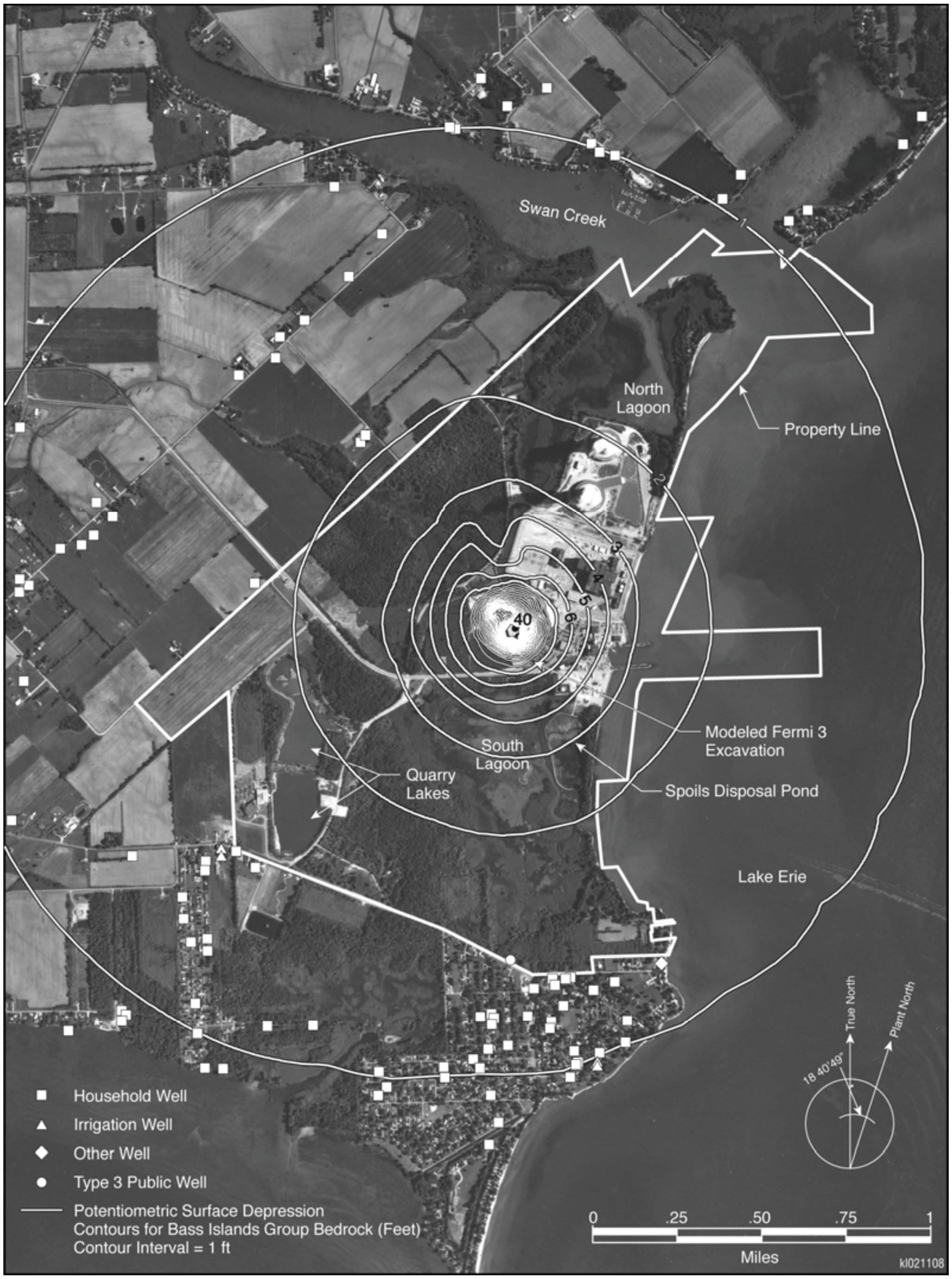

Figure 4-3. Modeled Drawdown of Groundwater in the Bass Islands Group as a Result of Dewatering for Fermi 3 Construction – Scenario 2 (Detroit Edison 2011a)

significant, long-term impacts on nearby water users. Detroit Edison has committed to supply water to meet all users' needs, if necessary (Detroit Edison 2011a).

The groundwater flow beneath the site has been reversed from toward Lake Erie (historically) to toward quarry operations to the north and southwest of the Fermi site. While dewatering at the site may affect groundwater flow directions in the area, these effects will be minor and temporary due to limited scope and timeframe of dewatering activities.

Groundwater dewatering activities are not expected to affect onsite wetlands, because these wetlands are hydraulically connected to Lake Erie and inflow from the lake would rapidly supply the wetland with water if dewatering caused drawdown of the groundwater table in wetland areas.

On the basis of information provided by Detroit Edison (2011a) and the review team's independent evaluation, the review team concludes that groundwater use impacts of construction and preconstruction activities for Fermi 3 would be SMALL and no further mitigation would be warranted. On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the impacts of NRC-authorized construction activities would be SMALL. The NRC staff also concludes that no further mitigation measures would be warranted.

4.2.3 Water Quality Impacts

Water quality impacts from construction activities are similar to those from other large industrial construction projects. Impacts on the quality of the water resources of the site are expressed for surface water (Swan Creek and Lake Erie) features and groundwater (i.e., the water table in the overburden and Bass Islands Group aquifer) features that are most directly affected by construction and preconstruction activities.

4.2.3.1 Surface Water Quality Impacts

The water quality of surface water bodies on or near the Fermi site could be affected by building and site clearing activities and impacts from these activities on the quality of surface water need to be considered. These impacts are discussed in the applicant's ER (Detroit Edison 2011a).

Installation of intake and discharge structures in and along the shoreline of Lake Erie would disturb sediments during building and dredging activities, potentially increasing turbidity near the intake and discharge structures at the Fermi site. Dredged sediments would be disposed of in the Spoils Disposal Pond (Figure 4-1), and the water draining from dredged sediments would drain through an NPDES outfall. The outfall from the Spoils Disposal Pond is regulated by the Fermi 2 NPDES permit. Discharge associated with Fermi 3 dredging activities would be regulated under the existing Fermi 2 NPDES permit, which allows 450 million gallons per year to be discharged from the pond (Detroit Edison 2011a). The applicant anticipates that the Spoils Disposal Pond has adequate capacity for the Fermi 3 dredged material (Detroit Edison 2011a).

Construction related activities may potentially impact water quality near the site. Pollutants (e.g., oil and grease, copper, zinc, and other pollutants from vehicles) resulting from increased traffic related to building activities could be entrained into stormwater runoff during rainfall events. Construction activities such as the discharge of water from dewatering, filling of the onsite canals, disposal of dredge spoils, and land clearing and grading could increase erosion and/or carry sediment in stormwater runoff from the site into the North Lagoon (to Swan Creek), South Lagoon, the Quarry Lakes, or Lake Erie. Areas of concern for potentially increasing sediment in runoff include the power block area, new buildings, transmission lines, a substation, laydown areas, and the meteorological tower. The impacts of these activities on surface water quality would be reduced by NPDES permitting, implementation of the approved SESC plan that includes soil erosion controls (such as silt fences and straw bales), and adherence to a Pollution Incident Prevention Plan (PIPP) to prevent contamination.

The NPDES construction permit requires monitoring of the discharges for turbidity during all construction and preconstruction activities (EPA 2009). Starting in August 2011, EPA-defined construction projects disturbing an area larger than 20 ac will be required to monitor construction-related discharges for turbidity (EPA 2009). After that date, the turbidity of EPA-defined construction[a] stormwater discharges from projects larger than 20 ac will be required to be below an average of 280 nephelometric turbidity units (NTUs).

As mentioned, to build and operate the proposed Fermi 3 Detroit Edison must obtain authorizations from Federal and State regulatory agencies. This would limit the impacts of regulated activities.

In summary, hydrological alterations resulting from site preparation and building activities, including discharge of water from dewatering, clearing, grading, filling and dredging for the intake and discharge, would be localized and temporary. In addition, State and Federal permits and certifications would require the disturbed land to be stabilized to prevent erosion through implementation of BMPs to minimize impacts, and potential impacts to be monitored. As a result, the review team concludes that the surface water quality impacts of construction and preconstruction activities for Fermi 3 would be SMALL, and no mitigation beyond the BMPs would be warranted. On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the surface water quality impacts of NRC-authorized construction activities would be SMALL. The NRC staff also concludes that no further mitigation measures beyond the BMPs would be warranted.

(a) EPA-defined construction would include all building activities occurring at the site, including both NRC-defined preconstruction activities and construction activities.

4.2.3.2 Groundwater Quality Impacts

During site preparation and building activities for the proposed Fermi 3, the potential would exist for spills to transport pollutants (e.g., gasoline) to groundwater in the overburden. As noted, Detroit Edison would develop a PIPP and the subsequent NPDES construction stormwater permit that would require the implementation of BMPs that would prevent or promptly mitigate any spills.

Because of the planned use of good housekeeping rules and BMPs, including maintaining an inventory of potential sources, performing preventative maintenance and inspections, providing signs and labels, and providing secondary containment, the review team concludes that the groundwater quality impacts of preconstruction and construction activities for proposed Fermi 3 would be SMALL, and no further mitigation beyond the BMPs would be warranted. On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the groundwater quality impacts of NRC-authorized construction activities would be SMALL. The NRC staff also concludes that no further mitigation measures beyond the BMPs would be warranted.

4.2.4 Water Monitoring

Detroit Edison (2011a) presented construction monitoring programs in Sections 2.3.4.1 and 6.3 of the ER. A discussion of previous monitoring efforts at the Fermi site is presented in Section 2.3.4.

Measurements at the NOAA gaging station (ID 9063090) on Lake Erie in the vicinity of the Fermi 2 intake structure are expected to continue to provide hourly Lake Erie water level measurements at the site. The NPDES permit for Fermi 2 requires monitoring of five outfalls, including the outfall associated with the Dredge Spoils Pond (Figure 4-1). In addition, Fermi 2 is required to analyze the intake water for total mercury on a monthly basis. Fermi 2 NPDES monitoring is anticipated to be ongoing during construction and preconstruction activities. The NPDES stormwater construction permit would require monitoring of any discharge from the building areas for turbidity. Monitoring frequency and location would be decided during the permitting process.

Currently, groundwater monitoring well networks exist on the Fermi site to monitor potential impacts on groundwater levels and quality. Some of these wells would be affected by land clearing and building activities for Fermi 3 and would be taken out of service prior to the start of work (Detroit Edison 2011a). Detroit Edison (2011a) has committed to follow NRC (2007) guidance in NUREG/CR-6948 for groundwater monitoring at the site during both the building and operation phases.

At the start of dewatering activities, Detroit Edison (2011a) would monitor groundwater levels both in the overburden and the Bass Islands Group aquifer at frequent intervals. When groundwater levels would reach equilibrium during the dewatering activities, Detroit Edison would reduce the monitoring frequency (Detroit Edison 2011a).

4.3 Ecological Impacts

This section describes potential impacts on ecological resources (terrestrial, wetlands, and aquatic resources) from the construction of Fermi 3.

4.3.1 Terrestrial and Wetland Impacts

This section addresses potential terrestrial and wetland impacts from building Fermi 3 and associated facilities at the Fermi site.

4.3.1.1 Terrestrial Resources – Fermi Site and Vicinity

Impacts on Habitats

All activities related to building Fermi 3, including ground-disturbing activities, would occur within the existing Fermi site boundary. Although all impacts on terrestrial ecosystems cannot be avoided, the footprint of Fermi 3 was established to minimize impacts on high-quality terrestrial habitats, including wetlands. The proposed location of the power block and cooling tower are in an area bounded by Fermi Drive, Doxy Road, Fermi 2, and Lake Erie, thereby minimizing impacts on the South Lagoon wetlands. The proposed facilities, as well as the needed temporary parking and laydown areas, have been sited to minimize impacts on undisturbed habitats, including wetlands (see Figure 4-1).

Approximately 197 ac of terrestrial wildlife habitat on the Fermi site would be disturbed while building the proposed Fermi 3 facilities (Detroit Edison 2011a). Approximately 51 ac of that habitat would be permanently lost because it would be cleared, grubbed, and graded to develop permanent facilities. Temporary disturbance of the remaining 146 ac of terrestrial habitat would be necessary to accommodate temporary laydown and parking areas (see Table 4-1). Although the project would reportedly disturb only 189 ac of previously undeveloped land, of which approximately 42 acres would be permanently occupied (Detroit Edison 2011a), some of the terrestrial habitat impacts would take place in areas of previous development. Detroit Edison has stated its intention to restore temporarily disturbed areas with regionally indigenous species (Detroit Edison 2011a).

Detroit Edison has determined the placement of proposed facilities in an effort to minimize impacts on wetlands and forest cover. Approximately 130 ac of the permanent and temporary impacts would involve grassland habitats. Approximately 42 ac of the impacts would involve

Table 4-1. Area of Terrestrial Habitat Types on Fermi Site To Be Disturbed by Building Fermi 3

Cover Type (Habitat)	Acres Permanently Lost	Acres Temporarily Disturbed	Total Acres of Habitat Type on Site
Terrestrial Habitats			
Coastal emergent wetland open water	0	0	35
Coastal emergent wetland vegetated	1.7	2.2	238
Grassland: right-of-way	9.6	13.5	29
Grassland: idle/old field/planted	25.7	17.6	75
Grassland: row crop	1.0	63.0	64
Shrubland	2.0	38.5	113
Thicket	1.7	0	23
Forest: coastal shoreline	1.0	0	47
Forest: lowland hardwood	0	4.8	92
Forest: woodlot	8.6	6.3	117
Total Terrestrial Habitats Lost	**51.3**	**145.9**	**833**
Developed Areas	**0**	**0**	**212**
Open Water			
Lakes, ponds, rivers	0	0	44
Lake Erie	0	0	171

Source: Detroit Edison 2011a

shrubland or thicket habitats. Only about 21 ac of impact would involve forest habitats. Less than 4 ac of coastal emergent wetland would be affected (this figure represents coastal emergent wetland as a generalized habitat type only; impacts to wetlands as defined by the USACE are discussed in Section 4.3.1.3.). Clearing and disposal of woody vegetation should be performed consistent with the provisions of the Michigan Department of Agriculture (MDA) Emerald Ash Borer Interior Quarantine on firewood and other ash tree products in effect at the time of site preparation activities to avoid spreading the emerald ash borer (*Agrilus planipennis*) (MDA 2009).

Even temporary clearing of forest, shrubland, and thicket areas would reduce shelter and forage habitat until woody vegetation can re-establish those habitat elements. Clearing forest habitat would have longer-term impacts, but revegetation would gradually restore the lost habitat.

Although forested areas would be cleared for the project, most of the forested areas to be cleared would be on the edges of forest cover patches. No large forested blocks would be fragmented by project activities. The impacts on species sensitive to forest fragmentation would, therefore, be minimal. As shown in Table 4-1, temporary forest clearings would occur on only about 11 ac of the Fermi site.

Temporarily disturbed vegetated areas would be revegetated with plants native to the project vicinity once no longer needed (Detroit Edison 2011a). Because many of the areas that would be disturbed contain substantial amounts of nonnative invasive plant species, a restored vegetation community of predominantly native species eventually could provide higher quality forage and shelter habitat than the existing vegetation community in those areas. However, especially for forested areas, several years would be needed for new vegetation to grow enough to replicate the ecological functions of the original vegetation.

As indicated in Section 4.3.1.3, approximately 34.5 ac of wetlands would be disturbed, including approximately 23.7 ac of temporary impacts, approximately 8.3 ac of permanent fill (conversion to non-wetland), and approximately 2.5 ac of forested wetland permanently cleared of trees (converted to emergent or scrub-shrub wetlands). This includes not only coastal emergent wetlands, as indicated in Table 4-1, but also some areas within forest and other habitats that were delineated as wetlands. Mitigation for the loss of wetlands (except for the loss of approximately 1.9 ac of isolated wetlands) would be required as a condition of receiving permits from the USACE and MDEQ. Mitigation would have to address only about 32.6 ac of the wetland impacts, as approximately 1.9 ac of the impacts affect isolated wetlands not under Federal or State jurisdiction.) Wetland losses and mitigation are discussed in more detail in Section 4.3.1.3. Detroit Edison's conceptual aquatic resource (wetland) mitigation strategy is presented in Appendix K of this EIS.

The potential for short-term impacts on undisturbed wetlands and terrestrial habitats would be minimized by using BMPs to reduce stormwater runoff and the risk of pollution from soil erosion and sediment and pollutant spills. Detailed measures for BMPs will be in the SESC plan and PIPP for the project (see Section 4.2).

Impacts on Wildlife

Wildlife inhabiting work areas could be inadvertently killed or forced to move into adjacent habitats. Larger and more mobile species would likely flee during land-clearing activities, such as tree felling, grubbing, and grading. Mortality is expected to be limited to the least-mobile wildlife, mainly small, slow-moving, burrowing, or cavity-dwelling species, such as certain small mammals and reptiles as well as nesting forest, shrub, and grassland birds. Increased wildlife mortality in the form of road kill may result from increased traffic volume on nearby roadways. Impacts on waterfowl, shorebirds, and other wetland birds are likely to be minimal considering the limited impacts on wetland habitats.

One of the small, slow-moving species that may be affected by land clearing and building activities is the eastern fox snake (*Pantherophis gloydi*). As discussed in Section 2.4.1, the eastern fox snake is the only terrestrial animal species of State concern on the Fermi site that could be affected in this manner. In addition to direct impacts, some of the snake's habitat on the Fermi site would likely be affected, some temporarily and some permanently.

Detroit Edison has prepared a draft Habitat and Species Conservation Plan (Detroit Edison 2010b) for the eastern fox snake, with the intention of minimizing impacts on individual specimens. The plan calls for training construction workers about the snake's rarity, protection status, and appearance, and instructing workers to inform inspectors with stop-work authority to allow time to catch and relocate the snakes. The Fermi 3 layout has been configured to minimize impacts on wetlands and other potential fox snake habitat. The review team expects Detroit Edison will submit the Habitat and Species Conservation Plan for the eastern fox snake to the MDNR. The potential impacts on the eastern fox snake are discussed in more detail in Section 4.3.1.3.

As stated previously, larger or more mobile mammals and birds, including most raptors, game birds, and forest, shrub, and wetland birds, would leave the area when site disturbance activities begin. Such wildlife is expected to consist mostly of common species that adapt readily to changing environments, such as opossum (*Didelphis virginiana*), white-tailed deer (*Odocoileus virginianus*), eastern cottontail rabbit (*Sylvilagus floridanus*), eastern gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamius striatus*), raccoon (*Procyon lotor*), woodchuck (*Marmota monax*), and skunk (*Mephitis mephitis*). Populations of these species on the Fermi site may experience increased mortality due to road kill or from hunting if displaced from the Fermi site, where no hunting is allowed, to private land where hunting is allowed. The carrying capacity of nearby habitats receiving displaced individuals may be exceeded, resulting in increased competition and mortality due to limited resources. However, all of these species are abundant in the region and highly adaptable. These animals are expected to move away from the impact area to neighboring habitats both onsite and offsite. Although approximately 51 ac of wildlife habitat would be permanently lost (with the exception of some wetlands types that would be mitigated), the types of affected habitat are common in the area. The resulting impacts on most wildlife would be minimal, with no mitigation measures needed. None of these species is of conservation concern in the State of Michigan or at the Federal level, and all are common in suitable habitats throughout the region. Impacts on important species are discussed in more detail below. Impacts on wildlife dependent on wetland habitat would be mitigated as a result of implementing the wetland mitigation discussed below.

Animals that move away from work areas may experience higher mortality rates due to road kill and increased competition with resident individuals in receiving habitats. Mammals that may suffer increased road kill include the white-tailed deer, eastern cottontail rabbit, eastern gray squirrel, eastern chipmunk, opossum, raccoon, and woodchuck. Most turtle, snake, and amphibian species, including the eastern fox snake, are also at risk for road kill. However, in a review of roads and their ecological impacts, Forman and Alexander (1998) concluded that except for local spots, road kill rates rarely limit population size.

The proposed new roads have been routed in a manner that minimizes forest fragmentation to the extent practicable. Fragmenting forest habitat can also be detrimental to many species of wildlife that favor forest-interior settings, including many migratory forest birds. The review team concluded that these impacts on common species would not be detectable beyond the local vicinity and would not destabilize regional populations. Impacts on the eastern fox snake and other rarer species are discussed further in Section 4.3.1.3.

Human activity, machinery operations, lighting, traffic, noise, and fugitive dust would likely displace wildlife in habitats surrounding work areas. The impact of fugitive dust is expected to be negligible because unpaved access roads and other exposed soils would be watered as necessary. Emissions from heavy equipment are expected to be minimal because of regularly scheduled maintenance procedures. The impact on terrestrial wildlife from these impact sources would be minimal, and no additional mitigation measures are needed.

There is limited published literature regarding bird collisions with elevated construction equipment, such as cranes. Erickson et al. (2005) reviewed the literature on anthropogenic bird mortality and concluded that collisions with communications towers, while potentially significant on a case-by-case basis, are far less important on a nationwide basis than is mortality from buildings, power lines, automobiles, domestic cats, and pesticides. Assuming elevated construction equipment such as cranes create a similar hazard as communication towers, it may reasonably be concluded that a small number of cranes for a limited duration (as planned for building Fermi 3) would have minimal impact on birds.

Noise generated by site activities, workers, and equipment can affect wildlife. Effects may include physiological changes, abandonment of nests or dens, curtailed use of foraging areas, and other behavioral modifications. Noise may displace wildlife, which may increase resource demand in adjacent habitats, exceeding carrying capacity and ultimately resulting in higher mortality rates. Because most of the noise would be close to the existing Fermi structures, much of the wildlife in the area may have already adapted to industrial noise levels. It is therefore expected that the overall impact of construction noise on wildlife would be minimal.

Noise from site-preparation and site-development activities can affect wildlife by inducing physiological changes, nest or habitat abandonment, or behavioral modifications, or it may disrupt communications required for breeding or defense (Larkin 1996). However, it is not unusual for wildlife to adapt to such noise (Larkin 1996). Development activities that would generate noise include operation of equipment such as jackhammers, pile drivers, and heavy construction vehicles. Short-term noise levels from development activities onsite could be as high as 90 dBA at a distance of 50 ft from construction activity (Detroit Edison 2011a). That level would not extend far beyond the boundaries of the construction footprint. The threshold at which birds and small mammals are startled or frightened is 80 to 85 dBA (Golden et al. 1980). The review team expects that noise levels associated with creation of the transmission line corridor would be similar to noise levels associated with development activities onsite, but would be incurred for a more limited duration at any given location. Thus, impacts on wildlife from noise are expected to be negligible.

Accidental spills associated with construction activities could affect terrestrial wildlife but are of a greater concern to aquatic organisms (see Section 4.3.2). Refueling stations, fuel storage, oil storage, and storage of other fluids also pose a risk to surface waters that some wildlife species rely upon. However, activities and spill countermeasures, including the use of BMPs, would be implemented in a way that minimizes the potential for spills and limits the spread of spilled materials, thereby limiting mortality and morbidity of wildlife. As discussed in Section 4.2, a PIPP that addresses actions to be taken in the event of such spills would be implemented. Accordingly, impacts from a spill occurrence are expected to be minor, and no additional mitigation measures would be needed. BMPs related to the management of effluent and stormwater runoff as required by the Storm Water Management Plan and NPDES permit would also limit these impacts.

Detroit Edison could minimize impacts on wildlife, especially important wildlife species (see Section 4.3.1.3), through mitigation measures, including restricting the timing of certain construction activities (such as avoiding primary nesting periods for the bald eagle or limiting disturbance of specific habitat types) to periods when migratory species that use those habitats have migrated out of the area (see Section 4.3.1.3). Detroit Edison has stated it would follow FWS guidance for bald eagle management (Detroit Edison 2011a).

4.3.1.2 Terrestrial Resources – Transmission Lines

Building Fermi 3 would require installing three new transmission lines in an assumed 300-ft-wide corridor from the Fermi site to the Milan Substation, a distance of approximately 29.4 mi. The proposed transmission line route is described and illustrated in Section 2.4.1.2 and Figure 2-5. The 345-kV transmission system and associated corridors are exclusively owned and operated by ITC*Transmission*. Detroit Edison would not control the development or operation of the transmission system. Accordingly, the impacts discussed for the proposed new transmission lines are based on publicly available information and reasonable expectations of the configurations and practices that ITC*Transmission* would likely follow based on standard industry practice. In general, the impacts on terrestrial resources from building new transmission lines for Fermi 3 would be similar to those for building onsite facilities, as described in Section 4.3.1.1.

Impacts on Habitats

Vegetation communities occurring along the transmission line route are similar to those away from the Lake Erie shoreline on the Fermi site, as described in Section 2.4.1.1. Impacts on vegetation in the initial 18.6 mi of the corridor are expected to be minimal because of the expected use of existing corridor and because access for installing new infrastructure is good. Potential impacts from building the transmission lines would, therefore, be limited primarily to the western 10.8 mi of the route. The level of vegetation maintenance to date within this undeveloped segment of the route has been minimal except to remove tall woody vegetation.

Initial development of this segment would likely result in clearing of trees and other woody vegetation, followed by more intensive maintenance during operation of the transmission lines. Clearing and disposal of woody vegetation would have to be performed in a manner consistent with the provisions of the MDA Emerald Ash Borer Interior Quarantine on firewood and other ash tree products in effect at the time of site preparation activities to avoid spreading the emerald ash borer (MDA 2009). Access from existing roads is sufficient such that few, if any, new access roads would need to be built. Clearing would likely be necessary in areas of deciduous forest and forested wetlands.

Table 2-6 presents the vegetative cover types that occur within the 29.4-mi Fermi 3 transmission line corridor. Table 4-2 presents similar information for just the 10.8-mi segment of the transmission line corridor that is currently undeveloped. Most impacts would occur in this 10.8-mi segment. Since ITC*Transmission* would determine the type of structures used (as well as quantity) at a time closer to installation of the new lines, the eventual structure placement is

Table 4-2. Vegetative Cover Types Occurring in the Undeveloped 10.8-mi Segment of the Transmission Line Corridor

Plant Community	Acres in Corridor[a]	Percent of Vegetative Community in Region[b]	Acres in Region[b]
Open water	0	0	725,910
Developed	11	0.001	1,089,795
Barren land	0	0	10,346
Deciduous forest	170	0.06	282,046
Evergreen forest	0	0	6717
Mixed forest	0	0	5765
Shrub/scrub	6	00.19	3179
Grassland/herbaceous	10	0.02	41,308
Pasture/hay	45	0.02	219,241
Cultivated crop	90	0.007	1,217,689
Woody wetlands	74	0.06	128,090
Emergent herbaceous wetland	9	0.02	56,711
Total	**415**	**0.01**[c]	**3,786,797**

Source: Adapted from Detroit Edison 2011a

(a) The number of acres in the corridor for each plant community was estimated by Detroit Edison using geographical information system (GIS) measurements of land cover data. The total area of these communities in the corridor sums to 415 ac, which is greater than the area within a 10.8 mi-long, 300 ft-wide corridor (393 ac). It is assumed that this difference results from slight inaccuracies in GIS measurements. This difference does not affect the analysis of impacts presented here.

(b) Region is defined as the area within a 50-mi radius of the Fermi site (see Section 2.2).

(c) Calculated using 415 as a percentage of 3,786,797.

not known at this time. Therefore, the amounts of each type of habitat affected cannot specifically be determined. However, since most of the affected habitats are previously disturbed, the potential magnitude of the impacts would be minimal when compared to the amount of the same cover types in the region.

As described in Section 4.3.1.1 for the site, most large or more mobile wildlife species present are expected to be sufficiently mobile and would temporarily move out of the way to avoid activity, but smaller, ground- and cavity-dwelling animals as well as nesting birds would be more vulnerable to mortality from land clearing. Wildlife species that favor disturbed vegetation communities would be expected to benefit and use the newly cleared corridor following erection of the transmission lines. The impact on terrestrial wildlife resources would therefore be relatively minor, and no additional mitigation would be warranted beyond that typically used by ITC*Transmission*. Impacts on important species that may inhabit the transmission line corridor are discussed in Section 4.3.1.3.

4.3.1.3 Important Terrestrial Species and Habitats

Important Species – Fermi Site

This section describes the potential impacts on important species, including Federally proposed, threatened, or endangered terrestrial species; State-listed species; and other ecologically important species, resulting from construction of Fermi 3 and the onsite 345-kV transmission lines. The species and the potential impacts of construction activities on these species are described in the following sections. As part of the NRC's responsibilities under Section 7 of the Endangered Species Act of 1973 (ESA), the NRC staff will prepare a Biological Assessment (BA) prior to issuance of the final EIS that evaluates potential impacts of preconstruction and construction activities on Federally listed (or proposed) threatened or endangered aquatic and terrestrial species.

Section 2.4.1 describes the important terrestrial species and habitats located within the Fermi site and vicinity and the transmission line corridors. When contacted by Detroit Edison in October 2007, the FWS stated that the proposed Fermi 3 occurs within the potential range of several plant and animal species listed under the Endangered Species Act of 1973 (ESA) (Detroit Edison 2010a). At that time, the FWS also indicated that it had had no records of occurrence of any ESA-listed species in the project area, and that no designated critical habitat for ESA-listed species occurred on or in the vicinity of the Fermi site (Detroit Edison 2010a). In a letter to the NRC in January 2009 (FWS 2009a), however, the FWS identified several terrestrial species that were ESA-listed or candidates for listing that could occur in the area of the Fermi 3 project and the transmission line corridor.

MDNR (Detroit Edison 2009d) identified eight terrestrial State-listed threatened and endangered animal and plant species that are known to occur or that could occur on or in the vicinity of the

Fermi site. Since that time, two species, the bald eagle (*Haliaeetus leucocephalus*) and Frank's sedge (*Carex frankii*), have been removed from the State list of threatened and endangered species. Field studies in 2007, 2008, and 2009 identified one State-listed animal (eastern fox snake) and one State-listed plant species (American lotus [*Nelumbo lutea*]) on the Fermi site (Detroit Edison 2009b). Table 4-3 lists the protected species that are known to occur or that could occur on the Fermi site.

Bald Eagle

The bald eagle is a State-listed species of concern and is no longer Federally listed as threatened (MNFI 2010). MDNR guidelines for bald eagle management follow those provided by the FWS *National Bald Eagle Management Guidelines* (FWS 2007). These guidelines suggest avoiding any activities within a 660-ft radius around a nest during the breeding season. The restricted area is imposed because bald eagles are extremely sensitive to human activity during the first 12 weeks of the breeding season. These guideline limitations would be adhered to during the building of Fermi 3. The bald eagle is unlikely to be adversely affected, given the distances between project activities and existing eagle nests, and as demonstrated by the continued nesting behavior near the Fermi 2 cooling towers. There is also evidence of the rebuilding of a nest in the coastal forest south of Fermi 2 (Detroit Edison 2011a).

Three eagle nests have been reported on the Fermi site, at least one of which was active in 2008 and 2009 (Detroit Edison 2009b). Two nests were located east of the Fermi 2 cooling towers near Lake Erie and are more than 700 ft away from any areas that would be disturbed by activities related to Fermi 3. The third was located in trees along the Lake Erie shoreline south of Fermi 2. However, the latter nest was apparently destroyed by winter storms in late 2007 or early 2008. What appeared to be a new eagle nest was observed in the coastal forest to the southeast of the Fermi 2 facilities in an eastern cottonwood (*Populus deltoides*) during the April 2009 survey session. This unconfirmed eagle nest was within 660 ft of an area that would be temporarily disturbed during construction and preconstruction of Fermi 3 (Detroit Edison 2009e). As of January 2011, none of the previously observed bald eagle nests could be seen on the Fermi site; they have presumably deteriorated because of nonuse and weather (Detroit Edison 2011c).

Bald eagles of various ages have been observed during all surveys conducted on the Fermi site. Three fledglings were observed on the Fermi site during the October 2008 survey. More fledglings or subadults (juveniles) were observed during the January 2009 survey and one subadult was observed during the April 2009 survey. The eagles using the Fermi site do not appear to be distressed by proximity to existing human activities, as demonstrated by successful fledging of young, even though the nests are adjacent to the existing Fermi 2 cooling towers, where mechanical noises and other human activities are common (Detroit Edison 2011a). Since the existing eagle nests to the northeast of the Fermi 2 cooling towers have been active and successful for several years and because no structural changes are being proposed

1 **Table 4-3**. Important Terrestrial Species Known or with Potential to Occur on the Fermi 3 Site

Common Name	Scientific Name	Federal Status[(a)]	State Status[(b)]	Potential Impacts
Plants				
American lotus	*Nelumbo lutea*	NL	T	Filling part of the south canal would require transplanting American lotus plants to other suitable areas on site
Arrowhead	*Sagittaria montevidensis*	NL	T	No impacts anticipated
Eastern prairie fringed orchid	*Platanthera leucophaea*	T	T	No impacts anticipated
Red mulberry	*Morus rubra*	NL	T	No impacts anticipated
Reptiles				
Eastern fox snake	*Pantherophis gloydi*	NL	T	Building of permanent and temporary facilities will disturb habitat; snakes will be relocated to extent possible; temporary facilities will be removed and habitat will be restored
Birds				
Barn owl	*Tyto alba*	NL	E	No impacts anticipated
Bald eagle	*Haliaeetus leucocephalus*	NL (also BGEPA)	SC	No impacts anticipated
Common tern	*Sterna hirundo*	NL	T	No impacts anticipated
Mammals				
Indiana bat	*Myotis sodalis*	E	E	Summer roost areas may be present in wooded areas; limiting tree clearing operations to seasons when bats would not be present on the site will minimize impacts
Insects				
Karner blue butterfly	*Lycaeides melissa samuelis*	E	T	No impacts anticipated

Sources: Detroit Edison 2009d, FWS 2009a

(a) ESA-E = listed under the ESA as endangered, ESA-NL = not listed under the ESA, ESA-T = listed under the ESA as threatened, BGEPA = protected under the Bald and Golden Eagle Protection Act, MBTA = protected under the Migratory Bird Treaty Act.

(b) E = endangered, SC = species of special concern, T = threatened.

in that area (i.e., no vegetation clearing or similar construction activities), it is not likely that bald eagles would be permanently displaced from that part of the Fermi site or otherwise disturbed in a substantial way during the building of Fermi 3.

Detroit Edison's ER states that scheduling of work would be carefully planned to avoid activities near active nesting areas during the breeding season, such as in the area near the potential new eagle nest, in accordance with the *Bald and Golden Eagle Protection Act* (BGEPA) and the Migratory Bird Treaty Act (MBTA) (Detroit Edison 2011a). The breeding season at the Fermi site starts as early as mid-January and extends through June (Hoving 2010). Detroit Edison would coordinate with the FWS on construction locations and schedules (Detroit Edison 2011a). Therefore, the review team anticipates that impacts on the bald eagle from the building of Fermi 3 would be minimal, and no additional mitigation measures, beyond those proposed by Detroit Edison in the ER, are needed.

<u>Eastern Prairie Fringed Orchid</u>

The eastern prairie fringed orchid (*Platanthera leucophaea*) is listed by the Federal and State governments as threatened. The FWS identified the eastern prairie fringed orchid as occurring in Monroe County. MDNR, however, did not include this orchid as known to occur on the Fermi site in its November 28, 2007, letter to Detroit Edison's consultant (Detroit Edison 2009d). Detroit Edison surveyed the vegetation of areas of the Fermi site most likely to be affected by construction of Fermi 3. In addition to reconnaissance surveys in 2007, more detailed surveys were conducted in 2008 and 2009, including during the plant's flowering period in early summer 2009. The surveys did not identify the eastern prairie fringed orchid on the Fermi site (Detroit Edison 2009b). From MDNR's review and Detroit Edison's more detailed surveys, the review team has concluded that the eastern prairie fringed orchid is unlikely to occur on the Fermi site, and the effects on this species would be negligible.

<u>Indiana Bat</u>

The Indiana bat (*Myotis sodalis*) is listed as endangered by the Federal and Michigan State governments. The NRC and Detroit Edison conferred with the FWS about this species in May 2009. There are no records of the Indiana bat being observed in Monroe County, but the habitat of the project site and transmission line corridor is suitable for roosting and is in the range of the species (FWS 2009a, b). Although there are no confirmed observations of the Indiana bat in Monroe County, the bat has been observed in nearby Washtenaw County as recently as 2005 (MNFI 2007a) and there are two known Indiana bat colonies in neighboring Lenawee County (Kurta 2010). Large trees with exfoliating bark are the preferred roosting habitat for the Indiana bat (NatureServe 2009), but trees as small as 5 in. in diameter at breast height (dbh) should be considered as potential roosting habitat (FWS 2009b). The death of many green ash (*Fraxinus pennsylvanica*) trees on the site and the wider region has resulted in many standing dead trees of 5 in. dbh or larger with peeling bark. These dead trees could temporarily serve as potential roosting habitat for Indiana bats until the dead bark sloughs off or the dead trees fall over. At least some of the Fermi site, therefore, should be considered potential Indiana bat summer roosting habitat. It is noted that the emerald ash borer has killed hundreds of thousands of ash trees in the southeastern Michigan region, creating habitat conditions similar to those on the Fermi site across a wide area. Tree clearing would result in the loss of some potential roosting habitat, but no impact on the Indiana bat is anticipated because it is likely that any bats present on site would use the substantial areas of remaining forest on the Fermi site and the vicinity.

The *Range-wide Indiana Bat Protection and Enhancement Plan Guidelines* (FWS 2009b) developed by the FWS for surface mining activities provides guidelines for avoidance, minimization, and mitigation measures to minimize effects on the Indiana bat. Among the measures identified are restrictions on timing of tree clearing to ensure no bats are present during clearing. The review team concludes that the impact of building Fermi 3 on the Indiana bat would be minimal as long as Detroit Edison follows the protection measures in the *Range-wide Indiana Bat Protection and Enhancement Plan Guidelines* (FWS 2009b), including limiting the clearing of potential roosting trees to the months when the bats would not be expected on the site, and no additional mitigation measures are needed.

<u>Karner Blue Butterfly</u>

The Karner blue butterfly (*Lycaeides melissa samuelis*) is listed by the Federal and State governments as endangered and threatened, respectively. The NRC and Detroit Edison conferred with the FWS about this species in May 2009. The most recent documented record of the Karner blue butterfly in Monroe County was in 1986 (MNFI 2007b). The preferred habitat for this insect is dry, sandy soils where wild lupine (*Lupinus perennis*), its sole food source, grows. The soils of the Fermi site are more fine-grained than the preferred habitat and are not well drained. Although lupines were established in the prairie creation area in the existing onsite transmission corridor and were observed in 2000 and 2002, no lupines were observed in subsequent vegetation surveys conducted between 2006 and 2009 (Detroit Edison 2009b). The MDNR Endangered Species Coordinator stated that Karner blue butterflies are not likely to occur on the Fermi site because none were found when the entire area was carefully surveyed in recent years prior to introduction of Karner blue butterflies in the Petersburg Wildlife Management Area near Petersburg, Michigan (Hoving 2010). The maximum movement of the butterflies from their point of introduction is about 1 km, eliminating the possibility that introduced butterflies would now occur on the Fermi site (Hoving 2010).

Based on this information, the likelihood of the Karner blue butterfly occurring on the Fermi site is considered very low and the effects on this species of building Fermi 3 would be negligible.

American Lotus

The American lotus is a Michigan State-listed threatened species. It is a wetland plant common in moderately shallow areas of the South and North Lagoons and the south canal on the Fermi site. The species reaches a northern limit of its distribution in southern Michigan, but several healthy populations exist in southeastern Michigan (Sargent 2010). American lotus grows from thick and creeping underground tubers that make it impractical to determine how many plants are actually present in a given area (Sargent 2010). American lotus occurring in the south canal may be affected by building Fermi 3. According to the ER, (Detroit Edison 2011a), MDNR endangered species specialists have recommended that plants in areas to be disturbed be transplanted to other areas on the Fermi site or possibly offsite, to minimize adverse impacts. The plants are hardy and have been successfully transplanted in the Southeastern Michigan area (Hoving 2010). Project activities are not expected to disturb the South or North Lagoons and, therefore, no American lotus in these areas should be affected. Detroit Edison intends to engage in further consultation with the MDNR in developing an appropriate mitigation strategy for this species (Detroit Edison 2011a). Impacts from building Fermi 3 would be minimal and no mitigation measures are needed beyond those already identified by Detroit Edison in the ER.

Arrowhead

The arrowhead (*Sagittaria montevidensis*), a State-listed threatened species, has not been conclusively identified on the Fermi property. A specimen of the *Sagittaria* genus was observed during the 2008–2009 vegetation surveys (Detroit Edison 2009b), but mature specimens with flowers were not available to conclusively identify the species. The judgment by Detroit Edison's contractor was that the plant's observable characteristics did not support identification as *S. montevidensis*. The area in which the plant was observed would not be directly affected by building Fermi 3, in any case. Most of the habitat that might have been suitable for the species has been invaded by common reed (*Phragmites australis*). Therefore, impacts from building Fermi 3 would likely be negligible.

Eastern Fox Snake

The eastern fox snake (a Michigan State-listed threatened species) has been observed several times since 1990 on the Fermi property. According to Detroit Edison, more than 15 documented sightings of the eastern fox snake have been made on the Fermi site since 1990, including two sightings in 2008 during the wetlands delineation survey (Detroit Edison 2010b). Between one and six snakes have been observed on each occasion. Eastern fox snakes have been observed in a variety of habitats, even near Fermi 2 buildings. The snake's most likely preferred habitat occurs along the cattail marshes or wetland shorelines around woody debris, but many of the habitats present on the Fermi site are usable as habitat by the snake (MNFI 2007c). Of the 1260 ac of the Fermi site, 656 ac are undeveloped, and much of it is potentially suitable habitat for the eastern fox snake. Fermi 3 building activities would affect approximately 197 ac of potential fox snake habitat (see Section 4.3.1.1). Of the potential fox snake habitat that would be disturbed, however, only approximately 21 ac would be emergent wetland, the snake's preferred habitat.

Approximately 51 ac of potential fox snake habitat would be converted permanently to developed uses. The remaining 146 ac of disturbed habitat would be restored to the pre-project vegetative cover type. The three largest areas to be disturbed (i.e., parking areas, construction laydown, and Fox Road construction) are expected to be restored to a condition of equivalent or better general ecological value following completion of the project, although forest and other habitat with woody vegetation will take years to re-establish many pre-project ecological functions.

Traffic into the site and vicinity would increase greatly during construction. Currently, approximately 800 employees and 150 contract supplemental employees operate Fermi 2. Increased traffic associated with operation of Fermi 3 has the potential to increase wildlife mortality, including mortality of eastern fox snakes, resulting from vehicle-wildlife interactions. Approximately 2900 construction workers would be employed at the peak of construction. Traffic into the Fermi site would increase correspondingly, and additional traffic would be generated by deliveries (Detroit Edison 2011a).

Detroit Edison's Habitat and Species Conservation Plan (Detroit Edison 2010b) identifies mitigation of direct impacts on the snake. The plan calls for: (1) surveying each area of potentially suitable habitat prior to initial disturbance, followed by removal of any snakes observed; (2) limiting disturbance of habitat to seasons when the snake is active so that surveyors could more readily spot any individuals present and that the snake would have the opportunity to move to undisturbed areas; (3) training of Fermi 3 construction workers on what the snake looks like; (4) instructions to notify inspectors when one is sighted; (5) providing trained inspectors with stop-work authority in order to protect individual snakes and occupied habitat when observed; and (6) posting signage warning drivers of the possible presence of eastern fox snakes.

Since the snakes are known to use open areas, they may cross roads or use the pavement for thermal regulation, leading to a risk of mortality from vehicles that could increase as traffic increases. The MDNR Endangered Species Coordinator stated, however, that some species of snakes may not be seriously affected if they have large undisturbed habitat areas nearby (Hoving 2010). It has not been determined whether there would be enough undisturbed habitat areas close enough to the project to allow fox snakes to avoid serious impacts. Large areas of potential eastern fox snake habitat would remain undisturbed near the disturbed habitat.

The Endangered Species Coordinator for MDNR has not yet reviewed Detroit Edison's proposed Habitat and Species Conservation Plan for the eastern fox snake and has not, therefore, commented on whether the plan's mitigation measures would be adequate to protect the eastern fox snake (Hoving 2010). He stated that monitoring of the eastern fox snake population during and after building of Fermi 3 could help determine whether the direct impacts from site activities and increased traffic warranted additional mitigation measures. An example of mitigation for increased traffic mortality risks, if needed, could be to install barriers, such as silt fences, along roads to impede surface crossing by snakes. (Impacts on the eastern fox snake from traffic during the operation of Fermi 3 are discussed in Section 5.3.1.)

Given the extent of potential eastern fox snake habitat that would be disturbed, albeit temporarily, and the increased construction traffic during construction and preconstruction, the review team recognizes that the Fermi 3 project could result in mortality of some individuals and reduce the local population unless appropriate avoidance and mitigation measures are taken. The majority of the suitable eastern fox snake habitat on the Fermi site would not be disturbed directly, however. In addition to the measures identified in Detroit Edison's Habitat and Species Conservation Plan for the eastern fox snake (Detroit Edison 2010b), the review team believes that monitoring of the snake would be necessary during and after building Fermi 3 to support development and implementation of effective mitigation measures. The review team expects that this monitoring would be required by and done under the direction of the MDNR.

Summary of Impacts on Important Species on the Fermi Site

The construction and preconstruction impacts on important species on the Fermi site are projected to be minimal for most species with no additional mitigation. However, impacts on eastern fox snake population levels could be noticeable unless adequate mitigation measures are developed and implemented. The Fermi 3 facility layout minimizes impacts on wetlands and forest cover. With the exception of habitat for the eastern fox snake, specific habitats preferred by the important species of the region are mostly absent from the area to be affected by building the project. State permitting would probably result in requirements to protect the eastern fox snake to the extent practicable and to mitigate impacts that cannot be avoided.

Important Habitat – Fermi Site

Wetlands

Detroit Edison conducted a wetlands investigation (Detroit Edison 2010a) to delineate wetland boundaries and assess functions and values of the wetlands present on the Fermi property. The results of the wetland investigation and the subsequent USACE jurisdictional determination and MDEQ Wetland Identification Program verification are summarized in Section 2.4.1.2. Detroit Edison revised its initial project plan to minimize impacts on wetlands, but requirements for placement of the proposed Fermi 3 and supporting facilities would result in unavoidable impacts on approximately 34.5 ac of wetland habitat on the Fermi site (see Figure 4-4). This area includes approximately 21.2 ac of emergent marsh, 8.0 ac of forested wetland, and 5.3 ac of scrub-shrub wetland. Of this area, approximately 23.7 ac would experience only temporary

Figure 4-4. Wetlands Affected by Building of Fermi 3 (Detroit Edison 2011a)

impacts; Detroit Edison would restore the contours, hydrology, and vegetation of temporarily impacted wetlands following construction (Detroit Edison 2011e).

Approximately 6.1 ac of emergent marsh and 2.2 ac of forested wetland (approximately 8.3 ac of total wetlands) would be filled and converted permanently to non-wetland (Detroit Edison 2011e). Before filling wetlands (except for approximately 1.9 ac of isolated wetlands not under USACE jurisdiction), Detroit Edison would be required to obtain a CWA Section 404 joint permit from the MDEQ and the USACE. A permit would also be required from the MDEQ to disturb State-regulated wetlands. Delineation data from the wetland investigation was submitted to the MDEQ and USACE for a Jurisdictional Determination of the wetlands. Detroit Edison has prepared a conceptual aquatic resource mitigation strategy proposing the compensatory mitigation of 82 ac offsite and 21 ac onsite (Detroit Edison 2011e) (see Appendix K of this EIS). Review and acceptance by the USACE and MDEQ would be conducted through their respective permitting processes. The USACE permitting process includes an opportunity for the public to review and comment on the proposed mitigation. Detroit Edison would comply with State and Federal wetland permit conditions with respect to mitigation of wetlands impacts and restoration of wetland habitat to offset permanent loss of wetlands resulting from building Fermi 3 (Detroit Edison 2011a).

Most of the wetland impacts noted above involve wetlands that are regulated by Federal and State agencies. However, they also include impacts approximately 1.9 ac of emergent wetlands (called “Wetland A” during the wetland delineation) that are not under Federal or State jurisdiction. No non-jurisdictional forested or scrub-shrub wetlands would be disturbed. The 1.9 ac of non-jurisdictional emergent wetlands would be permanently filled but are not addressed in Detroit Edison’s proposed mitigation.

Impacts on wetlands have been minimized by locating facilities on upland areas to the greatest extent possible. Detroit Edison has prepared four iterations to its proposed Fermi 3 site layout that have each successively reduced wetland impacts. Most notably, Detroit Edison moved the proposed cooling tower from wetlands in the South Lagoon to an upland area closer to the Fermi 3 powerblock. Detroit Edison clustered several support facilities at the edge of the existing Fermi 2 developed area that had originally been proposed for location in wetlands in the western part of the site. Work within wetlands would be carried out using BMPs to minimize impacts on adjacent wetlands near and downgradient of the disturbance zone. Temporary impacts on the soil and runoff would result from vegetation clearing and grading. Silt fences and other necessary erosion control features, as specified in a SESC plan to be approved by the MDEQ prior to site disturbance, would be erected prior to soil disturbance. The SESC must be developed consistent with Michigan’s Soil Erosion and Sediment Control Program, which includes requirements for design and the timing of implementation of BMPs. Exposed soil would be covered, bermed, or protected with a temporary seeding until backfilled and graded.

Construction effluent and stormwater runoff would be monitored as required by the NPDES stormwater construction permit and other applicable construction permits.

Silt fencing or other barriers to protect wetlands from sedimentation would be placed between areas of proposed ground disturbance and adjoining wetlands. Entry into the wetlands by equipment or workers would be prohibited unless necessary. Other BMPs would be applied as appropriate (Detroit Edison 2011a). Wherever possible, disturbed areas would be revegetated as soon as possible following disturbance to minimize the potential for soil erosion and stormwater runoff. Plantings would be of native species.

The impacts on wetlands from development of the Fermi site are expected to be noticeable, due to the size of the area of permanent and temporary impacts and the long-term time frame needed for recovery of temporarily disturbed forested wetlands. Detroit Edison has minimized activities in wetlands to the extent practicable and would use BMPs to further minimize impacts. Detroit Edison has also stated that it would prepare a wetland mitigation plan for Fermi construction activities to be submitted to the USACE and MNDEQ as a condition for receiving wetlands and NPDES stormwater permits (Detroit Edison 2011a).

Detroit River International Wildlife Refuge

The proposed Fermi 3 footprint would encroach into a portion of the Fermi site that is managed as part of the DRIWR. Additional discussion can be found in Section 4.1. The DRIWR Lagoona Beach Unit (a total of 656 ac) is located entirely within the Fermi site. Development of Fermi 3 would encroach into approximately 45 ac, or about 7 percent of the Lagoona Beach Unit (see Figure 4-5); approximately 19 ac would be permanently lost and approximately 26 ac would be temporarily lost for the duration of the construction period (Table 4-4) (Detroit Edison 2011a). The agreement between Detroit Edison and the FWS that established the wildlife refuge allows for modifications to the agreement (such as the proposed building of Fermi 3) by either party at any time (Detroit Edison 2003). The impacts of reducing the effective area of the DRIWR are principally land use impacts, which are discussed in Section 4.1.1. However, DRIWR is important as an ecological habitat because of its coastal wetlands. Accordingly, the impacts on the DRIWR are defined primarily by the overall wetlands impacts, as discussed above.

Important Terrestrial Species – Transmission Lines

Important species potentially occurring in or along the transmission line corridor are described in Section 2.4.1.3 and Section 2.4.1.4. The FWS (2009a) identified several terrestrial species that are Federally listed under the ESA or that are candidates for such listing that could occur in the area of the transmission line route. Species identified as potentially present in Monroe County are the Indiana bat, Karner blue butterfly, and eastern prairie fringed orchid. For Wayne County, the species identified are the Indiana bat and eastern prairie fringed orchid. For Washtenaw County, the species identified are the Indiana bat, Mitchell’s satyr butterfly

Figure 4-5. Permanent and Temporary Impacts on DRIWR, Lagoona Beach Unit from Fermi 3 Building Activities, Overlaid on Existing Terrestrial Communities (Detroit Edison 2011a)

Table 4-4. Area of DRIWR, Lagoona Beach Unit Affected by Fermi 3 Building Activities

Refuge Area	Area Size (acres)	Permanent Impacts (acres)	Temporary Impacts (acres)
NE	161.7	0	0
NW	161.1	16.1	22.7
SE	311.2	2.6	3.5
SW	22.4	0	0
Total	**656.4**	**18.7**	**26.2**

Source: Detroit Edison 2011a

(*Neonympha mitchellii mitchellii*), and eastern prairie fringed orchid. The FWS also noted that the eastern massasauga (*Sistrurus catenatus catenatus*), a candidate species, may be present in Washtenaw and Wayne Counties.

No Federally designated critical habitat occurs in the vicinity of the transmission line corridor. The discussion for the corridor is more general than for the Fermi site because detailed development plans have not yet been developed. Discussions between the NRC and FWS indicate that the potential for impacts on Federally listed species may need more detailed analysis before the transmission lines are built.

The State of Michigan has identified numerous State-listed species in Monroe and Wayne Counties, but MDNR has not commented on which species may be present in the proposed transmission line corridors. A list of Federally and State-listed species that occur in Monroe, Washtenaw, and Wayne Counties and that may occur within the transmission line corridor is provided in Table 2-8. The Indiana bat, eastern prairie fringed orchid, Karner blue butterfly, and Mitchell's satyr butterfly are also State-listed as threatened or endangered. The eastern massasauga is State-listed as a species of special concern. Among other threatened or endangered species that may be present within the transmission line corridor are the eastern fox snake and barn owl (*Tyto alba*).

ITC*Transmission* would need to confer with MDNR to determine which State-listed species could be affected by development of the transmission line. Once the exact corridor boundary has been defined, field surveys may be required prior to ground disturbance. Because ITC*Transmission* has some leeway in the locations of transmission line towers and because the transmission line development does not require the level of disturbance that Fermi 3 would require, the impacts on terrestrial species from transmission line development are expected to be minimal, assuming that measures to avoid, minimize, and mitigate impacts on habitats and wildlife equivalent to those implemented on the Fermi site are implemented.

The impacts on important species from development of the proposed transmission lines are projected to be minimal, conditional upon ITC*Transmission* coordinating with the FWS, MDEQ, and MDNR and implementing any avoidance, minimization, or mitigation measures those agencies require to minimize impacts on Federal and State-listed species.

Important Terrestrial and Wetland Habitats – Transmission Lines

Important habitats are defined in Section 2.4.1.2 and discussed for the proposed transmission line corridor in Section 2.4.1.4. Wetlands are the only important habitat crossed by the anticipated transmission line route. The locations of these wetlands are illustrated in Figure 2-11. Approximately 93.4 ac of forested wetland occur within the expected transmission line corridor; most, if not all, would be permanently cleared of trees. These wetlands would be converted to scrub-shrub or emergent wetlands to maintain clearance for the conductors. No wetlands would be affected in the initial 18.6 mi of the route because adequate cleared corridor to accommodate the new transmission lines is already present. No wetlands are present in the area where the Milan Substation site would be expanded. The undeveloped western 10.8-mi section could require placing towers in wetlands that cannot be spanned (span distances usually cannot exceed 900 ft). The total potential permanent impact on wetlands from installation of all the towers is expected to be approximately 0.5 ac, based on the surface area of tower foundations (Detroit Edison 2011a). Clearing trees from forested wetlands would be necessary to construct the transmission lines. After the transmission lines are in place, woody vegetation would be managed to maintain necessary clearance around the conductors; these impacts are discussed in Section 5.3.1. A conceptual transmission line corridor has been identified, but wetland delineation surveys have not yet been conducted to determine the precise locations and extent of wetlands. Permanent impacts on wetland areas would be mitigated according to a wetland mitigation plan ITC*Transmission* would develop in coordination with the MDEQ and/or USACE. Any mitigation measures required for the impacts are expected to be determined by ITC*Transmission* in coordination with applicable regulatory agencies, including the USACE, at the time permit applications are submitted.

The impacts on wetlands from building the transmission system are projected to be noticeable, due to the size of the area of temporary impacts and the long-term conversion of forested wetlands to scrub-shrub or emergent wetlands.

4.3.1.4 Terrestrial Monitoring

Detroit Edison has not proposed terrestrial monitoring during construction or preconstruction of Fermi 3. However, the USACE could monitor or require monitoring for compliance with USACE-issued permits. The USACE is expected to require short and long-term monitoring of Detroit Edison's wetland mitigation activities. The State and other Federal agencies may also require monitoring for compliance with permits issued, including, but not limited to, regular inspection of silt fences and seeded areas and other erosion control activities. MDNR may require monitoring in connection with possible eastern fox snake mitigation measures.

4.3.1.5 Potential Mitigation Measures for Terrestrial Impacts

In determining the site layout for Fermi 3, Detroit Edison has made efforts to avoid or minimize impacts on wildlife habitat, wetlands, and local wildlife and habitat. Nonetheless, some impacts on these resources are unavoidable. Accordingly, Detroit Edison has identified a number of measures that would serve to mitigate impacts on terrestrial habitats and species.

Adverse impacts on the bald eagle would be avoided by prohibiting most work within 660 ft of bald eagle nest sites during the nesting season for the eagles (approximately mid-January through June in southeastern Michigan). If plan changes would result in the need for work within that distance, the work would be timed to take place outside of the nesting season.

Development of Fermi 3 may affect, but is not likely to adversely affect, the Indiana bat, with the condition that Detroit Edison follows the protection measures in the *Range-wide Indiana Bat Protection and Enhancement Plan Guidelines* (FWS 2009b), including limiting the clearing of potential maternity roost trees to seasons when the bats would not be present on the site. Implementing these measures is expected to ensure at most minimal impacts on the Indiana bat.

A small area of American lotus plants that grow in the south canal could be affected by the project. Any affected plants of that species would be removed and relocated to other suitable habitat on or off of the Fermi site.

Fermi 3 building activities would affect approximately 197 ac of terrestrial habitat (see Section 4.3.1.1), much of it potentially suitable habitat for the eastern fox snake. Detroit Edison's proposed Habitat and Species Conservation Plan for the eastern fox snake (Detroit Edison 2010b) would mitigate direct impacts on the snake by training Fermi 3 construction workers to identify the snake and notify construction inspectors when one is sighted. Trained inspectors would have stop-work authority in order to protect individual snakes and snake habitat. Increased traffic from construction equipment and construction workers' vehicles could increase mortality of the eastern fox snake. Monitoring of the eastern fox snake population during and after building of Fermi 3 could help determine whether the direct impacts from construction and impacts from increased traffic during and after construction warranted additional mitigation measures. An example of mitigation for traffic mortality impacts, if needed, might be to install fences impermeable to snakes that would serve as barriers to the snake along roads and reduce the likelihood of snakes being hit by vehicles.

Detroit Edison has proposed compensatory wetland mitigation involving restoring or enhancing approximately 82 ac of wetland offsite and 21 ac onsite (Detroit Edison 2011e). Clearing, grubbing, and other site preparation work could contribute to wildlife mortality and habitat loss. Habitat loss would be mitigated by restoring appropriate natural vegetation through planting of native species appropriate to each cleared area. Any impacts on terrestrial or wetland ecological resources associated with the compensatory mitigation proposed by Detroit Edison would be evaluated by the USACE and MDEQ as part of the permitting process for that activity. It is anticipated that this process will be completed prior to issuance of the final Fermi 3 EIS.

Mortality for most species is not anticipated to have noticeable effects on local populations. The risk of possible mortality of eastern fox snakes would be mitigated according to Detroit Edison's Habitat and Species Conservation Plan for that species.

4.3.1.6 Summary of Construction Impacts on Terrestrial and Wetland Resources

Based on threatened and endangered species surveys, known threatened and endangered species locations, historical records, life history information, and information provided by Detroit Edison in its ER and Request for Additional Information (RAI) responses, and based on the review team's independent evaluation, the review team concludes that the impacts from construction and preconstruction activities for Fermi 3 on terrestrial resources on the Fermi site and transmission line corridor would be SMALL because mitigation would be required prior to conducting site preparation, preconstruction, and construction activities. This conclusion is based in part on implementation of mitigation for wetlands that would be required by USACE and MDEQ and mitigation for eastern fox snake and American lotus impacts that would be required by MDNR. This conclusion is also based on conclusion of consultation with the FWS under the ESA. Based on the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the impacts of NRC-authorized activities on terrestrial resources would be SMALL.

4.3.2 Aquatic Impacts

Impacts on aquatic resources from building Fermi 3 would potentially affect Lake Erie and the north, central, and south canals; quarry lakes; Swan Creek; Stony Creek; and wetlands on or adjacent to the Fermi site. Activities that could affect these aquatic habitats include (1) building of a new intake structure, (2) building of a cooling water discharge structure, (3) construction of the barge slip, (4) building of a parking structure and a warehouse, (5) dewatering of the Fermi 3 excavation area, (6) culverting of the south canal; and (7) filling of the north and central canal (Sections 3.2 and 3.3). Ground-disturbing activities that lead to soil erosion during site preparation and building of Fermi 3 could result in adverse effects on water quality in water bodies on or adjacent to the Fermi site including Lake Erie, the North and South Lagoons, Swan Creek, and wetlands. In addition, during building of new transmission lines, there is potential to affect stream habitats in Monroe, Washtenaw, and Wayne Counties. This subsection evaluates impacts that could occur on aquatic resources on or in the vicinity of the Fermi site during preconstruction and construction of Fermi 3 or during building of associated transmission lines.

Preconstruction- and construction-related impacts on wetlands are described in detail in Section 4.3.1.3 of this EIS. As discussed in Section 2.4.2.1, drainage ditches and the circulating water reservoir on the Fermi site do not provide suitable aquatic habitat to support significant populations of aquatic organisms. Consequently, there would be no preconstruction- or construction-related impacts on aquatic resources within these surface water features.

4.3.2.1 Aquatic Resources – Site and Vicinity

This subsection evaluates impacts that could occur on aquatic resources on or in the vicinity of the Fermi site during preconstruction and construction of Fermi 3, including those in Lake Erie, the overflow canals, North and South Lagoons, quarry lakes, Swan Creek, and Stony Creek.

Lake Erie

Temporary or permanent loss of some aquatic habitat in Lake Erie could result from the building of the intake and discharge structures and development of the barge slip for Fermi 3. In addition, other preconstruction and construction activities on the Fermi site that result in ground-clearing, alteration of runoff patterns, or altered water quality in onsite surface waters have the potential to affect water quality and aquatic resources in adjacent areas of Lake Erie. These impacts are discussed in the following paragraphs.

Preconstruction activities associated with installation of the intake structure for Fermi 3 would include building a pump house on the Lake Erie shoreline near the intake facility, hydraulic dredging of the existing intake bay to accommodate the new intake structure, and construction of bulkheads within the intake bay. Ground-clearing and preconstruction activities on the shoreline for the pump house could result in increases in runoff to and sedimentation in adjacent nearshore areas of Lake Erie and could cause temporary effects on benthic habitat and biota due to siltation, as well as short-term localized declines in phytoplankton productivity and zooplankton densities in the areas within and adjacent to the existing intake bay due to an increase in suspended sediments.

Dredging for the intake structure and for the barge slip would be conducted under existing permits for maintenance dredging that have been issued by the USACE and MDEQ and would require implementation of mitigation measures and BMPs stipulated in those permits to limit impacts on water quality (Section 4.2.3.1). Assuming that the entire area within the intake bay was dredged to accommodate the building of these structures, approximately 3.7 ac of previously disturbed benthic habitat would be affected.

As described in Section 3.3.1.4, the proposed cooling water discharge pipeline would extend approximately 1300 ft into Lake Erie from the shore. In order to bury the pipeline, mechanical trenching of an area approximately 5 ft wide and 1300 ft long would be required, and would affect approximately 0.15 ac of benthic habitat, of which approximately 0.02 ac has not been disturbed previously by maintenance dredging activities. Installation of the discharge structure would require additional USACE and MDEQ permits in areas that have not been previously disturbed, and it is anticipated that those permits would require implementation of mitigation measures to limit impacts on water quality and aquatic biota.

Dredging for these structures (considered preconstruction activities) would result in the temporary loss of benthic organisms because of the disturbance of substrate and physical impacts on individuals, as well as short-term localized declines in phytoplankton productivity and zooplankton density due to increased turbidity. The anticipated increases in turbidity would also temporarily degrade the quality of fish habitat in the affected area. Although backfilling of the discharge pipeline trench would restore the substrate and contours of the pipeline alignment, there would be permanent loss of a small amount of aquatic habitat (less than 1 ac) within the footprints of the intake structure and the barge slip, and at the end of the discharge pipeline where the diffusers would be located. There are no known sensitive or important aquatic habitats within the areas that would be affected by these activities (e.g., aquatic vegetation or other structured habitat), and species diversity within the area is generally low (Detroit Edison 2011a; AECOM 2009). As a consequence, impacts on aquatic biota and habitats from development of the barge slip, intake structure, and discharge structure would be temporary, easily mitigated, and minor.

As described in Section 4.2.3.1, stormwater runoff from preconstruction and construction areas and discharge of water from excavation dewatering into any onsite surface waters would eventually enter Lake Erie, where aquatic resources could be affected by sediment or contaminants. As described in Section 4.2.3.1, Detroit Edison would obtain an NPDES stormwater construction permit that would require monitoring of preconstruction and construction-related discharges and would require soil erosion controls and other BMPs to comply with regulations designed to prevent degradation of water quality.

The review team considered whether preconstruction and construction activities would affect the potential for harmful algal blooms in Lake Erie in the vicinity of the Fermi site. Because the NPDES stormwater construction permit, the stormwater management plan for the Fermi site, and the employment of BMPs would have sufficient controls to protect water quality in Lake Erie, the staff concluded that chemical and physical discharges from building activities would not affect the density and distribution of aquatic nuisance species, including lyngbya (*Lyngbya wollei*), in Lake Erie.

Based on the analysis of information regarding building the intake structure, barge slip, and discharge structure in Lake Erie, the potential for water quality impacts from building activities at other areas of the Fermi site, and the implementation of mitigation measures and BMPs that would be stipulated in required permits, the review team concludes that the preconstruction- and construction-related impacts on aquatic resources in Lake Erie would be temporary, easily mitigated, and minor, and no further mitigation measures beyond those identified in the appropriate permits would be warranted.

Overflow Canals (North, Central, and South Canals)

Building of the parking structure and a warehouse would result in the complete filling of the central and the north canals and portions of the south canal. Impacts from filling these areas would result in the loss of approximately 7 ac of aquatic habitat and would affect the communities and aquatic organisms that currently reside in them. Surveys of aquatic organisms within the north, central, and south canals in 2008 and 2009 indicated that the fish and macroinvertebrate species present are common in surrounding aquatic habitats within the region; no sensitive or unique species or habitats were observed (AECOM 2009). The isolated central canal has no direct hydrological connection with the other onsite water bodies (Section 2.3.1.1), and aquatic organisms within the central canal would be killed when it is filled. Filling of the north and partial filling of the south canal systems would mostly result in habitat loss along the canal banks. Although most benthic organisms within the filled areas of the north and south canals would be killed, some of the fish and other more mobile animals within the affected areas may be able to escape harm by leaving the affected areas and moving to other portions of the canals, Swan Creek, and the South Lagoon. Some impacts in the south canal will be temporary; a culvert will be installed in the south canal and the existing bottom may be maintained or restored after installation. Dewatering of excavation areas would not affect water levels in the north or south canals or the associated wetland areas because they are hydraulically connected to Lake Erie (see Section 4.2.1).

Backfilling these onsite water bodies may affect stormwater runoff flowing to the North and South Lagoons, potentially causing a small increase of sediment loading into the North and South Lagoons, Swan Creek, and Lake Erie. An NPDES stormwater construction permit issued by MDEQ would be needed for preconstruction and construction and, as part of the NPDES stormwater construction permit, a SESC Plan would be implemented. The SESC Plan would identify BMPs to be implemented to alleviate the potential for increased sediment loading to other surface water areas (Detroit Edison 2011a). Based on the amount of aquatic habitat that would be affected, the nature of the aquatic habitat and organisms that occupy the overflow canals and the hydrologically connected surface water habitats, and the planned implementation of BMPs to address concerns related to stormwater runoff, the review team concludes that the impacts associated with filling these areas for building the parking structure and warehouse (both considered preconstruction activities) would be minor and no additional mitigation would be warranted. No NRC-authorized construction activities would affect these water bodies.

Quarry Lakes

There would be no direct effects of NRC-authorized construction activities on the Quarry Lakes, and runoff from preconstruction and construction areas would not enter the lakes because of the topography of the Fermi site. Dewatering associated with the construction of Fermi 3 includes dewatering the excavation site for the reactor. Groundwater modeling conducted by Detroit Edison (2011a) indicated that water levels in the Quarry Lakes could drop between 1 and 2 ft as a result of dewatering operations for preconstruction and construction activities (see Section 4.2.2.2). Methods being considered by Detroit Edison for reducing the amount of groundwater that would be extracted during dewatering operations are described in Section 4.2.1.3. As identified in Section 2.4.2.1, the Quarry Lakes were created when water filled abandoned rock quarries used for site development and construction of Fermi 2. These small lakes are steep-sided, approximately 50 ft deep, and support aquatic species common to Lake Erie coastal marsh habitats. Because of the steep sides, a decrease in water depth of up to 2 ft would result in only small temporary changes in surface area and would expose only small areas of benthic habitat. Assuming a decrease in water depth of 2 ft, the overall change in water volume would be less than 5 percent. Based on the amount of aquatic habitat that would be affected and the nature of the aquatic organisms that occupy these lakes, the impacts associated with the estimated depth changes would be temporary and minor and no mitigation would be required.

Swan Creek

The entire Fermi site is located in the Swan Creek watershed. Although no preconstruction or construction activities would occur in Swan Creek, stormwater runoff into the creek from preconstruction and construction areas could occur, and water removed from the subsurface during excavation dewatering would be discharged into stormwater outfalls that flow to Swan Creek via the North Lagoon (see Section 4.2.1.3). As described in Section 4.2.3.1, Detroit Edison would obtain an NPDES stormwater construction permit that would require monitoring of construction-related discharges and soil erosion controls and other BMPs to comply with regulations designed to prevent the water quality in Swan Creek from being affected by runoff from construction areas. As a consequence, construction-related impacts on aquatic resources within Swan Creek and adjacent areas of Lake Erie would be temporary, easily mitigated, and minor, and no further mitigation measures beyond the identified BMPs would be warranted.

Stony Creek

The entire Fermi site is located in the Swan Creek watershed, and no preconstruction or construction activities for Fermi 3 are planned in the vicinity of Stony Creek or within the Stony Creek watershed. Consequently, there would be no construction-related impacts on aquatic resources within Stony Creek.

4.3.2.2 Aquatic Resources – Transmission Lines

A short length (less than 1 mi) of new transmission line corridor would be developed on the Fermi site to transmit power from the Fermi 3 generator to a new Fermi 3 switchyard. This new onsite transmission line corridor would be approximately 170 ft wide and include two sets of towers that would carry both rerouted Fermi 2 transmission lines and new Fermi 3 transmission lines (Detroit Edison 2011a). Surface water and wetland features located along the proposed onsite corridor include the south canal (see Section 2.4.2), a drainage area that is composed of a mosaic of emergent wetland, and some forested wetlands (Detroit Edison 2011a). There are no surface water features within the footprint for the new switchyard (Detroit Edison 2011a). Clearing of the onsite transmission line ROW, erecting the transmission towers, and stringing of the transmission lines would all be accomplished using methods that minimize impacts on wetlands and forest vegetation (Detroit Edison 2011a). The south canal and the drainage area within this portion of the Fermi site would be spanned by the transmission lines; impacts on the drainage area are expected to be minor because no activities associated with the transmission structure installation are expected to occur within the drainage channel (Detroit Edison 2011a).

Three new 345-kv transmission lines for Fermi 3 would be located within an assumed 300-ft-wide corridor from the Fermi site to the Milan Substation, a distance of approximately 29.4 mi. While the onsite Fermi 3 transmission lines would be owned by Detroit Edison up to the point of their interconnection with the new Fermi 3 switchyard, ITC*Transmission* would exclusively own and operate the offsite lines and other transmission system equipment between the Fermi 3 switchyard and the Milan Substation, and Detroit Edison would not control the building or operation of the transmission system. Detroit Edison expects to contract with ITC*Transmission* to maintain the transmission towers and lines located on Detroit Edison property (Detroit Edison 2011a).

The transmission line corridor route is described in Section 2.4.1.2 of this EIS and is illustrated in Figure 2-5. The three 345-kV lines for Fermi 3 would be built in an east-west common corridor that currently contains transmission lines for Fermi 2 for approximately 5 mi to a point just west of I-75. From this point, the three Fermi-Milan lines would be in a corridor shared with non-Fermi lines that travel to the west and north for approximately 13 mi. The last 10.8 mi of the proposed corridor that would proceed west to the Milan Substation are currently undeveloped, and no transmission infrastructure exists. This portion of the corridor has been under ITC*Transmission*'s control for future transmission development, but vegetation maintenance has been minimal except to remove tall, woody vegetation. According to FWS National Wetland Inventory mapping, the identified transmission route crosses about 30 wetlands or other waters that may be regulated by the USACE and MDEQ (FWS 2010). The 18.6-mi existing eastern section of the transmission route crosses 12 narrow agricultural drains and small streams; the undeveloped western 10.8-mi section of the route crosses nine drains and small streams. Reconfiguration of existing conductors would, for the most part, allow for the use of existing infrastructure to create the new lines, and access for installing additional lines is good because the vegetation has been managed to exclude tall woody vegetation. Therefore, preconstruction impacts on aquatic resources along the eastern 18.6 mi of the transmission line corridor are expected to be minor. Existing aquatic habitats in this portion of the corridor would be spanned, and BMPs would be used to protect aquatic habitats crossed by the new lines. Such BMPs include, but are not limited to, the use of silt fencing, hay bales, and similar practices to ensure the protection of aquatic habitats in close proximity to construction activity. Similarly, agricultural drains and small streams occurring in the undeveloped western corridor are narrow, and Detroit Edison anticipates using tower spans of 700–900 ft to avoid placing structures within stream channels (Detroit Edison 2011a). Roads in the vicinity are expected to provide sufficient access to this region of the corridor without the need for construction of new access roads. There are no aquatic habitats within the area that would be affected by the anticipated expansion of the Milan Substation. The review team concludes that impacts on aquatic habitats within the proposed transmission line corridor would be temporary, easily mitigated, and minor, and no additional mitigation would be required.

4.3.2.3 Important Aquatic Species and Habitats

This section describes the potential impacts of building Fermi 3 facilities and associated 345-kV transmission lines on important aquatic species including species that have been listed or are proposed for listing under the ESA, species that are listed by the State, and commercially and recreationally important species. The magnitude of impacts of preconstruction and construction activities would depend on the sensitivity of a species to localized disturbance and water quality changes, species-specific habitat requirements, critical time periods in a species' life cycle, and the intensity and duration of the disturbance. The general biology, status, and habitat requirements of important aquatic species are presented in Sections 2.4.2.

Commercially and Recreationally Important Species

Commercially and recreationally important species that could occur in the vicinity of the Fermi site are identified in Section 2.4.2.3, along with information about their habitat requirements and life histories. Building the parking structure and a warehouse (both considered preconstruction activities) would result in filling the isolated central canal and portions of the north and south canals on the Fermi site, resulting in mortality to all aquatic organisms in the central canal and mortality to some aquatic organisms in the north and south canals. Commercially and recreationally important species that inhabit the canals include channel catfish (*Ictalurus punctatus*), common carp (*Cyprinus carpio*), gizzard shad (*Dorosoma cepedianum*), goldfish (*Carassius auratus*), and largemouth bass (*Micropterus salmoides*), among others (AECOM 2009), although no fishing activities are allowed within the onsite canals. As described in Section 2.4.2, surveys conducted in the vicinity of the Fermi site indicated that the species in the habitats that would be affected by filling were also found to be relatively abundant in other aquatic habitats in the vicinity of the Fermi site.

Approximately 4 ac of aquatic habitat in Lake Erie would be affected during modification and dredging of the intake bay (i.e., the area between the rock groins), building the new intake structure and the barge slip within the intake bay, and placement of the discharge structure for the facility. Although some commercially and recreationally important fish species are known to occur within the intake bay and in the area that would be affected during development of the discharge structure (AECOM 2009), most individuals are expected to temporarily move away from the immediate area during in-lake activities. This short-term displacement of individuals is not expected to have noticeable population-level impacts on commercial and recreational fish species. Migratory pathways for commercially or recreationally important species would not be physically blocked during in-lake activities.

As described in Section 4.2.3.1, the water quality of surface waters on or near the Fermi site could be affected by site clearing and building activities. Stormwater runoff from the site into the North Lagoon (which drains to Swan Creek), South Lagoon, or Lake Erie could contain increased amounts of sediment or other pollutants, and installation of intake and discharge structures in and along the shoreline of Lake Erie would disturb sediments during building and dredging activities, potentially increasing turbidity near the Fermi site. Increased turbidity and noise could adversely affect migratory behavior, spawning behavior, and spawning success for some fish species.

To build and operate the Fermi 3, Detroit Edison must obtain approvals from Federal and State regulatory agencies, including Section 10 and 404 permits from the USACE, an NPDES construction stormwater permit from the MDEQ, and a Section 401 Water Quality Certification from the MDEQ. MDEQ would also require Detroit Edison to develop both an SESC and a PIPP prior to obtaining the NPDES permit. With the implementation of preconstruction and construction-runoff and spill-control measures to be detailed in the PIPP and compliance with regulatory permits, it is unlikely that turbidity or contaminants from construction activities would be present at levels that would substantially affect fish migration or spawning.

As described in Section 2.4.2.2, there are no important commercial or recreational fisheries present within the assumed transmission line route due to the small sizes of the drainages crossed by the transmission line corridor. However, some of the streams to be crossed by the proposed transmission lines support some commercially or recreationally important species. Building of transmission lines could affect individuals in the vicinity of stream crossings because of soil erosion, sedimentation, accidental spills of fuel or lubricants from construction equipment, and temporary disturbance and/or displacement of aquatic biota. Along the eastern 18.6 mi of the proposed transmission line corridor, reconfiguration of existing conductors would allow for the use of existing infrastructure to create the new lines. Aquatic habitats in this portion of the corridor would be spanned and best management practices, such as placement of silt fencing, hay bales, and similar practices, would be implemented to protect aquatic habitats in close proximity to construction activity. Similarly, streams occurring in the western portion of the proposed corridor are narrow, and Detroit Edison anticipates using line spans of 700-900 ft to avoid erecting towers within the active channel and blockage of waterways. Existing roads in the vicinity are expected to provide sufficient access to this region of the corridor without the need for construction of new access roads. MDEQ and the USACE would perform additional regulatory review of proposed plans for building of the needed transmission lines, which would be built, owned, and maintained by ITC*Transmission*. Potential impacts on water quality are expected to be addressed through mitigation measures and BMPs required under issued permits.

On the basis of an evaluation of information presented in Detroit Edison's ER and other existing information, the review team concludes that construction and preconstruction impacts on commercially and recreationally important species in the vicinity of the Fermi site and along associated transmission line corridors would be mostly temporary and minor, and no additional mitigation would be expected. Preconstruction and construction activities are expected to affect relatively little habitat and few individuals of commercially and recreationally important species in areas affected by building activities. Implementation of BMPs and other mitigation measures stipulated in required permits would further reduce impacts.

Federally and State-Listed Aquatic Species

This section evaluates the potential for Federally and State-listed aquatic species to be adversely affected by preconstruction and construction activities for Fermi 3. Section 2.4.2.3 identifies and describes Federally and State-listed species that could occur in Monroe, Wayne, and Washtenaw Counties within which building activities related to development of Fermi 3 would be conducted.

Based on habitat requirements, current distributions, and survey data, aquatic species with a potential to occur in the vicinity of the Fermi site or the proposed transmission line route were identified in Section 2.4.2.3 (see Table 2-15). One Federally listed aquatic species (northern riffleshell [*Epioblasma torulosa rangiana*]) and two species proposed for Federal listing as endangered (rayed bean [*Villosa fabalis*] and snuffbox mussel [*E. triquetra*]), all of which are freshwater mussels, were identified as having the potential to occur in Monroe, Washtenaw, or Wayne County, Michigan (Table 2-15). None of these species has ever been documented either on the Fermi site or along the proposed transmission line route, and, based on current population status, records of occurrence, and habitat preferences, only the rayed bean and the snuffbox mussel are believed to have the potential to occur on or in the immediate vicinity of the Fermi site.

The northern riffleshell is considered unlikely to occur on or adjacent to the Fermi site due to the lack of suitable stream habitat; it is unknown whether there could be suitable habitat for the northern riffleshell in portions of streams that would be crossed by the proposed transmission line route within Monroe or Wayne Counties, although the species has not been reported from the streams that would be crossed.

Including the species identified above, which also are all listed as endangered by the State of Michigan, the State-listed species that have been observed or that have a reasonable potential to occur on or adjacent to the Fermi site include three mussel species (rayed bean, salamander mussel [*Simpsonaias ambigua*], and snuffbox mussel) and three fish species (pugnose minnow [*Opsopoedus emiliae*], sauger [*Sander canadensis*], and silver chub [*Macrhybopsis storeriana*]) (Section 2.4.2.3; Table 2-15). Of these species, only the silver chub is known to occur at the Fermi site (Table 2-15).

The only known extant population of the white catspaw (*Epioblasma obliquata perobliqua*), which is Federally and State-listed as endangered, occurs in one stream drainage in Ohio. This species is presumed to be extirpated from Michigan; as a consequence, it is believed that this species would not be present near the Fermi site or in streams that would be crossed by the proposed transmission line corridor. Therefore, the review team concluded that the white catspaw would not be affected by preconstruction or construction activities for Fermi 3.

There are other State-listed mussel and fish species, as shown in Table 2-15, that are considered unlikely to occur at the Fermi site but have the potential to occur in streams that would be crossed by the proposed transmission line corridor in Monroe, Wayne, or Washtenaw County. There is currently insufficient information to determine whether any of those species are present in the streams that would be crossed.

Building of offsite transmission lines could affect Federally and State-listed organisms in the vicinity of stream crossings in the same ways as described in the previous section for commercially and recreationally important species. Additional regulatory review of proposed plans for construction of the needed transmission lines, which would be built, owned, and maintained by ITC*Transmission*, would be conducted by MDEQ, and potential impacts on Federally and State-listed aquatic species are expected to be addressed through mitigation measures and BMPs required under issued permits.

Potential impacts on Federally and State-listed species that were deemed to have a potential to occur in the waters on or in the immediate vicinity of the Fermi site or in streams that would be crossed by the proposed transmission line corridor, on the basis of previous records in the area or the expected overall range of the species, are evaluated in more detail in the following subsections.

<u>Northern Riffleshell (*Epioblasma torulosa rangiana*)</u>

The northern riffleshell is Federally listed as endangered and is also listed as endangered by the State of Michigan. Because there is no suitable habitat for the northern riffleshell on the Fermi site or in adjacent waters of Lake Erie (Section 2.4.2.3), construction activities at the Fermi site would have no impact on this species. Although suitable habitat for the northern riffleshell could be present in some of the streams that would be crossed by the proposed transmission line corridor, extant populations of this species in Michigan are only known to be present in the Black River in Sanilac County and the Detroit River in Wayne County (Carman and Goforth 2000). Even if present in streams crossed by the transmission line corridors, the building of transmission lines for Fermi 3 is not expected to affect the northern riffleshell because aquatic habitats that are crossed by the corridor would be spanned without placement of structures within stream channels and because BMPs would be implemented to protect water quality in aquatic habitats located near construction activity. Additional regulatory review of proposed plans for construction of the transmission lines, which would be built, owned, and maintained by ITC*Transmission*, would be conducted by MDNR, and potential impacts on water quality are expected to be addressed through mitigation measures and BMPs required under issued permits. On the basis of this information, the review team concludes that preconstruction- and construction-related activities would have no effect on the northern riffleshell.

Pugnose Minnow (*Opsopoeodus emiliae*)

The pugnose minnow is listed as endangered by the State of Michigan and has the potential to occur in streams in Monroe and Wayne Counties. Although there is a potential for suitable habitat for the pugnose minnow to be present in the vicinity of the Fermi site, especially in weedy aquatic habitats such as those present in the North Lagoon or Swan Creek, no individuals were collected during recent surveys on the Fermi site and none were reported in past biological surveys of Stony Creek or the Swan Creek estuary near the Fermi site (AECOM 2009; MDEQ 1996, 1998; Francis and Boase 2007). If occasional individuals are present in the North Lagoon or near the mouth of Swan Creek, there is a potential for adverse effects due to water quality changes and increased turbidity from stormwater runoff from preconstruction and construction areas (e.g., during building of the parking structure and warehouse) or due to discharge of water removed from the subsurface during excavation into stormwater outfalls that flow to Swan Creek via the North Lagoon (Section 4.2.1.3). As described in Section 4.2.3.1, Detroit Edison would obtain and implement an NPDES stormwater construction permit that would require monitoring of construction-related discharges and implement soil erosion controls and other BMPs to limit adverse effects on water quality due to runoff from construction areas. On the basis of this information, the review team concludes that preconstruction- and construction-related impacts on the pugnose minnow, if present, would be minor and that no additional mitigation would be required.

Rayed Bean (*Villosa fabalis*)

The rayed bean is proposed for Federal listing as endangered and is currently listed as endangered by the State of Michigan. There are no streams on the Fermi site with conditions suitable for the rayed bean, and no extant populations are known to occur in the stream drainages that would be crossed by the proposed transmission line route. Although there are records of rayed bean specimens from shallow, wave-washed areas of western Lake Erie, information supplied by Detroit Edison suggests that it is unlikely that the species occurs in the vicinity of the Fermi site for a number of reasons: (1) approximately 30 years of information on mussels in the western basin of Lake Erie (including in the vicinity of the Fermi site) have been collected and evaluated by the USGS, and no rayed bean specimens have been identified; (2) the USACE conducted mussel surveys in Lake Erie approximately 2 mi south of the Fermi site and found no live specimens or shells of the rayed bean; (3) the rayed bean was not observed in surveys conducted by the Michigan Natural Features Inventory just north of the Fermi site near the mouth of Swan Creek; and (4) observations made by divers during sediment sampling and buoy maintenance activities within the exclusion zone for the Fermi site indicate that the sediment is predominantly clay hardpan, which is not suitable for the rayed bean (Detroit Edison 2010c). In addition, most of the area that would be affected by development of the intake structure, the barge slip, and the discharge structure for Fermi 3 has been previously disturbed by periodic maintenance dredging.

The building of transmission lines for Fermi 3 is not expected to affect the rayed bean because the species has not been reported from the streams that would be crossed by the proposed transmission line corridor, and because aquatic habitats that are crossed by the corridor would be spanned without placement of structures within stream channels and BMPs would be implemented to protect water quality in aquatic habitats located near construction activity. On the basis of this information, the review team concludes that preconstruction- and construction-related activities for Fermi 3 would not affect the rayed bean.

<u>Salamander Mussel (*Simpsonaias ambigua*)</u>

The salamander mussel is listed as endangered by the State of Michigan and has the potential to occur in Monroe and Wayne Counties. There are no suitable stream habitats for the species on the Fermi site. There is the potential for suitable habitat and the appropriate host (mudpuppy; *Necturus maculosus*) for the salamander mussel to be present in Lake Erie near the Fermi site (see Section 2.4.2.3). Because the areas in Lake Erie that would be disturbed by modification and dredging of the intake bay, construction of the new intake structure, development of a barge slip within the intake bay, and placement of the discharge structure for the facility have either been previously disturbed by periodic maintenance dredging or have been identified as containing a clay hardpan substrate (Detroit Edison 2010c) and not the silt and sand substrate preferred by this species, it is considered unlikely that this species would be present.

Because no suitable habitat for this species (i.e., medium to large rivers or lakes) would be crossed by the proposed transmission line corridor, construction of the proposed transmission lines would not affect this species. On the basis of this information and the recommended mitigation described, the review team concludes that preconstruction- and construction-related impacts on the salamander mussel would be minor.

<u>Sauger (Sander *canadensis*)</u>

The sauger is considered a species of special concern by the State of Michigan and has the potential to occur in Lake Erie. However, the last reported occurrence of sauger in Monroe County was in 1996, and no individuals were collected during recent surveys on the Fermi site, Stony Creek, or the Swan Creek estuary (AECOM 2009; MDEQ 1996, 1998; Francis and Boase 2007). If present in nearshore areas of Lake Erie that could be affected by construction activities, sauger would likely move away during dredging and building activities because of increased noise and turbidity levels, resulting in temporary displacement but negligible levels of mortality. Detroit Edison would obtain and implement an NPDES stormwater construction permit that would require monitoring of construction-related discharges and would implement soil erosion controls and other BMPs to comply with regulations designed to prevent degradation of water quality in Swan Creek and other areas near the Fermi site. The small streams that would be crossed by the proposed transmission line corridor do not provide suitable habitat for the sauger. On the basis of this information, the review team concludes that preconstruction- and construction-related impacts on the sauger would be temporary and minor, and no additional mitigation would be warranted.

<u>Silver Chub (*Macrhybopsis storeriana*)</u>

The silver chub is considered a species of special concern by the State of Michigan. A single silver chub specimen was collected in July 2009 during monthly fish surveys conducted near the mouth of Swan Creek from 2008 to 2009. Although no construction activities for Fermi 3 would occur in the area where the individual was captured, increased stormwater runoff into the creek from preconstruction areas (e.g., from the parking structure and warehouse areas) could occur and groundwater removed during excavation dewatering would be discharged into stormwater outfalls that flow to Swan Creek via the North Lagoon (Section 4.2.1.3). Little is known about the life history of the silver chub, especially its tolerance of siltation and turbidity (Derosier 2004). While some researchers have suggested that silver chub are intolerant of turbidity and silt, others note that silver chub are found in silty rivers (Derosier 2004). As described in Section 4.2.3.1, Detroit Edison would obtain and implement an NPDES stormwater construction permit that would require monitoring of construction-related discharges and implement soil erosion controls and other BMPs designed to prevent water quality in Swan Creek from being affected by runoff from construction areas. As a consequence, preconstruction- and construction-related impacts on silver chub would be temporary and minor, and no additional mitigation would be warranted.

Snuffbox mussel (*Epioblasma triquetra*)

The snuffbox mussel is proposed for Federal listing as endangered and is listed as endangered by the State of Michigan. It has the potential to occur in Monroe, Wayne, and Washtenaw Counties. Although there are no suitable stream habitats on the Fermi site, there is the potential for suitable habitats in Lake Erie, and the host required by this species (logperch, *Percina caprodes*) has been collected near the Fermi site in Swan Creek and in Lake Erie near the South Lagoon (see Section 2.4.2.3). The areas in Lake Erie that would be disturbed during the building of Fermi 3 facilities have either been previously disturbed by periodic maintenance dredging or have a clay hardpan substrate (Detroit Edison 2010c) rather than the sand, gravel, or cobble substrate preferred by this species. Therefore, it is considered unlikely that this species would be present in the project area.

It is not known whether suitable stream habitat or populations of the snuffbox mussel occur along the proposed offsite transmission line corridor. It is anticipated that the small streams that would be crossed by the proposed transmission line corridor could be easily spanned without placing structures in stream channels and that BMPs would be implemented to protect water quality in streams during building activities. Additional regulatory review of proposed plans for construction of the offsite transmission lines, which would be built, owned, and maintained by ITC*Transmission*, would be conducted by the MDNR, and potential impacts on water quality are expected to be addressed through mitigation measures and BMPs required under issued permits. On the basis of this information, the review team concludes that preconstruction- and construction-related activities for Fermi 3 would not affect the snuffbox mussel.

Summary of Impacts on Federally and State-Listed Aquatic Species

Based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that impacts of construction and preconstruction activities on threatened and endangered aquatic species would be minor. For the northern riffleshell, the review team concluded that there would be no effect from preconstruction and construction activities because any streams containing suitable habitat could be easily spanned by the proposed transmission lines. Preconstruction activities also include building and upgrading transmission lines for Fermi 3. NRC-authorized construction activities, which exclude the preconstruction activities described above, would have no direct effects on any listed species. In addition, the implementation of BMPs that would be identified in the required NPDES stormwater construction permits would further reduce the potential for impacts from preconstruction and construction activities. The NRC staff concludes that the impacts of NRC-authorized construction activities on aquatic threatened and endangered species would be minor, and no additional mitigation measures would be warranted.

Critical Habitats

There are no areas designated as critical habitat for aquatic species in the vicinity of the Fermi site or along the route of the proposed transmission line.

4.3.2.4 Aquatic Monitoring

No monitoring of aquatic resources is planned for the site preparation and development activities onsite or in the transmission line corridor. Fermi 2 NPDES monitoring, which requires monitoring of five outfalls, is anticipated to be ongoing during construction and preconstruction activities. However, the current NPDES permit for the Fermi site does not require monitoring of aquatic ecological resources, and there are no requirements in the license for Fermi 2 to conduct monitoring of aquatic resources, including specific aquatic ecological monitoring of the algal community, benthic invertebrates, or fish. The NPDES stormwater construction permit for Fermi 3 would require monitoring for turbidity of any discharge from the building areas; monitoring frequency and location would be identified during the permitting process (Section 4.2.4). Ecological monitoring of aquatic resources during preconstruction and construction activities could be required as a condition of permits issued by various regulatory agencies. For example, the MDEQ could request monitoring of specific ecological attributes as part of stormwater construction permits, or the USACE could monitor or require monitoring of specific ecological attributes under permits required for activities with a potential to affect wetlands or for dredging in Lake Erie.

4.3.2.5 Potential Mitigation Measures for Aquatic Impacts

No additional mitigation measures, beyond those that may be identified in the required NPDES stormwater construction permit and in permits issued by the USACE and MDEQ would be needed to reduce potential impacts on water quality and aquatic resources.

4.3.2.6 Summary of Impacts on Aquatic Resources

Based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the impacts of preconstruction and construction activities on aquatic biota and habitats, including impacts on aquatic threatened and endangered species and other important species, would be SMALL, and no mitigation measures beyond those identified in the required NPDES stormwater construction permit, and in permits issued by the USACE and MDEQ are proposed at this time. Based on the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the impacts of NRC-authorized construction activities would be SMALL. Any impacts on aquatic resources associated with the compensatory mitigation proposed by Detroit Edison would be evaluated by the USACE and MDEQ as part of the permitting process for that activity. It is anticipated that this process will be completed prior to issuance of the final Fermi 3 EIS.

4.4 Socioeconomic Impacts

This section describes the socioeconomic impacts that might occur as a result of building activities for Fermi 3. Detroit Edison plans to have an initial workforce at the Fermi plant site in 2011 that would primarily focus on activities related to Fermi 1 and Fermi 2. This first phase would occur over 2 years, and would contribute to readying the site for subsequent building of Fermi 3. Detroit Edison plans to begin the preconstruction work specific to Fermi 3 in 2013 and to complete all building activities in 2020. The size of the construction workforce over the first phase of activities would average 100 workers. During the second and main phase of building activity, the construction workforce would range from a minimum of 200 workers to a peak of approximately 2900 workers. The average size of the onsite workforce during the 10-year building period would be approximately 1000 workers (Detroit Edison 2011a).

The review team expects most of the socioeconomic impacts related to demographics, economy and taxes, as well as infrastructure and community services, to occur in the general vicinity of Fermi 3 and in the communities where the majority of the new construction workers recruited for the project (i.e., in-migrating workers) reside. The review team expects the characteristics of the workers recruited from outside the region to be similar to the current workforce with respect to choices and preferences (e.g., commute distance, available amenities), and that they will reside primarily in Monroe and Wayne Counties in Michigan and Lucas County in Ohio during the building period. More than 87 percent of the current Fermi 2 workforce resides in these three counties. Therefore, the review team expects that most of the construction workforce relocating into the area during the building of Fermi 3 would also reside in these three counties.

As discussed in Chapter 2.5, no more than 3.2 percent of the current Fermi 2 workforce resides in any one county outside Monroe, Wayne, and Lucas Counties. In addition, the current and projected populations of the regional area are so large that the current workforce at the Fermi site represents less than 1 percent of the total population in any of the counties or locations where these employees reside. Therefore, the review team expects that impacts beyond the three counties will be minor. The following discussion focuses on the three-county economic impact area.

Section 4.4.1 presents a summary of the physical impacts of the project. Section 4.4.2 provides a description of the demographic impacts. Section 4.4.3 describes the economic impacts, including impacts on the economy and tax revenue. Section 4.4.4 describes the impacts on the infrastructure and community services. Section 4.4.5 summarizes the socioeconomic impacts.

4.4.1 Physical Impacts

Building activities will cause temporary and localized physical impacts, such as noise, odors, vehicle/equipment exhaust, and dust. Vibration and shock impacts are not expected because of the strict control of blasting and other shock-producing activities. The review team believes these impacts would be mitigated by compliance with all applicable Federal, State, and local environmental regulations and site-specific permit conditions. This section addresses potential physical impacts that may affect people, buildings, and roads.

4.4.1.1 Workers and the Local Public

The Fermi site is located along the relatively straight Lake Erie coastline that extends from the site approximately 20 mi southwest toward the Michigan/Ohio border and approximately 10 mi northeast toward the mouth of the Detroit River. East of this coastline are the open waters of Lake Erie. West of the site, the land is predominantly used for agriculture. Development within a 10-mi radius of the Fermi site is concentrated in the City of Monroe, which is about 8 mi southeast of the site, and along the Lake Erie shoreline in several beachfront communities. The community nearest to the Fermi site, Stony Point, is 2 mi south of it. Residential areas are also located in portions of Berlin Township and Frenchtown Charter Township. Relatively recent housing developments are present just south of Pointe Aux Peaux Road (the Fermi site's southern boundary).

The nearest designated recreational areas are the beaches at Stony Point (2 mi south of the site) and Estral Beach (2 mi northeast of the site). Nearby State recreational areas include Point Mouille State Game Area (3.1 mi to the northeast) and Sterling State Park (4.8 mi to the south-southwest). Scattered industrial facilities are located west and southwest of the Fermi site along the I-75 corridor and near the City of Monroe. Commercial development is present along major road corridors, including Dixie Highway, Telegraph Road, and I-75, and within the City of Monroe.

All building activities would occur within the Fermi site boundary and would be performed in compliance with Occupational Safety and Health Administration (OSHA) standards, BMPs, and other applicable regulatory and permit requirements. Approximately 89,198 people live within 10 mi of the site, but physical impacts attenuate rapidly with distance. Therefore, the people who would be the most exposed to noise, fugitive dust, and vehicle or equipment emissions resulting from building activities would be construction workers and, to a lesser extent, other personnel working onsite at Fermi 2. People working or living immediately adjacent to the Fermi site and transient populations, such as people using recreational facilities or temporary employees of other businesses in the area, would not be noticeably affected because of their lack of access to and distance from the site; these factors would limit the impacts on them from building activities.

Construction workers would receive safety training and would be required to use personal protective equipment to minimize health and safety risks. Emergency first-aid care would be available at the site, and regular health and safety monitoring would be conducted. People working onsite or living near the Fermi site would not experience any physical impacts greater than those that would be considered an annoyance or nuisance.

4.4.1.2 Noise

Noise is an environmental concern because it can cause adverse health effects, annoyance, and disruption of social interactions. Noise would result from clearing, earthmoving, preparing foundations, pile-driving, concrete mixing and pouring, erecting steel structures, and various stages of facility equipment fabrication, assembly, and installation. Blasting would be employed in a manner designed to prevent damage to existing structures, equipment, and freshly poured concrete (Detroit Edison 2011a).

People who would be the most exposed to noise would be construction workers and, to a lesser extent, other personnel working onsite at Fermi 2. Detroit Edison will comply with OSHA standards for the protection of worker safety (29 CFR Part 1910) and EPA standards governing the noise levels of compressors (40 CFR Part 204).

Although some building activities would occur near the main gate of the Fermi site, approximately1900 ft (0.36 mi) from the nearest residence, most building activity would occur at the locations of the reactor building and cooling tower, which are located more than 3200 ft (0.60 mi) from the nearest residence. At this distance, noise levels would be less than 54 dBA without pile-driving and 57 dBA with pile-driving. Projected noise impacts from building activities are discussed in further detail in Section 4.8.2.

Detroit Edison will comply with NRC and EPA guidance for implementing the Noise Control Act of 1972, as amended, and the Quiet Communities Act of 1978 (Detroit Edison 2011a). In addition, Detroit Edison will need to apply for a building permit from Frenchtown Charter Township, which would require that any building activities comply with Township Ordinances, including the Noise Ordinance and the Blasting and Vibration Regulation Ordinance. The Noise Ordinance prohibits noise disturbance of residences between the hours of 7:00 p.m. and 7:00 a.m.

Detroit Edison will employ standard noise control measures for construction equipment, such as the use of silencers on diesel-powered equipment exhausts, to limit engine noise during building. In addition, Detroit Edison will limit the types of building activities during nighttime and weekend hours, notify all potentially affected neighbors about planned activities, and establish a construction-noise monitoring program (Detroit Edison 2011a). Detroit Edison (2011a) stated that the noisiest activities would be limited to daytime hours. The review team expects that noise impacts on recreation and the general public would be minimal because of the distance between the site and recreational areas, because noise attenuates with distance, and because of intervening topography and foliage.

4.4.1.3 Air Quality

Air quality at the Fermi site is heavily influenced by the Detroit and Toledo metropolitan areas and surrounding emission sources. Monroe County is designated in nonattainment for the 1997 and 2006 National Ambient Air Quality Standard (NAAQS) for particulate matter smaller than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$) and is in a maintenance area for the 8-hr ozone standard (EPA 2010a). In July 2011, the MDEQ submitted a request asking the EPA to redesignate Southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011a). This request is based, in part, on air quality monitoring data collected in the 2007–2010 period showing all seven counties in Southeast Michigan in attainment for the $PM_{2.5}$ NAAQS.

Temporary and minor effects on local ambient air quality would occur as a result of building activities. Dust particle emissions would be generated during land-clearing, grading, and excavation activities. Air quality would also be affected by engine exhaust emissions from heavy construction equipment and machinery, concrete batch plant operations, and emissions from vehicles used to transport workers and materials to and from the site. Estimated emissions from building activities and the effect on local air quality are discussed in further detail in Section 4.7.

Detroit Edison will need to obtain a permit from the MDEQ, and will need to develop a dust-control program that will employ mitigation measures to control fugitive dust during building activities in accordance with MDEQ Rule 336.1372 (Detroit Edison 2011a). These mitigation measures may include but are not limited to the following:

- Spraying all work areas with water or other dust-suppressant compound;
- Covering debris, excavated earth, or other airborne materials with tarpaulins or any other approved material;
- Restricting the speed of vehicles that transport materials;
- Mechanically cleaning paved surfaces;
- Periodically maintaining off-road surfaces with gravel where trucks have frequent access; and
- Re-seeding work areas when no longer needed.

In addition, Detroit Edison will equip the onsite concrete batch plant with a dust control system that will be checked and maintained on a routine basis (Detroit Edison 2011a).

4.4.1.4 Buildings

Building activities would not affect any offsite buildings because they are distant from the site. In addition, vibration and shock impacts are not expected offsite because of the strict control of blasting and other shock-producing activities. Information about historic properties and the impacts of building on these properties is provided in Sections 2.7 and 4.6.

Building activities would not affect any onsite buildings. Controlled blasting would be employed to prevent damage to existing structures, equipment, and freshly poured concrete (Detroit Edison 2011a). In accordance with 10 CFR Part 50, Appendix A, Fermi 2 has been built to safely withstand any possible impact from natural phenomena, such as earthquakes, and could therefore withstand shock and vibration from activities associated with the development of Fermi 3, such as controlled blasting. Other onsite structures were constructed according to building codes and standards that address shock and vibration issues similar to those that would occur as a result of building activities associated with Fermi 3 (Detroit Edison 2011a).

4.4.1.5 Roads

This EIS assesses the impact of transporting workers and materials to and from the Fermi site from four perspectives: physical impacts related to deterioration in the quality of the roads, socioeconomic impacts resulting from congestion and reductions in level of service (LOS), air quality impacts resulting from the emissions from vehicles used to transport workers and materials to and from the site, and potential health impacts caused by additional traffic-related accidents. Only the physical impacts on roads are addressed in this section; the socioeconomic impacts resulting from congestion and reductions in LOS are discussed in Section 4.4.4.1. The air quality impacts are addressed in Section 4.7, and human health impacts are addressed in Sections 4.8 and 4.9. Use of area roadways by construction vehicle could contribute to physical deterioration of roadway surfaces. Detroit Edison stated that additional layers may be added to roadway surfaces to support the construction vehicles (Detroit Edison 2011a). Given that any necessary road improvements will be a condition of the site plan review process by the MCRC and MDOT, physical impacts to roadways are expected to be minor. Detroit Edison would be required to provide improvements to local roadways as needed.

4.4.1.6 Aesthetics

Fermi 3 would be located within the developed area of the Fermi site, along its eastern boundary by Lake Erie. Surrounding the developed area are 656 ac of wetlands, open water, and forested land that buffer the view of the developed area from public roadways.

The review team expects visual impacts from grade-level building activities to be limited. Surrounding land use is predominantly agricultural, with a few residential areas that are within the viewshed of the plant site. The area around the Fermi site is a security zone, as defined under 33 CFR Part 165. In this security zone, boat traffic or other public use of the waters within a 1-mi circumference of the plant is prohibited. Therefore, views of the plant construction from the water would also be limited.

Two 400-ft tall cooling towers are currently the predominant visible structures on the Fermi site and are visible from outside the site property boundaries in all directions. Several small beach communities are located along the Lake Erie shoreline within 5 mi of the Fermi site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. Activities associated with the building of the cooling tower for Fermi 3 would also cause aesthetic degradation from dust and night lighting that would be visible from locations within these communities and along the beaches and other recreational facilities (marinas, docks) along Lake Erie. Although taller than the existing cooling towers, building activities for the new 600-ft cooling tower would be consistent with the existing views of the Fermi site, and the review team expects no discernible adverse impact on visual aesthetics from the building of Fermi 3.

4.4.1.7 Summary of Physical Impacts

All building activities would occur within the site boundary. The review team has evaluated information provided by Detroit Edison, visited the site and its environs, and independently reviewed the potential physical impacts of building activities in the region and the local area around Fermi 3. The review team concluded that the expected physical impacts of building activities would be SMALL for all categories (workers and the local public, noise, air quality, buildings, roads, and aesthetics), and that no mitigation beyond that described by Detroit Edison in its ER would be warranted.

4.4.2 Demography

Detroit Edison plans to have an initial workforce at the Fermi plant site in 2011 that would primarily focus on activities related to Fermi 1 and Fermi 2. This first phase would occur over 2 years, and would contribute to readying the site for subsequent building of Fermi 3. Detroit Edison plans to begin the preconstruction work specific to Fermi 3 in 2013 and to complete all construction activities in 2020. The size of the workforce over the first phase of activities (2011 to 2012) would range between 35 and 150 workers, with an average onsite workforce of 100 workers.

During the second and main phase of building activity, the building workforce would range from a minimum of 200 workers to a peak workforce of approximately 2900 workers in 2017. Beginning in 2017, Detroit Edison plans to begin staffing for operation and maintenance of the plant. The size of the operations and maintenance workforce would increase from approximately 50 workers in 2017 to full staffing in 2020 of 900 workers, while the size of the construction workforce would decrease from approximately 2900 workers in 2017 to 150 workers when building is completed in 2020. Therefore, between 2017 and 2020, Detroit

Edison would have an average onsite workforce (combined building and operations and maintenance) of 1000 workers. Figure 4-6 shows the variation in the total onsite workforce over the building period.

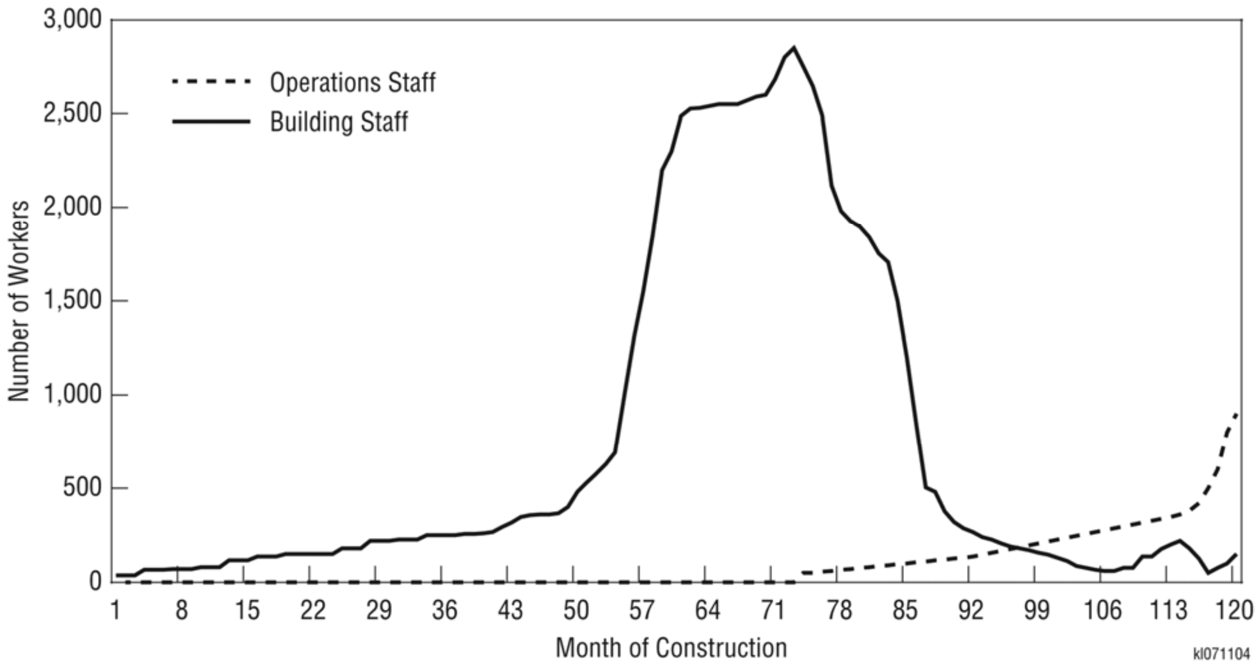

Figure 4-6. Total Number of Onsite Workers during the 10-year (120 Months) Building Period (Source: Detroit Edison 2011f)

The review team will consider the cumulative impacts of the building and operations workforce in the following analysis by evaluating the average onsite workforce of 1000 workers and/or peak workforce of 2900 workers during the building period. The review team will evaluate the socioeconomic impacts associated with long-term operation of Fermi 3 following the building period (e.g., when the operations and maintenance workforce is fully staffed) in Section 5.4. Given the number of construction workers in the region, which includes portions of the Detroit MSA and the Toledo MSA, compared with the estimated size of the construction workforce for Fermi 3, the review team expects that a large number of the workforce would be drawn from within a 50-mi radius of the Fermi site. For purposes of analysis, the review team has assumed that approximately 85 percent of the building workforce, or approximately 2465 workers during peak building employment and 850 workers on an average annual basis, would be drawn from within a 50-mi radius of the Fermi site. The residential distribution of the building workforce would likely differ from the residential distribution of the existing Fermi 2 workforce because a greater number of construction workers are located in Wayne and Lucas Counties, whereas Monroe County has the largest percentage of the operational workforce of Fermi 2. Within the economic impact area of Monroe and Wayne Counties, Michigan and Lucas County, Ohio, Lucas County has more than twice the number of construction workers as Monroe County, and Wayne County has more than seven times the number of construction workers as Monroe County (see Tables 2-27 and 2-28). Therefore, building of Fermi 3 would likely draw more heavily from the construction workers in Wayne and Lucas Counties than Monroe County. Because these workers currently reside in the local area, they are already housed and serviced by the community, and the review team does not anticipate additional benefits or stresses associated with building of Fermi 3 by the existing workforce.

Despite the size of the construction workforce in the region, the review team expects that approximately 15 percent of the construction workforce (approximately 435 workers during peak building employment and 150 workers on an average annual basis) would be drawn from outside a 50-mi radius of the Fermi site. This estimate is based on the need for specialized skills and training that may not be available in the regional workforce and the expectation that a portion of the construction management, inspection, and owner's engineering staff would also likely relocate to the region during building.

The review team expects the characteristics of the workers recruited from outside the region with respect to choices and preferences (e.g., commute distance, available amenities) will be similar to those of the current workforce. Consequently, the review team could also assume the in-migrating workforce would move into the 50-mi region in the same proportions as the current operations workforce: with 87 percent residing in the three county economic impact area and the remaining 13 percent outside of Monroe, Wayne, and Lucas Counties but within a 50-mi radius of Fermi 3. The settlement distribution of the in-migrating workers needed to support building of Fermi 3 is shown in Table 4-5.

Table 4-5. Counties Where In-migrating[(a)] Construction Workforce Would Reside

County	Peak In-Migrating Construction Workforce in 2017	Percent of In-Migrating Workforce		Average Annual In-Migrating Construction Workforce
		By County[(b)]	Cumulative	
Monroe	250	57.5	57.5	86
Wayne	83	19.0	76.5	29
Lucas	47	10.7	87.2	16
All others within 50-mi region	55	12.8	100.0	19
Total	**435**			**150**

(a) In-migrating workers are those moving into the 50-mi region from outside the region.
(b) The distribution of the in-migrating workforce by county is based on the residential distribution of the current Fermi 2 workforce (Detroit Edison 2008).

The greatest potential impact on demographics in the region and the three-county economic impact area of Monroe, Wayne, and Lucas Counties would occur as a result of the relocation of workers during the peak building employment period. The following analysis focuses on demographic impacts associated with the peak building employment workforce, estimated to occur in 2017.

To estimate the maximum projected population increase associated with the in-migrating workers, the review team has assumed that all workers drawn from outside the region move with their families, and that each worker would have an average household size of 2.6 persons, based on the national average household size in the U.S. Census Bureau's 2008 population estimate (USCB 2009e).[(a)] On the basis of this assumption and the proportional settlement pattern shown in Table 4-5, the review team estimates that 650 persons would potentially relocate to Monroe County, 216 persons would relocate to Wayne County, and 122 persons would relocate to Lucas County. Approximately 143 persons would relocate elsewhere in the region. Projected population increases are shown in Table 4-6.

Based on the review team's analysis, the in-migrating workers and their families would increase the populations in Monroe, Wayne and Lucas counties by less than 1 percent. As discussed in Section 2.5, Wayne and Lucas Counties are projected to experience population losses through 2020. Therefore, the projected increase in population associated with workers relocating to build Fermi 3 would have a beneficial impact on the two counties, because the population loss currently being experienced in Wayne and Lucas Counties, primarily due to the economy, would be partially offset by the in-migrating workers. While Monroe County is projected to have a modest population increase through 2020, the additional increase associated with the in-migrating construction workforce would be minimal. Therefore, the review team determined the three county economic impact area would experience a SMALL beneficial demographic impact from building Fermi 3.

In addition, a small number of workers would in-migrate to counties outside of Monroe, Wayne, and Lucas Counties. Therefore, their impact on any one jurisdiction would not be noticeable. The current and projected populations of the regional area are so large that the in-migrating construction workforce for Fermi 3 would represent less than 1 percent of the total population in any of the counties or locations where these employees would reside. Therefore, the review team concludes that the demographic impacts of building Fermi 3 on the remainder of the region would also be SMALL and beneficial.

(a) During the preparation of this draft EIS, the results of the mandated U.S. decadal census for 2010 were being released in topical and regional data sets. While the U.S. Census Bureau has not issued all of the data sets in final form, some of the preliminary information was considered by the review team. While some of the final data sets were released for National scale information, most of the fine scale information is still under review by the DOC and other Federal Agencies. The review team is not aware of information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier census.

Table 4-6. Potential Increase in Population during the Peak Building Employment Period in 2017

County	Peak In-Migrating Workforce in 2017	Percent of In-Migrating Workforce[(a)]	Estimated Increase in Population (number of workers × 2.6 persons per household)[(b)]	Projected 2020 Population[(c)]	Estimated Increase as Percent of Projected 2020 Population
Monroe	250	57.5	650	159,461	0.4
Wayne	83	19.0	216	1,812,593	0.01
Lucas	47	10.7	122	434,650	0.03
All others within region	55	12.8	143	–[(d)]	–
Total	**435**		**1131**		

(a) Percentage distribution is based on the residential distribution of the current Fermi 2 workforce (Detroit Edison 2008).
(b) National average household size in 2008 from population estimate by U.S. Census Bureau (USCB 2009e).
(c) Monroe and Wayne Counties 2020 and 2030 projections are from the Southeast Michigan Council of Governments (SEMCOG 2008). Lucas County projections are from the Office of Policy Research and Strategic Planning (Ohio Department of Development 2003).
(d) Projected populations are not provided for other counties within the 50-mi region. Given the small number of workers in-migrating to counties outside of Monroe, Wayne, and Lucas Counties, the impact on projected populations for any one jurisdiction would be minimal.

The projected increase in population in Monroe, Wayne, and Lucas Counties associated with in-migrating workers and their families is less than 1 percent of the projected 2020 population for any of these counties.

Given the size of the regional population projected for 2020 of 6,130,056 persons within a 50-mi radius of the Fermi site (see Table 2-25), the projected increase associated with the in-migrating construction workforce would be minimal within the regional or local area.

4.4.3 Economic Impacts on the Community

This section evaluates the economic impacts on the 50-mi region from building Fermi 3, focusing primarily on Monroe, Wayne, and Lucas Counties. In 2008, more than 50,000 workers were employed in the construction industry in Monroe, Wayne, and Lucas Counties (USCB 2009a, b) (see Tables 2-27 and 2-28). Therefore, the review team expects most of the workers needed to support the building activities of Fermi 3 to be available in the local area.

4.4.3.1 Economy

Building activities for Fermi 3 would have a beneficial impact on the local economy through direct purchase of materials and supplies within the local area and through direct employment of the construction workforce. Studies of new power plant construction indicate that the estimated construction costs of a nuclear power plant average approximately $4000 per kilowatt (kW) of electrical generating capacity (MIT 2009). With a planned capacity of 1605 megawatts (MW), the cost to construct Fermi 3 would be approximately $6.4 billion.

Given the highly specialized nature of nuclear plant components, a large portion of the capital goods would be imported from outside the region. However, new units require substantial amounts of bulk materials and supplies (including concrete, steel, piping, wiring, and electrical components), some of which would likely be procured locally. Detroit Edison has estimated that approximately $232 million would be expended in the purchase of materials and supplies over the 10-year building period, including bulk quantities of concrete, reinforced steel and embedded parts, structural steel, cables, wires, coils, and pipes. Based on materials and supplies purchased for Fermi 2 in 2008 and 2009, Detroit Edison estimates that approximately 23 percent of the materials and supplies (or approximately $53 million of materials and supplies) for Fermi 3 would be purchased from vendors or suppliers in the local area, depending on availability (Detroit Edison 2011a). Local purchases of supplies and materials would provide a short-term (but multi-year) beneficial stimulus to the regional economy.

In addition to the purchase of materials and supplies, direct employment for the building activities at Fermi 3 would benefit the local economy. The size of the construction workforce needed for Fermi 3 would range over an estimated 10-year building period from a minimum of 35 workers to a peak building employment workforce of 2900 workers. Detroit Edison estimates that the average size of the onsite workforce during the 10-year building period would be approximately 1000 workers (Detroit Edison 2011a).

The types of construction workers who would be used on the project and the number of construction workers in the economic impact area who would potentially be available to support building are shown in Table 2-30. As shown in Table 4-7, the average annual salary, based on 2008 U.S. Bureau of Labor Statistics (USBLS 2008a) data for workers in the construction industry within the economic impact area, is approximately $50,500. In 2008, workers in the construction industry also received an annual average nonwage compensation of $19,550, which included supplementary pay (i.e., premium pay for overtime and work on holidays and weekends), retirement benefits, insurance, and legally required benefits (worker's compensation, Social Security, etc.) (USBLS 2008b).

Although the size of the building workforce and associated payroll spending would vary depending on the building schedule and mobilization in each particular year, on the basis of an average annual workforce of 1000 workers and average annual salary of $50,500, the review team estimates that $50.5 million would be directly expended in payroll annually during the building activities for Fermi 3. Non-wage compensation has not been included in the average wage estimate for this analysis because Detroit Edison does not plan on using overtime (Detroit

Table 4-7. Wage Estimates for Construction Industry Occupations in the Economic Impact Area[(a)] in 2008

Occupation	Mean Annual Wages ($)[(b)]		
	Monroe, Michigan MSA	**Detroit-Livonia-Dearborn, Michigan Metropolitan Division**	**Toledo, Ohio MSA**
Construction and extraction occupations[(c)]	48,190	53,750	49,570
First-line supervisors/managers of construction Traces and extraction workers	56,200	69,470	67,740
Boilermakers	–[(d)]	66,420	54,090
Brick masons and block masons	–	53,290	52,260
Carpenters	42,910	52,100	45,380
Cement masons and concrete finishers	42,870	–	50,110
Stonemasons	–	–	–
Construction laborers	34,260	39,600	40,190
Paving, surfacing, and tamping equipment operators	–	43,880	47,050
Operating engineers and other construction equipment operators	53,990	51,470	54,000
Electricians	62,970	61,460	52,570
Insulation workers: floor, ceiling, and wall	–	–	26,130
Insulation workers: mechanical	–	–	–
Painters, construction, and maintenance	–	52,890	4410
Reinforcing iron and rebar workers	–	–	–
Plumbers, pipefitters, and steamfitters	60,100	66,740	60,120
Sheet metal workers	–	62,060	55,500
Structural iron and steel workers	50,240	60,190	45,970
Millwrights[(e)]	70,390	67,030	–

Source: USBLS 2008a

(a) Data are presented by the USBLS for metropolitan areas, which include the counties identified as the economic impact area.

(b) Annual wages have been calculated by multiplying the hourly mean wage by a "year-round, full-time" figure of 2080 hours. Wages include base rate pay, cost-of-living allowances, guaranteed pay, hazardous-duty pay, incentive pays such as commissions and production bonuses, tips, and on-call pay. Wages do not include back pay, jury duty pay, overtime pay, severance pay, shift differentials, non-production bonuses, employer costs for supplementary benefits, and tuition reimbursements.

(c) These estimates were calculated with data collected by the USBLS from employers in all sectors within the industry. Estimates do not include self-employed workers.

(d) – = This occupation is not reported in this metropolitan area.

(e) Millwrights are classified by the USBLS under the installation, maintenance, and repair occupations.

Edison 2011a) and because a portion of the nonwage compensation would be expended outside the local area (e.g., Social Security benefits).

Approximately 85 percent of the annual workforce, or an average of 850 workers, is expected to be drawn from the regional area. The review team assumes that a portion of the workers drawn from the regional area would be unemployed. As discussed in Section 2.5, the overall rate of unemployment in Monroe, Wayne, and Lucas Counties in 2009 ranged between 12.6 (Lucas County) to 16.0 (Wayne County) percent. Nationally, the rate of unemployment in the construction industry is slightly more than double the overall rate of unemployment. In 2009, the national rate of unemployment in the construction industry was 19.0 percent, compared to the overall unemployment rate in the country of 9.3 percent (USBLS 2009; data is not provided by industry at the State, county, or metropolitan level). Given the unemployment rate in the local area, specifically in the construction industry, the review team estimates that 25 percent of the 850 workers or approximately 212 workers would be drawn from the ranks of the unemployed on an annual basis over the 10-year building period. Approximately 15 percent of the annual workforce, or approximately 150 workers, is expected to relocate from outside the region.

New workers (i.e., in-migrating workers and those previously unemployed) would have an additional indirect effect on the local economy because these new workers would stimulate the regional economy by their spending on goods and services in other industries.[a] A model developed by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), called the Regional Input-Output Modeling System (RIMS II), quantifies this “ripple” effect through the use of regional industrial multipliers specific to a local economy. Each new direct job in the construction industry stimulates employment indirectly and results in additional job creation in other industry sectors, such as services. The indirect stimulus reflects additional economic activity from interdependent suppliers and vendors. The ratio of total jobs (direct plus indirect) to the number of new direct jobs is called the “employment multiplier.” Construction workers who already live and work in the local area are already producing a ripple effect through their spending and are therefore not included in the calculation of new indirect effects.

In the three-county economic impact area, BEA RIMS II estimates that for every new worker, an additional 0.7 jobs would be created (Detroit Edison 2011a). On the basis of the employment multiplier, the 362 “new workers” (i.e., in-migrating workers and those previously unemployed) would create an additional 253 new jobs (Table 4-8).

(a) The assessment of direct and indirect employment impacts in this analysis serves as a lower boundary estimate by only including in-migrating and formerly unemployed workers. For example, the nature of construction work is for transitory and workers typically move from job to job such that vacated positions are not necessarily available for new workers. However, the review team recognizes that direct construction employment does not necessarily “crowd out” private employment. In these cases if an already employed construction worker quits his/her job to work at Fermi 3 his/her old job would then become available for another worker to fill.

Table 4-8. Average Annual Direct and Indirect Employment for Fermi 3

	Category	Calculation	Number of Workers
A	Direct employment		1000
B	Reside in region	A × 85%	850
C	(Otherwise employed at time of hire for Fermi 3)	B × 75%	(638)
D	(Unemployed at time of hire for Fermi 3)	B × 25%	(212)
E	Relocate from outside region	A × 15%	150
F	Indirect employment	(D + E) × 0.7	253
G	Total annual employment	F + A	1253
	Total annual new employment	D + E + F	615

As stated above, an estimated $50.5 million (2008 dollars) would be expended in wages annually over the 10-year building period, on the basis of an average annual salary of $50,500 for 1000 workers. A regional multiplier was applied to the earnings of new workers (i.e., in-migrating workers and those previously unemployed) to determine the effect of the direct earnings on the local economy. For every dollar of wages earned by new workers on Fermi 3, BEA estimates that an additional 0.6 dollars or wages would be created in the local economy (Detroit Edison 2011a). For an estimated $18 million in new direct wages, an estimated $11 million in indirect wages would be created. Expenditures to support building of Fermi 3 would benefit the local economy because local vendors and suppliers would increase their spending as a result of the increase in demand for their materials and supplies. This additional spending would continue to cycle through the economy.

The employment of a large workforce over a 10-year building period would have short-term positive economic impacts on the local area by providing additional income to the regional economy, reducing unemployment, and creating business opportunities for housing and service-related industries for the duration of the building period. The review team concluded, on the basis of its own independent review of the likely economic effects of the proposed action, that on average, beneficial economic impacts – including 1253 direct and indirect jobs, $61.5 million in direct and indirect wages, and $53 million spending on purchases of materials and supplies from local vendors and suppliers – would be experienced throughout the 50-mi region during the 10-year building period. The beneficial impacts on the economy would end when the injection of funds into the regional economy as a result of the purchase of materials and supplies and construction employment and wages was completed.

Given the size of the regional economy, which includes a combined 2008 labor force in Monroe and Wayne Counties, Michigan and Lucas County, Ohio of approximately 1.6 million workers, the review team estimates the impact of the building of Fermi 3 on the regional economy would be positive, but minor.

4.4.3.2 Taxes

The tax structure of the region is discussed in Section 2.5 of this EIS. Building Fermi 3 would primarily impact four main tax revenue sources. These include (a) State and local taxes on worker incomes, (b) State sales taxes on worker expenditures, (c) State sales taxes on the purchase of materials and supplies, and (d) local property taxes or payments in lieu of taxes based on the assessed value of Fermi 3 during building.

State and Local Income Taxes

The States of Michigan and Ohio would receive additional income tax revenue from the income tax on wages of new workers. Table 4-9 summarizes the estimated new income tax revenue that would be received by the State annually during the 10-year building period. However, the exact amount of income tax revenue is determined on the basis of a number of factors, such as income tax rates, residency status, deductions taken, and other factors.

Table 4-9. Estimated New State Income and Sales Tax Revenue Associated with the Construction Workforce

New Workers and Revenue	Michigan	Ohio
Workers relocated from outside region	129	21
Workers previously unemployed	182	30
Total new workers	311	51
Estimated annual income (millions)	$15.7	$2.6
Estimated annual State income tax revenue (millions)	$0.6[(a)]	$0.08[(b)]
Estimated annual spending on goods and services (millions)[(c)]	$4.4	$0.7
Estimated annual sales tax revenue (millions)[(d)]	$0.3	$0.04
Total estimated annual new State revenue (millions)	$0.9	$0.12

(a) As discussed in Section 2.5, the income tax rate in Michigan will be set at 3.9 percent in 2015, following annual decreases through 2011. The current rate of 4.35 percent is applicable through 2011. The 3.9 percent tax rate was applied to a personal income of $50,500 for each of the new workers in the State of Michigan.
(b) Ohio has a graduated income tax; the scheduled tax rate for an income in the $40,000–$80,000 tax bracket beginning in 2011 is $1056.40 plus 4.109 percent of excess over $40,000. This was applied to a personal income of $50,500 for each of the new workers in the State of Ohio.
(c) Estimated annual spending of 22 percent of income before taxes is based on the USBLS Consumer Expenditure Survey for expenditures that would be subject to State sales taxes, including apparel and services, transportation, entertainment, personal care products and services, and tobacco products and smoking supplies (USBLS 2010c).
(d) The Michigan sales tax rate is 6 percent, and the Ohio sales tax rate is 5.5 percent.

New workers are those drawn from the ranks of the unemployed and those who relocate from outside the States of Michigan or Ohio. As discussed in Section 4.4.2, approximately 85 percent of the annual workforce, or an average of 850 workers annually, are expected to be drawn from the region. Construction workers who already live and work in the region are already contributing to State income tax and sales tax revenue. However, approximately 25 percent of the 850 workers, or approximately 212 workers, live in the area but are not currently working. Those workers would contribute to new State tax revenue during the building of Fermi 3.

Approximately 15 percent of the annual workforce, or approximately 150 workers, are expected to relocate from outside the region. If all in-migrating workers move to the region from outside the States of Michigan or Ohio, they would also provide new tax revenue. To estimate the income tax revenue for the State of Michigan and State of Ohio, the review team assumed a similar residential distribution to the current Fermi 2 workforce. On the basis of the current residential distribution of the Fermi 2 workforce, approximately 86 percent of the total workforce resides in Michigan, and 14 percent resides in Ohio (both within and outside of the economic impact area). (Fewer than 1 percent resides in Canada, and they are not included in this analysis.) Assuming the in-migrating workers and previously unemployed workers are divided between Michigan and Ohio in the same proportion as the current Fermi 2 workforce, approximately 86 percent of the new workers would pay taxes in the State of Michigan and 14 percent would pay taxes in the State of Ohio. Therefore, the estimated new State income tax revenue would be approximately $0.6 million annually for the State of Michigan (2008 dollars), based on an average annual salary for the new workers of $50,500 and a 40-hr work week, and it would be approximately $0.08 million annually for the State of Ohio. To the extent that in-migrating workers relocate to build Fermi 3 from other parts of the same State, Michigan and Ohio would not benefit from new income tax revenues and the benefits discussed above would actually be less.

As discussed in Section 2.5, several municipalities in Wayne County and in Lucas County impose taxes on income. Depending on the residential location of in-migrating workers, municipalities in Wayne County and Lucas County may also benefit from increased income associated with building Fermi 3.

State Sales Taxes on Worker Expenditures

The States of Michigan and Ohio and some of the local jurisdictions in Ohio would also receive sales tax revenue on expenditures made by the new workers. An estimated $0.3 million in new sales tax revenue would be received by the State of Michigan, and $0.04 million would be received by the State of Ohio, on the basis of the national averages for consumer spending on goods and services.

The review team determined that the impact of additional sales tax revenue at the State and local level would be positive but minimal – less than 1 percent of each State’s total income tax revenues.

State Sales Taxes on Construction Materials and Supplies

Detroit Edison has estimated that approximately $232 million would be expended in the purchase of materials and supplies over the 10-year building period, including bulk quantities of concrete, reinforced steel and embedded parts, structural steel, cables, wires, coils, and pipes. Based on materials and supplies purchased for Fermi 2 in 2008 and 2009, Detroit Edison estimates that approximately 23 percent of the materials and supplies (or approximately $53 million of materials and supplies) for Fermi 3 would be purchased from the local area. A detailed analysis of the sources for these materials and supplies has not been conducted. For purposes of analysis, the review team has assumed that 60 percent of the locally purchased materials and supplies would be purchased from within the State of Michigan and 40 percent would be purchased from within the State of Ohio. Based on a State sales tax rate in Michigan of 6 percent, as estimated $8.3 million would be received by the State of Michigan over the 10-year building period; and based on a State sales tax rate in Ohio of 5.5 percent, an estimated $5.1 million would be received by the State of Ohio over the 10-year building period.

The review team determined that the impact of additional sales tax revenue from the purchase of construction materials and supplies at the State level would be positive but minimal – less than 1 percent of each State's total sales tax revenues over a 10-year period.

Local Property Taxes

During building of Fermi 3, the assessed property value of the Fermi plant site would increase. For purposes of analysis, the review team has estimated that Monroe County would assess the property as a Construction in Progress, which allows for plants under construction to be assessed annually at 50 percent of the cost of construction expended each year.

Detroit Edison has estimated that approximately $232 million would be expended in the purchase of materials and supplies over the 10-year construction period, including bulk quantities of concrete, reinforced steel and embedded parts, structural steel, cables, wires, coils, and pipes. In addition, Detroit Edison would expend approximately $50.5 million on labor costs based on an average on-site workforce of 1000 workers and average annual salary of $50,500. Assuming an equal expenditure for materials and supplies over the 10-year construction period, the Fermi 3 plant construction would be assessed $141 million each year. The estimated annual property tax revenue based on current millage rates is shown in Table 4-10.

Monroe County, Frenchtown Charter Township, and other local jurisdictions would benefit from increased property taxes associated with Fermi 3. The tax revenue from the Construction in Progress assessment of Fermi 3 would result in a significant (20 percent) increase in property tax revenue for Monroe County, based on 2009 property tax revenue receipts.

Table 4-10. Estimated Annual Property Tax Revenue from Fermi 3 Construction Based on 2009 Millage Rates

Jurisdiction	Millage (2009)	Total Estimated Annual Property Tax Revenue for Construction in Progress
Monroe County – operation	4.8	$676,800
Monroe County – senior citizens	0.5	$70,500
Monroe County Community College	2.18	$307,380
Monroe County Library	1.0	$141,000
Monroe Intermediate School District	4.75	$669,750
Frenchtown Charter Township	6.8	$958,800
Jefferson schools	18.5	$2,608,500
State education tax	6.0	$846,000
Resort Authority	2.8	$394,800
Total Millage	47.33	$6,673,530

4.4.3.3 Summary of Economic Impacts on the Community

On the basis of information provided by Detroit Edison and the review team's evaluation, the review team concluded that the impact of building activities on the economy would be MODERATE and beneficial in Monroe County and in local jurisdictions within Monroe County and SMALL and beneficial elsewhere. An annual average of 150 new workers would relocate into the area (including 58 percent in Monroe County), and 212 workers who are currently unemployed would be employed for building the project over the 10-year building period. A portion of the estimated $6.4 billion construction cost of Fermi 3 would be spent on materials and supplies in the local area. Tax revenue to local jurisdictions would accrue through personal income, sales, and property taxes and would have a LARGE beneficial impact on Monroe County and on local jurisdictions within Monroe County and a SMALL beneficial impact elsewhere in the 50-mi region.

4.4.4 Infrastructure and Community Service Impacts

This section describes the estimated impacts on infrastructure and community services, including transportation, recreation, housing, public services, and education. These impacts are associated primarily with the construction workforce.

4.4.4.1 Traffic

Existing transportation routes would be affected by transportation of equipment, materials, and supplies to the Fermi site and the construction workforce commuting to and from the site.

The Fermi site can be accessed by road, rail, and water, and all three modes of transportation would likely be used during the building of Fermi 3 (Detroit Edison 2011a). A large portion of the major equipment, materials, and supplies required for building would be shipped via barge or rail (Mannik and Smith Group, Inc. 2009), and Detroit Edison may expand the existing barge slip to accommodate the construction equipment, materials and supplies (see Chapter 3). Facilities to support both barge and rail transport to the Fermi site are available onsite, and these modes of transportation would not affect other users of port or rail facilities in the area. Personal vehicles on roadways would be the primary transportation mode for the construction workforce and could affect the LOS on local roadways, particularly during the peak building employment period.

The interstate highways and local roadways described in Section 2.5.2.3 would be used by construction workers to commute to and from work and to transport a portion of the equipment, materials, and supplies to the Fermi site. The size of the workforce would vary over an estimated 10-year building period from a minimum of 35 workers to a peak building employment workforce of 2900 workers. As a result, traffic would increase on area roadways during the building employment period and would be highest during the morning commute to the site (5:30 to 7:30 a.m.) and the afternoon commute from the site (2:30 to 5:30 p.m.) (Mannik and Smith Group, Inc. 2009). Building-related traffic would be most concentrated on local roadways near the site, lessening as workers disperse in various directions on regional interconnecting roadways and highways. Traffic volumes associated with the Fermi site are shown in Table 4-11.

Table 4-11. Actual (2009) and Projected (2017) Traffic Volumes[(a)] – Fermi Site

Workforce	Number of Vehicles (a.m.)	Number of Vehicles (p.m.)
Current Fermi 2 workforce (2009)	466	418
Workforce during peak building employment period (2017)	1421	1276
Total during peak building employment period	1887	1694
Outage workforce for Fermi 2	758	615
Total during peak building employment period and outage	2645	2309

Source: Mannik and Smith Group, Inc. 2009

(a) Traffic volumes based on an actual recorded rate at the Fermi site in 2009 of 0.49 peak-hour vehicles per employee during the morning commute and 0.44 peak-hour vehicles per employee during the afternoon commute.

Detroit Edison conducted a traffic study to evaluate the effect of the building workforce on the LOS of local roadways, focusing on the peak building employment period. The analysis focused on seven local roadway intersections and three interstate (I-75) interchanges, listed below:

- N. Dixie Highway and Stony Creek Road,
- N. Dixie Highway and Pointe Aux Peaux Road,
- N. Dixie Highway and Leroux Road,
- N. Dixie Highway and Enrico Fermi Drive,
- N. Dixie Highway and Post Road,
- Leroux Road and Toll Road,
- Enrico Fermi Road and Leroux Road,
- I-75 and N. Dixie Highway,
- I-75 and Nadeau Road, and
- I-75 and Swan Creek Road.

The LOS analysis was conducted in accordance with the Transportation Research Board's *Highway Capacity Manual* to evaluate the operational efficiency at each intersection and its approaching roadways. The traffic analysis indicates that unsatisfactory traffic conditions (LOS of E or F) would occur at several intersections during both the morning and afternoon commutes during the peak building employment period (see Tables 4-12 and 4-13). The review team reviewed the traffic analysis prepared by The Mannik and Smith Group, Inc. for Detroit Edison and concurred with the findings.

Deficient roadway conditions (i.e., LOS E or F) could be mitigated by roadway or traffic-flow improvements, including signal timing/phasing optimization, left-turn signal phase addition, temporary or permanent signalization, roadway widening (turn-lane additions), modification of existing roads, or addition of new roads. MCRC and MDOT will be responsible for reviewing and approving site plans as the plans affect area roadways during the site plan review and approval process for a building permit within Frenchtown Charter Township (Assenmacher 2011; Ramirez 2011). If further information is needed, MCRC and MDOT may require that a traffic impact study be conducted in accordance with Traffic and Safety Note 607C, "Traffic Impact Studies" (MDOT 2009). Detroit Edison would be required to provide improvements to local roadways as needed.

Other measures to alleviate unsatisfactory traffic conditions include staggering the Fermi 2 workforce and Fermi 3 building workforce start times, establishing multiple shifts for the building workforce, and busing the workforce from a remote site to reduce trips to and from the site (Mannik and Smith Group, Inc. 2009). In addition, a new road would be constructed parallel to and north of the existing Enrico Fermi Drive to separate the Fermi 2 operations workforce and Fermi 3 building workforce, so delays in accessing the site should be alleviated.

Table 4-12. Impacts on Area Roadways during Peak Morning Building Workforce Commute

Intersection	Approach/Movement	Existing (2009) Level of Service	Peak Building Employment (2017) Level of Service	Potential Improvement Alternatives
Northbound I-75 ramps and N. Dixie Hwy.	Northbound ramp	C	F	• Signal timing/phasing modification
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp/ left turn	F	F	• Signalization • Lane use modification
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp/ left turn	D	F	• Signalization • Lane use modification
	Northbound ramp/ right turn	B	D	
Southbound I-75 ramps and Newport Rd.	Southbound approach	C	F	• Signalization • Lane use modification
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd./ eastbound	C	F	• Signalization • Eastbound Stony Creek left/right turn lanes
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy./ northeast-bound	B	F	• Signal timing/phasing optimization
N. Dixie Hwy. and Leroux Rd.	Leroux Rd./ southwest-bound	B	E	• Left turn restriction
N. Dixie Hwy. and Enrico Fermi Dr.	N. Dixie Hwy./ northbound	A	F	• Signal timing/phasing • Northbound/southbound turn lanes on N. Dixie Hwy.
	N. Dixie Hwy./ southbound	A	F	• Additional access point
	Enrico Fermi Dr./ westbound	C	F	• Westbound lane use/storage
N. Dixie Hwy. and Post Rd.	Post Rd./eastbound	C	F	• Signalization
	Post Rd./westbound	B	F	
Enrico Fermi Dr. and Leroux Rd.	Leroux Rd./northeast-bound	B	F	• Warning signage • Temporary closure

Source: Mannik and Smith Group, Inc. 2009

1 **Table 4-13**. Impacts on Area Roadways during Peak Afternoon Building Workforce Commute

Intersection	Approach/Movement	Existing (2009) Level of Service	Peak Building Employment (2017) Level of Service	Potential Improvement Alternatives
Southbound I-75 ramps and N. Dixie Hwy.	Westbound approach/ left turn	A	F	• Signal timing/phasing optimization • Westbound left-turn phase
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp/ left turn	F	F	• Signalization • Lane use modification
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp/ left turn	E	F	• Signalization • Lane use modification
Southbound I-75 ramps and Newport Rd.	Southbound I-75 ramp/ northbound approach	E	F	• Signalization • Lane use modification
	southbound approach	D	F	
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd./ eastbound	C	F	• Signalization • Eastbound Stony Creek left/right turn lanes
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy./ southwest-bound	C	F	• Signal timing/phasing optimization
N. Dixie Hwy. and Leroux Rd.	Leroux Rd./ southwest-bound	B	F	• Left turn restriction
N. Dixie Hwy. and Enrico Fermi Dr.	Enrico Fermi Dr./ westbound	B	F	• Signal timing/phasing optimization • Northbound/southbound turn lanes on N. Dixie Hwy. • Additional access point • Westbound lane use/storage
N. Dixie Hwy. and Post Rd.	Post Rd./eastbound	C	F	• Signalization
	Post Rd./westbound	B	E	
Enrico Fermi Dr. and Leroux Rd.	Leroux Rd./northeast-bound	B	F	• Warning signage
	Leroux Rd./southwest-bound	B	F	• Temporary closure

Source: Mannik and Smith Group, Inc. 2009

During Fermi 2 scheduled refueling outages, contract labor personnel are hired by Detroit Edison to carry out fuel reloading activities, equipment maintenance, and other projects associated with the outage. Detroit Edison employs approximately 1200–1500 workers for 30 days during each refueling outage, which occurs every 18 months for Fermi 2. During scheduled outages, traffic generated by the Fermi site is expected to increase by 758 vehicles during the peak morning commute and by 615 vehicles during the peak afternoon commute (Mannik and Smith Group, Inc. 2009). If the peak building employment period were to occur during a scheduled Fermi 2 outage, traffic conditions would be further exacerbated, especially during the morning and afternoon commute periods. However, these conditions would be short term for the length of the outage (approximately 30 days) and would not represent normal conditions.

From the information provided by Detroit Edison, interviews with local planners and officials, and the review team's independent evaluation, the review team concluded that the offsite impacts of traffic from building of Fermi 3 would be temporary and noticeable but not destabilizing during the peak building employment period. However, Detroit Edison commissioned a traffic study that identified strategies that would mitigate the traffic to a manageable level. Detroit Edison has committed in the ER to working with MDOT and MCRC to determine possible mitigation measures (Detroit Edison 2011a).

4.4.4.2 Recreation

Recreational resources in Monroe, Wayne, and Lucas Counties may be affected by building activities for Fermi 3. Impacts may include (1) increased user demand associated with the projected increase in population as a result of the in-migrating building workers and their families, (2) an impaired recreational experience associated with the views of the building for the 600-ft cooling tower, and (3) access delays associated with increased traffic from the building workers on local roadways. Increased user demand as a result of the in-migrating building workers and their families may include increased competition for recreational vehicle (RV) spaces at campgrounds, which would be used for temporary housing for the workers.

Impacts associated with the increased use of the recreational resources in the vicinity and region would be minimal. The projected increase in population in Monroe, Wayne, and Lucas Counties associated with in-migrating workers and their families is less than 1 percent of the projected 2020 population for any of these counties and would minimally affect the availability and use of recreational resources in the area, especially considering that Wayne and Lucas Counties have experienced and are projected to continue to experience population losses through 2020.

Detroit Edison identified a large number of short-term accommodations within 50 mi of the city of Monroe. These accommodations would be used by people using recreational areas and by other visitors/tourists to the region and may also be used by a portion of the in-migrating workforce that does not select a more permanent type of housing. More than 375 establishments, including hotels and motels, bed-and-breakfasts, cabins and cottages, condos, historic inns, and RV parks and campgrounds, are located within 50 mi of the city of Monroe. In addition, the review team expects only a portion of the in-migrating workers would select short-term accommodations. Therefore, the review team expects recreationalists would be minimally affected by the use of short-term accommodations in the region by in-migrating workers.

Users of recreational resources in the immediate vicinity of the Fermi site may have a diminished recreational experience due to the views of building activities, especially tall structures such as the 600-ft cooling tower. Several small beach communities are located along the Lake Erie shoreline within 5 mi of the Fermi site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. Several public and private beaches are located along the Lake Erie shoreline in Monroe and Wayne Counties. Many small marinas and docks also are located along the Lake Erie shoreline within the vicinity of the Fermi site. Building activities associated with the cooling tower may create dust and debris, and night lighting would also be visible from Point Mouille State Game Area (3.1 mi to the northeast) and Sterling State Park (4.8 mi to the south-southwest). Although the new 600-ft cooling tower will be taller than the existing cooling towers, building activities related to the new cooling tower would be consistent with the existing views of the Fermi site, and the review team determined there would be no discernible adverse impacts on recreational users from the building of the cooling tower for Fermi 3.

People using recreational facilities near the site may experience traffic congestion on the roads during the morning and afternoon commutes of the building workforce. Sterling State Park, in particular, is near the I-75 interchange with North Dixie Highway, which also provides access to the local road network for the Fermi site. However, measures to mitigate traffic delays at selected intersections and I-75 interchanges have been recommended for the building period; they would alleviate impacts on users of recreational facilities as well as members of the general public using local roadways.

4.4.4.3 Housing

As discussed in Section 2.5, the review team expects that approximately 85 percent of the building workforce would be local workers who currently reside within a commute of approximately 50 mi from the Fermi site. The majority of these workers would commute from their homes to the project site and not be expected to affect the housing market. The review team expects the remaining 15 percent of the building workforce, or approximately 435 workers during peak employment, to relocate into the region. The review team expects that these in-migrating workers will have characteristics similar to the current workforce with respect to choices and preferences (e.g., commute distance, available amenities). Therefore, the residential distribution of the in-migrating workforce is based on the residential distribution of the current Fermi 2 workforce, with most (about 85 percent) residing in Monroe and Wayne Counties in Michigan and Lucas County in Ohio during the building period. Table 4-14 compares the available housing with the number of in-migrating building workers.

Table 4-14. Impact on Housing Availability within Monroe, Wayne, and Lucas Counties

Parameter	Monroe	Wayne	Lucas
Workforce relocating from outside the region[(a)]	250	83	47
Vacant housing units[(b)]	4944	149,601	23,105
Estimated demand for housing as percent of housing availability	5.0	0.05	0.2

(a) Approximately 55 workers would choose to relocate elsewhere in the 50-mi region and not be expected to affect housing availability because of the large metropolitan area from which housing could be selected.
(b) As of the 2008 census estimate (USCB 2009c, d).

Given the relatively large size of the regional housing market, the increased demand for housing for the relocating workers and their families would have no noticeable impact on the availability or price of housing. As presented in Section 2.5, the U.S. Census Bureau estimates that more than 1 million housing units were located in Monroe, Wayne, and Lucas Counties in 2008, of which more than 300,000 were rental units. The vacancy rate within the three counties ranged between 1.8 and 6.4 percent for owner-occupied housing and 5.6 and 12.0 percent for rental units; approximately 178,000 housing units were vacant. The Southeast Michigan Council of Governments (SEMCOG 2008) reported 68 mobile home parks and 15,835 mobile home sites in Wayne County and 29 mobile home parks and 7452 mobile home sites, of which 17.2 percent surveyed in Monroe County were vacant, in 2006.

Substandard housing units are being demolished by Wayne and Monroe County, which has resulted in a net loss of housing units in Wayne County. However, the review team has also considered that a large number of housing units are in foreclosure, population in the local area is declining, and additional housing units are being approved for construction in Monroe County, which has resulted in a net gain in housing units. Despite the changes that are expected to occur in the housing market, the review team expects that the overall number of housing units will be more than sufficient to accommodate workers relocating from outside the local area.

In addition, more than 375 establishments are located within 50 mi of the city of Monroe and would be available as short-term accommodations for those relocating from outside the area or those choosing to minimize their commute for all or a portion of the work effort.

Given the large supply of housing and the size of the Detroit and Toledo metropolitan areas relative to the 435 in-migrating families during the peak building employment period, and the availability of short-term accommodations, the review team expects sufficient housing to be available for workers relocating to the area and that there would be minimal impacts on the housing supply or prices in the local area. In addition, given the large supply of housing as well as short-term accommodations, and the declining population in the area, the review team does not expect that the in-migration of 435 families would stimulate new housing construction.

Building Fermi 3 could affect housing values in the vicinity of the Fermi site. In a review of previous studies on the effect of seven nuclear power facilities, including four nuclear power plants, on property values in surrounding communities, Bezdek and Wendling (2006) concluded that assessed valuations and median housing prices have tended to increase at rates above national and State averages. Clark et al. (1997) similarly found that housing prices in the immediate vicinity of two nuclear power plants in California were not affected by any negative views of the facilities. These findings differ from studies that looked at undesirable facilities, largely related to hazardous waste sites and landfills, but also including several studies on power facilities (Farber 1998) in which property values were negatively affected in the short-term, but these effects were moderated over time. Bezdek and Wendling (2006) attributed the increase in housing prices to benefits provided to the community in terms of employment and tax revenues, with surplus tax revenues encouraging other private development in the area. Given the findings from the studies discussed above, the review team determines that the impact on housing value from building Fermi 3 would be minor.

4.4.4.4 Public Services

This section discusses the impacts on existing water supply and wastewater treatment and police, fire, and healthcare services in Monroe, Wayne, and Lucas Counties.

Water Supply and Wastewater Treatment Services

The in-migrating building workforce for Fermi 3 would increase the demand for water and for wastewater treatment services within the communities where the workers would choose to reside; the size of the total building workforce would increase the demand for water and for wastewater treatment services at the Fermi site.

Approximately 85 percent of the project workforce would be local workers who currently reside within a 50-mi radius of the Fermi site. The majority of these workers would commute from their homes to the project site and would not be expected to relocate. Therefore, the majority of workers are currently served by water supply and wastewater treatment services within the communities in which they reside.

The review team expects that 15 percent of the project workforce, or approximately 435 workers during peak building employment and 150 workers on an average annual basis, are expected to relocate with their families into the region, primarily to Monroe, Wayne, and Lucas Counties. These relocating workers would increase the demand on the water supply and on wastewater treatment services within the communities in which they choose to reside.

Given that 435 workers and their families would relocate from outside the area into a large housing market, the review team expects that these workers would obtain housing within the existing housing market rather than stimulate new housing construction, and would not expand existing water supply or wastewater treatment services to new areas. Potable water is available to the existing housing market through wells or municipal water supplies, and residents either have access to municipal wastewater collection and treatment systems or individually own onsite wastewater disposal systems.

The estimated demand for water supply and wastewater treatment services in Monroe, Wayne, and Lucas Counties is shown in Table 4-15.

Table 4-15. Estimated Increase in Demand for Water Supply and Wastewater Treatment Services in Monroe, Wayne, and Lucas Counties from In-migrating Building Workforce

Increases	Monroe	Wayne	Lucas
Estimated increase in population[(a)]	650	216	122
Estimated increase in residential daily water demand[(b)]	0.09 MGD	0.03 MGD	0.02 MGD
Estimated increase in residential daily wastewater flow[(c)]	0.05 MGD	0.02 MGD	0.01 MGD

(a) Approximately 55 workers would choose to relocate elsewhere throughout the 50-mi region, which would increase the population by 143 persons outside of Monroe, Wayne, and Lucas Counties. An increase of 143 persons is not expected to impact the water supply or wastewater treatment services because the metropolitan area in which these persons would settle is large.

(b) Average daily water use per person is estimated to be 135 gpd on the basis of the planning criteria used in DWSD (2004).

(c) Average daily wastewater flow per person is estimated to be 77 gpd on the basis of the planning criteria used in DWSD (2003).

The increase in demand for water supply by the in-migrating workers and their families is expected to have a minor impact on municipal water suppliers in the local area because (1) the increase in population is projected to be small, (2) the in-migrating population would be served by a number of municipalities and jurisdictions, and (3) moving into existing homes implies the residences would already be a part of the existing infrastructure.

In Monroe County, the largest municipal water supplier is the City of Monroe. The City of Monroe treatment plant is designed to treat 18 MGD, and its average daily water demand is 7.8 MGD (Monroe County Planning Department and Commission 2010). Other municipal water suppliers in Monroe County may also provide a water supply to the in-migrating population, including Frenchtown Charter Township; the City of Milan, Michigan; the City of Toledo, Ohio; and the Detroit Water and Sewerage Department (DWSD), which also serves portions of Monroe County. Therefore, the estimated water demand of 0.09 MGD for the additional people choosing to reside in Monroe County would have a minor impact on water suppliers.

Wayne County is serviced by the DWSD, which has a treatment capacity of 1720 MGD. The average daily water demand for the DWSD is 622 MGD (Ellenwood 2010). Therefore, the estimated water demand of 0.03 MGD for the additional people choosing to reside in Wayne County would have a minor impact on the DWSD.

The largest municipal water supplier in Lucas County is the City of Toledo, which also services the northeastern portion of the county where workers are more likely to settle. Its plant has a treatment capacity of 120 MGD, with an average daily demand of 73 MGD (Leffler 2010). Therefore, the estimated water demand of 0.02 MGD for the additional people choosing to reside in Lucas County is expected to have a minor impact on the municipal water suppliers in Lucas County.

The increase in demand for wastewater treatment is expected to have a minor impact on wastewater treatment plants in the local area because of the number of jurisdictions that provide wastewater collection and treatment services in the local area compared with the size of the population increase associated with Fermi 3.

In Monroe County, the largest wastewater treatment plant is operated by the City of Monroe. It is designed to treat 24 MGD wastewater flows, and its average daily wastewater flow is 15.9 MGD (MDEQ 2011b). In addition, wastewater treatment services are provided by a number of municipalities in Monroe County, including the townships of Bedford, Berlin, Ida and Raisinville; cities of Milan, Petersburg, and Luna Pier; and villages of Dundee, Carleton, and Maybee. Therefore, the estimated wastewater treatment flow of 0.05 MGD for the additional people choosing to reside in Monroe County would have a minor impact on wastewater treatment capability.

Wayne County is served by two large wastewater treatment facilities: the DWSD, which has a treatment capacity of 930 MGD and treats an average wastewater flow of 727 MGD (Ellenwood 2010), and the Downriver Treatment Plant, which has a treatment capacity of 125 MGD and treats an average wastewater flow of 52 MGD. In addition, Gross Ile Township, City of Rockwood, and City of Trenton maintain wastewater treatment facilities. Therefore, the estimated wastewater treatment flow of 0.02 MGD for the population choosing to reside in Wayne County would have a minor impact on wastewater treatment capability in Wayne County.

The City of Toledo’s wastewater treatment plant is the largest in Lucas County. The plant has a treatment capacity of 195 MGD, with an average daily demand of 71 MGD (McGibbeny 2010). Therefore, the estimated wastewater treatment flow of 0.01 MGD for the population choosing to reside in Lucas County is expected to have a minor impact on wastewater treatment capability in Lucas County.

During the building of Fermi 3, the onsite workforce would place additional demands on the potable water supply to the Fermi site and on wastewater treatment services at the site. Potable water is currently provided to the plant site by Frenchtown Charter Township, and wastewater is treated through the City of Monroe wastewater treatment plant. Detroit Edison estimates that approximately 8700 gpd of potable water would be required during the peak the peak building employment period (Detroit Edison 2011a). The Frenchtown Charter Township water treatment plant and Monroe County wastewater treatment plant both have the capacity to accommodate the increased demand for these public services.

Surface water withdrawn directly from Lake Erie would provide the water supply for other building activities, including concrete batching, dust suppression, and fire protection. Therefore, municipal water supply services would not be affected by building activities. Impacts associated with surface-water withdrawal are discussed in Section 4.2.

The review team has concluded from the information provided by Detroit Edison, interviews with local planners and officials, and its own independent evaluation that the building of Fermi 3 would have minimal impacts on the local water supply and on wastewater treatment facilities.

Police, Fire Response, and Health Care Services

The building workforce for Fermi 3 would increase the demand for police, fire response, and health care services within the communities where the workers reside and at the Fermi site.

The review team expects that approximately 85 percent of the project workforce would be local workers who currently reside within a radius of approximately 50 mi of the Fermi site. The majority of these workers would commute from their homes to the project site and would not be expected to relocate; they are already currently served by the police, fire response, and health care services within the communities in which they reside. Although these workers' commute from their residences to their place of work would change, the demand for police, fire response, or health care services in any one jurisdiction associated with new commuting patterns cannot be estimated and would not be appreciably different from that of the baseline population served by any one jurisdiction.

The review team expects that the remaining 15 percent of the project workforce, or approximately 435 workers during peak building employment and 150 workers on an average annual basis, to relocate into the region, primarily to Monroe, Wayne, and Lucas Counties. These relocating workers would increase the demand on police, fire response, and health care services within the communities in which they chose to reside.

As discussed in Section 4.4.2, the projected population increase associated with the in-migrating workers, based on an average household size of 2.6 persons, is 1131 persons. On the basis of the existing distribution pattern of the Fermi 2 operational workforce, it is estimated that 650 persons would relocate to Monroe County, 216 persons would relocate to Wayne County, and 122 persons would relocate to Lucas County (see Table 4-6). Approximately 143 persons would relocate elsewhere in the region. As shown in Table 4-16, the projected increase in population would have no measurable effect on the ratio of police officers, firefighters, or health care workers per 1000 residents who serve the population in Monroe, Wayne, or Lucas Counties.

Building Fermi 3 may result in an increased demand for police, fire response, or health care services onsite, especially in the event of construction workplace injuries or accidents. Police, fire response, and other emergency response personnel may encounter traffic congestion on local roadways when responding to calls when the building workforce is commuting to the site, especially during peak building employment periods. However, the area around the Fermi site is sparsely populated, so there would not be a high demand for police, fire response, or other emergency response personnel. In addition, measures to mitigate traffic delays at selected intersections and I-75 interchanges have been recommended for the construction period; these would reduce the impacts on emergency responders as well as on members of the general public using local roadways. During the site plan review and approval process, Frenchtown Charter Township will require that the project, as necessary, be reviewed by the MCRC and MDOT. The Monroe County Road Commission (MCRC) may require that a traffic impact study be conducted in accordance with Traffic and Safety Note 607C, “Traffic Impact Studies” (MDOT 2009), and improvements to local roadways be considered by Detroit Edison at that time.

Detroit Edison will prepare and implement a construction safety plan that conforms to industry requirements and OSHA regulations to minimize the number of safety incidents that could occur onsite. The workers would be required to take training and become familiar with the plan and adhere to safety standards applicable to the construction industry (Detroit Edison 2011a). Fire suppression equipment and a first aid station are available onsite, and Detroit Edison has existing agreements with local emergency response organizations (Detroit Edison 2011a). Because of these offsite and onsite safety strategies, the review team expects that the impact of building activities on the demand for local emergency room service personnel would be minimal.

4.4.4.5 Education

The building workforce for Fermi 3 would increase the demand for educational services.

The review team expects that approximately 85 percent of the project workforce would be local workers who currently reside within 50 mi of the Fermi site. Therefore, most of the building workers would commute from their homes to the project site and would not be expected to

Table 4-16. Changes in Population Served by Law Enforcement Personnel, Firefighters, and Health Care Workers in Monroe, Wayne, and Lucas Counties

Type of Public Service Workers	Number of Officers/Firefighters/ Health Care Workers	Existing Conditions: Population Served(a)	Existing Conditions: Officers/Firefighters/ Health Care Workers per 1000 Residents	Conditions with In-migrating Workers and Families Associated with Building Fermi 3: Population Served(b)	Conditions with In-migrating Workers and Families Associated with Building Fermi 3: Officers/Firefighters/ Health Care Workers per 1000 Residents
County Sheriff and Municipal Law Enforcement Personnel					
Monroe	277	152,945	1.8	153,595	1.8
Wayne	6957	1,949,929	3.6	1,950,145	3.6
Lucas	973	440,456	2.2	440,578	2.2
Firefighters					
Monroe	606	152,949	4.0	153,455	4.0
Wayne	3407	1,949,929	1.7	1,950,212	1.7
Lucas	1195	440,456	2.7	440,578	2.7
Health Care Workers(c)					
Monroe, MI, MSA	2770	152,949	18.1	153,455	18.1
Detroit-Livonia-Dearborn Metro Division	69,030	1,949,929	35.4	1,950,212	35.4
Toledo, OH, MSA	34,600	649,104	53.3	649,226	53.3

Sources: FBI 2009; FEMA 2010; USBLS 2008a

(a) 2008 population estimate is from the USCB (2009f, g).

(b) Population served includes the 2008 population estimate plus the projected population increase associated with relocating workers and their families. Normal population increases or decreases and any associated changes in the public services provided are not considered here.

(c) Occupational employment and corresponding population served are provided for the metropolitan area in which the county is located.

relocate or make any additional demands on educational services in Monroe, Wayne, and Lucas Counties.

As described in Section 4.4.2, the review team expects that 15 percent of the project workforce, or approximately 435 workers during peak construction and 150 workers on an average annual basis, would relocate into the region, primarily to Monroe, Wayne, and Lucas Counties. If the in-migrating workers during the peak building employment period were to relocate with their families and settle in the same distribution pattern as the current Fermi 2 workforce, school enrollments would increase by an estimated 133 school-aged children in Monroe County, 44 school-aged children in Wayne County, and 25 school-aged children in Lucas County (Table 4-17).

Table 4-17. Estimated Number of School-Aged Children Associated with In-migrating Workforce Associated with Building Fermi 3

Workers and Their Children	Monroe	Wayne	Lucas
Estimated number of building workers in-migrating to county	250	83	47
Estimated increase in population[(a)]	650	216	122
Estimated increase in number of school-aged children[(b)]	133	44	25

(a) Based on 2.6 persons per household (USCB 2009e).
(b) Based on the 2008 census estimate for the country, which shows that 20.4 percent of the population is between 5 and 19 years old (USCB 2009e).

During the 2008–2009 school year, enrollment in the nine public school districts in Monroe County was 23,283, and in Wayne County, enrollment in 35 public school districts was 276,862 (Table 4-18). During the same year, enrollment in eight school districts in Lucas County was 57,263. The review team determined that the impact of the projected increase in population associated with the building workforce for Fermi 3 on local schools would be negligible because the children of the households associated with the relocated workers would be dispersed throughout numerous public schools in these school districts as well as in numerous private, parochial, charter, and alternative schools.

4.4.4.6 Summary of Infrastructure and Community Services Impacts

The review team has concluded from the information provided by Detroit Edison, interviews with staff from county departments, and its own independent evaluations that the impact of building activities on regional infrastructure and community services – including recreation, housing, water and wastewater facilities, police, fire, and medical facilities, and education – would be SMALL. The estimated peak workforce of 2900 would have a MODERATE, temporary adverse impact on traffic on local roadways near the Fermi site. These traffic-related impacts could be reduced but not eliminated with proper planning and mitigation measures similar to those discussed in the traffic study conducted for Detroit Edison by The Mannik and Smith Group, Inc.

Table 4-18. Changes in Student/Teacher Ratio for School Districts in Monroe, Wayne, and Lucas Counties

	Existing Conditions			Conditions with In-migrating Workers and Families	
County	Total Countywide Number of Teachers	Total Countywide Student Enrollment	Student/ Teacher Ratio throughout County	Total Countywide Student Enrollment[(a)]	Student/ Teacher Ratio throughout County
Monroe	1254	23,283	18.6	23,416	18.7
Wayne	15,853	276,862	17.5	276,906	17.5
Lucas	3716	57,263	15.4	57,288	15.4

Source: U.S. Department of Education 2010

(a) Population served includes the 2008–2009 countywide school enrollment plus the projected number of school-aged children associated with in-migrating workers. Normal population increases or decreases and any associated changes in the educational services provided are not considered here.

(Mannik and Smith Group, Inc. 2009). These conclusions are predicated on the specific assumptions about the size, composition, and behavior of the project workforce discussed in detail in Section 4.4.2 of this EIS. Therefore, the projected increase in population associated with workers relocating to build Fermi 3 would mitigate the economic consequences of current population losses and have a beneficial impact on the two counties.

4.4.5 Summary of Socioeconomic Impacts

The review team has assessed the proposed building activities related to Fermi 3 and the potential socioeconomic impacts in the region and local area. Physical impacts on workers and the general public include impacts on noise levels, air quality, existing buildings, roads, and aesthetics. The review team has concluded that all physical impacts in the region and in the local area from building activities at Fermi 3 would be SMALL.

On the basis of information supplied by Detroit Edison and the review team interviews conducted with public officials in Monroe, Wayne, and Lucas Counties, the review team concluded that impacts from building activities on the demographics of the entire 50-mi region would be beneficial and SMALL. Economic impacts would be beneficial and SMALL for all areas except Monroe County and the local jurisdictions within Monroe County, which the review team determined would receive MODERATE beneficial impacts on the economy, and LARGE beneficial impacts on property taxes.

Infrastructure and community services impacts span issues associated with traffic, recreation, housing, public services, and education. Impacts from building activities on infrastructure and community services would be SMALL in all these areas except for traffic impacts during the peak employment period. Traffic-related impacts on local roadways near the Fermi site would be short-term, MODERATE, and adverse during the peak employment period, but manageable with the implementation of mitigation strategies similar to those discussed by Detroit Edison.

On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concluded that the socioeconomic impacts of NRC-authorized construction activities would be SMALL, with two exceptions, which are outlined below. The NRC staff also concluded that no further mitigation measures beyond the actions outlined by the applicant in its ER would be warranted.

To determine the portion of the short-term MODERATE adverse traffic impact attributable to NRC-authorized construction activities, the NRC staff assumes, on the basis of Detroit Edison's ER, that 70 percent of traffic-related impacts over the life of the project would be associated with NRC-authorized construction activities. The NRC staff concluded that the applicant's percentage allocation of 70–30 based on expected labor hours was a reasonable estimate of the actual allocation. Using this allocation, the NRC staff concluded that the impact on traffic from Fermi 3 NRC-authorized construction activities would be short-term, MODERATE, and adverse and would largely occur during the peak building employment period. Detroit Edison may choose to implement the traffic-mitigation activities noted in Section 4.4.4.1, and it will implement the roadway improvements that are determined by MDOT and MCRC as a condition of Frenchtown Charter Township's site plan approval, which would reduce the traffic impacts to SMALL levels. To determine the portion of the MODERATE beneficial economic impact and LARGE beneficial tax impact in Monroe County attributable to NRC-authorized construction activities, the NRC staff assumes, on the basis of Detroit Edison's ER, that 70 percent of tax-related impacts over the life of the project would be associated with NRC-authorized construction activities. The NRC staff concluded that the applicant's percentage allocation of 70–30 based on expected labor hours was a reasonable estimation of the actual allocation. Using this allocation, the NRC staff concluded that the economic impact on Monroe County from NRC-authorized construction activities would be MODERATE and beneficial and the tax impact on Monroe County from NRC-authorized construction activities would be LARGE and beneficial.

4.5 Environmental Justice Impacts

In the context of the questions outlined in Section 2.6.1, the review team evaluated whether minority or low-income populations would experience disproportionately high and adverse human health or environmental effects from the building of Fermi 3. To perform this assessment, the review team (1) identified (through U.S. Census Bureau demographic data[a]

(a) During the preparation of this draft EIS, the results of the mandated U.S. decadal census for 2010 were being released in topical and regional data sets. While the U.S. Census Bureau has not issued all of the data sets in final form, some of the preliminary information was considered by the review team. While some of the final data sets were released for National scale information, most of the fine and on-the-ground assessments) minority and low-income populations of interest, (2) identified all potentially significant pathways for human health, environmental, physical, and socioeconomic effects to those identified populations of interest; (3) determined the impact of each pathway for individuals who are within minority or low-income populations; and (4) determined whether or not the characteristics of the pathway or special circumstances of the minority or low-income populations would result in a disproportionately high and adverse impact.

4.5.1 Health Impacts

Section 4.9 of this EIS assesses the radiological doses to construction workers and concludes that the doses would be within NRC and EPA dose standards. Section 4.9 further concludes that radiological health impacts on the construction workers for proposed Fermi 3 would be SMALL. In addition, there would be no radioactive material on the construction site except for very small sources such as those commonly used by radiographers; therefore, there would be no radiation exposure to members of the public living near the construction site. Based on this information, the review team concludes there would be no disproportionately high and adverse impact on low-income or minority members of the construction workforce or the local population.

Section 4.8 of this EIS assesses the nonradiological health effects for construction workers and the local population from fugitive dust, noise, occupational injuries, and transport of materials and personnel. In Section 4.8, the review team concludes nonradiological health impacts on construction workers and the local population would be SMALL. The review team's investigation and outreach did not identify any unique characteristics or practices among minority or low-income populations that might result in disproportionately high and adverse nonradiological health effects.

4.5.2 Physical and Environmental Impacts

For the physical and environment-related considerations described in Section 2.6.1, the review team determined through literature searches and consultations that (1) the impacts on the natural or physical environment would not significantly or adversely affect a particular group; (2) no minority or low-income population would experience an adverse impact that would appreciably exceed or be likely to appreciably exceed those on the general population; and (3) the environmental effects would not occur in groups affected by cumulative or multiple adverse exposure from environmental hazards. Sections 4.5.2.1 through 4.5.2.4 summarize the physical and environmental effects on the general population, and Section 4.5.2.5 assesses the potential for disproportionately high and adverse physical and environmental impacts on minority or low-income populations.

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scale information is still under review by the DOC and other Federal agencies. The review team is not aware of information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier census.

The review team determined that the physical and environmental impacts from onsite building activities at the Fermi 3 site would attenuate rapidly with distance, intervening foliage, and terrain. There are four primary exposure media in the environment: soil, water, air, and noise. The following four subsections discuss each of these pathways in greater detail.

4.5.2.1 Soil

Building activities on the Fermi site represent the largest source of soil-related environmental impacts. The site is well-defined, and access is restricted. Soil-disturbing activities are localized on the site, sufficiently distant from surrounding populations, and have little ability to migrate, resulting in no noticeable offsite impacts. Soil migration will be minimized by adherence to regulations and permits and the use of BMPs.

4.5.2.2 Water

Water-related environmental impacts from erosion-related degradation of surface water and the introduction of anthropogenic substances into surface and groundwater would occur, but the impacts would be mitigated through adherence to permit requirements and BMPs. Increased water turbidity during dredging activities could affect near-shore water quality, but the effect would be minimized through adherence to permit requirements and BMPs. Consumptive use of surface water for building activities would also occur but would have only a minimal effect because the water supply is from Lake Erie. The water-related impacts of building activities associated with the proposed action would be of limited magnitude, localized, and temporary.

4.5.2.3 Air

Air emissions are expected from increased vehicle traffic, construction equipment, and fugitive dust from building activities. Emissions from vehicles and construction equipment would be unavoidable but would be temporary and minor in nature, and subject to management under State and Federal air regulations and permits. Furthermore, because of the distance between building activities and the closest minority or low income population of interest, the review team did not identify any disproportionately high and adverse impacts from air related pathways.

4.5.2.4 Noise

Noise would result from clearing; moving earth; preparing foundations; pile-driving; concrete mixing and pouring; erecting steel structures; and various stages of facility equipment fabrication, assembly, and installation. Detroit Edison, however, would employ standard noise control measures for construction equipment, limit the types of building activities during nighttime and weekend hours, notify all potentially affected neighbors of planned activities, and establish a construction-noise monitoring program. The review team determined that noise impacts on the public would be temporary and would not be significant; therefore the review team determined there would be no disproportionately high and adverse impact on any minority or low-income population from noise.

4.5.2.5 Summary of Physical and Environmental Impacts on Minority or Low-Income Populations

The review team's investigation and outreach did not identify any unique characteristics or practices among minority or low-income populations that might result in physical or environmental impacts on them that were different from those on the general population.

As discussed in Section 2.6, most of the census block groups classified as minority or low-income lie in urban centers to the north and south of the Fermi site, within and near Detroit (at the edge of the 50-mi region) and Toledo (about 25 mi from the Fermi site). The closest population of interest is a single census block group within Monroe County that qualifies as both a minority and a low-income population of interest. It is located approximately 8 mi from the Fermi site. This census block group would not be affected by any physical or environmental impact because the census block group is distant from the site. The review team did not identify any pathways by which any physical impacts would affect migrant farm workers if they were employed in transient farming activity near the Fermi site, and no subsistence activities are known to occur near the Fermi site.

On the basis of information provided by Detroit Edison and the review team's independent review, the review team found no pathways from soil, water, air, and noise that would lead to disproportionately high and adverse impacts on minority or low-income populations.

4.5.3 Socioeconomic Impacts

Socioeconomic impacts (discussed in Section 4.4) were reviewed to evaluate whether there would be any building activities that could have a disproportionately high and adverse effect on minority or low-income populations. Except for effects on traffic, any adverse socioeconomic impacts associated with the building of Fermi 3 are expected to be SMALL. While there likely would be adverse MODERATE impacts on traffic, these impacts are not expected to disproportionately impact low-income and minority populations.

4.5.4 Subsistence and Special Conditions

NRC's environmental justice methodology includes an assessment of minority or low-income populations of interest with unique circumstances, such as minority communities exceptionally dependent on subsistence resources or identifiable in compact locations, such as Native American settlements.

As discussed in Section 2.6.3, access to the Fermi site is restricted; such restricted access reduces any impact on plant-gathering, hunting, and fishing activities at the site. Detroit Edison and the review team interviewed community leaders in Monroe County with regard to subsistence practices, and no such practices were identified in the vicinity of the Fermi site. There is no documented subsistence fishing in Lake Erie, Swan Creek, or Stony Creek, and no documented subsistence plant-gathering or hunting in the vicinity of the Fermi site. From the information provided by Detroit Edison, interviews with local planners and officials, and the review team's independent evaluation, the review team concluded that there would be no building-related disproportionately high and adverse impacts on subsistence activities by minority or low-income populations.

4.5.5 Summary of Environmental Justice Impacts

The review team evaluated the proposed activities related to building Fermi 3 and potential environmental justice impacts in the vicinity and region. The review team did not identify any potential environmental pathways by which the identified minority or low-income populations in the 50-mi region would be likely to experience disproportionately high and adverse human health, environmental, physical, or socioeconomic effects as a result of building activities; therefore, environmental justice impacts would be SMALL. On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that there are no environmental pathways by which the identified minority or low-income populations in the 50-mi region would be likely to experience disproportionately high or adverse environmental or health impacts as a result of the NRC-authorized construction activities. Environmental justice impacts would therefore be SMALL.

4.6 Historic and Cultural Resources

The NEPA requires Federal agencies to take into account the potential effects of their undertakings on the cultural environment, which includes archaeological sites, historic buildings, and traditional places important to local populations. The NHPA also requires Federal agencies to consider impacts on those resources if they are eligible for listing on the *National Register of Historic Places* (NRHP) (such resources are referred to as "Historic Properties" in the NHPA). As outlined in 36 CFR 800.8, "Coordination with the National Environmental Policy Act of 1969," the NRC coordinated compliance with Section 106 of the NHPA in meeting the requirements of the NEPA.

Building new nuclear units can affect either known or undiscovered cultural resources. Therefore, in accordance with the provisions of the NHPA and NEPA, the review team must make a reasonable and good faith effort to identify historic properties in the area of potential effects (APE) and, if any such properties are present, determine whether any significant impacts are likely to occur. Identification is to occur in consultation with the SHPO, American Indian

Tribes, interested parties, and the public. If significant impacts are possible, efforts should be made to mitigate them. As part of the NEPA/NHPA integration, even if no historic properties (i.e., places eligible for listing on the NRHP) are present or affected, the NRC and the USACE must notify the SHPO before proceeding with their respective authorized activities. If it is determined that historic properties are present, the NRC and the USACE are required to assess and resolve adverse effects of their respective authorized activities for the undertaking.

4.6.1 Onsite Historic and Cultural Resources Impacts

Historic and cultural resources on the Fermi site are described in Section 2.7. As explained in Section 2.7, previous cultural resource identification efforts indicated the presence of eight archaeological site locations on the Fermi site (within the direct APE), none of which are recommended eligible for listing in the NRHP (Demeter et al. 2008; Taylor 2009). One architectural resource located on the Fermi site (within the direct APE), Fermi 1, has been recommended eligible for listing in the NRHP under Criteria A and C as part of a separate undertaking (Kuranda et al. 2009). In its letter dated May 9, 2011 (which was received on May 10, 2011), the Michigan SHPO stated that Fermi 1 appears to meet the criteria for listing in the NRHP (Conway 2011).

The review team analyzed the construction and preconstruction activities related to building Fermi 3 and the potential cultural and historic resources impacts. Detroit Edison has not determined whether to remove the Fermi 1 external structure after the site is decommissioned and its NRC license is terminated. If the external structure is present when Fermi 3 building activities begin, then the NRC staff has determined that such activities would adversely affect Fermi 1. Thus, for the purposes of NHPA Section 106 consultation, based on (1) the measures that Detroit Edison would take to avoid or limit adverse impacts to significant cultural resources, (2) the review team's cultural resource analysis and consultation, and (3) Detroit Edison's commitment to follow its procedures should ground-disturbing activities discover cultural and historic resources, the NRC staff concludes with a finding of historic properties adversely affected (36 CFR Section 800.5(d)(2)) onsite and within the APE, based on the demolition of Fermi 1. The NRC staff is consulting with the Michigan SHPO and Detroit Edison in developing a MOA to resolve the adverse effects on Fermi 1 pursuant to 36 CFR 800.6(c).

The review team also reviewed Detroit Edison's plan to develop procedures or guidance necessary to address the steps that Detroit Edison and its contractors will follow upon the unanticipated discovery of archaeological resources or human remains during construction and preconstruction activities. These procedures or guidelines will be in place prior to beginning ground-disturbing activities (e.g., preliminary site work, excavation, grading) for Fermi 3. The protective measures that will be reflected in these procedures and guidelines will consist of temporarily suspending activities in the area that may damage or alter any unanticipated cultural resources or human remains; securing the area to prevent additional disturbance of the unanticipated discovery; and notification of Detroit Edison's Engineering, Procurement, and

Construction (EPC) Executive or his/her representative so that the Michigan SHPO and the Office of the State Archaeologist can be notified and determine the significance of the unanticipated discovery and what, if any, special disposition of the finds should be made (Detroit Edison 2009c, 2010b).

For the purposes of the review team's NEPA analysis, based on information provided by Detroit Edison, the review team's independent evaluation, and the review team's consideration of the intrinsic attributes of Fermi 1 that contributed to its cultural significance, the review team concludes that the impacts from building Fermi 3 on onsite historic properties would be MODERATE if the Fermi 1 structure is present when Fermi 3 construction activities begin. The attributes that make Fermi 1 eligible for listing in the NRHP are National Register Criterion A, for Fermi 1's role in the development of the nuclear power industry, and Criterion C, for the engineering design of the reactor and its associated components. Because access to the Fermi 1 site is restricted, the public will have an increased opportunity to learn about and understand Fermi 1's attributes once mitigation measures, which will consist of recordation documents and a public exhibit, are implemented. Thus, impacts on Fermi 1 are considered MODERATE because of these mitigation measures, even though its non-accessible external structure will be removed.

The review team concludes that the potential MODERATE impacts on cultural resources (i.e., Fermi 1) would be the result of NRC-authorized construction activities. The cumulative impacts on historic and cultural resources are analyzed and discussed in Chapter 7 of this EIS.

4.6.2 Offsite Historic and Cultural Resources Impacts

Offsite historic and cultural resources information is provided in Section 2.7. As explained in Section 2.7, previous cultural resource identification efforts indicated the presence of two archaeological resources and 83 architectural resources offsite, but within the indirect APE for Fermi 3. Neither of the two archaeological resources has been evaluated for NRHP eligibility (Demeter et al. 2008). Of the architectural resources, 21 were determined or recommended eligible for the NRHP listing under Criteria A, B, and/or C and the remaining 62 have been recommended not NRHP-eligible (Demeter et al. 2008). The Michigan SHPO has indicated concurrence with the identification of historic properties for the Fermi 3 project in the letter dated May 9, 2011 (Conway 2011).

The process of building Fermi 3 would result in new facilities that would visually impact historic and cultural resources that are offsite, but within the indirect APE for the Fermi 3 project, and would have the potential to result in alterations to the visual landscape within the indirect APE for the Fermi 3 project. These alterations would consist of the introduction of new power plant facilities, including buildings and structures, into the existing viewsheds and settings of the 21 determined or recommended NRHP-eligible architectural resources and the settings of the two previously archaeological sites that have not been evaluated for NRHP eligibility. However, the existing viewsheds and settings of these 21 architectural resources and two archaeological sites include three existing power plant facilities along the shoreline of Lake Erie: the onsite decommissioned Fermi 1 facilities, the onsite operating Fermi 2 facilities, and the offsite operating Detroit Edison Monroe Power Plant to the south near the City of Monroe. As such, the indirect visual impacts that may result from building Fermi 3 would be consistent with existing landscape features in the viewsheds and settings of these 21 offsite architectural resources, such that there would be no new significant visual impacts that would affect the NRHP-eligibility determination or recommendations for the 21 offsite architectural resources that are within the indirect APE for the Fermi 3 project (Demeter et al. 2008). Similarly, there would be no new significant visual impacts on the two offsite archaeological resources that would affect NRHP-eligibility determinations or recommendations.

For the purposes of NHPA Section 106 consultation pursuant to 36 CFR 800.8, the NRC concludes with a finding of no adverse effect on offsite historic properties within the indirect APE, because, based on the characteristics of the existing offsite setting within the indirect APE, indirect visual impacts resulting from building Fermi 3 would be consistent with, and would not result in significant changes to, offsite historic properties within the indirect APE.

For the purposes of the review team's NEPA analysis, based on information provided by Detroit Edison, and the review team's independent evaluation, the review team concludes that the impacts from Fermi 3 construction and preconstruction activities on offsite cultural resources and/or historic properties within the indirect APE for the Fermi 3 project would be minor, because new facilities would be consistent with the landscape features within the existing setting of these offsite historic properties.

The portions of the proposed offsite transmission line route that are within the indirect APE for the Fermi 3 project will utilize an existing transmission line route, and will not result in new impacts on offsite historic or cultural resources within the Fermi 3 APE. The portion of the proposed offsite transmission line route that is located outside the Fermi 3 APE and extends north and west from the Fermi 3 project area to the Sumpter-Post Road junction in Wayne County will also utilize an existing transmission line route and will also result in no new impacts on offsite historic or cultural resources. The approximately 11-mi portion of the proposed offsite transmission line route from the Sumpter-Post Road junction in Wayne County to the Milan Substation in Washtenaw County will require a new transmission line route and may result in impacts on historic and/or cultural resources. The process of building new transmission lines may result in direct impacts on archaeological or architectural resources crossed by the proposed transmission lines or indirect visual impacts on architectural resources in the vicinity of the new transmission lines. These impacts could be unavoidable if significant archaeological or architectural resources are located within the direct APE for the new transmission line route and/or if architectural resources that are located in the indirect APE are significant because of their setting. Given the length of new transmission lines and the possibility of finding significant cultural resources along the transmission lines, some impacts on historic and cultural resources may be possible. The potential for direct and indirect or visual impacts exists, and in the absence of more detailed information, these impacts cannot be evaluated with certainty.

Detroit Edison has indicated that construction and operation of the transmission lines will be the responsibility of ITC*Transmission*, an intrastate transmission company. As such, any further investigations to identify the presence of cultural and historic resources and to evaluate the NRHP-eligibility of such resources would be the responsibility of ITC*Transmission*, who would conduct such investigations in accordance with applicable regulatory and industry standards to assess impacts (Detroit Edison 2011a).

Based on the review team's NEPA analysis of cultural resources, building the offsite transmission lines has the potential to impact cultural resources. Impacts could be minor if there are no significant alterations to the cultural environment. If these activities result in significant alterations to the cultural environment, the impact could be greater.

According to 10 CFR 50.10(a)(2)(vii), transmission lines are not included in the definition of construction and are not an NRC-authorized activity. Therefore, the NRC considers the offsite proposed transmission lines to be outside the NRC's APE and therefore not part of the NRC's consultation.

4.7 Meteorological and Air Quality Impacts

Section 2.9 describes the meteorological characteristics and air quality of the Fermi site. The primary impacts building of Fermi 3 would have on local air quality would be from fugitive dust from soil disturbances, engine exhaust emissions from heavy construction equipment and machinery, concrete batch plant operations, and emissions from vehicles used to transport workers and materials to and from the site. Open burning of wastes is prohibited by the MDEQ (Detroit Edison 2011a).

4.7.1 Preconstruction and Construction Activities

Building the proposed Fermi 3 would result in temporary impacts on local air quality as a result of emissions associated with construction and preconstruction activities. Equipment and vehicle emissions from these activities would contain carbon monoxide, oxides of nitrogen, and volatile organic compounds (VOCs). As with any large-scale construction project, dust particle emissions would also be generated during land-clearing, grading, and excavation activities. Fugitive dust particles would be generated by recently disturbed or cleared areas during windy periods and by the movement of machinery and materials over these areas. In general, emissions from these activities would vary based on the level and duration of each specific activity and site-specific factors such as local meteorology and soil conditions. The overall impact from fugitive dust is expected to be temporary and limited in magnitude because the site is relatively flat and limited amounts of earthmoving will be required.

In the ER, Detroit Edison (Detroit Edison 2011a) concluded that, in view of the relatively isolated nature of the Fermi 3 construction area, the net impact of construction and preconstruction on air quality would be small and no mitigation measures beyond those required for dust under the Permit to Install would be warranted. Detroit Edison has not yet applied to the MDEQ for a Permit to Install, which will be needed prior to beginning preconstruction and construction activities at the proposed Fermi 3 site. The detailed data needed to support such a permit application remains to be developed, and modeling and emissions estimates were not presented in the ER.

Monroe County is in an area that has been designated a nonattainment area for $PM_{2.5}$ NAAQS and a maintenance area for 8-hr ozone (EPA 2010a). In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011a). This request is based, in part, on air quality monitoring data collected in the 2007–2010 period showing all seven counties in southeast Michigan in attainment for the $PM_{2.5}$ NAAQS. If this request is eventually approved, Monroe County would then become a maintenance area for $PM_{2.5}$. In either case, the direct and indirect emissions of air pollutants associated with NRC's proposed Federal action to issue a COL for construction and operation of a new nuclear power plant at the Fermi 3 site and the USACE proposed Federal action to issue a permit to perform certain regulated activities at the Fermi 3 site would be subject to conformity evaluations. These conformity evaluations must show that the Federal actions would not affect the ability of southeast Michigan to meet and maintain $PM_{2.5}$ and ozone NAAQS.

Detroit Edison (2011d) provided construction-related emission estimates to assist the NRC in developing its conformity applicability analysis regarding whether a general conformity determination would be required under 40 CFR Part 93, Subpart B. This regulation requires a conformity determination for Federal actions in nonattainment and maintenance areas if the action results in emissions exceeding specified *de minimis* levels. Detroit Edison provided estimates for construction-related direct and precursor emissions of $PM_{2.5}$ and ozone ($PM_{2.5}$, NO_x, VOCs, and SO_2). PM_{10} emissions from construction were not estimated.

As part of its construction-related emission estimates, Detroit Edison included a list of construction activities, the preliminary construction schedule, and an estimate of equipment use by year (Detroit Edison 2011d). It was assumed that construction would begin in April 2011 and last for 62 months (18 months of site preparation followed by 44 months of preconstruction and construction) up to May 2016. From this list, Detroit Edison estimated construction emissions from 2011 to 2016. The review team examined the construction activity and equipment usage estimates and performed an independent assessment of the construction emissions using current EPA emissions factors and models. The first year of construction (2011) is expected to result in the highest emissions of VOCs, while the third year of construction (2013) is expected to result in the highest emissions of $PM_{2.5}$, NO_x, and SO_2.

Detroit Edison (2011a) estimates that emissions associated with NRC-authorized construction activities would account for about 50 percent of the impacts from fugitive dust and 70 percent of the impacts from mobile equipment during the overall construction and preconstruction period.

Table 4-19 presents the highest annual emissions estimates for combined preconstruction and construction (NRC-authorized) activities during the 62-month construction schedule. Peak emissions from the activities associated with building Fermi 3 would be up to about 1.1 percent (for $PM_{2.5}$) of total emissions in Monroe County and up to 0.2 percent (for $PM_{2.5}$) of total emissions in all neighboring counties that are currently designated as $PM_{2.5}$ nonattainment or ozone maintenance areas (EPA 2010b). Given these relatively small and temporary emissions, impacts are expected to be minor. Notwithstanding these small emissions, the NRC and the USACE will each perform a Clean Air Act Section 176 air conformity applicability analysis pursuant to 40 CFR Part 93, Subpart B, to determine whether additional mitigation may be warranted.

Table 4-19. Estimated Maximum Annual Emissions of $PM_{2.5}$, NO_x, VOCs, SO_2, and CO_2 Associated with Preconstruction and Construction of Fermi 3[(a), (b)]

	Annual Emissions (tons)				
Source Category	**$PM_{2.5}$**	**NO_x**	**VOCs**	**SO_2**	**CO_2**
Mobile equipment[(c)]	5.8	131.0	53.4	0.4	27,045
Fugitive dust[(d)]	66.0	NA[(e)]	NA	NA	NA
Total	**71.8**	**131.0**	**53.4**	**0.4**	**27,045**

Source: Detroit Edison 2011d

(a) The peak year is 2011 for VOCs, while the peak year is 2013 for $PM_{2.5}$, NO_x, SO_2, and CO_2.

(b) Notation for air pollutants: CO_2 = carbon dioxide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 microns or less; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.

(c) Includes emissions from on-road vehicles, worker vehicles, nonroad engines, marine engines, and locomotive engines. It is assumed that construction workers would travel through the nonattainment/maintenance area to and from the Fermi site with a roundtrip distance of 57.2 mi.

(d) Includes emissions from material transfer, bulldozing, grading, blasting, cement production, wind erosion from active piles and the construction area, paved roads, and unpaved roads.

(e) NA = Not applicable.

Specific mitigation measures to control fugitive dust would be identified in a dust-control plan or a similar document prepared prior to starting the project in accordance with all applicable State and Federal permits and regulations. As stipulated in MDEQ Rule 336.1372, Detroit Edison states the mitigation measures for transporting of bulk materials, roads and lots, and general construction activities (Detroit Edison 2011a). Some of these mitigation measures would include the following:

- using practices for dust control that are consistent with State requirements;
- spraying all work areas with water or other dust suppressants approved by the MDEQ;
- reseeding laydown and other areas as they are no longer needed; and
- installing a dust control system on the concrete batch plant that will be checked and maintained regularly.

Preconstruction and construction activities including on-road construction vehicles, worker vehicles, off-road construction equipment, marine engines, and locomotive engines will result in emissions of greenhouse gases (GHGs), primarily carbon dioxide (CO_2). As a site-specific estimate, during the 6-year construction period, the highest CO_2 emissions of 27,045 tons/yr (24,535 metric tons/yr) are estimated in the third year, 2013 (Detroit Edison 2011a). This amounts to about 0.010 percent of the total projected GHG emissions in Michigan at 253,800,000 metric tons (MT) of gross[(a)] CO_2 equivalent (CO_2e)[(b)] in 2010 (CCS 2008). This also equates to about 0.0005 percent of total CO_2 emissions in the United States at about 5.5 billion MT in 2009 (EPA 2011).

Another estimate of the relative size of the Fermi 3 building emissions can be made based on the information in Appendix L, which provides the review team's estimate of emissions for a generic 1000 MW(e) nuclear power plant. If conservatively assuming that building emissions are proportional to design electric output, the scaled building equipment and workforce emissions for Fermi 3 equate to about 313,000 tons (284,000 MT) over 7 years, which is an average of about 45,000 tons/yr (41,000 MT/yr). This also amounts to a small percentage of projected GHG emissions for Michigan and the United States.

As noted in Section 4.7.2, the site-specific estimate shows transportation accounts for about 50 percent of building CO_2 emissions, and there are measures that could be implemented to reduce traffic emissions. Detroit Edison has committed to developing and implementing a traffic management plan and controlling vehicle emissions by regularly scheduled maintenance. Implementing such measures could reduce the percentages of the projected Michigan and U.S. GHG emissions constituted by Fermi 3 construction emissions.

(a) Excluding GHG emissions removed due to forestry and other land uses and excluding GHG emissions associated with exported electricity.

(b) A measure to compare the emissions from various GHGs on the basis of their global warming potential (GWP), defined as the ratio of heat trapped by one unit mass of the GHG to that of one unit mass of CO_2 over a specific time period.

Based on these two analyses, the review team concludes that the potential impacts of GHG emissions from construction and preconstruction activities would not be noticeable, and thus additional mitigation measures would not be warranted.

In general, emissions from construction and preconstruction activities (including GHG emissions) would vary based on the level and duration of a specific activity, but the overall impact is expected to be temporary and limited in magnitude. Considering the information provided by Detroit Edison and its commitments to implement a fugitive dust control program in accordance with MDEQ regulations and control vehicle emissions through regularly scheduled maintenance, the review team concludes that the impacts from Fermi 3 construction and preconstruction activities on air quality would not be noticeable because appropriate mitigation measures would be adopted. Additional mitigation may be warranted, depending on the outcome of conformity applicability analyses being performed by the NRC and USACE pursuant to the Clean Air Act Section 176 (42 USC section 7506) and 40 CFR Part 93, Subpart B.

4.7.2 Transportation

The construction workforce at Fermi 3 will vary significantly over the construction period. In the ER, Detroit Edison estimated that the maximum construction workforce would be about 2900 (Detroit Edison 2011a). Combined with the workers and deliveries for the existing Fermi 2 and maintenance workers for Fermi 2 refueling, the total workforce onsite could temporarily reach a maximum of more than 5000 workers. With up to 5000 workers commuting to and from the Fermi site at the time of peak Fermi 3 construction activity, there is the potential for large traffic impacts around the major access roads to the site and along Enrico Fermi Drive, the main plant entrance road (see Section 4.4.2.4.1 of this EIS).

The primary access roads to the Fermi site could experience a significant increase in traffic during shift changes that could lead to periods of congestion. Stopped vehicles with idling engines would lead to increased emissions beyond what would occur from normal vehicle operation alone. However, the overall impact caused by increased traffic volume and congestion is difficult to estimate because exact worker residence locations, the time of construction activities and shift changes, and local weather conditions (such as wind speed and direction, atmospheric stability, and ambient temperature) are largely unknown.

As discussed in Section 4.4.2.4.1 of this EIS, potential transportation-related impacts could be mitigated by implementing improvements including signal installations and signal modifications; staggering worker shifts for operating staff, outage workers, and construction workers; busing and carpooling employees from offsite; and minor lane additions and/or a second entrance to the site.

Emissions related to transportation are also included in Table 4-19 but are not presented separately from other building-related emissions. During the peak year, annual emissions from transportation would be about 18.5 tons per year for NO_x. This emission estimate corresponds to about 14 percent of total building emissions. Annual emissions for $PM_{2.5}$ and SO_2 would be far less than 1 ton per year, while those for VOCs range from 1.3 to 27.3 tons per year. Emissions from the increase in vehicular traffic associated with construction and preconstruction activities would be temporary in nature.

Fermi 3 construction workforce transportation would also result in GHG emissions, principally CO_2. During the peak year, annual CO_2 emissions from transportation would be about 13,384 tons (12,142 MT) CO_2, which corresponds to about 50 percent of total building emissions. The building workforce for the generic 1000 MW(e) reference plant in Appendix L would produce on average about 23,620 tons per year (21,430 MT per year) of CO_2. Both of these estimates are small fractions of the total projected GHG emissions in Michigan at 253,800,000 MT CO_2e in 2010 (CCS 2008) and of total CO_2 emissions in the United States at 5.5 billion MT CO_2 in 2009 (EPA 2011).

Based on Detroit Edison's commitment to developing and implementing a traffic management plan and control construction vehicle emissions through regulatory scheduled maintenance, information provided by Detroit Edison, and the review team's independent evaluation, the review team concludes that potential transportation impacts of construction and preconstruction activities on ambient air quality would be temporary and would not be noticeable because appropriate mitigation measures would be adopted. Based on its assessment of the relatively small construction workforce carbon footprint as compared to the Michigan and U.S. annual CO_2e emissions, the review team concluded that the atmospheric impacts of GHG from construction workforce transportation would not be noticeable and additional mitigation would not be warranted.

4.7.3 Summary of Meteorological and Air Quality Impacts

The review team evaluated potential impacts on air quality associated with criteria pollutants and greenhouse gas emissions during Fermi 3 site preconstruction and construction activities. The review team concludes that the impacts of Fermi 3 site development on air quality from emissions of criteria pollutants and CO_2 emissions are SMALL. Because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the air quality impacts of NRC-authorized construction activities would also be SMALL. Nonetheless, some mitigation beyond those the applicant has committed to implement may be warranted, depending on the outcome of conformity applicability analyses being performed by the NRC and USACE pursuant to the Clean Air Act Section 176 (42 USC section 7506) and 40 CFR Part 93, Subpart B.

4.8 Nonradiological Health Impacts

Nonradiological health impacts on the public and workers from preconstruction and construction activities include exposure to dust and vehicle exhaust, occupational injuries, and noise, as well as the transport of materials and personnel to and from the site. Detroit Edison discussed these impacts qualitatively in Sections 4.4.1, 4.4.2, and 4.7.6 of the ER (Detroit Edison 2011a) and determined that for Fermi 3, these health impacts would be small.

The area around the Fermi site is predominantly rural, with a population of approximately 89,198 people within 10 mi of the site (Detroit Edison 2011a). This area is mostly used for agricultural production (Detroit Edison 2011a). The western basin of Lake Erie is adjacent to the Fermi site on the east (Detroit Edison 2011a). People who would be vulnerable to nonradiological health impacts from preconstruction and construction activities include construction workers and personnel working at the proposed Fermi 3 site; people working or living in the vicinity or adjacent to the site; and transient populations in the vicinity (e.g., temporary employees, recreational visitors, tourists).

The nonradiological impacts on health are described in the following sections: impacts on public and occupational health (Section 4.8.1), impacts of noise (Section 4.8.2), and impacts of transporting construction materials and personnel to and from the proposed site (Section 4.8.3). A summary of nonradiological health impacts is provided in Section 4.8.4.

4.8.1 Public and Occupational Health

This section includes a discussion of the impacts of site preparation and construction on public health and worker health.

4.8.1.1 Public Health

The physical impacts on the public from the building of Fermi 3 would include those from the air pollution from dust and vehicle exhaust during site preparation (Detroit Edison 2011a). Detroit Edison stated that operational controls would be imposed to mitigate dust emissions to meet the State requirements. Methods employed could include putting a dust-control system on the concrete batch plant, stabilizing construction roads and spoils piles, periodically spraying work areas with water or dust-suppressant compound, and revegetating unneeded disturbed areas (Detroit Edison 2011a).

Engine exhaust would be minimized by maintaining equipment in good mechanical order. Detroit Edison stated that open burning or the operation of vehicles and other combustion-engine equipment will comply with applicable standards, regulations, and requirements (Detroit Edison 2011a). The exhausts from the vehicles and operation of machinery during construction would comply with the Clean Air Act and the National Emission Standards for Hazardous Air

Pollutants (NESHAP). Detroit Edison would obtain all necessary air quality permits from the MDEQ.

Preconstruction and construction activities would occur away from the public. The nearest accessible public area is approximately 0.48 mi from the Fermi 3 construction site (Detroit Edison 2011a), and the nearest residence is approximately 0.60 mi from preconstruction and construction areas (Detroit Edison 2011a). On the basis of the dust suppression and vehicle exhaust mitigation measures discussed above and the general public's distance from the Fermi site, the staff concludes that the nonradiological health impacts on the public from construction activities would be minimal. As discussed in Section 4.7, additional mitigation may be warranted, depending on the outcome of conformity applicability analyses being performed by the NRC and USACE pursuant to the Clean Air Act Section 176 (42 USC 7506) and 40 CFR Part 93, Subpart B.

4.8.1.2 Construction Worker Health

In general, human health risks to construction workers and other personnel working onsite are dominated by occupational injuries (e.g., falls, electrocution, asphyxiation, burns). Prior to the start of preconstruction and construction activities, Detroit Edison proposes to develop and implement a safety plan that adheres to all OSHA safety and health regulations for construction (Detroit Edison 2011a).

In addition to onsite preconstruction and construction activities, three new transmission lines and a separate switchyard would be needed for Fermi 3 (Detroit Edison 2011a). Most of the transmission lines would be built within or adjacent to existing transmission line corridors, but 10.8 mi of the proposed line would be built within a new ROW (Section 2.4.2.9). The transmission system in southeastern Michigan is owned and operated by ITC*Transmission*. The transmission lines and associated switchyards would be built in accordance with the National Electrical Safety Code and applicable construction standards and codes (Detroit Edison 2011a).

National nonfatal injury and illness recordable rate in 2009 for construction workers, including specialty trade contractors, averaged 4.3 percent (USBLS 2010a). The recordable rate for construction workers in Michigan was 3.2 percent (USBLS 2010b). The recordable rate takes into account occupational injuries and illnesses as total recordable cases, which includes the cases that result in death, loss of consciousness, days away from work, restricted work activity or job transfer, or medical treatment beyond first aid. The average and maximum onsite preconstruction and construction workforce for Fermi 3 during the 8-year construction period would be 1000 and 2900 workers, respectively (Detroit Edison 2011a).

The estimated yearly average and maximum occupational injuries and illnesses associated with construction activities based on the National recordable rate would be 43 and 125, respectively.

When interpreting these results, it is especially important to recall that they are gross (total) injury estimates. If the workers are not employed building Fermi 3, they would be doing other work or would be unemployed. As noted above, the injury rate for construction activities in Michigan was even lower. Thus, the estimates developed above are conservative worst-case estimates of the net impact of Fermi 3 construction activities on workplace injuries.

Other nonradiological impacts on workers who would be clearing land or building the facility would include noise, fugitive dust, and gaseous emissions resulting from site preparation and development activities. Mitigation measures discussed in this section for the public, such as operational controls and practices, would also help limit impacts on workers. Onsite impacts on workers also would be mitigated through training and use of personal protective equipment to minimize the risk of potentially harmful exposure. First-aid stations would be available in the Fermi 3 construction area (Detroit Edison 2011a). The NRC staff assumes that Detroit Edison would adhere to all applicable NRC, OSHA, and State safety standards, practices, and procedures during building activities.

4.8.1.3 Summary of Public and Construction Worker Health Impacts

On the basis of mitigation measures identified by Detroit Edison in its ER, permits and authorizations required by State and local agencies, and the review team's independent review, the review team concludes that the nonradiological health impacts on the public and workers from preconstruction and construction activities would be minimal, and additional mitigation beyond the actions stated above would not be warranted.

4.8.2 Noise Impacts

Development of a nuclear power plant is similar to that of other large industrial projects and involves many noise-generating activities. Regulations governing noise from construction activities are generally limited to worker health. Federal regulations governing construction noise are found in 29 CFR Part 1910 and 40 CFR Part 204. The regulations in 29 CFR Part 1910 deal with noise exposure in the construction environment, and the regulations in 40 CFR Part 204 generally govern the noise levels of compressors. The Fermi site is located in unincorporated Frenchtown Township in Monroe County. Currently, there are no county or State noise regulations for Monroe County or Michigan (Detroit Edison 2011a). The only local noise regulation applicable to the Fermi site is Frenchtown Charter Township Noise Ordinance No. 184, which generally prohibits construction noise "unreasonably annoying to other persons, other than between the hours of 7:00 a.m. and 7:00 p.m." No violations of this ordinance are expected because of the distance from the construction site to the nearest residence and the anticipation that good noise control practices (including limiting the noisiest construction activities to daytime hours) will be used.

In general, noise emissions vary with each phase of construction, depending on the level of activity, the mix of construction equipment for each phase, and site-specific conditions. Noise propagation to receptors is affected by several important factors, including source-receptor configuration, land cover, meteorological conditions (temperature, relative humidity, and vertical wind and temperature profiles), and screening (such as topography, and natural or man-made barriers). In the ER (Detroit Edison 2011a), Detroit Edison indicated that typical construction equipment, such as dump trucks, loaders, bulldozers, graders, scrapers, air compressors, and mobile cranes would be used, and that pile driving and blasting activities would take place, during the building of Fermi 3. This construction equipment would have peak noise levels ranging from 67 dBA for a concrete vibrator to 89 dBA for a pile driver at a distance of 50 ft.

The nearest sensitive receptor (residence) is about 1900 ft north-northeast of the construction area for the proposed Fermi 3 switchyard, which will be located near the main security gate, and more than 3200 ft northwest and north-northwest, respectively, of the proposed reactor building and natural-draft cooling tower (NDCT). Under the conservative assumption that all construction equipment operates simultaneously and continuously, and if only geometric spreading of noise is considered, the ER (Detroit Edison 2011a) indicates that the peak noise level at 1000 ft from the power block construction area would be less than 64 dBA without pile driving and 67 dBA with pile driving. For building activities at the reactor building or NDCT, noise levels at the nearest residence would be about 54 dBA without pile driving and 57 dBA with pile driving, based on the Detroit Edison's estimate. For switchyard construction, it was conservatively assumed that four noisiest pieces of equipment (other than the pile driver) would be operating simultaneously and continuously. The peak switchyard construction noise level at the nearest residence would be about 56 dBA. These estimates probably overestimate actual sound levels, in that all construction equipment is unlikely to operate simultaneously and continuously at the same location. For comparison, Tipler (1991) lists the sound level of a quiet office as 50 dBA, normal conversation (at 1 m) as 60 dBA, busy traffic as 70 dBA, a noisy office with machines or an average factory as 80 dBA, and construction noise (at 3 m) as 110 dBA. Tipler (1991) lists hearing and pain thresholds as 0 dBA and 120 dBA, respectively.

For a work schedule of 24 hr per day, noise levels from reactor and NDCT building activities at the nearest residence, which is more than 3200 ft from these areas, would be about 60 dBA L_{dn} without pile driving and 63 dBA L_{dn} with pile driving (L_{dn} is defined in Section 2.10.2). Considering a background level of 62 dBA L_{dn} at the nearest residence, the calculated combined, or total (including background), noise level from either of these activities would be 64 dBA L_{dn} without pile-driving and 66 dBA L_{dn} with pile driving. For switchyard building activities, the noise level at the nearest residence, which is about 1900 ft from this area, would be about 63 dBA L_{dn} and the combined noise level would be about 65 dBA L_{dn}.

Preconstruction and construction activities would be expected to occur 24 hr per day, 7 d per week during the peak construction period. However, as mentioned previously, simultaneous and continuous operation of all construction equipment is highly unlikely. Moreover, noisier activities, such as pile driving, are anticipated to be limited to daytime hours to minimize potential noise impacts. In addition, if other noise attenuation mechanisms, such as ground effects or atmospheric absorption, are considered, noise levels from building Fermi 3 would be lower than the aforementioned values.

Detroit Edison has stated that it will comply with NRC and EPA guidance for implementing the Noise Control Act of 1972, together with subsequent amendments (Quiet Communities Act of 1978). In addition, the ER (Detroit Edison 2011a) lists various standard noise control measures and administrative measures that could be undertaken to reduce potential adverse effects of noise, including the following:

- using silencers on construction equipment exhausts;
- limiting the types of construction activities during nighttime or weekend hours;
- notifying all affected neighborhoods of planned activities; and
- establishing a construction noise monitoring program.

NUREG-1437 (NRC 1996) states that noise levels below 60 to 65 dBA as the day-night average noise level (DNL or L_{dn}) are considered to be of small significance. More recently, the impacts of noise were considered in NUREG-0586, Supplement 1 (NRC 2002). The criterion for assessing the level of significance was not expressed in terms of sound levels but based on the effect of noise on human activities. The criterion in NUREG-0586, Supplement 1, is stated as follows:

> The noise impacts…are considered detectable if sound levels are sufficiently high to disrupt normal human activities on a regular basis. The noise impacts…are considered destabilizing if sound levels are sufficiently high that the affected area is essentially unsuitable for normal human activities, or if the behavior or breeding of a threatened and endangered species is affected.

In addition to the above activities, blasting may also occur during construction. Blasts would be designed and coordinated by a qualified blasting professional and vibration control specialist to ensure protection of adjacent structures (Detroit Edison 2011b). Controlled blasting techniques including cushion blasting, pre-splitting, and line drilling may be used. Blasting techniques are designed and controlled to prevent damage to structures, equipment, and freshly poured concrete (Detroit Edison 2011a). These controls also attenuate blasting noise. Distances to offsite buildings make additional mitigation unnecessary (Detroit Edison 2011a). However, given the impulsive nature of blasting noise, it is critical that blasting activities be avoided at night and on weekends and that affected neighborhoods be notified in advance of scheduled blasts.

Based on the temporary nature of peak construction and preconstruction activities, the distance to the nearest residence from the locations where construction and preconstruction activities would take place, the location and characteristics (i.e., ground cover) of the Fermi site, and good noise control practices, the review team concludes that the potential noise impacts of construction and preconstruction activities would be small, and no further mitigation measures would be warranted.

4.8.3 Transporting Building Materials and Personnel to the Fermi 3 Site

This EIS assesses the impact of transporting workers and materials to and from the Fermi site from three perspectives: socioeconomic impacts, air quality impacts resulting from the dust and particulate matter emitted by vehicle traffic, and potential health impacts caused by additional traffic-related accidents. The socioeconomic impacts are addressed in Sections 4.4.1.5 and 4.4.4.1. The air quality impacts are addressed in Section 4.7, and human health impacts are addressed here and in Section 4.9. The general approach used to calculate nonradiological impacts of fuel and waste shipments is the same as that used to calculate impacts from transportation of construction materials and construction personnel to and from the Fermi 3 site. However, the only data available to estimate the demand for these transportation services were preliminary estimates. The assumptions that were made to determine reasonable estimates of the data needed to calculate nonradiological impacts are discussed below.

Building material requirements are based on information taken from the ER (Detroit Edison 2011a). The Detroit Edison ER estimates that building a new 1605-MW(e) reactor requires up to 460,000 yd^3 of concrete and 71,000 tons of structural steel and rebar, in addition to 6.8 million ft of power cable and control wire and up to 260,000 ft of piping that is more than 2.5 in. in diameter.

- The review team assumed that shipment capacities are about 13 yd^3 of concrete, 11 tons of structural steel, and 3300 ft of piping and cable per shipment. It was assumed that these materials would be transported to the site in a levelized manner over an 8-year period on the basis of the construction schedule given in the ER (Detroit Edison 2011a).
- Detroit Edison estimated that the number of workers would peak at 2900, with a daily average of approximately 1000 onsite workers over the 8-year construction period (Detroit Edison 2011a). With approximately 10 percent of the workforce expected to carpool (Detroit Edison 2011a), there would be about 950 vehicle roundtrips per day if, of those who carpooled, two persons shared a ride. It was assumed that each person would travel to and from the Fermi 3 site 250 days per year.
- On the basis of the approximate one-way shipping distance from Detroit, Michigan, the review team assumed that the average shipping distance for building materials would be 40 mi one way. The team assumed that the average commute distance for workers would be 37 mi one way (Detroit Edison 2011a).

- Accident, injury, and fatality rates for building materials were taken from Table 4 in ANL/ESD/TM-150, *State-Level Accident Rates for Surface Freight Transportation: A Reexamination* (Saricks and Tompkins 1999). Rates for the State of Michigan were used for construction material shipments, typically conducted in heavy-combination trucks. The data in Saricks and Tompkins (1999) are representative of heavy-truck accident rates and do not specifically address the impacts associated with commuter traffic (i.e., workers traveling to and from the site). For commuter traffic, accident, injury, and fatality rates were estimated by using data provided by the Michigan Department of State Police (MDSP 2005, 2006, 2007, 2008, 2009). A 5-year average for each rate was estimated by using data for Lenawee, Monroe, Washtenaw, and Wayne Counties.
- The U.S. Department of Transportation (DOT) Federal Motor Carrier Safety Administration evaluated the data underlying the Saricks and Tompkins (1999) rates, which had been taken from the Motor Carrier Management Information System. It determined that the rates were underreported. Therefore, the accident, injury, and fatality rates in Saricks and Tompkins (1999) were adjusted by using factors derived from data provided by the University of Michigan Transportation Research Institute (UMTRI 2003). The UMTRI data indicate that accident rates for 1994 to 1996 – the same data used by Saricks and Tompkins (1999) – were underreported by about 39 percent. Injury rates were underreported by 16 percent, fatality rates by 36 percent. As a result, the accident, injury, and fatality rates were increased by factors of 1.64, 1.20, and 1.57, respectively, to account for the underreporting. These adjustments were applied to the materials that are transported by heavy truck shipments, similar to those evaluated by Saricks and Tompkins (1999), but not to commuter traffic accidents.

The estimated nonradiological impacts of transporting materials to the proposed Fermi 3 site and of transporting workers to and from the site are shown in Table 4-20. The nonradiological impacts are dominated by transport of workers to and from the proposed Fermi site. The total annual construction fatalities represent an increase of about 0.8 percent above the average of 23 traffic fatalities per year that occurred in Monroe County from 2004 to 2008 (MDSP 2005, 2006, 2007, 2008, 2009). This represents a small increase relative to the current traffic fatality risks in the area surrounding the proposed Fermi 3 site.

On the basis of information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the transportation impacts of preconstruction and construction activities would be minimal and that no further mitigation is warranted. On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the impacts of NRC-authorized construction activities would be minimal. The NRC staff also concludes that no further mitigation measures would be warranted.

Table 4-20. Impacts of Transporting Workers and Construction Materials to and from the Fermi 3 Site

Items Transported	Accidents per Year	Injuries per Year	Fatalities per Year
Workers	5.2×10^{1}	1.5×10^{1}	1.6×10^{-1}
Materials			
Concrete	2.0×10^{-1}	1.5×10^{-1}	9.6×10^{-3}
Structural steel/rebar	3.7×10^{-2}	2.7×10^{-2}	1.8×10^{-3}
Cable	1.2×10^{-2}	8.8×10^{-3}	5.6×10^{-4}
Piping	4.5×10^{-4}	3.4×10^{-4}	2.2×10^{-5}
Total	**5.2×10^{1}**	**1.5×10^{1}**	**1.8×10^{-1}**

4.8.4 Summary of Nonradiological Health Impacts

The review team evaluated the mitigation measures identified by Detroit Edison in its ER, relevant permits and authorizations required by State and local agencies, and permits and authorizations required by local agencies to build the proposed Fermi 3. The review team also evaluated impacts on public health and on construction workers from fugitive dust, occupational injuries, noise, and the transport of materials and personnel. No significant impacts related to the nonradiological health of staff or personnel were identified during the course of this review.

On the basis of information provided by Detroit Edison in its ER (Detroit Edison 2011a) and the review team's independent evaluation, the review team concludes that the impacts of preconstruction and construction activities on nonradiological health from proposed Fermi 3 would be SMALL, and no further mitigation would be warranted. Based on the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the nonradiological health impacts of NRC-authorized activities would be SMALL.

4.9 Radiation Exposure to Construction Workers

The sources of radiation exposure for construction workers during the construction phase of Fermi 3 include direct radiation exposure, exposure from discharges of liquid radioactive waste, and exposure from gaseous radioactive effluents from the existing Fermi 2. In addition, there would be potential exposure from the residual radioactive material contamination after the decommissioning of Fermi 1. The impacts of radiation exposure are described in the following sections and are summarized in Section 4.9.6. For the purposes of this discussion, construction workers are assumed to be members of the public rather than occupational workers; therefore, the dose estimates are compared to the dose limits for the public, pursuant to 10 CFR Part 20, Subpart D. Detroit Edison (Detroit Edison 2011a) noted that all major construction and preconstruction activities are expected to occur outside the current Fermi 2 protected area boundary but inside the exclusion area boundary.

4.9.1 Direct Radiation Exposures

In its ER (Detroit Edison 2011a), Detroit Edison identified four sources of direct radiation exposure from the Fermi site: (1) "skyshine"[(a)] from the nitrogen-16 (N-16) source present in the operating Fermi 2 main turbine steam cycle, (2) condensate storage tanks, (3) the onsite low-level waste storage facility, and (4) the planned Independent Spent Fuel Storage Installation (ISFSI). The doses from skyshine and the planned ISFSI are identified as the primary sources of direct radiation exposure to proposed Fermi 3 construction workers. The doses from direct radiation from condensate storage tanks and the onsite low-level waste storage facility are negligible when compared to the skyshine and ISFSI doses because of the minimal activity in the storage tanks and the concrete shielding at the low-level waste storage facility. At certain times during construction, Detroit Edison would also receive, possess, and use specific radioactive byproduct, source, and special nuclear material in support of construction and preparations for operation. These sources of low-level radiation are required to be controlled by the applicant's radiation protection program and have very specific uses under controlled conditions. The Detroit Edison staff did not identify any additional sources of direct radiation during the site audit or during document reviews.

Detroit Edison used onsite thermoluminescent dosimeters (TLDs) and environmental TLDs to measure direct radiation levels at locations in and around the Fermi site protected area (Detroit Edison 2011a). Environmental TLDs are located in multiple rings around the Fermi site, in an inner ring near the site boundary, and in additional rings at locations approximately 2, 5, and 10 mi from the plant (Detroit Edison 2009c, Table 3.12.1-1). All of these TLDs are read quarterly and measure the contribution to dose from any direct radiation source, including natural background, skyshine, the condensate storage tanks, and the low-level waste storage facility.

Detroit Edison estimated the total direct radiation exposure to construction workers by adding the measured TLD dose to the estimated dose from the planned ISFSI. The dose from the ISFSI was estimated by using the radiological data from other ISFSIs that have a facility design similar to that proposed for the Fermi site. The location with the highest direct radiation dose rate that a construction worker could receive from the ISFSI is located 820 ft from the ISFSI. At this distance, a construction worker would receive a maximum estimated dose of about 13.8 mrem/yr from the ISFSI, assuming a 2080-hr occupancy (i.e., a 2000-hr work year plus 4 percent overtime; Detroit Edison 2011a).

In estimating the direct radiation exposure to construction workers from sources other than the ISFSI, Detroit Edison evaluated 10 years of measured TLD data and selected the maximum annual TLD doses from the two locations that were closest to the expected construction site for

(a) Skyshine is the scattered radiation of a primary gamma radiation source generated by aerial dispersion.

Fermi 3 (Detroit Edison 2011a). The estimated dose using an average of two locations for a 2080-hr work year would be 56.3 mrem after the background radiation is subtracted (Detroit Edison 2011a). This calculation conservatively assumes that the construction worker is at this location for the entire work year. The dose to construction workers from byproduct, source, and special nuclear material is expected to have a negligible contribution to this value.

4.9.2 Radiation Exposures from Gaseous Effluents

The Fermi 2 site releases gaseous effluents via the radwaste building vent, reactor building vent, and turbine building vent (Detroit Edison 2011a). The Fermi 2 Visitors Center is near (within 0.5 mi of) the Fermi 3 construction site; therefore, it is assumed that the dose rates calculated from gaseous effluents at the Visitors' Center approximate the dose rates from gaseous effluents to the construction worker. Detroit Edison estimated the gaseous effluents component of the construction worker dose by using release data for the year 2001 (the year that resulted in the highest public exposure for the period from 1999 to 2008) (Detroit Edison 2011a). The estimated annual total effective dose equivalent to a construction worker from gaseous effluents would be 1.6 mrem/yr (assuming an occupancy of 2080 hr per year) (Detroit Edison 2011a). The dose to construction workers from gaseous effluent releases would be small when compared with the dose from direct radiation exposure.

4.9.3 Radiation Exposures from Liquid Effluents

Prior to 1995, Fermi 2 radioactive liquid effluent was released directly to Lake Erie through the circulating water reservoir blowdown line (Detroit Edison 2011a). The Fermi 2 discharge is located along the shoreline of Lake Erie, north of Fermi 2 (Detroit Edison 2011a); however, there has been no liquid radioactive effluent discharge reported from Fermi 2 since 1994 (Detroit Edison 2011a). Because Fermi 2 is currently a zero liquid radwaste discharge plant (Detroit Edison 2011a), and because construction activities would occur away (at least 0.5 mi) from the liquid effluent release points (Detroit Edison 2011a), it is likely that construction workers would not receive any significant dose from liquid effluents.

4.9.4 Radiation Exposures from Decommissioned Fermi 1

Fermi 1 is scheduled to be decommissioned before the construction of Fermi 3. Construction activities for Fermi 3 would occur near the Fermi 1 site, and the construction workers would be exposed to any residual contamination from Fermi 1 (Detroit Edison 2009a, Section 4.5.3.1). The residual levels of radioactive material that would be authorized to remain after Fermi 1 decommissioning would result in a dose of less than 25 mrem/yr to an average member of the critical group[a] (10 CFR 20.1402). The construction workers would not be exposed to all

(a) The critical group is the group of individuals reasonably expected to receive the greatest exposure to residual activity for any applicable set of circumstances.

exposure pathways applicable to an average member of the critical group – represented by a hypothetical resident farmer after Fermi 1 is decommissioned. However, Detroit Edison used 25 mrem/yr as the bounding estimate of the dose to the construction worker from the decommissioned Fermi 1. The actual dose to the construction worker would be expected to be much less than 25 mrem/yr.

4.9.5 Total Dose to Construction Workers

The maximum annual dose to a construction worker was estimated to be 96.6 mrem, which is the sum of the four components described above: (1) direct radiation from existing sources (56.3 mrem), (2) direct radiation from the planned ISFSI (13.8 mrem), (3) exposure from gaseous effluents (1.6 mrem), and (4) exposure from the decommissioned Fermi 1 (25 mrem). The dose would primarily be the result of direct radiation. The maximum annual dose to a construction worker is overestimated because of the conservatism included in the four components of the dose discussed above. This maximum individual construction worker dose rate is much smaller than the approximately 311 mrem/yr that each worker would receive from natural background radiation (NCRP 2009). The estimated annual dose of 96.6 mrem is also less than the 100 mrem/yr annual dose limit to an individual member of the public found in 10 CFR 20.1301.

4.9.6 Summary of Radiological Health Impacts

The NRC staff concludes that the estimate of doses to construction workers during building of the proposed 3 are within NRC annual exposure limits (i.e., 100 mrem) designed to protect the public health. Based on information provided by Detroit Edison and the NRC staff's independent evaluation, the NRC staff concludes that the radiological health impacts on workers for Fermi 3 would be SMALL, and no further mitigation would be warranted. Radiation exposure from all NRC-licensed activities, including operation of Fermi 2, is regulated by the NRC. Therefore, the NRC staff concludes the radiological health impacts for NRC-authorized construction activities would be SMALL, and no further mitigation would be warranted.

4.10 Nonradioactive Waste Impacts

This section describes the environmental impacts that could result from the generation, handling, and disposal of nonradioactive waste during the building of Fermi 3. The types of nonradioactive waste that would be generated, handled, and disposed of during building activities would include construction debris, municipal waste, excavation spoils, and sanitary waste. The potential impacts from these different types of waste are assessed in the following subsections.

4.10.1 Impacts on Land

Building activities related to Fermi 3 would generate wastes, such as construction debris and spoils. The Fermi site has a recycling and waste minimization program in place for Fermi 2, and this program would be implemented for the building of Fermi 3 (Detroit Edison 2011a). Detroit Edison would not allow open burning of refuse, garbage, or any other waste material onsite. The solid waste would be taken to the nearest suitable landfill for disposal (Detroit Edison 2011a). Hazardous and nonhazardous solid wastes would be managed according to county and State handling and transportation regulations.

Suitable excavated materials from the power block and circulating water pipe trenches would be reused as backfill and structural fill. It is estimated that excess excavated material would amount to about 265,000 yd^3 and be disposed of in onsite construction laydown and parking areas and for filling in canals (Detroit Edison 2011a). Dredged materials removed during construction of the intake and discharge structure and barge slip in Lake Erie would be disposed of in the existing spoils disposal pond (Detroit Edison 2011a).

Wastes generated from building Fermi 3 would be handled according to county, State, and Federal regulations. County and State permits and regulations for the handling and disposal of solids and USACE permits for the disposal of dredged spoils would be obtained and implemented. The review team expects that solid waste impacts would be minimal and that additional mitigation would not be warranted.

4.10.2 Impacts on Water

Surface water runoff from site development activities would be controlled under the development and implementation of a SESC Plan (Detroit Edison 2011a). Water collected in this manner may then be discharged under a NPDES permit. As discussed in Section 4.2.3.1, stormwater runoff generated by site development activities could increase turbidity and sedimentation to North Lagoon, South Lagoon, the Quarry Lakes, and Lake Erie. The impacts would be minimized through the use of settling ponds and other BMPs that would be implemented under the SESC Plan. There would be an increase in the generation of sanitary wastewater at the Fermi site as a result of the presence of construction workers, but the additional sanitary wastewater could be managed in existing onsite sewage treatment facilities and through provision of portable toilets.

Based on the regulated practices for managing liquid discharges, including wastewater, and the plans for managing stormwater, the review team expects that impacts on water from nonradioactive effluents when building Fermi 3 would be minimal, and additional mitigation would not be warranted.

4.10.3 Impacts on Air

As discussed in Sections 4.4.1.3 and 4.7.1, fugitive dust generated during preconstruction and construction activities need to be managed. Detroit Edison would develop a dust-control program in accordance with the State of Michigan's regulatory code prior to beginning construction and preconstruction activities (Detroit Edison 2011a).

The Construction Environmental Controls Plan would include air quality protection procedures to be used to minimize the generation of fugitive dust and the release of emissions from equipment and vehicles. These actions would include managing the use of unpaved roads (speed limits, use of dust suppression, and minimization of dirt tracking onto paved roads); covering haul trucks; phasing grading activities to minimize the exposed amount of disturbed soils; stabilizing roads and excavated areas with coarse material covers or vegetation; and performing proper maintenance of vehicles, generators, and other equipment.

Based on the regulated practices for managing air emissions from construction equipment and temporary stationary sources, best management practices for controlling fugitive dust, and vehicle inspection and traffic management plans, the review team expects that impacts on air from nonradioactive emissions from building Fermi 3 would be minimal. As discussed in Section 4.7, additional mitigation may be warranted, depending on the outcome of conformity applicability analyses being performed by the NRC and USACE pursuant to the Clean Air Act Section 176 (42 USC section 7506) and 40 CFR Part 93, Subpart B.

4.10.4 Summary of Nonradioactive Waste Impacts

Solid, liquid, and gaseous wastes generated when building Fermi 3 would be handled according to county, State, and Federal regulations. Solid waste would be recycled or disposed of in existing, permitted landfills.

Sanitary wastes would be removed to an existing licensed sewage-treatment facility or discharged locally after being treated to the levels stipulated in the NPDES permit. A Storm Water Pollution Prevention Plan would specify the mitigation measures to be put in place to manage stormwater runoff.

To avoid any noticeable offsite air quality impacts, the use of BMPs to control dust and minimize vehicle emissions would be expected.

Based on information provided by Detroit Edison and the review team’s independent evaluation, the review team concludes that nonradioactive waste impacts on land, water, and air would be SMALL and that additional mitigation would not be warranted. Because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the nonradioactive waste impacts of NRC-authorized construction activities also would be SMALL and that no further mitigation would be warranted.

4.11 Measures and Controls to Limit Adverse Impacts during Preconstruction and Construction

In its evaluation of the environmental impacts of building the proposed Fermi 3 reactor, the review team relied on Detroit Edison's compliance with the following measures and controls that would limit adverse environmental impacts:

- compliance with applicable Federal, State, and local laws, ordinances, and regulations intended to prevent or minimize adverse environmental impacts (e.g., solid waste management, erosion and sediment control, air emissions, noise control, stormwater management, spill response and cleanup, hazardous material management)
- compliance with applicable requirements of permits or licenses required for construction of Fermi 3 (e.g., USACE Section 404 Permit, NPDES permit)
- compliance with existing Fermi 2 processes and/or procedures applicable to Fermi 3 construction environmental compliance activities for the Fermi site (e.g., solid waste management, hazardous waste management, and spill prevention and response)
- incorporation of environmental requirements into construction contracts
- identification of environmental resources and potential impacts during the development of the ER and the COL process.

Table 4-21 summarizes the measures and controls to limit adverse impacts when building Fermi 3 at the Fermi site based on a table supplied by Detroit Edison (2011a), as adjusted by the review team when considered to be appropriate. Some measures apply to more than one impact category.

4.12 Summary of Preconstruction and Construction Impacts

Impact category levels for construction and preconstruction activities associated with building Fermi 3 are summarized in Table 4-22. The impact category levels for NRC-authorized construction, and combined construction and preconstruction are denoted in the table as SMALL, MODERATE, or LARGE as a measure of their expected adverse environmental impacts. The bases for these determinations are provided in detail in Sections 4.1 through 4.10 of this EIS; a brief statement explaining the basis for the impact level for each major resource category is provided in the table. Some impacts, such as the addition of tax revenue from Detroit Edison for the local economies, are likely to be beneficial impacts on the community.

Table 4-21. Summary of Measures and Controls Proposed by Detroit Edison to Limit Adverse Impacts When Building Fermi 3

Affected Environment/Resource Area	Specific Measures and Control
Land Use Impacts	
Site and vicinity	• Conduct ground-disturbing activities in accordance with permit requirements. Implement erosion control measures described in the SESC Plan. • Limit vegetation removal to those areas designated for construction activities. Restore temporarily disturbed areas. • Remove hazardous wastes/spills in compliance with applicable regulations. Implement PIPP measures. • Restrict soil stockpiling and reuse to designated areas within the construction footprint on the Fermi site. • Use BMPs listed in the SESC Plan and minimize footprint of the designated construction area. Place dredge materials in the designated dredge spoils area. • Obtain Coastal Zone Consistency Determination for work in coastal zone.
Transmission line corridors and offsite areas	• The 345-kV transmission system and associated corridors are exclusively owned and operated by ITC*Transmission*. Detroit Edison has no control over the construction or operation of the transmission system. The construction impacts are based on publicly available information and reasonable expectations on the configurations and practices that ITC*Transmission* is likely to use based on standard industry practice. Such efforts are assumed to include transmission design considerations and industry-standard BMPs that would minimize the effects on land use.
Water-Related Impacts	
Hydrologic alterations	• Develop and implement the SESC Plan. This plan may require use of silt fences, straw bales, slope breakers, and other erosion prevention measures. • Obtain and adhere to all applicable Federal, State, and local permits regulating hydrological alterations.

Table 4-21. (contd)

Impact Category	Specific Measures and Control
Water use and quality	• Implement the construction SESC Plan to limit sedimentation of drainage to Lake Erie. • Implement dewatering plan to minimize the amount of water discharged. • Develop and implement a PIPP. • Comply with requirements of CWA Section 404 permit, Section 402(p) NPDES permit, and Section 10 of the RHAA permit, and MDEQ Act 451 Section 325. • Obtain Clean Water Act Section 401 Water Quality Certification and CZMA Certification.
Ecological Impacts	
Terrestrial and wetland resources	• Follow MDNR construction limitation recommendations for bald eagle nests. • Control fugitive dust through construction watering, and vehicle emissions by regularly scheduled maintenance. • Maximize use of developed and previously disturbed grounds where possible. Limit clearing to the smallest practical quantity of land. Revegetate after construction is complete. • Comply with requirements of CWA Section 404 permit to minimize and mitigate impacts on wetlands. Wetland mitigation would be developed in consultation with MDEQ and USACE. • Develop American lotus mitigation in consultation with MDNR. • Implement Habitat and Species Conservation Plan for the eastern fox snake.
Aquatic resources	• Implement measures in the SESC permit and NPDES permit. • Implement measures in the PIPP. • Implement measures outlined in the RHAA Section 10 and CWA Section 404 permit.
Socioeconomic Impacts	
	• Implement standard noise control measures for construction equipment (silencers). • Limit the types of construction activities during nighttime and weekend hours. • Notify all affected neighbors of planned activities. • Establish a construction noise monitoring program. • Control fugitive dust through construction watering. • Control vehicle emissions by regularly scheduled maintenance. • Add surfacing on local roadways to prevent deterioration from construction vehicles. • Traffic control and management measures would reduce traffic congestion impacts. These would be developed in conjunction with

Table 4-21. (contd)

Impact Category	Specific Measures and Control
	MDOT, MCRC, and other appropriate agencies.
Environmental Justice	• No mitigating measures or controls required.
Historic Properties and Cultural Resources	• ITC*Transmission* would be expected to conform to regulatory requirements pertaining to historic and cultural resources that could be impacted by transmission line development. • Adverse effect of demolition of the one onsite historic property, NRHP-eligible Fermi 1, would be mitigated according to measures and plans developed during NRC's consultation with the Michigan SHPO and Detroit Edison. • The closest offsite above-ground historic resource within the indirect APE is located 0.5 mi from the construction site boundary, and all others are located 1 to 3.5 mi away. Visual impacts are not substantial, and no measures or controls are warranted.
Air Quality	• Implement BMPs to reduce vehicle and equipment exhaust emissions and fugitive dust in accordance with all applicable State and Federal permits and regulations.
Nonradiological Health	• Comply with Federal, State, and local regulations governing construction activities and construction vehicle emissions. • Comply with Federal and local noise-control ordinances. • Comply with Federal and State occupational safety and health regulations. • Implement traffic management plan.
Radiation Exposure to Construction Workers	• Doses to construction workers would be maintained below NRC public dose limits (10 CFR Part 20).
Nonradioactive Wastes	• Hazardous and nonhazardous solid wastes would be managed according to county and State handling and transportation regulations. Implement recycling and waste minimization program.

Source: Detroit Edison 2011a

1 **Table 4-22**. Summary of Preconstruction and Construction Impacts for Proposed Fermi 3

Resource Area	Comments	NRC-Authorized Construction Impact Level	Construction and Preconstruction Impact Level
Land Use			
Site and vicinity	Building activities would take place within the existing site boundaries.	SMALL	SMALL
Offsite transmission line corridors	Approximately 10.8 mi of a 29.4-mi transmission line corridor would be along an undeveloped ROW.	Not applicable	SMALL
Water Resources			
Water use			
Surface water	Lake Erie water would be used for concrete batch plant operation, temporary fire protection, dust control, and sanitary needs.	SMALL	SMALL
Groundwater	Dewatering systems would depress the water table in the general vicinity, but the impacts would be localized and temporary.	SMALL	SMALL
Water quality			
Surface water	Hydrological alterations associated with building on and near the Fermi site include dredging, bedding placement, and cover material for the intake and discharge structures, altering the surface topography and hydrology (e.g., site grading, laydown areas, filling of onsite water bodies), culverting the south canal, and dewatering the excavation for construction of the nuclear facilities. Offsite alterations are associated with the proposed new or expanded transmission line corridors where they cross streams and wetlands. BMPs will be used to limit construction stormwater impacts and address potential spills or leaks of petroleum and other chemicals into surface water bodies.	SMALL	SMALL

Table 4-22. (contd)

Resource Area	Comments	NRC-Authorized Construction Impact Level	Construction and Preconstruction Impact Level
Groundwater	BMPs will prevent or mitigate the impacts of spills on groundwater.	SMALL	SMALL
Ecological Resources			
Terrestrial and wetlands resources	Loss or disturbance of upland and wetland habitat and associated plant and animal species onsite and along the transmission line corridor. Proposed wetland and wildlife habitat mitigation would offset some impacts. Potential impact on eastern fox snake (State-listed as threatened) and its habitat.	SMALL	SMALL
Aquatic resources	Loss or disturbance of aquatic habitat and associated plant and animal species onsite and along the transmission line corridor. Increased runoff and sedimentation from the addition of impervious surfaces. BMPs will be used to limit construction stormwater impacts.	SMALL	SMALL
Socioeconomics			
Physical impacts	Small increases in noise and air emissions. Small impact on condition of road surfaces during construction period.	SMALL	SMALL
Demography	Minor increase in population resulting from in-migrating construction workforce.	SMALL beneficial	SMALL beneficial
Economy	Economic impact would be beneficial to local economies in the 50-mi region, especially in Monroe County.	SMALL beneficial in the region to MODERATE beneficial in Monroe County	SMALL beneficial in the region to MODERATE beneficial in Monroe County

Table 4-22. (contd)

Resource Area	Comments	NRC-Authorized Construction Impact Level	Construction and Preconstruction Impact Level
Taxes	Entire 50-mi region would receive beneficial changes to tax revenues, especially in Monroe County, where the impacts would be greatest (from Fermi 3 property taxes).	SMALL and beneficial in the region to LARGE and beneficial in Monroe County	SMALL and beneficial in the region to LARGE and beneficial in Monroe County
Infrastructure and community services	Recreation, housing, public services, and education are generally adequate for the influx of construction workers. Local traffic would increase during construction, resulting in increased congestion during the peak building employment period, when the traffic-related impact would be short-term and MODERATE.	SMALL (all categories except traffic) to short-term MODERATE traffic impacts during peak building employment	SMALL (all categories except traffic) to short-term MODERATE traffic impacts during peak building employment
Environmental Justice	No environmental pathways or preconditions exist that could lead to disproportionately high and adverse impacts on minorities or low-income populations.	SMALL	SMALL
Historic and Cultural Resources	Onsite preconstruction and construction activities would result in the demolition of recommended NRHP-eligible Fermi 1. Because new Fermi 3 facilities would be consistent with the landscape features within the existing setting of offsite historic resources, there would be no new significant visual (i.e., indirect) impacts on these resources. However, the approximately 11-mi portion of the proposed offsite transmission line route from the Sumpter-Post Road junction to the Milan Substation will require a new transmission line route and may result in direct and visual impacts on offsite historic and/or cultural resources. In the absence of more detailed information, these impacts cannot be evaluated with certainty.	MODERATE	MODERATE

Table 4-22. (contd)

Resource Area	Comments	NRC-Authorized Construction Impact Level	Construction and Preconstruction Impact Level
Air Quality	Vehicle and equipment exhaust emissions and fugitive dust emissions from operation of earthmoving equipment are sources of air pollution, but impacts would be temporary.	SMALL	SMALL
Nonradiological Health	Temporary public health impacts from exposure to fugitive dust and vehicular emissions, noise, and increased occupational injuries and traffic fatalities during the building phase.	SMALL	SMALL
Radiological Health	Doses to construction workers would be maintained below NRC public dose limits (10 CFR Part 20).	SMALL	SMALL
Nonradioactive Wastes	Hazardous and nonhazardous solid wastes would be managed according to county and State handling and transportation regulations. Implement recycling and waste minimization program.	SMALL	SMALL

4.13 References

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10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

29 CFR Part 1910. Code of Federal Regulations, Title 29, *Labor*, Part 1910, "Occupational Safety and Health Standards."

33 CFR Part 165. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 165, "Regulated Navigation Areas and Limited Access Areas."

36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties."

40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

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40 CFR Part 204. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 204, "Noise Emission Standards for Construction Equipment."

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5.0 Operational Impacts at the Proposed Site

This chapter examines environmental impacts associated with operation of the proposed new Enrico Fermi Unit 3 (Fermi 3) at the Enrico Fermi Atomic Power Plant (Fermi) site for an initial 40-year period, as described in the application for a combined license (COL) submitted by Detroit Edison Company (Detroit Edison). As part of its COL application, Detroit Edison submitted an Environmental Report (ER) that discussed the environmental impacts of station operation (Detroit Edison 2011a), In its evaluation of operational impacts, the review team, composed of U.S. Nuclear Regulatory Commission (NRC) staff, its contractor staff, and U.S. Army Corps of Engineers (USACE) staff, relied on operational details supplied by Detroit Edison in its ER and its responses to NRC Requests for Additional Information (RAIs), and the review team's own independent review. Also consulted were permitting correspondences between Detroit Edison and the USACE, a cooperating agency in this action.

This chapter is divided into 14 sections. Sections 5.1 through 5.12 discuss the potential operational impacts related to land use, water, terrestrial and aquatic resources, socioeconomics, environmental justice, historic and cultural resources, meteorology and air quality, nonradiological and radiological health effects, nonradioactive waste impacts, postulated accidents, and applicable measures and controls, respectively, that would limit the adverse impacts of station operation during the 40-year operating period. In accordance with Title 10 of the Code of Federal Regulations (CFR) Part 51, impacts have been analyzed and a significance level of potential adverse impacts (i.e., SMALL, MODERATE, or LARGE) has been assigned to each impact category. In the area of socioeconomics related to taxes, the impacts may be considered beneficial and are stated as such. The review team's determination of significance levels is based on the assumption that the mitigation measures identified in the ER or activities planned by various State and county governments, such as infrastructure upgrades, as discussed throughout this chapter, are implemented. Failure to implement these mitigation measures and upgrades might result in a change in significance level. Possible additional mitigation to further reduce adverse impacts is also presented, where appropriate. A summary of these impacts is presented in Section 5.13. The references cited in this chapter are listed in Section 5.14.

5.1 Land Use Impacts

Sections 5.1.1 and 5.1.2 contain information regarding land use impacts associated with operation of Fermi 3. Section 5.1.1 discusses land use impacts at the site and in the vicinity of the site. For the purposes of the analysis, the vicinity is defined as the area encompassed by a 7.5-mi radius around the existing Fermi site. Section 5.1.2 discusses land use impacts resulting from the proposed offsite transmission line corridors and other offsite areas.

5.1.1 The Site and Vicinity

Although approximately 302 ac of land onsite would be disturbed to build Fermi 3, only about 155 ac would be permanently occupied by the Fermi 3 facilities for the duration of the operational period (Detroit Edison 2011a). Operation of the facilities would be compatible with existing and readily foreseeable adjacent land uses. No additional land of the Fermi site would be occupied due to Fermi 3 operations. While there is the potential for icing, salt drift deposition, fogging, and noise from cooling tower operations to affect land areas close to an operating reactor (NRC 1996), review of the application for Fermi 3 suggests that these impacts would be negligible (see Sections 5.3.1.1 and 5.7.1). Ambient noise level impacts from transformer operation would also be minimal (see Section 5.8.2). Operations are therefore expected to have only minimal impacts on forest, wetland, floodplain, maintained grassland, and developed land on or near the Fermi site. Although some prime farmland may remain onsite following initial development of Fermi 3, no crop production is expected to occur anywhere on the Fermi site during plant operation. Any alteration of prime farmland soils would take place while the proposed Fermi 3 facilities were being built, not during operations.

Although development of Fermi 3 would permanently remove approximately 19 ac of land from the Detroit River International Wildlife Refuge (DRIWR), operation of Fermi 3 is not expected to noticeably affect management of the remaining DRIWR lands on or near the Fermi site.

Spoils from maintenance dredging of the Fermi 3 intake and barge slip area would be disposed of in the existing Spoils Disposal Pond. Dredging for the Fermi 2 intake embayment has been performed every 4 years and has resulted in the removal of approximately 22,000 yd^3 of material (Detroit Edison 2011a). Based on Detroit Edison's experience with Fermi 2 spoils disposal, dredging to operate Fermi 3 is not expected to require any additional land outside of the existing Spoils Disposal Pond.

Soil erosion impacts on the site or the surrounding vicinity are unlikely during operation of Fermi 3. Vegetation stabilization measures would be in place to prevent erosion and sedimentation impacts on the site and vicinity, and erosion would be prevented through the use of erosion control measures identified in the existing Stormwater Pollution Prevention Plan (Detroit Edison 2011a).

Land throughout the Fermi site is zoned as "industrial" by Monroe County and as "public service" by Frenchtown Charter Township (Monroe County Planning Department and Commission 2010; James D. Anulewicz Associates, Inc. and McKenna Associates, Inc. 2003). No impacts on land use planning in Monroe County or Frenchtown Charter Township are expected as a result of the operation of Fermi 3. Operation of the facility is expected to be consistent with and comply with all applicable land use and zoning regulations of Monroe County and Frenchtown Charter Township. Regional and State land use plans do not contain measures that apply specifically to the Fermi site, and these plans would not be affected by

Fermi 3 operation. Detroit Edison has not indicated that operation of Fermi 3 would interfere with any future land uses that it anticipates for the Fermi site.

The Fermi site and some areas in the vicinity of the site fall under the Coastal Zone Management Act, which is designed to ensure the reasonable use of coastal areas (see Section 3.1). As stated in Section 4.1.1, Detroit Edison would obtain a coastal zone consistency determination from the MDEQ before initiating ground disturbance for Fermi 3, in conjunction with other permits and authorizations required from the Michigan Department of Environmental Quality (MDEQ) (Detroit Edison 2011a) (see Section 2.1.1). That consistency determination would encompass the complete anticipated operational life of the proposed Fermi 3 facilities.

As is true during the building of Fermi 3, some offsite land use changes could indirectly result from operation of Fermi 3. As discussed in Section 4.1.1, possible impacts include the conversion of some land in surrounding areas to housing developments (e.g., recreational vehicle parks, apartment buildings, single-family condominiums and homes, and manufactured home parks) and retail development to accommodate workers. Property tax revenue from the addition of Fermi 3 could induce additional growth in Monroe County as a result of infrastructure improvements (e.g., new roads and utility services). However, the employment offered during operations would generally be lower and less rapidly changing than during the development phase. Additional information on roads, housing, and construction-related infrastructure impacts is presented in Section 4.4.

Based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the land use impacts of operation of Fermi 3 would be SMALL, and additional mitigation would not be warranted.

5.1.2 Transmission Line Corridors and Other Offsite Facilities

The activities associated with transmission line operations that could affect land use include maintenance, inspection, and vegetation management in the corridors and at the Milan Substation. Impacts would be seasonal and would occur within a 500-ft onsite corridor, a 300-ft-wide offsite corridor, and the Milan Substation. Occasional vehicular access to the corridor may cause some temporary erosion and compaction along certain areas, especially if heavy vehicles are used in wet weather conditions and on any access roads that have gravel or other unpaved surfaces (Detroit Edison 2011a). Siltation of streams and wetlands and the disturbance of wildlife and wildlife habitat may also occur where the corridor crosses floodplains and wetlands. Vegetative cover would be seeded to stabilize the soil exposed by corridor maintenance activities and prevent erosion, and water diversion measures would be used to direct water off the sides of the access roads and prevent erosion impacts (Detroit Edison 2011a). Operations would use best management practices (BMPs) outlined in a soil erosion and sedimentation control (SESC) plan or right-of-way (ROW) maintenance manual used by Detroit Edison and/or the International Transmission Company (ITC*Transmission*).

Operation of the transmission facilities is not expected to interfere with adjacent land uses or with agricultural use of farmland spanned by transmission conductors.

It is expected that ITC*Transmission* would continue maintenance activities currently conducted on the existing transmission line corridors extending out from the Fermi site. It is expected that ITC*Transmission* would extend these same practices to the new corridor and substation facilities. These activities include periodic removal and trimming of trees, mowing of herbaceous and low woody vegetation and cutting of large shrubs, and the use of pesticides and herbicides applied with either ground or aerial spraying methods. The corridors would be periodically inspected by helicopter or ground-patrolled to ensure that they are in proper condition for safe operation of the transmission line (Detroit Edison 2011a). Vegetation clearing would be limited to the minimum needed to allow access for maintenance vehicles and to prevent the growth of trees that could interfere with the operation of the lines (Detroit Edison 2011a). Vegetation management on transmission line corridors is discussed in more detail in Section 5.3.

ITC*Transmission* would implement BMPs involving minimal use of maintenance vehicles and access roads to the extent possible and limiting transmission line maintenance work during wet weather conditions. Other BMPs would be outlined in a SESC plan or ROW maintenance manual used by Detroit Edison and/or ITC*Transmission*. Herbicides would be applied by licensed personnel in accordance with their labels, and only herbicides labeled for aquatic environments would be used in wetlands.

The review team concludes that the offsite land use impacts of operating Fermi 3 and its associated transmission lines would be SMALL, and additional mitigation would not be warranted.

5.2 Water-Related Impacts

This section discusses water-related impacts on the surrounding environment from operation of the proposed Fermi 3. The primary water-related impacts would be associated with Fermi 3's cooling water system. Details of the operational modes and cooling water systems associated with operation of the plant are presented in Section 3.2.2.

Managing water resources requires understanding and balancing the trade-offs between various, often conflicting, objectives. At the Fermi site, these objectives include navigation, recreation, visual aesthetics, a fishery, and a variety of beneficial consumptive uses of water. The responsibility for regulating any structures or work in or affecting navigable waters of the United States is delegated to the USACE. The responsibility for regulating water use and water quality is delegated to MDEQ.

Water use and water quality impacts involved with operation of a nuclear plant are similar to the impacts associated with any large thermoelectric power generation facility, and Detroit Edison must obtain the same water-related permits and certifications as these other facilities. Permits and certifications needed would include the following:

- CWA Section 401 Certification. This water quality certification would be issued by MDEQ and would ensure that operation of the plant would not conflict with State water quality management programs.
- CWA Section 402(p) National Pollutant Discharge Elimination System (NPDES) Discharge Permit. MDEQ administers the NPDES program for the U.S. Environmental Protection Agency (EPA) Construction General Permit and industrial discharge permits. These permits regulate point source stormwater and wastewater discharges.
- CWA Section 404 Permit. This permit is required for the discharge of dredged and/or fill material into waters of the United States.
- CWA Section 316(a). This section regulates the cooling water discharges to protect the health of the aquatic environment. The scope will be covered under the NPDES permit with MDEQ.
- CWA Section 316(b). This section regulates cooling water intake structures to minimize the environmental impacts associated with their location, design, construction, and capacity. The scope will be covered under the NPDES permit with MDEQ.
- MDEQ Water Quality Standards Certification (Administrative Rule R 323.1041 et seq.). The regulations define the water quality standards in Lake Erie, the mixing zones, and the applicability of the standards. The standards include two temperature criteria for thermal discharge into Lake Erie.
- MDEQ Large Quantity Water Withdrawal Permit, issued under Part 327 of the Safe Drinking Water Act. This permit is required for water withdrawals of more than 5 million gallons per day (MGD) from the Great Lakes per MCL 324.32723(1)(a)-(b).
- MDEQ Water Withdrawal Registration. This permit is required for development of withdrawal capacities exceeding 100,000 gal per day under MCL 324.32705.
- MDEQ Natural Resources and Protection Act 451, Natural Resources and Environmental Protection Act, Part 325, Great Lakes Submerged Lands Permit. This permit is required for dredging activities in the Great Lakes.
- Section 10 of the Rivers and Harbors Appropriation Act of 1899 Permit. This permit would be issued by USACE to regulate any structure or work in or affecting waters of the United States, such as Lake Erie.
- Federal Coastal Zone Management Act of 1972 Certification. This concurrence of consistency with the State coastal program's policies would be issued by MDEQ. It applies

to any activity that is on land or in water or that affects land use, water use, or any natural resource in the coastal zone, if the activity requires a Federal license or permit.

Section 5.2.1 discusses the hydrologic alterations in surface water and groundwater related to operation of Fermi 3. Water use impacts for surface water are discussed in Section 5.2.2.1 and for groundwater in Section 5.2.2.2. Water quality impacts for surface water are discussed in Section 5.2.3.1 and for groundwater in Section 5.2.3.2. Water monitoring for surface water is discussed in Section 5.2.4.1 and for groundwater in Section 5.2.4.2. Potential mitigation measures for operations-related water impacts are discussed in Section 5.2.5. The combined impacts of operating the proposed Fermi 3 along with the existing Fermi 2, as well as other activities in the surrounding environment, are discussed in Chapter 7 (Cumulative Impacts).

5.2.1 Hydrological Alterations

This section discusses the hydrological alterations and the resulting effects from operation of the proposed Fermi 3. Fermi site hydrological alterations would include a change in the local landscape and drainage patterns, which could cause increased runoff or erosion. Hydrological alterations to Lake Erie from operation of Fermi 3 would include increased water use, discharge of cooling water (thermal and chemical impacts), and maintenance dredging of the intake canal.

The proposed Fermi 3 power block would be placed on an elevated area, with drainage directed away from the facilities. Modifications of the land surface made during preconstruction and construction activities would alter the local hydrology. The proposed location of Fermi 3 is mostly within the Swan Creek watershed, and water running off of the Fermi 3 developed area would drain primarily to Swan Creek before entering Lake Erie. Drop inlets on the nuclear island will collect the stormwater runoff resulting from storm events and route it to Swan Creek via the North Lagoon. If storm drains on the nuclear island were blocked, runoff would drain off the elevated area in all directions, and some water would drain directly to Lake Erie. A Stormwater Pollution Prevention Plan (SWPPP) would be in place to manage stormwater runoff and prevent erosion. Specifically, surface water would be routed away from the nuclear plant through subgrade storm drains and off the slopes of the elevated area as needed.

In addition, groundwater infiltration areas would be reduced because of the increase in the amount of impervious surfaces at the site and the filling of some onsite water bodies. The aquifer beneath the Fermi site would be affected by the new hydrological conditions resulting from dewatering operations and the increased impervious surfaces for a period shortly after preconstruction and construction, but since the changes are limited to the site and dewatering is temporary, the effects would also be limited and temporary and water levels within the aquifer should stabilize at or near current conditions.

Discharge of cooling water blowdown into Lake Erie would occur approximately 1300 ft east of the shore. The discharge pipe would discharge approximately 1.5 ft above the bottom of the lake and would contain a three-port diffuser. The maximum velocity of the discharge water would be approximately 8.5 fps. The flow would be divided among the three ports to reduce possible scour. The diffuser would also mix the discharge, increasing the thermal and chemical mixing of the discharge into Lake Erie. Thermal plume modeling indicated that the Fermi 3 discharge would not reach the shoreline (Section 5.2.3). The existing Fermi 2 power plant has a restricted area that prohibits recreational activity and navigation. Consequently, the additional discharge of another reactor would not directly affect recreational uses, because recreation will not be allowed within the zone.

The intake structure for Fermi 3 would use the intake bay between the existing rock groins that extend 600 ft into the lake from the facility shoreline. Since the existing intake bay is being utilized, erosion and deposition in Lake Erie during operation would be relatively unchanged from the current condition. Maintenance dredging of the intake bay would be required periodically during operation of Fermi 3, and dredging would be within the same footprint and also be of similar volume and frequency to that done during operation of Fermi 2. Therefore, there is no change in impact from maintenance dredging.

Water use impacts on Lake Erie are evaluated in terms of total water use within the Lake Erie basin; these impacts are discussed in Section 5.2.2.

Groundwater would not be used during operation of Fermi 3. The hydrologic alterations of groundwater due to preconstruction and construction activities (e.g., site grading, changes in recharge, fill materials, excavation dewatering) are discussed in Section 4.2 of this environmental impact statement (EIS).

In summary, the hydrological alterations applicable to operations are limited to the intake of Lake Erie water, the discharge of blowdown water and associated waste streams to the lake, altered drainage patterns from landscape changes, and periodic dredging of the intake canal.

5.2.2 Water Use Impacts

A description of water use impacts on surface water and groundwater resources is presented in this section. The primary cooling-water source for Fermi 3 would be Lake Erie. Potable water used for drinking water and sanitary purposes at the plant would come from the Frenchtown Water Plant, which uses water from Lake Erie. Groundwater is not anticipated to be used for the operation of Fermi 3.

5.2.2.1 Surface Water Use Impacts

Lake Erie would be the only source of makeup water for the operation of the proposed Fermi 3. Almost all makeup water is supplied back to the cooling water system, where most consumptive losses occur due to evaporation and drift from the cooling towers. Maximum water use and loss during normal power operation would occur during the hottest summer months. Minimum usage and loss would occur during the winter months (January), and average usage and loss would occur during the spring and fall. Figure 5-1 presents a diagram of the water use for the proposed Fermi 3. Table 5-1 presents a summary of the water use for the proposed Fermi 3.

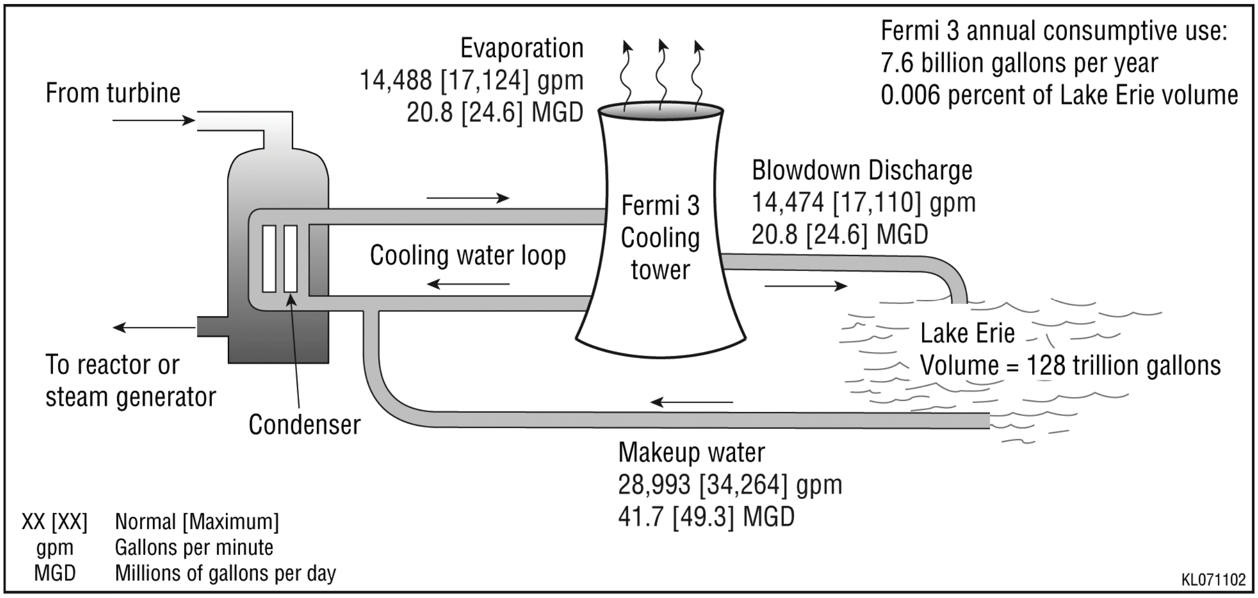

Figure 5-1. Fermi 3 Water Use Diagram

Table 5-1. Fermi 3 Water Use

Use	Average (gpm)	Maximum (gpm)
Intake	28,993	34,264
Discharge	14,474	17,110
Evaporation and Drift	14,488	17,124

Source: Detroit Edison 2011a

During the summer, Fermi 3 would withdraw a maximum of approximately 34,264 gpm from Lake Erie. Approximately 17,124 gpm of this inflow would be lost, and approximately 17,110 gpm would be returned to Lake Erie through the discharge pipe. Total water withdrawn would be a maximum of 49.3 MGD, and consumptive use would be a maximum of 24.6 MGD (Detroit Edison 2011a). During the spring and fall, the average water withdrawn would be 28,993 gpm (41.7 MGD); consumptive use would be about 14,488 gpm (20.8 MGD); and approximately 14,474 gpm (20.8 MGD) would be returned to Lake Erie. In the winter, the minimum water withdrawn from Lake Erie for makeup to the plant systems would be about

23,780 gpm (34.2 MGD); consumptive use would be about 11,882 gpm (17.1 MGD); and 11,868 gpm (17.1 MG) would be returned to the lake (Detroit Edison 2011a). The Great Lakes Compact of 2008 requires that any new water use of more than 5 MGD be subjected to a regional review, so Fermi 3 would be subject to such a review by the other Great Lakes States and provinces.

The Frenchtown Water Plant would be the source for potable, sanitary, and demineralized makeup water during operations. It is estimated that the monthly average potable water use by Fermi 3 would be approximately 35 gpm (Detroit Edison 2011a). The Frenchtown Water Plant has the capacity to supply Fermi 3 with the required water (Detroit Edison 2009a), as it has recently expanded its capacity from 4 MGD to 8 MGD. This expanded capacity is expected to be sufficient for Fermi 3 needs for at least 20 years (Detroit Edison 2011a).

The volume of Lake Erie is approximately 116 mi^3, or about 128 trillion gal (EPA 1995). The average annual consumptive use of water within the Lake Erie basin from all users is about 183 billion gal (GLC 2005a, b, c; 2006a, b; 2009a, b), and Fermi 3 would have an average consumptive use of approximately 7.6 billion gal per year. The incremental average withdrawal associated with operation of Fermi 3 would be approximately 0.006 percent of the volume of water in Lake Erie and 4.2 percent of the average consumptive water use in Lake Erie between 2000 and 2006; thus, it would represent a relatively minor change in lake water availability and cumulative consumption and result in no measurable effect on other users. The review team concludes that there would be a SMALL impact on surface water resources in Lake Erie, and mitigation is not warranted.

5.2.2.2 Groundwater Use Impacts

No groundwater is planned to be used for operation of the proposed Fermi 3 (Detroit Edison 2011a). In addition, no dewatering-related pumping is planned to occur during the operation of Fermi 3. Therefore, the review team concludes that the impact on groundwater and groundwater users from operating Fermi 3 is SMALL, and mitigation is not warranted.

5.2.3 Water Quality Impacts

This section discusses the impacts on water quality that could result from the operation of proposed Fermi 3. Surface water impacts include thermal, chemical, and radiological wastes and physical changes in Lake Erie resulting from stormwater runoff and effluents discharged by the proposed plant. Section 5.2.3.1 discusses the impacts on surface water quality, and Section 5.2.3.2 discusses the impact on groundwater quality. The impacts of radiological liquid effluents are discussed in Section 5.9.

5.2.3.1 Surface Water Quality Impacts

During operation of Fermi 3, stormwater runoff to the receiving water bodies, the Quarry Lakes, Swan Creek, and Lake Erie, would be controlled by adherence to any SWPPP and design features as required by the NPDES permit. Adherence to the NPDES permit would reduce the impacts on the quality of surface water near the plant from stormwater runoff.

During normal operation of Fermi 3, cooling water blowdown from the natural draft cooling tower would be discharged to Lake Erie through a multi-port diffuser located approximately 1300 ft east of the shore. Surface water impacts associated with cooling tower blowdown include the chemical, thermal, and radiological effluents that would be discharged by the plant. Cooling water returned to Lake Erie would have higher chemical (mineral) content than the water withdrawn from Lake Erie for the cooling. Cooling towers concentrate solids and solutes from the raw makeup water during the process of evaporative heat loss. Cooling water is also treated prior to use to inhibit scale, growth of plant and animal life, and corrosion. These solids and solutes are contained in blowdown.

Makeup water to the station water system (SWS) would be treated with the biocide/algaecide sodium hypochlorite before it entered the pumps at the intake from Lake Erie (Detroit Edison 2011a). The SWS would supply water to the circulating water system (CIRC), plant service water system (PSWS), and fire protection system (FPS) (Detroit Edison 2011a). Biocide injection would remove plant and animal life, including the invasive zebra mussels, from the water (Detroit Edison 2011a). If mussels did reach the SWS, they could be removed through either additional chlorination or thermal shock treatment (Detroit Edison 2011a). Additional chemicals injected into the CIRC water would include sodium silicate (a corrosion inhibitor) and a scale inhibitor (Detroit Edison 2011a). An additional chemical to disperse suspended solids would be injected into the PSWS when the water from Lake Erie was highly turbid (Detroit Edison 2011a). Before the water would be discharged into Lake Erie, sodium bisulfite would be added to the CIRC blowdown to remove chlorination from (dehalogenate) the water.
Table 3.3-1 of the ER presents the estimated quantities of each chemical to be injected into the CIRC and PSWS (Detroit Edison 2011a).

Estimated concentrations of chemicals in Fermi 3 discharge are presented in ER Table 3.6-2 (Detroit Edison 2011a). The NPDES permit for Fermi 3 would specify the allowable concentrations of chemicals in the Fermi 3 discharge, and regular testing would evaluate compliance with the effluent limitations (Detroit Edison 2011a). As a result, the estimated impacts on water quality of Lake Erie from the proposed Fermi 3 discharges are expected to be minor.

Cooling water would be returned to Lake Erie at higher temperatures than it is withdrawn. Estimated monthly discharge temperatures and flow rates are presented in Table 5-2. These

Table 5-2. Fermi 3 Monthly Discharge Rates and Temperatures

Month	Discharge Rate (gpm)	Discharge Temperature (°F)
January	12,035	55.0
February	12,360	55.3
March	13,260	59.4
April	14,460	66.0
May	15,560	72.7
June	16,640	78.4
July	16,910	81.5
August	16,860	80.8
September	16,260	76.3
October	14,960	68.8
November	13,910	62.7
December	12,660	56.6

Source: Detroit Edison 2011a

temperature values and discharge rates are referred to in the ER as the anticipated maximum values (Detroit Edison 2011a). MDEQ enforces two standards related to thermal impacts in Lake Erie under Michigan Water Quality Standards Section R 323.1070. One of these standards is related to the change from ambient temperature, and the other is an absolute maximum temperature. Water that is 3°F above the ambient temperature of the lake is considered part of a thermal plume. Table 5-3 presents the estimated mean monthly ambient temperatures in Lake Erie in the vicinity of the discharge port and the difference between the ambient temperature and the discharge temperature. In addition, there are maximum monthly water temperatures that, when exceeded in Lake Erie, are considered part of a thermal plume; these are also presented in Table 5-3 along with the amount that these standards will be exceeded during each month. MDEQ allows the water quality standards to be exceeded within mixing zones per Michigan Water Quality Standards Section R 323.1041 *et seq*. The MDEQ defines the allowable size of a mixing zone within Lake Erie on a case-by-case basis. The allowable size for Fermi 3 would be determined during the permitting process. As described below, the simulated size of the maximum thermal plume was very small when compared to the area of the entire western basin of Lake Erie, and impacts from the thermal plume are expected to be minor.

To investigate the potential impacts of discharged cooling water with elevated temperatures on Lake Erie, Detroit Edison used CORMIX, a hydrodynamic model that simulates mixing processes, to evaluate the impact and size of discharge thermal plumes (Detroit Edison 2011a). Detroit Edison performed a suite of steady-state simulations based on both of the MDEQ water

Table 5-3. Temperature Increases within the Thermal Plume for Fermi 3

Month	Mean Ambient Lake Temperature (°F)[a]	Increase in Temperature (above Ambient) within Thermal Plume (°F)	MDEQ Maximum Allowable Temperature (°F)[b]	Degrees Exceedance of MDEQ Maximum Allowable Temperature (°F)
January	35.5	19.5	45.0	10.0
February	32.9	22.4	45.0	10.3
March	35.8	23.6	45.0	14.4
April	43.2	22.8	60.0	6.0
May	53.6	19.1	70.0	2.7
June	64.1	14.3	75.0	3.4
July	68.6	12.9	80.0	1.5
August	73.1	7.4	85.0	–
September	70.0	6.3	80.0	–
October	61.5	7.3	70.0	–
November	49.7	13	60.0	2.7
December	39.6	17	50.0	6.6

(a) Detroit Edison (2011a).
(b) Michigan Water Quality Standards Section R 323.1041 *et seq*.

quality standards to examine the size of thermal plumes. These scenarios evaluated the following:

- Compliance with MDEQ Water Quality Standards for Lake Temperature: The first set of simulations, described in the ER as Model Set 1, evaluated (1) monthly variations in the size of the plume that was 3°F or more than ambient lake water temperature and (2) monthly variations in the size of the thermal plume that exceeded the maximum allowable temperature (presented in Table 5-3).
- Sensitivity of Maximum Plume to Changes in Water Depth: A second set of simulations, described in the ER as Model Set 2, evaluated the sensitivity of the size of the thermal plume caused by a rise in ambient lake temperatures higher than 3°F to lake depth. This scenario was performed to evaluate the effects of extremely low water conditions caused by a wind-driven seiche. To be conservative, this analysis used the largest plume determined in the first set of simulations. This plume occurred in the month of May.
- Potential Impact of Plume Cooling Water Intake Temperatures: A final simulation was performed to investigate the potential for a thermal plume to reach the shore and affect the temperature of water withdrawn from Lake Erie for cooling Fermi 3.

These scenarios are described in greater detail below and summarized in Table 5-4.

Table 5-4. Summary of Model Scenarios, Parameters, and Results

Scenario Name and Description	Important Input Parameters: Parameter	Important Input Parameters: Value	Results
Model Set 1:			
Compliance with MDEQ Water Quality Temperature Standards (3°F above ambient limit)	Lake temperature	10th percentile monthly temperature predicted by LEOFS NOAA model	Largest plume of water greater than 3°F above ambient lake temperature occurs during May assuming maximum current velocity (29,500 ft^2).
	Fermi 3 discharge rate	Maximum discharge (Table 5-1)	
	Fermi 3 discharge temperature	Maximum discharge temperature (Table 5.2-2)	
	Water depth	Monthly averages measured at Fermi Power Plant	
	Current velocity	High (maximum) and low (10th percentile) values from LEOFS model	
Model Set 1:			
Compliance with MDEQ Water Quality Temperature Standards (total allowable maximum temperature)	Lake temperature	90th percentile monthly temperature predicted by LEOFS NOAA model	11 of 12 months exceeded the MDEQ maximum allowable temperature standard and would require a mixing zone.
	Fermi 3 discharge rate	Maximum discharge (Table 5.2-2)	
	Fermi 3 discharge temperature	Maximum discharge temperature (Table 5.2-2)	
	Water depth	Monthly averages measured at Fermi Power Plant	
	Current velocity	High (maximum) and low (10th percentile) values from LEOFS model	
Model Set 2:			
Sensitivity of Maximum Plume to Changes in Water Depth	Fermi 3 discharge temperature	Maximum discharge temperature (Table 5.2-2)	Use of 1st percentile depth (7 ft) increases plume size relative to May mean depth (8.5 ft) by 46 percent (from 29,500 ft^2 to 55,300 ft^2).
	Fermi 3 discharge rate	Maximum discharge (Table 5.2-2)	
	Current velocity	High (maximum current velocity near discharge output by LEOFS model)	
	Lake temperature	10th percentile monthly temperature predicted by LEOFS NOAA model	
	Water depths evaluated	8.5 ft (May mean from Model Set 1)	
		8 ft (20th percentile; once in 5-year depth for May)	
		7.6 ft (5th percentile; once in 20-year depth for May)	
		7 ft (1st percentile; once in 100-year depth for May)	

Table 5-4. (contd)

Scenario Name and Description	Important Input Parameters		Results
	Parameter	Value	
Model Set 3:			
Potential Impact of the Plume on Cooling Water Intake Temperature	Water depth	8.5 ft	Plume dissipates 1300 ft from shore. No impact on intake temperature or shoreline.
	Single-port diffuser angled toward Fermi 3 intake		
	Wind speed	1 fps (high velocity from May)	
	Current speed	High (1.5 times the maximum observed current velocity)	
	Current direction	West, toward the plant	
	Discharge temperature	Maximum discharge temperature (Table 5.2-2)	
	Discharge rate	Maximum discharge (Table 5.2-2)	
	Lake temperature	10th percentile monthly temperature predicted by LEOFS NOAA model	

Compliance with MDEQ Water Quality Standards for Lake Temperature

The monthly simulations in Model Set 1 were performed to characterize the timing and size of potential thermal plumes created by Fermi 3 at different times of the year using conservative input parameters. Input data for the CORMIX simulations included discharge rate, discharge temperature, water depth, ambient lake temperature, and ambient lake current velocity and direction. Data were derived from the several sources shown in Table 5.3-3 of the ER (Detroit Edison 2011a). Both the ambient lake temperature and the ambient lake current inputs were derived from Lake Erie Operational Forecast System (LEOFS) model estimates. LEOFS is a National Oceanic and Atmospheric Administration (NOAA) project and is a part of the Great Lakes Operational Forecast System (GLOFS). Detroit Edison analyzed LEOFS results to determine the mean high and low monthly values of lake temperature and lake currents in the vicinity of the Fermi site (Detroit Edison 2011a). Ambient mean monthly lake depth was derived by using data from a National Oceanic and Atmospheric Administration (NOAA) gage located on a buoy offshore from Fermi 2 (Detroit Edison 2011a). Detroit Edison used the mean monthly wind velocity measured at the airport in Grosse Ile, Michigan, which is approximately 11 mi from the Fermi site (Detroit Edison 2011a).

Detroit Edison first evaluated plumes caused by a rise in ambient temperature greater than 3°F. It investigated two scenarios: one with a low ambient current velocity and one with a high ambient current velocity. Detroit Edison assumed that the ambient temperature of Lake Erie for each month was in the 10th percentile of values simulated by LEOFS for that month (model simulated values used for temperature). The use of a low ambient temperature allowed for a conservative analysis of the impacts of high-temperature discharge on plume size for the maximum change in temperature simulations. The results of these simulations are presented in Table 5.3-12 of the ER (Detroit Edison 2011a).

Next, plumes that exceeded the maximum allowable temperature for each month were simulated. For these simulations, Detroit Edison assumed that the ambient temperature of Lake Erie for each month was in the 90th percentile of values simulated by LEOFS for that month. The use of a high ambient temperature allowed for a conservative analysis of the impacts of high-temperature discharge on plume size for the maximum allowable temperature simulations. Two monthly scenarios were investigated: one with a low ambient current velocity and one with a high ambient current velocity. The results of these simulations are presented in Table 5.3-13 of the ER (Detroit Edison 2011a). Detroit Edison estimated that the largest plume would occur during the month of May as a result of the change in ambient temperature and high ambient current velocity, with an area of approximately 29,500 ft^2.

The technical review team reviewed and verified the model input values. The model results are presented in the text of the ER (Detroit Edison 2011a) and were provided to the technical review team as electronic files. The technical review team reviewed the files and found them to be acceptable.

Results of the thermal plume simulation were presented as rectangular areas in the ER (Detroit Edison 2011a). However, the plume would be shaped more like a triangle than a rectangle, so the values of the plume area would be lower than those calculated by multiplying the plume length and the plume width at the edge of the mixing zone. The values for the simulated plume were found to be smaller than the values presented by Detroit Edison (2011a); therefore, the review team found Detroit Edison’s analysis to be conservative and acceptable.

Sensitivity of Maximum Plume to Changes in Water Depth

Detroit Edison examined the impacts of shallower water depths on the largest plume for Model Set 2. Detroit Edison examined the plume size that resulted from four alternate depth scenarios for the month of May (Detroit Edison 2011a). The depths used were the May mean depth of 8.5 ft (also used in the monthly simulations in Model Set 1), the 20th percentile depth of 8.0 ft (once-in-5-year depth for May), the 5th percentile depth of 7.6 ft (once-in-20-year depth for May), and the 1st percentile depth of 7.0 ft (once-in-100-year depth for May). Detroit Edison found that the largest plume covered an area of approximately 55,300 ft^2 and resulted from the shallowest simulated water depth of 7.0 ft.

Potential Impact of Plume on Cooling Water Intake Temperature

The final simulation was performed to investigate the potential for Fermi 3 thermal discharges to travel back toward the shore and affect the temperature of the intake cooling water. For this simulation, a high-velocity wind was assumed to blow in a westerly direction toward the Fermi site during the month of May. In addition, the problem was simulated in CORMIX by using only a single-port diffuser pointed toward Fermi 3. A water depth of 8.5 ft and a wind velocity of 1 fps were assumed. Detroit Edison calculated that the thermal plume would pose no threat to the shoreline, because it was estimated to dissipate 1300 ft east of the shoreline (Detroit Edison 2011a). The review team verified the simulations and determined that this analysis is conservative and acceptable.

Summary of Surface Water Quality Impacts

In summary, because the cooling water discharges have relatively low projected contaminant levels, which would be controlled through the permitting process and would be similar to an already permitted discharge, and given the review team's independent analysis of the thermal and chemical constituents in plant discharges to Lake Erie, the review team concludes that the impacts of the proposed Fermi 3 discharges on the water quality of Lake Erie would be SMALL, and additional mitigation is not warranted.

5.2.3.2 Groundwater Quality Impacts

The proposed Fermi 3 would not use groundwater during operations and would not discharge any liquids to groundwater during operations. Therefore, the review team concludes that the impacts on groundwater quality from operation of Fermi 3 would be SMALL, and mitigation is not warranted.

5.2.4 Water Monitoring

There are no water use or nonradiological water quality monitoring requirements imposed by the NRC. However, hydrological, thermal, and chemical monitoring of the proposed new discharge would likely be required by MDEQ as a part of the NPDES permit. Also, it is anticipated that measurements at the NOAA gauging station (ID 9063090) on Lake Erie in the vicinity of the Fermi 2 intake structure would continue to provide hourly Lake Erie water level measurements. Detroit Edison (2011a) has committed to following NRC guidance (NRC 2007a) for groundwater monitoring at the site. Section 2.3.1.2.4 of the ER (Detroit Edison 2011a) describes the current and planned groundwater monitoring programs. Groundwater elevations and radionuclide concentrations would be measured quarterly at upgradient and downgradient locations as part of the Radiological Environmental Monitoring Program (REMP) (Detroit Edison 2011a). Additional monitoring would be triggered by an accidental liquid release from Fermi 3, including monthly sampling both upgradient and downgradient from the release point (Detroit Edison 2011a). Monitoring during operations would establish the impacts from the plant and would detect any impacts that would result during operations.

5.3 Ecological Impacts

This section describes the potential impacts on ecological resources (terrestrial and aquatic ecosystems, including threatened and endangered species) from operation of Fermi 3 at the Fermi site, operation of the associated transmission line, and maintenance of the associated transmission line corridor. Evaluation of potential impacts on terrestrial and aquatic biota from radiological sources is discussed in Section 5.9.

5.3.1 Terrestrial and Wetland Impacts Related to Operation

Concern for possible impacts on terrestrial communities and species from operation of the proposed Fermi 3 facilities is mostly attributable to cooling system operations and transmission line operation and maintenance. Operation of cooling systems can result in deposition of dissolved solids; increased local fogging, precipitation, or icing; increased noise levels; a greater risk of avian collision mortality; and shoreline alteration of Lake Erie (Detroit Edison 2011d; NRC 1996). Operation of Fermi 3 would also result in increased automotive traffic from additional employees at the site, which would result in the loss of wildlife. Possible impacts on terrestrial biota from operation and maintenance of a transmission line system include collision mortality and electrocution, electromagnetic fields, and the maintenance of vegetation within transmission line corridors.

5.3.1.1 Terrestrial Resources – Site and Vicinity

Cooling System Impacts on Vegetation

Concern for possible vegetation impacts from operation of Fermi 3 would be primarily associated with operation of the cooling system. As described in Chapter 3, the proposed cooling system for Fermi 3 consists of two primary components: the Normal Power Heat Sink and the Auxiliary Heat Sink (AHS). The Normal Power Heat Sink would be a hyperbolic natural draft cooling tower (NDCT). The AHS would consist of two linear mechanical draft cooling towers. The NDCT would be approximately 600 ft high (Detroit Edison 2011a). The heat would be transferred to the atmosphere in the form of water vapor and drift. In some cases, vapor plumes and drift from cooling towers can affect crops, ornamental vegetation, and native plants; water losses from cooling tower operation can affect shoreline habitat. In addition, bird collisions with tall structures, such as the NDCT, and noise-related impacts are possible (NRC 1996). The auxiliary towers would be much shorter than the NDCT, and the heat they would release would be orders of magnitude less. Because their impacts would be far smaller than impacts from the NDCT, discussion of potential impacts from operation of the cooling system is limited to the impacts of the NDCT.

Under certain conditions, native plants, ornamental plants, and agricultural crops can be affected by cooling tower drift, fogging, and increased humidity. Total dissolved solids (TDS), including salt, can stress vegetation after being deposited directly onto foliage or indirectly from accumulation in the soil (NRC 1996). The NDCT emits solids in its exhaust plume as a result of the evaporative process. The guidance in NUREG-1555, Section 5.3.3.2 (NRC 2000a) indicates that deposition of salt drift from operation of cooling towers at rates of 1 to 2 kg/ha/mo is generally not damaging to plants. Conversely, deposition rates approaching or exceeding

10 kg/ha/mo in any month during the growing season could cause leaf damage in many species. Detroit Edison's analysis of solids deposition conservatively assumed that all TDSs were salt. The ER states that the maximum predicted annual salt deposition rate at any receiving location is approximately 1 kg/ha/mo (Detroit Edison 2011a). This value is within the range that NUREG-1555 considers to be generally not damaging to plants. Therefore, cooling tower operation impacts on vegetation are expected to be negligible both on the Fermi site and in the vicinity.

Detroit Edison's modeling of the operation of the NDCT predicts that no increased fogging would result from operation. Any event that may occur is likely to be coincident with a natural fog event and be transient, similar to what is seen with the existing NDCTs used by Fermi 2, and would result in less than 18 hr of fog per year (Detroit Edison 2011a). Any impact would be aesthetic and unlikely to affect ecological resources. Therefore, the impacts of cooling tower plume-induced fogging are anticipated to be minimal and to not warrant mitigation. Likewise, Detroit Edison's modeling also predicts that substantial ground-level icing from the NDCT would not occur. Localized icing may be possible from the operation of the AHS, but impacts are expected to be minimal and contained onsite and would therefore not warrant mitigation.

According to the ER, modeling results indicate the average hours per year of plume shadowing beyond the nearest property boundary (2765 ft) is predicted to be 92 hr per year (2.1 percent of the daylight hours per year) from the NDCT, considering all plume directions. The resulting hours per year of shadowing (especially at the nearest property boundary) are predicted to be an insignificant fraction of the total daylight hours needed for agricultural production. Additionally, shadowing events are not expected to occur at downwind agricultural or residential areas (Detroit Edison 2011a). Thus, the plume shadowing impacts are expected to be minimal and to not warrant mitigation.

Bird Collisions with Power Plant Structures

The potential for avian mortality from colliding with the proposed nuclear power plant structures does exist. Typically, the cooling tower and the meteorological tower are the structures likely to pose the greatest risk. The potential for avian collisions increases as structure height increases (NRC 1996). The mechanical draft cooling towers are of little concern because of their relatively low height compared to existing and proposed structures onsite. The NDCT, however, would be 600 ft high. Avian collisions at existing Fermi facilities are not currently monitored by Detroit Edison, but dead birds are occasionally found around the Fermi 2 NDCTs. Typically, only a few birds are observed at any one time, but events during which more than a few birds have been killed by collisions with the cooling towers have been recorded infrequently. 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, all occurring during a one-week period in October 2007 (Detroit Edison 2011a).

In 10 CFR 51, Appendix B to Subpart A, Table B-1, it is stated that for nuclear power plant license renewal, bird collisions with cooling towers have not been found to be a frequent occurrence at operating nuclear power plants. Table B-1 further states that avian mortality resulting from collisions with cooling towers is of small significance.

While acknowledging that some bird collisions with cooling towers take place, the NRC concluded in the generic environmental impact statement (GEIS) for license renewal (NRC 1996) that effects of bird collisions with existing cooling towers "involve sufficiently small numbers for any species that it is unlikely that the losses would threaten the stability of local populations or would result in a noticeable impairment of the function of a species within local ecosystems." Thus, the impacts at Fermi 3 are expected to be minimal and would not warrant mitigation.

Shoreline Alteration

Periodic maintenance dredging of the intake bay is expected, potentially resulting in erosion and shoreline scouring. To offset this effect, rock groins extend into the lake, limiting the turbidity to the intake bay and protecting the shoreline from the zone of influence associated with the pumping activities. As a result, physical impacts on the shoreline area in the vicinity of the intake structure are anticipated to be minimal.

Noise

The predicted noise emissions from normal operation of the cooling tower would conform to NRC and EPA sound-level guidelines for minimizing noise impacts (see Section 5.8.2). According to Detroit Edison, the maximum predicted increase in ambient sound levels of 3 dB at the nearest noise-sensitive receptors would be a barely perceptible change in ambient sound level during the quietest nighttime hours based on existing conditions (Detroit Edison 2011a). The potential noise impacts due to the operation of Fermi 3 are, therefore, expected to be similar to background and current noise levels, to which local species are adapted. Accordingly, noise impacts on terrestrial ecosystems are expected to be minimal.

Impacts of Increased Vehicle Traffic

Increased traffic associated with operation of Fermi 3 has the potential to increase wildlife mortality caused by collisions (road kills). Detroit Edison (2011a) has estimated the Fermi 3 workforce to number approximately 900, which would approximately double the number of employees at the Fermi site. Additional work trips during peak hours would occur on the rural roads and highways in the vicinity. Local wildlife could decline if road-kill rates were to exceed the rates of reproduction and immigration. However, although roadkills occur frequently in the United States, they reportedly have minimal effect on wildlife populations (Forman and Alexander 1998). The review team concludes that, with the possible exception of the eastern fox snake (*Pantherophis gloydi*), these impacts would not be detectable beyond the local vicinity and would not destabilize regional wildlife populations. Since the eastern fox snake's preferred habitat is emergent wetlands, open areas not shaded by trees are not barriers to their movement (Hoving 2010). This species has been observed in developed and undeveloped sections of the Fermi site (Detroit Edison 2011a). It is reasonable to conclude, therefore, that the snakes would be likely to cross roads as they move about the Fermi site, possibly for thermoregulation, and that the increased traffic anticipated from operation of Fermi 3 could increase the risk of mortality for the eastern fox snake. See Section 5.3.1.3 for additional discussion.

5.3.1.2 Terrestrial Resources – Transmission Lines

Electricity transmission systems have the potential to affect terrestrial ecological resources through corridor maintenance, bird collisions with transmission lines and towers, and electromagnetic fields (EMFs).

Vegetation

Operations impacts in the transmission line corridor, including the western 10.6 mi, would be mainly limited to vegetation maintenance. Maintenance of the corridor would be conducted in accordance with ITC*Transmission's* Transmission Vegetation Management Plan, which was developed in compliance with the North American Electric Reliability Council Reliability Standard FAC-003-1 – Transmission Vegetation Management Program. The work would likely consist of periodic removal of trees to provide adequate clearance from the lines. Pesticides and herbicides may also be used selectively as needed to maintain the corridor. Selective removal of undesirable species through cutting by hand and/or by mowing, as needed, would likely be the practice routinely used; this would encourage the growth of vegetation types that provide low-growing ground cover, erosion control, treatment of invasive species, and wildlife habitat. Vegetation management in wetlands, including cutting or removal of woody vegetation, would indefinitely maintain the wetland in a shrub/scrub or emergent state.

The corridor would typically be inspected by helicopter and ground-patrolled periodically to ensure that the corridor is in proper condition for safe operation of the transmission line (Detroit Edison 2011a). There would be occasional vehicular traffic in the corridor for maintenance purposes, which could result in only minimal impacts on vegetation and soils and minor amounts of soil erosion within the immediate area of the transmission line corridor. Impacts on natural vegetation during maintenance of the Milan Substation would be minimal. Where access is needed to sensitive areas along the corridor, such as wetlands, matting would be used to avoid soil disturbance and minimize damage to plants.

Wildlife

Impacts of the transmission line system on wildlife (e.g., bird collisions and habitat loss) resulting from the addition of the new lines to the existing towers and potential new towers in the existing corridor are expected to be minor. Section 4.5.6.2 of the GEIS for license renewal (NRC 1996) provides a thorough discussion of the topic and concludes that bird collisions associated with the operation of transmission lines would not cause long-term reductions in bird populations. The same document also concludes that once a transmission line corridor has been established, the impacts on wildlife populations are from continued ROW maintenance and are not significant (NRC 1996).

The overall effect of operation of the new line on wildlife is expected to be minor because maintenance activities would be limited and because most of the corridor has been previously developed and, in less-maintained areas, there are existing disturbances such as farming, neighboring residences, and roadways. Because of these local conditions, it is expected that ITC*Transmission* would not implement any new wildlife management practices within the corridor.

Operation of the expanded substation at Milan would be expected to have minimal effect on wildlife in the area because area wildlife has adjusted to the existing substation, the substation expansion is confined to a relatively small area, and maintained grass and cropland habitat in the surrounding vicinity are already of low quality. The review team concludes that impacts of maintenance activities in the corridor on terrestrial resources would be minimal.

Impact of Electromagnetic Fields on Flora and Fauna

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle, according to the NRC's GEIS conclusions (NRC 1996). As discussed in the GEIS, a careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures. Thus, the conclusion presented in the GEIS was that the impacts of EMFs on terrestrial flora and fauna were not significant at operating nuclear power plants, including transmission line systems with variable numbers of power lines. On this basis, it is concluded that the incremental EMF impacts posed by possible additions of new power lines for Fermi 3 would be minimal.

5.3.1.3 Important Terrestrial Species and Habitats

This section discusses the potential impacts of operating Fermi 3 on Federally and State-listed species and on other important species and/or habitats (including wetlands) as defined by the NRC (NRC 2000a). To meet responsibilities under Section 7 of the U.S. Endangered Species Act of 1973 (ESA), the review team will prepare a Biological Assessment (BA) prior to issuance of the final EIS that will evaluate potential impacts of preconstruction, construction, and operations on Federally listed threatened or endangered aquatic and terrestrial species.

Important Terrestrial Species – Fermi Site and Vicinity

The Federally and State-listed species that could occur on the Fermi site and nearby in Monroe County are described in Section 2.4.1.3 (Table 2-7). None of the Federally listed species identified by U.S. Fish and Wildlife Service (FWS) are likely to be affected by operation of the Fermi facility. Operation of Fermi 3 would result in effects on wildlife similar to operation of Fermi 2, although the effects would occur over a wider area. The bald eagle (*Haliaeetus leucocephalus)* has adapted to the presence and operation of Fermi 2. Fermi 3 would be located farther from the lakeshore from where eagle nests had been located prior to January 2011. Operation of the Fermi 3 project is not expected to have impacts on Indiana bats (*Myotis sodalis*). The American lotus (*Nelumbo lutea*) appears to be thriving on wetlands on the Fermi site, but operation of Fermi 3 would not alter conditions for that species.

The eastern fox snake is State-listed as threatened and has been observed on the Fermi site in several locations at several times in recent years (Detroit Edison 2009b, 2011a). During operation of Fermi 3, increased traffic from a larger workforce would present the potential for increased impacts on this species. Detroit Edison has prepared a draft Habitat and Species Conservation Plan for the eastern fox snake (Detroit Edison 2010b). The draft plan makes provisions for mitigating impacts from initial development of the Fermi 3-related facilities, but does not yet contain provisions for mitigating potential impacts from operations, such as higher rates of mortality due to increased traffic.

The Endangered Species Coordinator for the Michigan Department of Natural Resources (MDNR) has not yet reviewed Detroit Edison's proposed Habitat and Species Conservation Plan for the eastern fox snake, and has not yet commented on whether the plan's mitigation measures would be adequate to protect the eastern fox snake (Hoving 2010). The Coordinator stated, however, that monitoring of the eastern fox snake population during and after building of Fermi 3 could help determine whether the direct impacts from increased traffic warranted additional mitigation measures. An example of mitigation for traffic mortality impacts, if needed, would be installing fences along roads to serve as barriers to the snake and reduce the likelihood of snakes being hit by vehicles. Monitoring and implementing any necessary mitigation measures, as discussed in Section 5.3.1.1, would likely hold the effects on the eastern fox snake from project operation to minimal levels.

Operation of Fermi 3 would subject habitat and individual animals on the site to impacts similar to those that currently result from operation of Fermi 2 and related facilities, with the exception that onsite automotive traffic from employees would approximately double over current levels when Fermi 3 goes into operation. With the possible exception of the eastern fox snake, increased traffic would not cause new impacts on Federally or State-listed species. Game species such as white-tailed deer (*Odocoileus virginianus*) and a variety of waterfowl species are common inhabitants of the Fermi site. Increased noise levels near the cooling towers might cause these wildlife species to avoid the immediate area, and increased activity and traffic might also cause wildlife to avoid the habitats immediately adjacent to Fermi 3. Drift, fogging, and icing are expected to cause at most negligible impacts on terrestrial habitats and would not be expected to affect important game species. Although game might avoid habitats adjacent to the new facilities during operation, the Fermi property and surrounding landscape contain large expanses of terrestrial habitat to which these species could relocate. Thus, operational impacts on commercially and recreationally important species would be minimal and no mitigation would be warranted.

Important Terrestrial Habitats – Fermi Site and Vicinity

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.

The Fermi site includes wetlands, including emergent, forested, and shrub/scrub wetlands. Impacts on wetlands by preconstruction and construction are addressed in Section 4.3.1.3. Wetlands would not be adversely affected by Fermi 3 operations. One other important habitat on the Fermi site is a 29-ac restored prairie area in the onsite transmission line corridor along the north side of the existing facility approach road. The restored prairie area would be permanently converted to use by Fermi facilities. The plan to convert the prairie restoration area resulted from the need to minimize impacts on high-quality forested wetlands.

Approximately 656 ac of the Fermi site is managed as part of the DRIWR. Much of DRIWR land consists of coastal wetlands, which are common in the 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.” Much of the area included in the DRIWR is forested, emergent, or scrub/shrub wetland. Construction of the Fermi project would permanently convert approximately 19 ac of the refuge (see Section 4.3.1), which would reduce the refuge area on the Fermi site to approximately 637 ac.

Operation of Fermi 3 is not anticipated to create conditions that would negatively affect the DRIWR or other important habitats on the Fermi site or offsite. Stormwater runoff may increase due to an increase in impervious surfaces, but increased flows would be directed primarily to Lake Erie (see Section 5.2). Stormwater flows would be adequately controlled by design considerations and by the SWPPP contained within the NPDES permit. Adherence to the NPDES permit will ensure that any increase in sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts. Only Lake Erie would be used for source water. Other sources of surface water and groundwater would not be used. As discussed in Section 5.3.1.1, salt deposition would be far below the levels that could cause damage to plants or soils. Operation of Fermi 3 is expected to have only minimal impact on any of these important habitats.

Important Terrestrial Species – Transmission Lines

The review team has not yet formally consulted with Federal, State, or local agencies regarding the transmission line routing and substation expansion. However, Detroit Edison did informally contact the FWS and MDNR requesting information on known occurrences of Federally and State-listed protected species in the project vicinity (Detroit Edison 2011a). The review team has also researched Federal and State Web sites for information on Federal and State threatened and endangered species. Information available to the review team is summarized in Section 2.4.1.3. Based on information obtained from Web sites maintained by the FWS, there is currently no designated critical habitat for species listed under the ESA along the transmission line route (FWS 2010). According to information provided by ITC*Transmission* to Detroit Edison (Detroit Edison 2010b), ITC*Transmission* maintains access to a database of known occurrences of Federal and State threatened and endangered species obtained from the Michigan Natural Features Inventory (MNFI) to identify locations where seasonal constraints or other regulatory conditions affect vegetation management activities in habitats occupied by rare species. ITC*Transmission* also informed Detroit Edison that it operates in accordance with these seasonal constraints to the degree practicable.

<u>Federally Listed Species</u>

The FWS has identified four terrestrial species that are Federally listed as threatened or endangered and that have the potential to occur in Monroe, Washtenaw, and Wayne Counties, where the new transmission line would be constructed. The species identified by FWS are the Indiana bat, the Karner blue butterfly (*Lycaeides melissa samuelis*), Mitchell’s satyr butterfly (*Neonympha mitchellii mitchellii*), and the eastern prairie fringed orchid (*Platanthera leucophaea*) (FWS 2009). Because the exact location of the transmission line corridor has not been established, FWS has not been provided specific location information. Although the impacts of transmission line operation on Federally listed species are likely to be minimal, final corridor location information would have to be provided to FWS prior to construction of the transmission line in support of ITC*Transmission’s* application for a CWA Section 404 wetlands permit. Site-specific biological surveys would also need to be conducted in coordination with threatened and endangered species review by the FWS.

<u>State-Listed Species</u>

The MNFI lists nearly 100 terrestrial plant and animal species listed by the State of Michigan as either endangered or threatened (see Table 2-8). As discussed above with respect to Federally listed species, however, final corridor location information would have to be provided to the MDNR prior to construction of the transmission line. Site-specific biological surveys would also need to be conducted in coordination with the state species review by the MDNR. Impacts of transmission line operation on State-listed species are likely to be minimal as long as ITC*Transmission* adheres to all conditions that USACE and/or MDEQ may place on operations and management in the wetland permitting process.

Wetlands and Floodplains

Only minimal impacts on wetlands and floodplains are anticipated from operation of the new transmission lines and Milan Substation. Vegetation management actions may include, but are not limited to, pruning, wall trimming, tree removal, mowing, and herbicide application. Work would be conducted under the direct supervision of appropriately qualified personnel. Wetlands within the corridor that have the potential to regenerate in forest vegetation are expected to be manually cleared of woody vegetation periodically for line safety clearance, thereby being kept in a low-growing scrub/shrub or emergent wetland state. Access to these areas for maintenance would likely be on foot or by the use of matting for vehicle equipment, so as not to disturb the soil. Detroit Edison expects that ITC*Transmission* would minimize the use of pesticides in wetland portions of the transmission corridor (Detroit Edison 2010b). The review team therefore expects potential impacts on wetlands from the operation of the transmission line system to be minimal.

5.3.1.4 Terrestrial Monitoring during Operations

The review team believes that MDEQ and MDNR may require monitoring for eastern fox snake mortality at least early in the operations period. There appears to be no apparent need for other terrestrial monitoring activities related to Fermi 3.

5.3.1.5 Potential Mitigation Measures for Operation-Related Terrestrial Impacts

Except for impacts on eastern fox snake habitat, impacts on terrestrial ecosystems resulting from operation of the transmission lines are expected to be minor, and no mitigation is anticipated at this time. MDEQ and MDNR may require Detroit Edison to develop and implement a plan to reduce the potential for mortality of eastern fox snakes during operations.

5.3.1.6 Summary of Operational Impacts on Terrestrial Resources

Given the information provided in the ER (Detroit Edison 2011a), Detroit Edison’s responses to RAIs, interactions with State and Federal agencies, the public scoping process, and the review team’s independent assessment, the review team has concluded that impacts from operations on terrestrial resources would be MODERATE. The MODERATE conclusion is based solely on the potential for eastern fox snake mortality caused by vehicular traffic on onsite roads. Impacts on other terrestrial ecological resources would be minimal. The review team expects that MDEQ and MDNR may require Detroit Edison to develop a mitigation plan incorporating some or all of the mitigation measures proposed in Detroit Edison's Habitat and Species Conservation Plan for the construction phase of the project (see Section 4.3.1.3). The review team believes that implementation of such a mitigation plan would likely reduce the potential terrestrial ecological impacts to SMALL.

5.3.2 Aquatic Impacts Related to Operation

This section discusses the potential impacts of operation of the proposed Fermi 3 on the aquatic ecosystems in water bodies on or adjacent to the Fermi site, including Lake Erie, and potential impacts on aquatic ecosystems from the operation and maintenance of associated transmission lines. Impacts on aquatic resources from operation of Fermi 3 would primarily be associated with withdrawal and consumption of water for cooling, discharge of cooling water, maintenance dredging, discharge of wastewater, and stormwater runoff. Transmission line impacts would primarily be associated with erosion from maintenance vehicles and other equipment and the effects of vegetation management activities on nearby water bodies.

5.3.2.1 Aquatic Resources – Site and Vicinity

This subsection evaluates impacts on aquatic resources that could occur on or in the vicinity of the Fermi site during operation of Fermi 3, including those in Lake Erie, the overflow canals, the Quarry Lakes, Swan Creek, and Stony Creek.

Lake Erie

During the operation of Fermi 3, aquatic habitats and biota in Lake Erie could be affected by cooling water withdrawal and consumption, discharge of heated effluent from the cooling water system, maintenance dredging, discharge of wastewater, and stormwater runoff at the Fermi site.

<u>Water Withdrawal and Consumption</u>

All cooling water for the operation of Fermi 3 would be withdrawn from Lake Erie, and impacts associated with operation of the water intake system would be limited to aquatic resources within Lake Erie. For aquatic resources, the primary concerns are related to the amount of water withdrawn and the amount of water consumed through evaporation and the potential for organisms to be impinged on the intake screens or entrained into the cooling water system. Impingement occurs when organisms are trapped against the intake screens by the force of the water withdrawn by the Cooling Water Intake Structure (CWIS) (NRC 1996). Impingement can result in starvation and exhaustion, asphyxiation (water velocity forces may prevent proper gill movement or organisms may be removed from the water for prolonged periods of time), and physical damage (NRC 1996). Entrainment occurs when organisms are small enough or fragile enough to be drawn through the intake screens into the proposed Fermi 3 cooling system.

Organisms that become entrained are normally relatively small benthic, planktonic, and nektonic (organisms in the water column) forms, including early life stages of fish and shellfish, which often serve as prey for larger organisms (NRC 1996). As entrained organisms pass through the CWIS into the proposed plant's cooling system, they would be subject to mechanical, thermal, and toxic stresses, and survival is unlikely.

A number of factors, such as the type of cooling system, the design and location of the intake structure, and the amount of water withdrawn from the source water body greatly influence the degree to which impingement and entrainment affect aquatic biota. Detroit Edison has proposed that a closed cycle recirculating cooling system comprising a cooling basin and natural draft cooling tower be used for Fermi 3. Water loss from the cooling towers through evaporation, drift, and blowdown would be made up by water from Lake Erie. Closed-cycle recirculating cooling water systems can, depending on the quality of the makeup water, reduce water use by 96 to 98 percent of the amount that the facility would use if it employed a once-through cooling system (NRC 1996). This significant reduction in water withdrawal rate results in a substantial reduction in impingement and entrainment.

The intake design through-screen velocity is another factor that greatly influences the rate of impingement of fish and shellfish at a facility. In general, the higher the through-screen velocity, the greater the number of fish impinged. The EPA has established a national standard for the maximum design through-screen velocity of no more than 0.5 fps (66 FR 65256). The EPA determined that species and life stages evaluated in various studies could endure a velocity of 1.0 fps and then applied a safety factor of two to derive the threshold of 0.5 fps. Detroit Edison has stated that the proposed intake structure would be designed to have a through-screen velocity of 0.5 ft/s or less under all operating conditions (Detroit Edison 2011a). The resulting low through-screen velocity would reduce the probability of impingement because most fish can swim against such low flows to avoid or swim off of intake screens. Fish that enter the intake bay would be able return to the lake the same way they entered.

Under the proposed design, the cooling water intake for Fermi 3 would include a trash rack, travelling screens, and a fish return system. The trash rack, equipped with a trash rake, would be positioned at the inlet to the pump house structure to capture larger debris; trash collected from the trash racks would be disposed of. Three dual-flow traveling screens (mesh size 3/8 in.) would be arranged side by side behind the trash rack to further prevent debris from entering the pump house and to collect aquatic organisms large enough to be caught on the screens. Aquatic organisms would first be washed from the traveling screens using a low-pressure water spray followed by a high-pressure wash to remove remaining debris. Strainers would be in place to collect the organisms washed from the screens, and a strainer backwash would then be used to direct those organisms back to Lake Erie via a fish return system in a manner compatible with the limits of the applicable NPDES permit (Detroit Edison 2011a). The point of return for the fish return system would be outside the zone of influence of the intake bay (Detroit Edison 2011a).

The EPA indicated (66 FR 65256) that the optimal design requirement for the intake location is to place the inlet of the CWIS in an area of the source water body where impingement and entrainment of organisms are minimized by locating intakes away from areas with the potential for high productivity. The existing intake bay for Fermi 2 is formed by two rock groins that extend approximately 600 ft into Lake Erie. The intake bay is periodically dredged to maintain appropriate operating conditions; such dredging would limit the potential for the intake bay to support high-productivity habitat. The intake bay faces the open waters of Lake Erie; substrate outside the intake bay area consists of packed clay and sand, along with areas of soft sediments that would provide limited structure that could be used for cover or spawning by fish (AECOM 2009a; Detroit Edison 2010c). During surveys conducted from 2008 to 2009, fish numbers, fish species counts, and the density of benthic macroinvertebrates were found to be lower in the vicinity of the intake bay than in another nearby Lake Erie sampling location (AECOM 2009a). On this basis, the area of Lake Erie in the vicinity of the intake bay is unlikely to provide habitat with high levels of productivity. The intake structure for Fermi 3 would be located within the existing Fermi 2 intake bay.

Historical impingement and entrainment data were collected at the Fermi 2 intake over a 1-year period from October 1991 to September 1992 (Lawler, Matusky, and Skelly Engineers 1993). During the study, a total of 1944 fish representing 23 fish species and 9 families were collected during 53 sampling events. This resulted in an estimated annual impingement of 13,699 fish with a total biomass of approximately 725 lb. The dominant species impinged was gizzard shad (*Dorosoma cepedianum*), accounting for 71 percent of the total numbers of fish observed. Other prevalent species in the impingement samples included white perch (*Morone americana*, 7.1 percent), rock bass (*Ambloplites rupestris*, 3.3 percent), and freshwater drum (*Aplodinotus grunniens*, 3.2 percent). Ten of the 23 species impinged were considered sport fish species. Impingement rates varied seasonally, with greater numbers of fish impinged during the winter and fall and lesser numbers during the summer. The greater numbers of fish during the winter were represented primarily by gizzard shad (Lawler, Matusky, and Skelly Engineers 1993), which experience increased mortality when exposed to cold water temperatures (Bolsenga and Herdendorf 1993).

Entrainment of fish eggs and larvae was sampled at two different locations downstream of the two traveling screens for Fermi 2. A total of 13,547 eggs and larvae representing 15 fish species and 10 families were collected and it was estimated that approximately 2.9 million larvae and 72,000 eggs were entrained annually by Fermi 2 operations (Lawler, Matusky, and Skelly Engineers 1993). The dominant species collected were gizzard shad (59 percent), spottail shiner (*Notropis hudsonius*, 18 percent), yellow perch (*Perca flavescens*, 7 percent), and emerald shiner (*Notropis atherinoides*, 5 percent). Entrainment rates varied seasonally, with greater numbers collected during June and July and lesser numbers collected from October through February. Gizzard shad eggs and larvae made up the highest proportion of the entrained specimens during the summer, which corresponds with their peak spawning periods (Lawler, Matusky, and Skelly Engineers 1993).

A second impingement study, conducted from 2008 to 2009 at the Fermi 2 intake (AECOM 2009a), was summarized in Section 2.4.2.1 (Tables 2-10 and 2-11). Overall, it was estimated that 3102 individual fish representing 15 species were impinged in the study. Impingement information was not collected in April 2009 because of a large amount of debris in the sampling area. Thus the total number of fish impinged during the year may have been underestimated by several hundred individuals (AECOM 2009a). Similar to the previous study, samples collected from the 2008–2009 impingement study also contained high proportions of gizzard shad (35 percent) and white perch (10 percent) (Table 2-11). However, the recent study had a higher proportion of emerald shiner than the 1991–1992 study (34 percent versus 3 percent). In addition, the recent study identified the round goby (*Neogobius melanostomus*), a nonnative invasive species (Section 2.4.2.3) not collected during the earlier study. Based on the similarities in operational water withdrawal rates, locations of the intakes, intake designs, and flow-through velocities for Fermi 2 and Fermi 3, impingement rates are expected to be similar. The applicant determined the number of fish impinged per unit volume of water for Fermi 2 based on the impingement study and operational flow rates (AECOM 2009a). They then scaled the impingement losses to the expected flow rates for Fermi 3. The results of this analysis are presented in Table 5-5.

Entrainment sampling conducted from 2008 to 2009 (AECOM 2009a) at the Fermi 2 intake identified eggs and larvae from 13 fish species (Table 2-10). In comparison, studies conducted from 1991 to 1992 identified eggs and larvae of 28 species (Lawler, Matusky, and Skelly Engineers 1993). Overall, it was estimated that 62,566,649 fish (3,940,823 eggs and 58,625,825 larvae) were entrained at the Fermi 2 intake during the 2008–2009 study (AECOM 2009a). Compared to the 1991–1992 study, a comparable proportion of gizzard shad eggs and larvae, but a smaller proportion of white perch larvae, were entrained during the 2008–2009 study period. In addition, the 2008–2009 study found higher proportions of emerald shiner, bluntnose minnow (*Pimephales notatus*) and yellow perch in entrainment samples. From 1991 to 1992, lake whitefish (*Coregonus clupeaformis*; 2 percent of total entrainment) were collected during late March and April 1992, but no lake whitefish eggs or larvae were collected in the 2008–2009 study. The round goby was not collected during the 1991–1992 entrainment study, but accounted for more than 2 percent of the individual fish entrained by Fermi 2 from 2008 to 2009. Based on the entrainment rates for Fermi 2 from the AECOM (2009a) study and the maximum estimated intake water volume for Fermi 3, it was estimated that approximately 55 million fish eggs and larvae would be entrained annually by Fermi 3 (Table 5-6). Many of the species observed during entrainment studies are species that exhibit high fecundity and produce large numbers of eggs and larvae (Table 5-7) or that are common

Table 5-5. Estimated Numbers of Fish that Would Have Been Impinged by the Proposed Fermi 3 Cooling Water Intake with the Intake Pumps at Maximum Capacity Based on Sampling at the Fermi 2 Intake from August 2008 through July 2009[(a)]

Common Name	Scientific Name	Jan	Feb	Mar	Apr[(b)]	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Percentage of Total
Gizzard shad	*Dorosoma cepedianum*	65									61	159	962	1247	35.0
Emerald shiner	*Notropis atherinoides*	97	87	589	295				25	24	30		64	1211	33.9
White perch	*Morone americana*		29	98	49				49	24	30	32	32	343	9.6
Bluegill	*Lepomis macrochirus*	32	29	131	66								32	290	8.1
Round goby	*Neogobius melanostomus*	32			15	30			25	24				126	3.5
Smallmouth bass	*Micropterus dolomieu*			33	17				25					75	2.1
Spottail shiner	*Notropis hudsonius*				15	30		26						71	2.0
Banded killifish	*Fundulus diaphanous*										30			30	0.8
Largemouth bass	*Micropterus salmoides*										30			30	0.8
Brook silverside	*Labidesthes sicculus*								25					25	0.7
Bluntnose minnow	*Pimephales notatus*									24				24	0.7
Channel catfish	*Ictalurus puctatus*									24				24	0.7
Freshwater drum	*Aplodinotus grunniens*						24							24	0.7
Green sunfish	*Lepomis cyanellus*									24				24	0.7
Rock bass	*Ambloplites rupestris*									24				24	0.7
Total		**226**	**145**	**851**	**456**	**60**	**24**	**26**	**149**	**168**	**181**	**191**	**1090**	**3567**	**100.0**

(a) Calculations based on measured impingement rates from August 2008 through July 2009 at the Fermi 2 intake (AECOM 2009a). Impingement rates for each species computed for unit volume of water and then estimated for Fermi 3 based on projected maximum withdrawal capacity of 32,264 gpm.

(b) Measured impingement values for April were unavailable because heavy debris prevented sample collection. April impingement values were estimated by averaging the estimates for March and May.

Table 5-6. Estimated Numbers of Fish Eggs and Larvae (in Millions) that Would Have Been Entrained by the Proposed Fermi 3 Cooling Water Intake with the Intake Pumps at Maximum Capacity Based on Sampling at the Fermi 2 Intake from August 2008 through July 2009[a]

		2008						2009								
Common Name	**Scientific Name**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec[b]**	**Jan[b]**	**Feb[b]**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Total**	**% of Total**
Gizzard shad	*Dorosoma cepedianum*	0.05										1.42	0.95	22.69	25.11	45.7
Emerald shiner	*Notropis atherinoides*	0.87	1.51								0.20	2.92	0.73	3.24	9.46	17.3
Bluntnose minnow	*Pimephales notatus*		0.06								0.03	4.77	0.45		5.31	9.7
Yellow perch	*Perca flavescens*										0.25	4.02	0.45		4.72	8.6
Unidentified spp.	–				4.23										4.23	7.7
Freshwater drum	*Aplodinotus grunniens*													1.91	1.91	3.5
Round goby	*Neogobius melanostomus*	0.05	0.41	0.11								0.75	0.17	0.06	1.55	2.8
Bigmouth buffalo	*Ictiobus cyprinellus*											1.24	0.34		1.58	2.9
Channel catfish	*Ictalurus punctatus*	0.36													0.36	0.7
Largemouth bass	*Micropterus salmoides*										0.11	0.09			0.20	0.4
Sunfish sp.	*Lepomis* spp.											0.14			0.14	0.3
White perch	*Morone americana*	0.10													0.10	0.2
Unknown Centrarchids	Family Centrarchidae												0.06		0.06	0.1
Brook silverside	*Labidesthes sicculus*											0.06			0.06	0.1
Total		**1.4**	**2.0**	**0.1**	**4.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.6**	**15.4**	**3.1**	**27.9**	**54.7**	**100.0**

(a) Calculations based upon entrainment rates measured from July 2008 through July 2009 at the Fermi 2 intake (AECOM 2009a) and a projected maximum withdrawal capacity of 32,264 gpm for Fermi 3.

(b) Entrainment sampling was not conducted during December, January, and February. Estimates are based on samples collected during November and March. The numbers of eggs and larvae are expected to be low during these months because it is outside the normal spawning period for most Lake Erie fish species (AECOM 2009a).

Table 5-7. Reported Fecundity of Fish Species Identified during the 2008–2009 Entrainment Study

Common Name	Estimated Annual Entrainment[a]	Reported Fecundity (eggs per female)	Source
Gizzard shad	25,106,522	22,000–544,000	Bodola (1965)
Emerald shiner	9,461,244	868–8733	Texas State University (2010)
Bluntnose minnow	5,306,690	1112–4195	Gale (1983)
Yellow perch	4,720,370	12,641–135,848	Sztramko and Teleki (1977)
Freshwater drum	1,909,922	127,000	Bur (1984)
Round goby	1,546,530	84–606	MacInnis and Corkum (2000)
Bigmouth buffalo	1,579,402	Up to 400,000	ODNR (2007)
Channel catfish	357,910	4000–100,000	Bolsenga and Herdendorf (1993)
Largemouth bass	198,706	5000–43,000[b]	MDNR (2004)
White perch	102,260	64,480–388,736	Bur (1986)
Brook silverside	57,862	73–785	Eakins (2010)

(a) Estimated entrainment based on measured impingement rates from August 2008 through July 2009 at the Fermi 2 intake and a projected maximum withdrawal capacity of 32,264 gpm for Fermi 3 (AECOM 2009a).
(b) Based on the numbers of eggs per nest (MDNR 2004).

forage species (e.g., gizzard shad, emerald shiner, bluntnose minnow, brook silverside [*Labidesthes sicculus*]).

Based on the planned low through-screen intake velocity, the use of closed-cycle cooling, the location and design of the intake bay, and the historic low impingement rates during operations of the existing Fermi 2, the review team concludes that impacts on fish populations from impingement during Fermi 3 operations would be minor. Removing impinged biota from the screens and operating the fish return system would further reduce this impingement impact. Based on the small proportion of water that would be withdrawn from Lake Erie relative to the volume of water in the western basin, the use of closed-cycle cooling to reduce water withdrawals, the location of the intake bay away from sensitive or productive habitats, the historic entrainment rates for Fermi 2, and the relatively high fecundities exhibited by the species that experience the highest entrainment rates, the review team concludes that impacts on fish populations from entrainment for Fermi 3 would also be minor. The EPA 316(b) Phase I regulations established location- and capacity-based limits on proportional intake flow. The regulation states that "for lakes or reservoirs, intake flow may not disrupt natural thermal stratification or turnover patterns (where present) of the source water body." Because of the large quantity of water in the western basin of Lake Erie and the relatively small hydraulic zone of influence of the intake withdrawal, the review team has determined that the operation of Fermi 3 would have no detectable effect on thermal stratification in Lake Erie.

Cooling Water Discharge System

Cooling tower blowdown from Fermi 3 would be discharged directly into Lake Erie via a three-port diffuser system located approximately 1300 ft from shore. The preliminary design of the diffuser assumes that the ports would be elevated 1.6 ft above the lake bed and angled at 20 degrees above the horizontal pointing to the east away from shore. Sections 3.2.2.2 and 5.2.3.1 discuss the location, design, and operation parameters for the discharge structure. This section evaluates potential thermal, chemical, and physical impacts on the Lake Erie aquatic ecosystem from the operation of the cooling water discharge system.

Thermal Impacts. Potential thermal impacts on aquatic organisms could include heat stress, cold shock, and the creation of favorable conditions for invasive species.

Heat Stress. Thermal conditions influence the health of aquatic ecosystems by influencing water chemistry (e.g., dissolved oxygen levels) and an array of ecological processes such as feeding rate, metabolic rate, growth, reproduction, development, distribution, and survival. Aquatic biota are often able to persist (e.g., grow, reproduce, and survive) under a range of thermal conditions. While many species have similar temperature tolerances, optimal growth and survival are linked to optimal thermal conditions that are driven by species-specific requirements (Kellogg and Gift 1983).

Operational Impacts at the Proposed Site

The thermal tolerance for aquatic organisms is defined in different ways. Some definitions relate to the temperature that causes fish to avoid the thermal plume; other definitions relate to the temperature that fish prefer for spawning; and others relate to the temperatures (upper and lower) that may cause mortality. Spatially, thermal pollution may exist at the local site level, or it may include larger extents (i.e., lake or watershed). Temporally, conditions resulting in water temperatures that exceed ambient levels may be more pronounced during certain time periods (i.e., winter). Finally, the consequences of thermal pollution within aquatic ecosystems may be confined to individual species and, depending on ecosystem conditions, may include a population-level response (Coutant 1976).

Section 5.2.3.1 describes the estimated cooling water discharge rates and temperatures that would occur as a result of the operation of Fermi 3 and evaluates the characteristics of the thermal plume that would result, including the likely increases in ambient water temperature and the dimensions of the thermal plume. As described in Section 5.2.3.1, MDEQ would specify allowable characteristics of the thermal plume through the NPDES permitting process. Thermal plume simulation modeling was conducted by Detroit Edison (2011a) and independently confirmed by the review team. Based on the expected volumes and water temperatures of cooling water blowdown discharged from Fermi 3, the estimated maximum extent of the thermal plume (i.e., where ambient water temperatures would be increased by 3°F or more) would encompass an area of no more than approximately 55,300 ft^2 (1.3 ac) during any period of the year (Detroit Edison 2011a). It was also estimated that the portion of the plume that would be equal to or exceed the temperature standard established by MDEQ for Lake Erie for each month would encompass an area of 188 ft^2 or less during any period of the year (Detroit Edison 2011a). MDEQ would define the allowable area and characteristics of the thermal plume mixing zone in the NPDES permit based, in part, on the areas where temperatures would be elevated. Based on these results, it is concluded that the area of the thermal plume would be small relative to the large extent of similar open water habitat in the immediate area. Because of the small area affected by the thermal plume, it is unlikely that fish migration or spawning efforts would be significantly hindered; however, some fish species may avoid the area altogether in the summer when maximum lake temperatures are reached. During winter months, the thermal plume may act as an aggregation point for some species that prefer warmer water temperatures (e.g., gizzard shad).

The largest increases in ambient water temperatures would occur during wintertime when ambient lake water temperatures decline. Maximum absolute lake water temperatures would occur in summer months and could result in water temperatures approaching the reported critical thermal maximum for some cool or coldwater fish species in the immediate vicinity of the discharge diffusers. Ambient water temperatures during summer months have been documented to exceed 76°F (Detroit Edison 2011a). However, even during such periods, it is estimated that the area that would exceed ambient temperatures by 3°F or more would be 188 ft^2 or less based on modeling for the thermal plume (Detroit Edison 2011a), and most fish species would be capable of detecting and avoiding the affected area; consequently, it is concluded that impacts on populations of aquatic organisms would be minor.

Based on the foregoing evaluation, the review team concludes that the impacts of heat stress on Lake Erie fish populations from the discharge of cooling water blowdown from Fermi 3 would be minor and additional mitigation, aside from compliance with conditions established in NPDES permits developed by MDEQ, would not be warranted.

Cold Shock. Another factor related to thermal discharges that may affect aquatic biota is cold shock. Cold shock occurs when aquatic organisms that have been acclimated to warm water, such as fish in a power plant's thermal plume, are exposed to a sudden temperature decrease that exceeds their ability to acclimate and results in mortality. This sometimes occurs when power plants shut down suddenly in winter. As described above, some species with particular temperature preferences (e.g., gizzard shad) would be likely to aggregate in the areas of warmer water near the Fermi 3 discharge in Lake Erie. Overall, it is anticipated that cold shock mortality would be rare because sudden power plant shutdowns are infrequent, and because the thermal plume would encompass a relatively small area, the numbers of individual fish that could be affected by such events would not significantly affect populations of fish species in Lake Erie. In the NPDES permit for Fermi 3 (or a combined NPDES permit for the Fermi site), MDEQ could require gradual reduction of effluent discharge to Lake Erie during winter months to reduce the potential for fish mortality due to cold shock. The existing NPDES permit for the Fermi site requires that cessation of cooling water inputs to Lake Erie occur gradually during the winter months in order to avoid fish mortality from cold shock, and Detroit Edison reported that there have been no observations of fish kills during wintertime shutdowns for Fermi 2. Based on the foregoing, the review team recommends that if a shutdown of Fermi 3 were planned during the winter months, the discharge of cooling water should be gradually reduced as mitigation. Assuming the implementation of this mitigation measure, the review team concludes that the thermal impacts on fish populations due to cold shock would be minor

Chemical Impacts. Section 5.2.3.1 describes the chemical additions that would be made to the cooling system water both prior to and after use for cooling. Sodium hypochlorite would be added to the intake water as a biocide/algaecide to control the proliferation of organisms in the cooling system, including zebra and quagga mussels. Additional treatment, including chlorination or thermal shock, could be used to control invasive mussels if deemed necessary. Additional chemicals would be used to control corrosion and scale deposits, and to disperse sediment (if needed). Chlorine would be removed from cooling water (i.e., dehalogenated) with sodium bisulfate before the water is discharged into Lake Erie. The use of sodium bisulfate for dehalogenation avoids the use of phosphorus-containing compounds (e.g., phosphoric acid) that could contribute to nutrient enrichment and development of algal blooms in Lake Erie (Detroit Edison 2011a).

Operational Impacts at the Proposed Site

The concentrations of chemicals in the effluent from Fermi 2 are regulated by an existing NPDES permit from MDEQ. The chemical concentrations at the thermal discharge outfall for Fermi 2 have consistently complied with the permitted NPDES limits, and no impacts on the aquatic ecology of Lake Erie from Fermi 2 discharges have been reported. Effluent limits identified in the NPDES permit for Fermi 3 will be developed in accordance with EPA ambient water quality criteria. Ambient water quality criteria were developed on the basis of numerous toxicity studies to aid in determining appropriate limit levels to prevent facility effluents from harming natural resources, including aquatic biota. The levels identified in the existing NPDES permit for Fermi 2 are set well below documented lethal levels for indicator organisms to ensure protection of organisms in the receiving water body (Detroit Edison 2011a).

The chemical concentrations in Fermi 3 discharges (1) would be expected to be relatively low, (2) would be similar to those in Fermi 2 discharges, and (3) would be established and controlled through the NPDES permitting process. In addition, Detroit Edison has stated that it would not use phosphorus-containing corrosion and scale inhibitors for Fermi 3, replacing them with two non-phosphorus-containing water treatment chemicals (Detroit Edison 2010c). On this basis, the review team concludes in Section 5.2.3.1 that the impacts of Fermi 3 discharges on water quality would be SMALL. Similarly, it is concluded that the impacts on aquatic biota from the chemical concentrations in the proposed Fermi 3 discharge would be minor, and no additional mitigation is warranted.

Physical Impacts. Physical impacts associated with discharge from the Fermi 3 site could include shoreline erosion, effects on lake stratification, and bottom scour in the location of the diffuser, which could result in increased turbidity and siltation.

There is likely no potential for benthic scouring in the immediate vicinity of the discharge outfall. Proposed design features such as the presence of riprap around the submerged discharge port and orientation of the discharge ports in an upward direction are intended to reduce scouring (Detroit Edison 2011a). Given the small areal extent of the thermal plume from operation of Fermi 3, effects on existing stratification patterns in Lake Erie in the vicinity of the Fermi site would be negligible. Consequently, physical changes in aquatic habitat and impacts on aquatic organisms from scouring and thermal stratification would be minor. Because the discharge ports would be located at least 1300 ft from the shoreline and would direct water upward, shoreline erosion is not expected to result from the discharge of cooling water.

Based on the analysis of the potential for physical impacts on the aquatic ecosystem from the discharge of cooling water to Lake Erie, the review team concludes that the physical impacts from cooling water discharges from Fermi 3 would be minor, and no further mitigation would be warranted.

Maintenance Dredging

It is anticipated that maintenance dredging activities and the volume of dredged sediments at the Fermi site would remain similar after Fermi 3 operations commence because the intake areas for Fermi 2 and Fermi 3 would be colocated within the intake bay. Under existing operations at the Fermi site, the intake bay is dredged approximately every 4 years to maintain appropriate operating conditions. Such dredging, which is currently authorized under permits from the USACE and MDEQ, results in the mortality of benthic invertebrates and other organisms associated with the accumulated sediments that are removed and a temporary localized increase in turbidity in the vicinity of the intake bay. Dredged material is expected to be disposed of in the Spoil Disposal Pond, where sediment would be allowed to settle out prior to discharge of the water back into Lake Erie as allowed and managed under existing NPDES permit regulations. The periodic dredging of the intake bay would result in minor impacts on aquatic biota and habitats in Lake Erie, and no mitigation measures beyond those identified in the appropriate permits would be warranted.

Stormwater Drainage

During the period of operation, onsite streams and wetlands could be affected by stormwater drainage. Stormwater from the finished grade at Fermi 3 would be directed to a sump that would discharge to the north canal via an outlet pipe. The north canal would discharge to the North Lagoon, which is hydrologically connected to Swan Creek, and eventually to Lake Erie. Stormwater may also run off directly either to the North Lagoon or to the South Lagoon. The South Lagoon is hydrologically connected to Lake Erie. Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff and sediment loading to Lake Erie (Detroit Edison 2011a).

On the basis of the planned implementation of a SWPPP similar to that currently in place for Fermi 2, the review team concludes that impacts on aquatic resources from stormwater drainage to Lake Erie due to the operation of Fermi 3 would be minor.

North and South Canals and Swan Creek

During Fermi 3 operations, aquatic habitats in Swan Creek could be affected by stormwater drainage. Stormwater from the finished grade at Fermi 3 would be directed to a sump that would discharge to the north canal via an outlet pipe. The north canal discharges to Swan Creek via the North Lagoon; water draining into Swan Creek eventually reaches Lake Erie. Uncontrolled stormwater runoff may also travel directly either to the North Lagoon or to the South Lagoon. Water entering the south canal would be discharged to the South Lagoon and eventually would discharge to Lake Erie through an outfall near the southern boundary of the Fermi site. Historically, stormwater runoff to these areas has been managed and controlled through Detroit Edison's existing SWPPP, and diverse aquatic communities have been maintained in these areas.

On the basis of the planned implementation of a SWPPP similar to that currently in place for Fermi 2, the review team concludes that impacts on aquatic resources in Swan Creek and the north and south canals from stormwater runoff due to the operation of Fermi 3 would be minor and no mitigation measures beyond those identified in the SWPPP and in applicable NPDES permits would be warranted.

Quarry Lakes

There are no plans to withdraw water from the Quarry Lakes as part of Fermi 3 operations. Stormwater runoff from areas surrounding the Quarry Lakes will continue to drain into the Quarry Lakes via NPDES-permitted outfalls (Outfall 004, Outfall 005, and Outfall 007, as shown in Figure 2-6). This would include runoff originating from buildings and landscaping associated with the proposed multiple-level parking garage, Fermi 3 simulator facility, and the joint Fermi 2/Fermi 3 administration building, as shown in Figure 3-1. On the basis of the planned implementation of a SWPPP for the Fermi site similar to that currently in place, the review team concludes that impacts on aquatic resources from permitted stormwater runoff drainage to the Quarry Lakes would be minor, and no additional mitigation beyond that required in the associated NPDES permits would be warranted.

Stony Creek

The Stony Creek watershed is entirely outside the Fermi site. There are no plans to discharge stormwater runoff from Fermi 3 facilities into the Stony Creek watershed, and no water withdrawals or releases associated with operation of Fermi 3 would affect water quantity or water quality in Stony Creek. Consequently, there would be no operation-related impacts on aquatic resources within Stony Creek, and no mitigation would be warranted.

5.3.2.2 Aquatic Resources – Transmission Lines

Transmission lines from Fermi 3 would be owned by Detroit Edison up to the point of their interconnection with the proposed Fermi 3 switchyard. Outward from interconnection with the Fermi 3 switchyard, ITC*Transmission* would own the lines and other transmission system equipment. Although Detroit Edison will maintain ownership and control of the land in the new onsite transmission corridor, Detroit Edison expects to contract with ITC*Transmission* to maintain the transmission towers and lines located on Detroit Edison property (Detroit Edison 2011a). Accordingly, the impacts from operation and maintenance of transmission lines discussed in this EIS are based on publicly available information and reasonable expectations of the configurations and practices that ITC*Transmission* would likely follow based on standard industry practice. The operation and maintenance of electricity transmission systems have the potential to affect aquatic ecological resources primarily through corridor maintenance activities, such as vegetation management, which would affect shorelines or could introduce sediment from erosion or contaminants from vehicles or herbicide treatments into waterways. As identified in Section 4.3.2.2, the identified transmission line route crosses about 30 wetlands or other waters that may be regulated by MDEQ and/or USACE. The 18.6-mi existing eastern section of the transmission line route crosses 12 narrow agricultural drains and small streams, and the currently undeveloped 10.8-mi western section of the route crosses nine agricultural drains and small streams.

Maintenance activities along the proposed 345-kV transmission line corridor could lead to periodic temporary impacts on waterways crossed by the transmission lines. However, BMPs currently employed by ITC*Transmission* for the existing Fermi 2 facility transmission line corridors would likely be applied to the proposed transmission line corridor to limit the potential for impacts (Detroit Edison 2011a). As described in Section 5.3.1.3 for wetlands and floodplains, it is anticipated that vegetation clearing in proximity to waterways would be limited to the minimum needed to allow access by maintenance vehicles and to keep the transmission lines free from intrusion of trees that could interfere with safe, reliable operation. To the extent practicable, existing access roads are expected to be used for ROW maintenance in the portion of the proposed corridor that already has existing transmission facilities and existing roads, and new access roads would be used for the currently undeveloped 10.4-mi segment of the proposed transmission line corridors. However, as described in Section 5.3.1.2, there would be occasional vehicular traffic in the corridor for maintenance purposes, which could result in minor amounts of soil erosion within the immediate area of the transmission line corridor.

ITC*Transmission* is a member of the EPA's voluntary Pesticide Environmental Stewardship Program (PESP). PESP members adopt risk reduction strategies and undertake specific steps toward reaching their goals of pesticide practices that reduce risks to humans and the environment (Detroit Edison 2011a). As described for wetlands and floodplains in Section 5.3.1.3, it is anticipated that the application of pesticides and herbicides in riparian areas near waterways would be minimized to the greatest extent possible to protect ecological resources (Detroit Edison 2011a).

Because of the periodic nature and typically small areas being maintained at any one time, the limited number of aquatic habitats that would be crossed by the proposed transmission corridor for Fermi 3, and the anticipated implementation of maintenance protocols similar to those in effect for the existing Fermi 2 transmission line corridor (Detroit Edison 2011a), the effects of ROW area maintenance on aquatic resources are expected to be minor during operation of Fermi 3, and additional mitigation beyond that described above would not be warranted.

5.3.2.3 Important Aquatic Species and Habitats

This section describes the potential impacts of the operation of Fermi 3 and associated 345-kV transmission lines on important aquatic species and habitats, including any species that have been listed or proposed for listing under the ESA, species that are listed by the State, and commercially and recreationally important species. The general biology, status, and habitat requirements of important aquatic species, along with the potential for species to occur in the vicinity of the Fermi site are presented in Section 2.4.2. Potential impacts on important aquatic species from operation of Fermi 3 would primarily be associated with intake and consumption of water for cooling, discharge of cooling water, maintenance dredging, discharge of wastewater, and stormwater runoff. Transmission line impacts would primarily be associated with erosional effects from use of vehicles and other equipment and physical and chemical vegetation management activities that occur in the vicinity of aquatic habitats.

Operations of Fermi 3 have a potential to affect populations of important aquatic species due to impingement and entrainment mortality, as well as effect changes in water quality (including water temperatures) associated with the cooling water intake and discharge systems. The magnitude of impacts from operations of Fermi 3 would depend on the susceptibility of a species to impingement and entrainment at the intake structure, sensitivity of a species to water quality changes (including temperature changes) associated with the cooling water discharge structure and stormwater runoff, species-specific habitat requirements, critical time periods in a species' life cycle, and the intensity and duration of the disturbance.

Commercially and Recreationally Important Species

Commercially and recreationally important species that could occur in the vicinity of the Fermi site are identified in Section 2.4.2.3, along with information about their habitat requirements and life histories. In addition to the waters of Lake Erie, commercially and recreationally important species may also use nearshore ponds, marshes, and streams as spawning, nursery, or adult habitat. Consequently, the analysis of potential effects considered those species that could be present in aquatic habitats that could be reasonably affected by Fermi 3 operations including Lake Erie, the north and south canals, North and South Lagoons, Swan Creek, and streams that would be crossed by the proposed transmission line route. As identified in Section 5.3.2.1, impacts from Fermi 3 operations on aquatic resources present in the Quarry Lakes or other onsite aquatic habitats or on aquatic resources in Stony Creek are expected to be SMALL.

Eight fish species that are considered commercially or recreationally important in Lake Erie (bigmouth buffalo, channel catfish, freshwater drum, gizzard shad, largemouth bass, smallmouth bass, white perch, and yellow perch) were entrained or impinged during studies conducted at the Fermi 2 intake in 2008 and 2009 (Tables 5-5 and 5-6). Based on those studies, it is estimated that 24 to 1247 individuals of seven of these species (gizzard shad, white perch, bluegill, smallmouth bass, largemouth bass, channel catfish, and freshwater drum) would be impinged (Table 5-5) and approximately 100,000 to 25 million eggs and larvae of these species (Table 5-6) would be entrained annually at the cooling water intake for Fermi 3 with the intake pumps at full capacity. Considering the large numbers of these species that are commercially and recreationally harvested each year in Michigan waters of the western basin of Lake Erie, impingement mortality at the estimated levels would represent a negligible impact on populations of these species. The commercially and recreationally important species observed during entrainment studies are species that exhibit high fecundity and produce large numbers of eggs and larvae (Table 5-7), and the gizzard shad is a common forage species in the western basin of Lake Erie. Based on the low proportion of water that would be withdrawn from Lake Erie relative to the volume of water in the western basin, the use of closed-cycle cooling to minimize water withdrawals, the location of the intake bay away from any known sensitive spawning or nursery habitats, the historic impingement and entrainment rates for the existing Fermi 2, and the relatively high fecundities exhibited by the commercially and recreationally important species that are likely to be impinged or entrained, the review team concludes that impacts on commercially and recreationally important fish populations from impingement and entrainment during Fermi 3 operations would be minor.

During operation of Fermi 3, aquatic habitat in Lake Erie near the discharge would be affected by altered water quality, especially increased water temperature, in the vicinity of the cooling water discharge. As described in Section 5.3.2.1, the thermal and chemical impacts on aquatic habitats and biota from cooling water discharge due to Fermi 3 operations would be SMALL, because the thermal impacts would be confined to a small mixing zone area (1.3 ac or less) where water temperatures would exceed ambient temperatures, and because MDEQ would regulate the allowable thermal and chemical characteristics of the discharged waters through the NPDES permitting process. Scouring or other physical impacts due to cooling water discharge would also be limited (see Section 5.3.2.1). For these reasons, the review team concludes that impacts on commercially and recreationally important fish populations from the discharge of cooling water by Fermi 3 would be negligible.

As identified in Section 5.3.2.1, periodic maintenance dredging of the intake bay and permitted discharges of effluent and stormwater at the Fermi site could temporarily alter water quality in the vicinity of the intake bay. These are areas that have been periodically dredged as part of the maintenance activities at the Fermi site. Although the presence of some commercially and recreationally important fish species has been documented within the intake bay and in the area that would be affected during periodic maintenance dredging for the Fermi site (AECOM 2009a), it is anticipated that most individuals of commercially and recreationally important species would temporarily move away during dredging activities because of noise and increased turbidity. While this would result in temporary short-term displacement of individuals, it is anticipated that population-level impacts on commercially and recreational fish species would be negligible.

Stormwater from the finished grade at Fermi 3 would be directed to a sump that would discharge to the north overflow canal via an outlet pipe. The overflow canal would discharge to the North Lagoon, which discharges to Swan Creek and eventually to Lake Erie. Stormwater may also travel directly either to the North Lagoon or to the South Lagoon. The South Lagoon also discharges to Lake Erie. Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff to the receiving water bodies to ensure that any increase in sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts (Detroit Edison 2011a). On the basis of the planned implementation of a SWPPP similar to that currently in place for Fermi 2, the review team concludes that impacts from Fermi 3 operations on commercially and recreationally important aquatic species due to stormwater runoff would be SMALL and that no additional mitigation would be warranted.

As described in Section 2.4.2.2, there are no important commercial or recreational fisheries present within the assumed transmission line route because of the small sizes of the drainages crossed by the transmission line corridor. However, some of the streams to be crossed by the proposed transmission lines support some commercially or recreationally important species. Maintenance of transmission lines could periodically and temporarily affect individuals in the vicinity of stream crossings because of erosion of soils and deposition of sediment via runoff, potential pollutant discharge from maintenance equipment, and temporary disturbance and/or displacement of aquatic biota. As described in Section 5.3.2.2, it is anticipated that the proposed transmission line corridor would be operated and maintained by ITC*Transmission* in the same fashion as the existing transmission line corridor for Fermi 2 (Detroit Edison 2011a). Vegetation clearing is expected to be limited to the minimum needed to allow access by maintenance vehicles and to keep the transmission lines free from intrusion of trees that could interfere with safe, reliable operation (Detroit Edison 2011a), thereby reducing the potential for impacts on commercially or recreationally important species resulting from erosion, sedimentation, and disturbance.

As described in Section 5.3.2, pesticides and herbicides are expected to be used selectively, in accordance with specified labeling, and only where needed, thus minimizing the potential for significant impact on aquatic resources. Because of the periodic nature and typically small areas being maintained at any one time and the limited number of aquatic habitats that would be crossed by the proposed transmission line corridor for Fermi 3, the effects of ROW maintenance on commercially and recreationally important aquatic resources are expected to be SMALL during operation of Fermi 3.

On the basis of an evaluation of information presented in the ER and other existing information, the review team concludes that impacts on commercially and recreationally important species due to the operation of Fermi 3 and the associated transmission line corridors would be minor, and no additional mitigation would be warranted. Implementation of BMPs and other mitigation measures stipulated in required permits would further reduce impacts.

Federally and State-Listed Aquatic Species

This section evaluates the potential for Federally and State-listed aquatic species to be affected by operation of Fermi 3. Federally and State-listed species that could occur in the counties (Monroe, Wayne, and Washtenaw Counties) within which activities related to operation of Fermi 3 would occur were identified in Section 2.4.2.3, along with information about their habitat requirements and life histories. As part of the NRC's responsibilities under Section 7 of the ESA, the review team will prepare a BA that evaluates potential impacts of preconstruction, construction, and operations on Federally listed threatened or endangered aquatic and terrestrial species.

Based on habitat requirements, current distributions, and survey data, aquatic species with a potential to occur in the vicinity of the Fermi site or the proposed transmission line route were identified in Section 2.4.2.3 (see Table 2-15). One species of freshwater mussels that is Federally listed as endangered (northern riffleshell [*Epioblasma torulosarangiana*] and two species of freshwater mussels that are proposed for Federal listing as endangered (rayed bean [*Villosa fabilis*] and snuffbox mussel [*E. triquetra*]) were identified as having the potential to occur in Monroe, Washtenaw, or Wayne Counties, Michigan. No Federally listed aquatic species or species proposed for listing were identified for Washtenaw County, Michigan, which include the proposed transmission line route (Table 2-15). None of these species have ever been documented either on the Fermi site or along the proposed transmission line route, and only the rayed bean and the snuffbox mussel have a potential to occur on the Fermi site based on information about the current status of populations, records of occurrence, and habitat preferences (Section 2.4.2.3). The northern riffleshell is considered unlikely to occur on or adjacent to the Fermi site because of the lack of suitable stream habitat; it is unknown whether there could be suitable habitat for the northern riffleshell in portions of streams that would be crossed by the proposed transmission line route within Monroe or Wayne Counties, although the species has not been reported from the streams that would be crossed.

Including the Federally listed and proposed species identified above, which are all listed as endangered by the State of Michigan, State-listed species that have been observed or that have a potential to occur on or adjacent to the Fermi site include three mussel species (rayed bean, salamander mussel [*Simpsonaias ambiqua*], and snuffbox mussel) and three fish species (pugnose minnow [*Opsopoeodus emiliae*], sauger [*Sander canadensis*], and silver chub [*Macrhybopsis storeriana*]) (Section 2.4.2.3; Table 2-15). Of these species, only the silver chub is known to occur at the Fermi site (Table 2-15).

The only known existing population of the white catspaw (*Epioblasma obliquata perobliqua*), a freshwater mussel that is Federally and State-listed as endangered, occurs in one stream drainage in Ohio and is considered extirpated from Michigan. As a consequence, it is believed that this species would not be present near the Fermi site or in streams that would be crossed by the proposed transmission line corridor and that it would not be affected by construction activities for Fermi 3.

There are other State-listed mussel and fish species (as shown in Table 2-15) that are considered unlikely to occur at the Fermi site but have a potential to occur in streams that would be crossed by the proposed transmission line corridor in Monroe, Wayne, or Washtenaw Counties. Currently there is insufficient information to determine whether any of those species are present in the streams that would be crossed.

Maintenance of transmission lines could affect listed organisms in the vicinity of stream crossings because of erosion of soils and deposition of sediment via runoff, potential for pollutant discharge from maintenance equipment and vehicles, and temporary disturbance and/or displacement of individuals. As described in Section 5.3.2.2, it is assumed that BMPs employed by ITC*Transmission* for the existing Fermi 2 facility transmission line corridors would also be applied to the proposed transmission line corridor (Detroit Edison 2011a) to limit the potential for impacts on aquatic species, including listed species. ITC*Transmission* maintains a database of known occurrences of threatened and endangered species obtained from the MNFI to identify locations where seasonal constraints or other regulatory conditions need to be considered for vegetation management activities in habitats occupied by rare species (Detroit Edison 2010b). Because of the periodic nature of maintenance, the typically small areas being maintained at any one time, and the limited number of aquatic habitats that would be crossed by the proposed transmission line corridor for Fermi 3, the effects of ROW area maintenance on Federally and State-listed species are expected to be small during operation of Fermi 3.

Potential impacts on Federally and State-listed species that were deemed to have a potential to occur in the waters on or in the immediate vicinity of the Fermi site or in streams that would be crossed by the proposed transmission line corridor are evaluated in more detail in the following subsections.

<u>Northern Riffleshell (*Epioblasma torulosa rangiana*)</u>

The northern riffleshell is Federally listed as endangered and is also listed as endangered by the State of Michigan. Because there is no suitable habitat for the northern riffleshell on the Fermi site or in adjacent waters of Lake Erie (Section 2.4.2.3), operation of Fermi 3 would have no impact on this species. Although suitable habitat for the northern riffleshell could be present in some of the streams that would be crossed by the proposed transmission line corridor, it is not expected to occur along the transmission line route because extant populations of this species in Michigan are known to be present only in the Black River in Sanilac County and the Detroit River in Wayne County (Carman and Goforth 2000). Even if the northern riffleshell is present in streams crossed by the transmission line corridors, impacts on it from maintenance of transmission lines are unlikely, provided that BMPs identified in permits for the transmission lines are implemented. Additional regulatory review and permitting of proposed plans for maintenance of the transmission lines (e.g., for annual vegetation management plans) would be required prior to implementation (Detroit Edison 2011a). On the basis of this information, the review team concludes that operation of Fermi 3 would have no effect on the northern riffleshell.

<u>Pugnose Minnow (*Opsopoeodus emiliae*)</u>

The pugnose minnow is listed as endangered by the State of Michigan and has the potential to occur in streams in Monroe and Wayne Counties. Although there is a potential for suitable habitat for the pugnose minnow to be present in the vicinity of the Fermi site, especially in weedy aquatic habitats such as those present in the North Lagoon or Swan Creek, no individuals were collected during recent surveys on the Fermi site and none were reported in past biological surveys of Stony Creek or the Swan Creek estuary near the Fermi site (AECOM 2009a; MDEQ 1996, 1998; Francis and Boase 2007). If individuals are occasionally present in the North Lagoon or near the mouth of Swan Creek, there is a potential for adverse effects due to water quality changes and increased turbidity from stormwater runoff during operation of Fermi 3. Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff to ensure that any increase in sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts (Detroit Edison 2011a). No suitable habitat is present for the pugnose minnow in the vicinity of the intake bay or the location of the outlet for the proposed cooling water discharge. Consequently, impacts from impingement, entrainment, thermal effects, or water quality changes associated with those structures are unlikely. On the basis of the planned implementation of a SWPPP similar to that currently in place for Fermi 2, the review team concludes that impacts from Fermi 3 operations on the pugnose minnow would be minor, and no additional mitigation would be required.

<u>Rayed Bean (*Villosa fabalis*)</u>

The rayed bean is proposed for Federal listing as endangered and is listed as endangered by the State of Michigan. If present, threats to the survival of the rayed bean include siltation, dredging, and channelization of inhabited areas and the introduction of exotic species, such as Asian clams (*Corbicula fluminea*), quagga mussels (*Dreissena rostriformi*), and zebra mussels (*Driessena polymorpha*) (FWS 2002). As identified in Section 2.4.2.3, there are no streams on the Fermi site with conditions suitable for the rayed bean; no extant populations are known to occur in the stream drainages that would be crossed by the proposed transmission line route; and it is believed that the species is unlikely to be present in Lake Erie near the Fermi site. Because the intake bay would be periodically dredged, it is unlikely that the substrate would be suitable for the rayed bean to become established in this area.

As eggs, native unionid mussels are not likely to be affected by entrainment through the cooling water intake because they are not free-floating, but rather develop into larvae within the female. The glochidial stage, during which juvenile mussels attach to a suitable fish host, may be indirectly vulnerable through impingement and entrainment of host species. Post-glochidial and adult stages are not likely to be susceptible to entrainment because they bury themselves in sediment. As identified in Section 2.4.2.3, fish hosts for the glochidia of the rayed bean could include the Tippecanoe darter (*Etheostoma tippecanoe*), greenside darter (*Etheostoma blennioides*), rainbow darter (*Etheostoma caeruleum*), mottled sculpin (*Cottus bairdi*), and largemouth bass (*Micropterus salmoides*). Of these potential host species, only the largemouth bass was observed in fish collections in Lake Erie near the intake structure or near the discharge from the South Lagoon, and based on impingement studies conducted at the existing Fermi 2 intake in 2008 and 2009, it is estimated that small numbers of largemouth bass individuals (approximately 30) would be impinged annually with the intake pumps for Fermi 3 at full operating capacity (AECOM 2009a).

It is anticipated that operation of Fermi 3 would not result in water quality unsuitable for the rayed bean if a population were present in Lake Erie near the Fermi site. Thermal effects associated with cooling water discharge during operation of Fermi 3 would be unlikely to affect mussels, because the discharge ports would direct water upward and not toward the lake bottom. In addition, it is anticipated that suitable water quality would be maintained because (1) the NPDES permit for Fermi 3 would specify allowable concentrations of chemicals in the Fermi 3 discharge and would require regular testing to evaluate compliance, and (2) Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff to ensure that sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts (Detroit Edison 2011a).

The operation and maintenance of transmission lines for Fermi 3 are not expected to affect the rayed bean because the species has not been reported from the streams that would be crossed by the proposed transmission line corridor, because structures requiring maintenance (e.g., transmission towers) would not be placed in aquatic habitats that are crossed by the corridor, and because BMPs would be implemented to protect water quality in aquatic habitats during maintenance activities such as vegetation management (Detroit Edison 2011a). On the basis of the above information, the review team concludes that of the operation of Fermi 3 would have no effect on the rayed bean.

Salamander Mussel (*Simpsonaias ambigua*)

The salamander mussel is listed as endangered by the State of Michigan and has the potential to occur in Monroe and Wayne Counties. Although there are no suitable stream habitats for the species on the Fermi site, there is the potential for suitable habitat and the mudpuppy (*Necturus maculosus)* host required by this species to occur in Lake Erie near the Fermi site (see Section 2.4.2.3). Because no suitable habitat for this species (i.e., medium to large rivers or lakes) would be crossed by the proposed transmission line corridor, operation and maintenance of the proposed transmission lines would have a negligible impact on this species.

Salamander mussels are not known from areas on or near the site that would be affected by the cooling water intake or discharge, by periodic maintenance dredging during the operation of Fermi 3, or by stormwater runoff. Identified threats to the survival of the salamander mussel include siltation and runoff from human activities and the introduction of exotic species such as Asian clams, quagga mussels, and zebra mussels (Section 2.4.2.3).

The areas in Lake Erie that would be disturbed by modification and dredging of the intake bay, development of a barge slip within the intake bay, and placement of the discharge structure for the facility either have been previously disturbed by periodic maintenance dredging (Detroit Edison 2011a) or have been identified as containing a clay hardpan substrate (Detroit Edison 2010c) and not the silt and sand substrate preferred by this species. Consequently, there is only a small potential for the species to be present in the area. Because the intake bay would be periodically dredged, it is unlikely that the substrate would be suitable for the salamander mussel to become established in this area.

As eggs, native unionid mussels are not likely to be affected by entrainment through the cooling water intake because they are not free-floating, but rather develop into larvae within the female mussel. The glochidial stage, during which juvenile mussels attach to a suitable host, may be indirectly vulnerable through impingement and entrainment of host species. Post-glochidial and adult stages are not likely to be susceptible to entrainment because they bury themselves in sediment. As identified in Section 2.4.2.3, the identified host for the glochidia of the salamander mussel is the mudpuppy. The mudpuppy was not observed during impingement studies conducted in 2008 and 2009 at the Fermi 2 intake, and it is considered highly unlikely that mudpuppies would occur within the intake bay because of the lack of suitable cover such as submerged rocks or logs.

It is anticipated that operations of Fermi 3 would not result in water quality unsuitable for the salamander mussel if a population was present in Lake Erie near the Fermi site. Thermal effects associated with cooling water discharge during operation of Fermi 3 would be unlikely to affect mussels because the discharge ports would direct water upward and not toward the lake bottom. In addition, it is anticipated that suitable water quality would be maintained because (1) the NPDES permit for Fermi 3 would specify allowable concentrations of chemicals in the Fermi 3 discharge and would require regular testing to evaluate compliance, and (2) Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff to ensure that sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts (Detroit Edison 2011a).

On the basis of the above information, the review team concludes that the impacts of Fermi 3 operations on the salamander mussel would be minor.

Sauger (*Sander canadensis*)

The sauger is considered a species of special concern by the State of Michigan and has the potential to occur in Lake Erie. However, the last reported occurrence of sauger in Monroe County was in 1996, and no individuals were collected during recent surveys on the Fermi site, Stony Creek, or the Swan Creek estuary (AECOM 2009a; MDEQ 1996, 1998; Francis and Boase 2007). If present in nearshore areas of Lake Erie, sauger could be affected by Fermi 3 operations because of impingement or entrainment at the intake structure, by changes in water temperatures associated with the cooling water discharge, by maintenance dredging, or by water quality changes associated with discharges and stormwater runoff from Fermi 3. Because no sauger were observed during impingement and entrainment studies conducted during 1991 and 1992 (Lawler, Matusky, and Skelly Engineers 1993) or during 2008 and 2009 (AECOM 2009a) at the Fermi 2 intake, it is considered unlikely that significant numbers would be affected by the intake of cooling water for operation of Fermi 3. As with most fish, it is anticipated that sauger in the project area would temporarily move away during dredging activities because of increased noise and turbidity levels, resulting in temporary displacement but negligible levels of mortality. As described in Section 5.3.2.1, MDEQ would specify allowable characteristics of the thermal plume and chemical concentrations associated with the cooling water discharge for Fermi 3 through the NPDES permitting process and Detroit Edison would implement a SWPPP to control stormwater runoff, thereby limiting the potential for water quality impacts on the sauger if individuals were to be present in the vicinity of the Fermi site. The small streams that would be crossed by the proposed transmission line corridor do not provide suitable habitat for sauger, and this species would not be affected by operation and maintenance of the transmission lines for Fermi 3. On the basis of this information, the review team concludes that impacts on the sauger from Fermi 3 operations would be minor, and no additional mitigation is warranted.

Silver Chub (*Macrhybopsis storeriana*)

The silver chub is considered a species of special concern by the State of Michigan. A single silver chub specimen was collected in July 2009 during monthly fish surveys conducted near the mouth of Swan Creek from 2008 to 2009 (AECOM 2009a). This species is typically found in deep waters of low-gradient streams and rivers and also in lakes. Little is known about the life history of the silver chub, especially its tolerance of siltation and turbidity (Derosier 2004). While some researchers have suggested that silver chub are intolerant of turbidity and silt, others note that silver chubs are found in silty rivers (Derosier 2004). If present in nearshore areas of Lake Erie, silver chubs could be affected by Fermi 3 operations because of impingement or entrainment at the intake structure, by changes in water temperatures associated with the cooling water discharge, by maintenance dredging, or by water quality changes associated with discharges and stormwater runoff from Fermi 3. Because no silver chubs were observed during impingement and entrainment studies conducted during 1991 and 1992 (Lawler, Matusky, and

Skelly Engineers 1993) or during 2008 and 2009 (AECOM 2009a) at the Fermi 2 intake, it is considered unlikely that significant numbers would be affected by the intake of cooling water for operation of Fermi 3. It is anticipated that silver chub in the project area would temporarily move away during maintenance dredging activities because of increased noise and turbidity levels, resulting in temporary displacement but negligible levels of mortality. As described in Section 5.3.2.1, MDEQ would specify allowable characteristics of the thermal plume and chemical concentrations associated with the cooling water discharge for Fermi 3 through the NPDES permitting process, and Detroit Edison would implement a SWPPP to control stormwater runoff to Swan Creek and Lake Erie, thereby limiting the potential for water quality impacts on silver chub if individuals were present in the vicinity of the Fermi site.

Although suitable habitat for the silver chub could be present in some of the streams that would be crossed by the proposed transmission line corridor, it is currently unknown whether any populations are present. Even if the silver chub is present, impacts on it from the operation and maintenance of transmission lines for Fermi 3 are not anticipated because structures requiring maintenance (e.g., transmission towers) would not be placed in aquatic habitats that are crossed by the corridor and because BMPs would be implemented to protect water quality in aquatic habitats during maintenance activities such as vegetation management (Detroit Edison 2011a). On the basis of the available information, the review team concludes that impacts on the silver chub from Fermi 3 operations would be minor, and no additional mitigation is warranted.

Snuffbox Mussel (*Epioblasma triquetra*)

The snuffbox mussel, a freshwater mussel, that is proposed for Federal listing as endangered and is listed as endangered by the State of Michigan has the potential to occur in Monroe, Wayne, and Washtenaw Counties. Although there are no suitable stream habitats on the Fermi site, there is potential for suitable habitats in Lake Erie, and the host required by this species (logperch, *Percina caprodes*) has been collected from the Fermi site at sampling locations in Swan Creek and in Lake Erie near the South Lagoon (see Section 2.4.2.3). The intake bay would be periodically dredged, and it is unlikely that the substrate would be suitable for the snuffbox mussel to become established in this area.

As eggs, native unionid mussels are not likely to be affected by entrainment through the cooling water intake because they are not free-floating, but rather develop into larvae within the female. The glochidial stage, during which juvenile mussels attach to a suitable fish host, may be indirectly vulnerable through impingement and entrainment of host species. Post-glochidial and adult stages are not likely to be susceptible to entrainment because they bury themselves in sediment. As identified in Section 2.4.2.3, fish hosts for the snuffbox mussel include the logperch, which was observed in fish collections in Lake Erie near the discharge from the South Lagoon and in Swan Creek. Based on impingement studies conducted during 1991 and 1992, Lawler, Matusky, and Skelly Engineers (1993) estimated that approximately 31 logperch were impinged annually by the Fermi 2 cooling water intake. However, impingement studies conducted during 2008 and 2009 at the Fermi 2 intake did not observe impingement of any logperch (AECOM 2009a). Together, these two impingement studies suggest that small numbers of logperch could be impinged by the operation of the cooling water intake for Fermi 3.

It is anticipated that operation of Fermi 3 would not result in water quality unsuitable for the snuffbox mussel if a population were present in Lake Erie near the Fermi site. Thermal effects associated with cooling water discharge during operation of Fermi 3 would be unlikely to affect mussels, because the discharge ports would direct water upward and not toward the lake bottom. In addition, it is anticipated that suitable water quality would be maintained because (1) the NPDES permit for Fermi 3 would specify allowable concentrations of chemicals in the Fermi 3 discharge and would require regular testing to evaluate compliance, and (2) Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff to ensure that sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts (Detroit Edison 2011a).

It is not known whether suitable stream habitats for, or populations of, the snuffbox mussel occur along the proposed transmission line corridor. Even if present, impacts on the snuffbox mussel from the operation and maintenance of transmission lines for Fermi 3 are not anticipated because structures requiring maintenance (e.g., transmission towers) would not be placed in aquatic habitats that are crossed by the corridor, and BMPs would be implemented to protect water quality in aquatic habitats during maintenance activities such as vegetation management (Detroit Edison 2011a). On the basis of the above information, the review team concludes that the operation of Fermi 3 would have no effect on the snuffbox mussel.

Summary of Operational Impacts on Federally and State-Listed Aquatic Species

Based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that impacts of Fermi 3 operation on aquatic threatened and endangered species would be minor. For the one Federally listed species and the two species proposed for Federal listing, the review team determines that there would be no effect from operation of Fermi 3. Impacts on listed aquatic species from degradation of water quality would be limited by the implementation of BMPs that would be identified in the required NPDES discharge permit to be issued by MDEQ and in the SWPPP to be developed by Detroit Edison.

Critical Habitats

There are no areas designated as critical habitat for aquatic species in the vicinity of the Fermi site or along the route of the proposed transmission line.

Invasive Nuisance Organisms

Invasive nuisance organisms that have been found or are presumed to occur in Lake Erie in the vicinity of the Fermi site include lyngbya (*Lyngbya wollei*), fishhook water flea (*Cercopagis pengoi*), spiny water flea (*Bythotrephes longimanus*), quagga mussel, zebra mussel, sea lamprey (*Petromyzon marinus*), and round goby (*Neogobius melanostomus*) (Section 2.4.2.3). None of these species are considered abundant in the vicinity of the Fermi site. While it is not clear that any of these species rely upon thermal refuge to tolerate the ambient wintertime water temperatures in Lake Erie, it is anticipated that the area of the thermal plume from Fermi 3 would not be large enough to provide substantial thermal refuge for invasive nuisance organisms. Detroit Edison reported that there has been no excessive growth of algae observed in the vicinity of the water discharge for Fermi 2.

The review team specifically evaluated the potential for algal blooms caused by species such as *Microcystis* spp., *Anabaena* spp., *Aphanisomenon* spp., and more recently, lyngbya. In addition, there have been extensive growths of *Cladophora* spp., an attached green alga, in the western basin of Lake Erie. The principal contributor to the development of algal blooms has long been attributed to increased nutrient levels (especially phosphorus concentrations) resulting from changes in land use practices, altered hydrology, and food web changes.

Large shoreline mats of lyngbya were first seen in western Lake Erie in Maumee Bay in 2006 (Bridgeman and Penamon 2010). Life history information for lyngbya is provided in Section 2.4.2.3. The review team considered the effects of temperature, nutrients, substrate type, and irradiance on lyngbya blooms and examined the history of algal blooms associated with the discharge for Fermi 2. Overall, it appears that the potential for excessive growth of lyngbya is related to the amount of light penetration into the water column (a function of water turbidity), water depth, nutrient availability, and the type of substrate that is present (Bridgeman and Penamon 2010; LaMP Work Group 2008). Additionally, it is thought that increased water temperatures could exacerbate the potential for algal blooms to occur.

Operation of Fermi 3 is not expected to alter turbidity levels or light penetration in the vicinity of the site compared to existing conditions. Although maintenance dredging activities could result in infrequent, temporary, and localized increases in turbidity, the frequency of dredging and the areas affected by dredging would be the same as for Fermi 2. Therefore, maintenance dredging during Fermi 3 operations would not alter the potential for algal blooms to occur.

As stated above, algal blooms have long thought to be controlled by the concentrations of specific nutrients in Lake Erie. Phosphorus has been identified as a nutrient that can affect the frequency and occurrence of algal blooms. Blooms of lyngbya in Maumee Bay have been primarily attributed to increased nutrient loading due to agricultural runoff and urbanization. The principal limiting nutrient responsible for controlling algal blooms in Lake Erie is phosphorus. The review team examined historic water quality information for Maumee Bay and recent water quality information for Lake Erie near the Fermi site and found that levels of nutrients such as nitrate, orthophosphate, and total phosphorus reported from Maumee Bay (Moorhead et al. 2007) were substantially higher than those reported for the Fermi site (AECOM 2009b). Detroit Edison has stated that it would not use phosphorus-containing corrosion and scale inhibitors for Fermi 3, replacing them with two non-phosphorus-containing water treatment chemicals (Detroit Edison 2010c). Therefore, operation of Fermi 3 is not expected to measurably increase nutrient levels that could affect algal blooms in the vicinity of the site.

The review team concluded that the substrate in the vicinity of the Fermi site is, in general, similar to the substrates upon which lyngbya was found growing in the vicinity of Maumee Bay and other areas of the western basin of Lake Erie (Bridgeman and Penamon (2010). Although the substrate may be suitable, no algal blooms of lyngbya or other species have been reported from the Fermi site. The nearest reported observation of lyngbya in the western basin was near Sterling State Park, approximately 5 mi south-southwest of the Fermi site.

The review team also considered the possibility that thermal discharge from Fermi 3 could affect the frequency of algal blooms, including lyngbya, at the Fermi site. Because Fermi 3 would use a closed cycle cooling system, the amount of heated effluent is significantly reduced compared to a once-through plant, such as the plants located near the mouth of the Maumee River. Additionally, the heated effluent would be discharged offshore through a three-port diffuser with the flow directed upwards toward the surface. Such a system facilitates rapid mixing of the thermal plume and minimizes the effects on the benthic environment. Although heated water could periodically reach the bottom, such occurrences would be infrequent and would not encompass a large area. Therefore, the review team concludes that the heated discharge from Fermi 3 would not significantly increase the potential for development of algal blooms.

In addition, no significant algal blooms have been reported in the vicinity of the discharge from Fermi 2, which has been operating commercially since 1988.

Based on the analysis of the potential for impacts on the aquatic ecosystem of Lake Erie and an independent assessment of the discharge from Fermi 3, the review team concludes that the impacts of the operation of Fermi 3 would not appreciably increase the potential for establishment or survival of nuisance species in Lake Erie.

5.3.2.4 Aquatic Monitoring during Operation

No monitoring of water quality or aquatic ecosystems is imposed by the NRC. However, hydrological, thermal, and chemical monitoring of the proposed new discharge would likely be required by MDEQ as a part of the NPDES permit. Detroit Edison has not identified any plans to conduct formal monitoring of aquatic ecosystems during operations (Detroit Edison 2011a). Ecological monitoring of aquatic resources during operations could be required as a condition of permits issued by various regulatory agencies. For example, MDEQ could request monitoring of specific ecological attributes as part of the NPDES permit (although such monitoring is not required by the existing NPDES permits for Fermi 2) or its permit authorizing dredging. In addition, USACE could, as a condition of a permit authorizing dredging, require a silt containment system during dredging and no excessive turbidity outside the system. Water quality monitoring may be conducted voluntarily by Detroit Edison to ensure permit condition compliance.

5.3.2.5 Potential Mitigation Measures for Operation-Related Aquatic Impacts

The review team recommends that if a shutdown of the proposed Fermi 3 were to be planned during the winter months, the discharge of cooling water should be gradually reduced to prevent cold shock.

5.3.2.6 Summary of Operational Impacts on Aquatic Resources

Based on information provided in the ER (Detroit Edison 2011a), Detroit Edison's responses to requests for additional information, interactions with State and Federal agencies, the public scoping process, and the review team's independent assessment, the review team concludes that impacts from operation of Fermi 3 and associated transmission lines on aquatic resources would be SMALL and additional mitigation measures beyond those identified in Section 5.3.2.5 and any potential permit conditions would not be warranted.

5.4 Socioeconomic Impacts

This section describes the socioeconomic impacts that may occur as a result of the operation of Fermi 3. Detroit Edison plans to begin commercial operation in 2020, and its operating license would extend for 40 years. Detroit Edison estimates the workforce needed to operate Fermi 3 to be 900 full-time and contract employees. Workers would be employed in multiple shifts in order to operate the plant 24 hr per day, all days of the year (Detroit Edison 2011a).

In addition to the full-time and contract workforce of 900, an estimated 1200 to 1500 additional workers would be employed at Fermi 3 during scheduled outages. During these scheduled outages, contract labor would be hired by Detroit Edison to carry out fuel-reloading activities, equipment maintenance, and other projects associated with the outage. These workers would increase the transient population in the local area approximately every 24 months for a period of 30 days (Detroit Edison 2011a). Workers who do not currently reside in the region would be housed in temporary, short-term accommodations for the duration of the scheduled outage.

The review team expects most of the socioeconomic impacts related to demographics, economy and taxes, and infrastructure and community services to occur in the general vicinity of Fermi 3 and in the communities in which the majority of the new workers recruited for operation of Fermi 3 (i.e., in-migrating workers) reside. The review team expects that characteristics of the workers recruited from outside the region with respect to choices and preferences (e.g., commute distance, available amenities, etc.) to be similar to those of the current workforce and that they will reside primarily in Monroe and Wayne Counties, Michigan, and Lucas County, Ohio. More than 87 percent of the current Fermi 2 workforce resides in these three counties. Therefore, the review team expects that most of the operations workforce relocating into the area for employment at Fermi 3 would also reside in these three counties.

As discussed in Chapter 2.5, no more than 3.2 percent of the current Fermi 2 workforce resides in any one county outside Monroe, Wayne, and Lucas Counties. In addition, the current and projected populations of the regional area are so large that the current workforce at the Fermi site represents less than 1 percent of the total population in any of the counties or locations where these employees reside. Therefore, the review team expects that impacts beyond the three counties will be minor. The following discussion focuses on the three-county area.

Section 5.4.1 presents a summary of the physical impacts of the project. Section 5.4.2 provides a description of the demographic impacts. Section 5.4.3 describes the economic impacts, including impacts on the economy and tax revenue, and Section 5.4.4 describes the impacts on the infrastructure and community services. Section 5.4.5 summarizes the socioeconomic impacts.

5.4.1 Physical Impacts

Operation of Fermi 3 will cause physical impacts, including noise, odors, exhausts, thermal emissions, and visual intrusions. The review team believes these impacts would be mitigated but not eliminated through operation of the facility in accordance with all applicable Federal, State, and local environmental regulations and site-specific permit conditions. This section addresses potential physical impacts that may affect people, buildings, and roads.

5.4.1.1 Workers and the Local Public

The Fermi site is located along the relatively straight Lake Erie coastline, which extends from the Fermi site approximately 20 mi southwest toward the Michigan-Ohio border and approximately 10 mi northeast toward the mouth of the Detroit River. To the east of this coastline lie the open waters of Lake Erie. To the west of the site, the land is used predominantly for agriculture. Development within a 10-mi radius of the Fermi site is concentrated in the City of Monroe, which is about 8 mi southeast of the site, and along the Lake Erie shoreline in several beachfront communities. The community nearest to the Fermi site, Stony Point, is located 2 mi south of the site. Residential areas are also located in portions of Berlin Township and Frenchtown Charter Township. Relatively recent housing developments are present just south of Pointe Aux Peaux Road (the Fermi site’s southern boundary).

The nearest designated recreational areas are the beaches at Stony Point (2 mi south of the site) and Estral Beach (2 mi northeast of the site). Nearby State recreational areas include Point Mouille State Game Area (3.1 mi to the northeast) and Sterling State Park (4.8 mi to the south-southwest). Scattered industrial facilities are located west and southwest of the Fermi site along the I-75 corridor and near the City of Monroe. Commercial development is present along major road corridors, including Dixie Highway, Telegraph Road, and I-75, and within the City of Monroe.

All activities related to operation of Fermi 3 would occur within the Fermi site boundary and would be performed in compliance with Occupational Safety and Health Administration (OSHA) standards, BMPs, and other applicable regulatory and permit requirements. While approximately 89,198 people live within 10 mi of the site, physical impacts attenuate rapidly with distance, intervening foliage, and terrain. Therefore, people who would be most exposed to noise, air emissions, and gaseous emissions resulting from operation of Fermi 3 would be the onsite workforce. People working or living immediately adjacent to the Fermi site, transient populations such as people using recreational facilities, or temporary employees of other businesses in the area would be minimally affected because of lack of access to the site and distance from the site, which would limit the effects of operational activities.

Operations workers would receive safety training and would be required to use personal protective equipment to minimize health and safety risks. Emergency first aid care would be available at the site, and regular health and safety monitoring would be conducted. People working onsite or living near the Fermi site would not experience any physical impacts greater than those that would be considered an annoyance or nuisance.

5.4.1.2 Noise

Primary noise sources associated with operation of Fermi 3 would be transformers, the cooling system, and transmission lines (Detroit Edison 2011a). Noise would be buffered by the distance between the plant and residences or recreational areas offsite, such that the ambient sound level should not increase appreciably. The review team expects average day-night noise levels from the Fermi 3 cooling towers will be less than 65 dBA at the nearest noise-sensitive receptor. Noise along the transmission lines would be very low, except possibly directly below the line on a quiet, humid day (Detroit Edison 2011a). Therefore, the review team concludes that physical impacts from noise will be minimal. Projected noise impacts from operation of Fermi 3 are discussed in further detail in Section 5.8.2.

5.4.1.3 Air Quality

Air emissions associated with operation of Fermi 3 would include stationary source emissions from two standby diesel generators (SDGs), two ancillary diesel generators (ADGs), an auxiliary boiler, and two diesel-driven fire pumps (FPs). These emissions sources would be small, would be used infrequently, and would be permitted for use by MDEQ. The cooling tower would emit small amounts of particulate matter, which would be minimized further by drift eliminators. Emissions from worker vehicles, onsite support vehicles and heavy equipment, and vehicles used in delivery of materials and fuels would also occur (Detroit Edison 2011a). However, emissions from these sources would be expected to minimally affect nearby residences and recreational areas offsite. Therefore, the review team concludes that physical impacts on air quality will be minimal. Projected air emissions and impacts on air quality from operation of Fermi 3 are discussed in further detail in Section 5.7.

5.4.1.4 Buildings

Activities associated with operation of Fermi 3 would not affect offsite buildings. Noise levels would not increase appreciably and would not affect building structures offsite. Onsite buildings are designed to withstand any impact from operational activities. Consequently, the review team determines the operations impacts on onsite and offsite buildings would be minimal.

5.4.1.5 Roads

This EIS assesses the impact of workers commuting to and from the Fermi site from three perspectives: socioeconomic impacts resulting from congestion and reductions in levels of service (LOS),[(a)] the air quality impacts resulting from the emissions from vehicles used to transport workers to and from the site, and the potential health impacts caused by additional traffic-related accidents. Only the physical impacts are addressed here. The socioeconomic impacts are addressed here and in Section 5.4.4.1. The air quality impacts from vehicle emissions are addressed in Section 5.7, and human health impacts are addressed in Sections 5.8 and 5.9.

Use of area roadways by commuting workers could contribute to physical deterioration of roadway surfaces. However, some or all of the mitigation measures incorporated during the building phase will remain in place during the operation of the Fermi 3 plant. Given the much smaller volume of traffic on the roads during operations than during building, the review team determines that the overall impacts on road quality would be less than the impacts on road quality from building activities. Therefore, the operations-related impacts on road quality would be minimal.

5.4.1.6 Aesthetics

Fermi 3 would be located within the developed area of the Fermi site, along its eastern boundary by Lake Erie. Surrounding the developed area are 656 ac of wetlands, open water,

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(a) LOS is a designation of operational conditions on a roadway or intersection, ranging from A (best) to F (worst). LOS categories as defined in the *Highway Capacity Manual* are listed on Table 2-40.

and forested land that are included within the DRIWR and that buffer the view of the developed area from public roadways.

The review team expects visual impacts from grade-level operations activities to be limited. Surrounding land use is predominantly agricultural, with a few residential areas that are within the viewshed of the plant site. The area around the Fermi site is a security zone as defined in 33 CFR Part 165. In this security zone, boat traffic or other public use of the waters within a 1-mi circumference of the plant is prohibited. Views of the plant grade-level operational activities from the water would therefore also be limited. Therefore, the review team determines that aesthetics impacts from grade level activities would be minimal.

Two 400-ft-tall natural draft cooling towers are currently the predominant visible structures on the Fermi site, and these are visible from outside the site property boundaries in all directions. Several small beach communities are located along the Lake Erie shoreline within 5 mi of the Fermi site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. The proposed 600-ft cooling tower for Fermi 3 and a steam plume associated with operation of Fermi 3 would also be visible from locations within these communities and along the beaches and other recreational facilities (marinas, docks) along Lake Erie. Although taller than the existing cooling towers, the new 600-ft cooling tower would be consistent with the existing views of the Fermi site, and the review team expects a minor impact on visual aesthetics from operation of Fermi 3.

5.4.1.7 Summary of Physical Impacts

Based on the information provided by Detroit Edison, review team interviews with local public officials, and NRC's own independent review, the review team concludes that all the physical impacts of operation of Fermi 3 would be SMALL. Thus, additional mitigation measures beyond those identified by Detroit Edison are not warranted.

5.4.2 Demography

Detroit Edison expects the workforce needed to operate Fermi 3 to be 900 full-time and contract employees (Detroit Edison 2011a). Given the size of the labor force in the region (which includes portions of the Detroit and Toledo metropolitan areas), the range of operations jobs needed, and the specialized nature of nuclear power plant operations, the review team expects approximately 70 percent of the operations workforce, or approximately 630 workers, would be drawn from within a 50-mi radius of the Fermi site and the remaining 30 percent of the operations workforce, or approximately 270 workers, would need to be recruited from outside the region.

For the same reasons that formed the basis for the review team's anticipated residential distribution of building-related in-migrating workers in Section 4.4.2, the review team expects that characteristics of the workers recruited from outside the region with respect to choices and preferences (e.g., commute distance, available amenities, etc.) will be similar to those of the current workforce. Consequently, the review team could also assume the in-migrating workforce would move into the 50-mi region in the same proportions as the current operations workforce; with 87 percent residing in the three-county economic impact area and the remaining 13 percent outside of Monroe, Wayne, and Lucas Counties, but within a 50-mi radius of Fermi 3. The settlement distribution of the in-migrating workers needed for operation of Fermi 3 is shown in Table 5-8.

Table 5-8. Counties Where In-Migrating[a] Operations Workforce Would Reside

County	In-migrating Operations Workforce in 2020	Percentage of In-migrating Workforce	
		By County[b]	Cumulative
Monroe	155	57.5	57.5
Wayne	51	19.0	76.5
Lucas	29	10.7	87.2
All others within 50-mi region	35	12.8	100.0
Total	**270**		

(a) In-migrating workers are those moving into the 50-mi region from outside the region.
(b) Percentage of workforce by county is based on the residential distribution of the current Fermi 2 workforce (Detroit Edison 2008).

The review team also assumed that workers drawn from outside the region move with their families and that each worker would have an average household size of 2.6 persons, based on the national average household size in the U.S. Census Bureau's 2008 population estimate (USCB 2009a).[a] Based on this assumption and the proportional settlement pattern shown in Table 5-9, the review team estimates that approximately 403 persons (155 operations workers and 248 additional family members) would relocate to Monroe County, approximately 133 persons (51 operations workers and 82 family members) would relocate to Wayne County, and approximately 75 persons (29 operations workers and 46 family members) would relocate to Lucas County. Thirty-five operations workers and an additional 91 family members would move into the remainder of the 50-mi region. Projected population increases are shown in Table 5-9.

(a) During the preparation of this draft EIS, the results of the mandated U.S. decadal census for 2010 were being released in topical and regional data sets. While the U.S. Census Bureau has not issued all the data sets in final form, some of the preliminary information was considered by the review team. While some of the final data sets were released for National scale information, most of the fine-scale information is still under review by the U.S. Department of Commerce (DOC) and other Federal agencies. The review team is not aware of information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier census.

Table 5-9. Potential Increase in Population Associated with In-Migrating Operations Workforce

County	Workforce Relocating from Outside Region	As Percentage of Total Relocating Workforce[(a)]	Estimated Increase in Population (number of workers × 2.6 persons per household)[(b)]	Projected 2020 Population[(c)]	Estimated Increase as Percentage of Projected 2020 Population
Monroe	155	57.5	403	159,461	0.3
Wayne	51	19.0	133	1,812,593	0.007
Lucas	29	10.7	75	434,650	0.02
All others within region	35	12.8	91	– [(d)]	–
Total	**270**		**702**		

(a) Percentage distribution is based on the residential distribution of the current Fermi 2 workforce (Detroit Edison 2008).
(b) National average household size as of 2008 population estimate (USCB 2009a).
(c) Monroe and Wayne Counties 2020 and 2030 projections were provided by the Southeast Michigan Council of Governments (SEMCOG) in April 2008 (SEMCOG 2008). For Lucas County, projections are provided by the Ohio Department of Development (2003).
(d) Projected populations are not provided for other counties within the 50-mi region. Given the small number of workers in-migrating to counties outside of Monroe, Wayne, and Lucas Counties, the impact on projected populations for any one jurisdiction would not be noticeable

The projected increase in population in Monroe, Wayne, and Lucas Counties associated with in-migrating workers and their families is less than 1 percent of the projected 2020 population for any of these counties. As discussed in Section 2.5, Wayne and Lucas Counties are projected to experience population losses through 2020. Therefore, the projected increase in population associated with workers relocating for work at Fermi 3, would have a minor beneficial impact on the two counties, because the population loss currently being experienced in Wayne and Lucas Counties, primarily due to the economy, could be lessened. While Monroe County is projected to have a modest population increase through 2020, the additional increase associated with the in-migrating operations workforce would be minimal.

Given the size of the regional population projected for 2020 of 6,130,056 persons within a 50-mi radius of the Fermi site (see Table 2-25), the projected increase associated with the in-migrating operations workforce would be minimal within the region or local area.

In addition to the full-time and contract workforce of 900, an estimated 1200 to 1500 additional workers would be employed at Fermi 3 during scheduled outages. These workers would increase the transient population in the local area approximately every 24 months for a period of 30 days (Detroit Edison 2011a). Workers who do not currently reside in the region would be housed in temporary, short-term accommodations for the duration of the scheduled outages.

The size of the contract labor for the scheduled outages for Fermi 3 is similar to the size of the workforce for scheduled outages at Fermi 2. However, Detroit Edison would not schedule outages for Fermi 2 and Fermi 3 at the same time. Therefore, the projected increase in the transient population would not be greater with operation of Fermi 3, but would result in an increase in transient population occurring more frequently in the local communities around the Fermi plant site.

Based on the review team's analysis, the in-migrating workers and their families would increase the populations in Monroe, Wayne, and Lucas counties by less than 1 percent. As discussed in Section 2.5, Wayne and Lucas Counties are projected to experience population losses through 2020. Therefore, the projected increase in population associated with operations workforce would have a beneficial impact on the two counties, because the population loss currently being experienced in Wayne and Lucas Counties, primarily due to the economy, would be partially offset by the in-migrating workers. While Monroe County is projected to have a modest population increase through 2020, the additional increase associated with the in-migrating operations workforce would be minimal. Therefore, the review team determines the three-county economic impact area would experience a SMALL and beneficial demographic impact from operations at Fermi 3.

In addition, a small number of operations workers would in-migrate to counties outside of Monroe, Wayne, and Lucas Counties. Therefore, their impact on any one jurisdiction would not be noticeable. The current and projected populations of the regional area are so large that the in-migrating operations workforce for Fermi 3 would represent less than 1 percent of the total population in any of the counties or locations where these employees would reside. Therefore, the review team concludes that the demographic impacts of operation on the remainder of the region would also be SMALL and beneficial.

5.4.3 Economic Impacts on the Community

This section evaluates the economic impact of operation of Fermi 3 on the 50-mi region around the Fermi site, focusing primarily on Monroe, Wayne, and Lucas Counties. Detroit Edison plans to start commercial operation of Fermi 3 in 2020.

5.4.3.1 Economy

Operation of Fermi 3 would have a positive impact on the local and regional economy through direct employment of the operations workforce, purchase of materials and supplies for operation, and maintenance of the plant and any capital expenditures that occur within the region.

Detroit Edison estimates direct employment for Fermi 3 to be 900 full-time and contract employees (Detroit Edison 2011a). In addition, Detroit Edison would employ an estimated

1200 to 1500 workers at Fermi 3 during scheduled outages, which would occur every 24 months and require workers for a period of 30 days (Detroit Edison 2011a).

The types of workers that Detroit Edison expects to employ for Fermi 3 operations are shown in Table 2-31 and Table 5-10. As shown in Table 5-10, the average annual salary, based on 2008 U.S. Bureau of Labor Statistics (USBLS) data for the types of occupations that would be needed for Fermi 3, would range from $22,100 (security guard) to $111,340 (general or operations manager). For purposes of analysis, the review team has estimated the overall payroll based on an average salary of approximately $63,625. For an annual workforce of 900 full-time and contract employees, Detroit Edison would expend an estimated $57.3 million directly in payroll on an annual basis during the 40-year operating license of Fermi 3. In addition, every 24 months, Detroit Edison would expend an additional $6.3 to $7.9 million in payroll for the outage workforce for Fermi 3.

Employees would also receive an annual nonwage compensation, which would be for supplementary pay (i.e., premium pay for overtime and work on holidays and weekends), retirement benefits, insurance, and legally required benefits (i.e., worker's compensation, Social Security, etc.) A portion of the nonwage compensation (e.g., overtime pay) may also be expended in the local area, but is not included in this analysis because a portion of it would also not likely be expended in the local area (e.g., Social Security benefits).

The review team estimates that approximately 70 percent of the operations workforce, or approximately 630 workers, would be drawn from within a 50-mi radius of the Fermi site. The review team assumes that a portion of the workers drawn from the regional area would be unemployed. As discussed in Section 2.5, the overall rate of unemployment in Monroe, Wayne, and Lucas Counties in 2008 ranged between 8.3 percent (Lucas County) and 9.9 percent (Wayne County). Although employment in the local area is likely to change by 2020, the review team calculated an average of the 2008 unemployment rates for Monroe, Wayne, and Lucas Counties (9 percent) to estimate the number of workers that would likely be drawn from the ranks of the unemployed. The review team estimates that 9 percent of the 630 workers, or approximately 57 workers, would be drawn from the ranks of the unemployed. Approximately 30 percent of the annual workforce (approximately 270 workers) is expected to relocate from outside the region.

New workers (i.e., in-migrating workers and those previously unemployed) would have an additional indirect effect on the local economy, because these new workers would stimulate the regional economy by their spending on goods and services in other industries.[a] A model developed by the DOC, Bureau of Economic Analysis (BEA), called the Regional Input-Output Modeling System (RIMS II), quantifies this "ripple" effect through the use of regional industrial

(a) The assessment of direct and indirect employment impacts in this analysis serves as a lower boundary estimate by including only in-migrating and formerly unemployed workers.

Table 5-10. Wage Estimates for Occupations of the Operations Workforce in the Economic Impact Area(a) (2008)

	Mean Annual Wages(b)		
Occupation Title	Monroe, Michigan MSA	Detroit-Livonia-Dearborn, Michigan Metropolitan Division	Toledo, Ohio MSA
General and Operations Managers	$91,240	$111,340	$97,920
Accountants and Auditors	$52,420	$68,850	$65,020
Computer Software Engineers, Applications	–(c)	$88,420	$68,720
Computer Software Engineers, Systems Software	–	$82,250	$72,940
Network and Computer System Administrators	$55,390	$67,090	$57,970
Chemical Engineers	–	$79,940	$72,570
Civil Engineers	$64,270	$70,810	$68,330
Electrical Engineers	$79,960	$80,480	$61,180
Mechanical Engineers	$67,620	–	$68,380
Nuclear Technicians	$66,910(d)	$66,910(d)	$66,910(d)
Security Guards(e)	$22,100	$27,230	$23,420
Office and Administration Support	$30,190	$34,980	$30,440
Nuclear Power Reactor Operators(d)	$73,510(d)	73,510(d)	$73,510(d)
Power Distributors and Dispatchers	–	–	$61,410
Power Plant Operators	–	$58,350	$62,070
Stationary Engineers and Boiler Operators	–	$56,630	$50,160

Source: USBLS 2008

(a) Data are presented according to the USBLS metropolitan areas, which include the counties identified as the economic impact area.

(b) Annual wages have been calculated by multiplying the hourly mean wage by a “year-round, full-time” hours figure of 2080 hr. Wages include base rate pay, cost-of-living allowances, guaranteed pay, hazardous-duty pay, incentive pays such as commissions and production bonuses, tips, and on-call pay. Wages do not include back pay, jury duty pay, overtime pay, severance pay, shift differentials, nonproduction bonuses, employer costs for supplementary benefits, and tuition reimbursements.

(c) – = This occupation is not reported in this metropolitan area.

(d) The mean annual wage for “Nuclear Technician” and for “Nuclear Power Reactor Operator” is a national mean annual wage; the mean annual wage for these occupations in the Monroe, Michigan MSA, Detroit-Livonia-Dearborn, Michigan Metropolitan Division, and the Toledo, Ohio MSA was not available. Annual wages for these occupations have been included to estimate the average annual salary for the operations workforce.

(e) The review team recognizes that the wages of security workers at nuclear power plants are higher than the average wage of all security workers. This occupation type includes all levels of security work.

multipliers specific to a local economy. Each new direct job in the "utility sector" industry stimulates employment indirectly and results in additional job creation in other industry sectors, such as services. The indirect stimulus reflects additional economic activity from interdependent suppliers and vendors. The ratio of total jobs (direct plus indirect) to the number of new direct jobs is called the "employment multiplier." Operations workers who already live and work in the local area are already producing a multiplier effect through their spending and, therefore, are not included in the calculation of new indirect effects.

In the three-county economic impact area, BEA RIMS II estimates that for every new worker, an additional 1.4 jobs would be created (Detroit Edison 2011a). Based on the employment multiplier, the 327 "new workers" (i.e., in-migrating workers and those previously unemployed) would create an additional 458 new jobs, for a total of 1358 new direct and indirect jobs (Table 5-11).

Table 5-11. Average Annual Direct and Indirect Employment for Fermi 3

		Calculation	Number of Workers
A	Direct employment[(a)]		900
B	Reside in region	A × 70%	630
C	(Otherwise employed at time of hire for Fermi 3)	B × 91%	(573)
D	(Unemployed at time of hire for Fermi 3)	B × 9%	(57)
E	Relocate from outside region	A × 30%	270
F	Indirect employment	(D + E) × 1.4	458
G	**Total annual employment**	**A + F**	**1358**
	Total annual new employment	**D + E + F**	**785**

(a) Indirect impacts associated with the outage workforce have not been included.

As stated above, an estimated $57.3 million (2008 dollars) would be expended in wages annually over the 40-year licensing period, based on an average annual salary of $63,625 for 900 workers. A regional multiplier was applied to the earnings of new workers (i.e., in-migrating workers and those previously unemployed) to determine the effect of the direct earnings on the local economy. For every dollar of wages earned by new operations workers on Fermi 3, BEA estimates that an additional 0.5 dollars of wages would be created in the local economy (Detroit Edison 2011a). For an estimated $57.3 million in new direct wages, an estimated $28.7 million in indirect wages would be created annually, for an annual total of about $86 million.

Purchase of materials and supplies for operation and maintenance of the plant and any capital expenditures that occur within the region would also have direct and indirect effects on the regional economy. Detroit Edison estimates that purchases of material and supplies for operation and maintenance of Fermi 2 and capital expenditures averaged $60.4 million per year between the years 2002 to 2007, of which approximately 23 percent ($13.9 million) is purchased from local vendors and suppliers (Detroit Edison 2011a). The review team expects that purchases of material and supplies for operation and maintenance and any capital expenditures for Fermi 3 would be similar to those for Fermi 2, although some economies of scale may result in a reduction in total expenditures for the two operating plants.

The review team concludes, based on its own independent review of the likely economic effects of the proposed action, that beneficial economic impacts, including (1) 1358 direct and indirect jobs, (2) $86 million in direct and indirect annual wages, (3) an additional $7.9 million in wages during scheduled refueling outages every 24 months, and (4) $13.9 million spending on purchases of materials and supplies from local vendors and suppliers, would be experienced throughout the 50-mi region during the 40-year licensing period.

5.4.3.2 Taxes

The tax structure of the region is discussed in Section 2.5 of this EIS. Several tax revenue categories would be affected by operation of Fermi 3. These include (a) State and local taxes on worker incomes, (b) State sales taxes on worker expenditures; (c) State sales taxes on the purchase of materials and supplies for operation and maintenance of the plant, (d) State sales taxes on consumer purchases of electricity, (e) State business taxes, and (f) local property taxes.

State and Local Income Taxes

The States of Michigan and Ohio would receive additional income tax revenue from the income tax on wages of new workers. Table 5-12 summarizes the estimated new annual income tax revenue that would be received by each State. However, determining the exact amount of income tax revenue relies on a number of factors such as income tax rates, residency status, deductions taken, and other factors.

New workers are those drawn from the ranks of the unemployed and those who relocate from outside the States of Michigan or Ohio. As discussed in Section 5.4.2, approximately 70 percent of the annual workforce, or an average of 630 workers annually, are expected to be drawn from the region. Workers recruited for the operations workforce at Fermi 3 who already live and work in the region are already contributing to State income and sales tax revenue. However, approximately 9 percent of the 630 workers, or approximately 57 workers, would live in the area but would be unemployed. Those workers would contribute to new State tax revenue as they become employed at Fermi 3. Approximately 30 percent of the operations workforce, or approximately 270 workers, are expected to relocate from outside the region.

If all in-migrating workers move to the region from outside the States of Michigan and Ohio, they would also provide new tax revenue. To estimate the income tax revenue for the State of Michigan and State of Ohio, the review team assumed a similar residential distribution to the

Table 5-12. Estimated New State Income and Sales Tax Revenue Associated with the Operations Workforce

New Workers and Revenue	Michigan	Ohio
Relocate from outside region	232	38
Previously unemployed	49	8
Total new workers	**281**	**46**
Estimated annual income (million)	$17.9	$2.9
Estimated annual State income tax revenue (million)	$0.7[(a)]	$0.09[(b)]
Estimated annual spending on goods and services (million)[(c)]	$3.9	$0.6
Estimated annual sales tax revenue (million)[(d)]	$0.2	$0.03
Total estimated annual new State revenue (million)	**$0.9**	**$0.12**

(a) As discussed in Section 2.2, the income tax rate in Michigan will be set at 3.9 percent in 2015, following annual decreases after 2011. The current present rate of 4.35 percent is applicable through 2011. The 3.9 percent rate was applied to a personal income of $63,625 for each of the new workers in the State of Michigan.

(b) Ohio has a graduated income tax; the scheduled tax rate for an income in the $40,000 to $80,000 tax bracket beginning in 2011 is $1056.40 plus 4.109 percent of excess over $40,000. This was applied to a personal income of $63,625 for each of the new workers in the State of Ohio.

(c) Estimated annual spending of 22 percent of income before taxes is based on the USBLS Consumer Expenditure Survey for expenditures that would be subject to State sales taxes, including apparel and services, transportation, entertainment, personal care products and services, and tobacco products and smoking supplies (USBLS 2010).

(d) The Michigan sales tax rate is 6 percent, and the Ohio sales tax rate is 5.5 percent.

current Fermi 2 workforce. Based on the current residential distribution of the Fermi 2 workforce, approximately 86 percent of the total workforce resides in Michigan and 14 percent resides in Ohio (both within and outside of the economic impact area) (fewer than 1 percent reside in Canada and are not included in this analysis). Assuming the in-migrating workers and previously unemployed workers are divided between Michigan and Ohio in the same proportion as the current Fermi 2 workforce, approximately 86 percent of the new workers would pay taxes in the State of Michigan and 14 percent would pay taxes in the State of Ohio. Therefore, the estimated new state income tax revenue would be approximately $0.7 million annually for the State of Michigan (2008 dollars) based on an average annual salary for the new workers of $63,625 and a 40-hour work week, and approximately $0.09 million annually for the State of Ohio.

As discussed in Section 2.5, several municipalities in Wayne and Lucas County impose taxes on income. Depending on the residential location of in-migrating workers, municipalities in Wayne County and Lucas County may also benefit from increased income associated with the operation of Fermi 3.

State and Local Sales Taxes on Worker Expenditures

The States of Michigan and Ohio and some of the local jurisdictions in Ohio would also receive sales tax revenue on expenditures made by the new workers. An estimated $0.2 million in new sales tax revenue would be received by the State of Michigan and $0.03 million by the State of Ohio, based on national averages for consumer spending on goods and services.

In addition, Detroit Edison would employ an estimated 1200 to 1500 workers at Fermi 3 during scheduled outages, which would occur every 24 months and require workers for a period of 30 days (Detroit Edison 2011a). During the outages, these workers would purchase local goods and services, generating additional but minimal sales tax revenue for the State of Michigan.

The review team determines that the impact of additional income taxes at the State level would be positive but minimal – less than 1 percent of each State's total sales tax revenues.

In Michigan, local jurisdictions have taxing authority for selected sales revenue (i.e., hotel accommodations and stadium and convention facilities), and counties in Ohio may levy a general sales tax revenue. Therefore, local jurisdictions would also benefit from expenditures of goods and services.

State and Local Sales Taxes on Operating Materials and Supplies

The States of Michigan and Ohio would receive sales tax revenue from the purchase of material and supplies for operation and maintenance of Fermi 3. Based on its reported average annual operations expenditures for Fermi 2 between the years 2002 to 2007, Detroit Edison spent about $60.4 million annually for materials and supplies, of which approximately 23 percent ($13.9 million) was purchased from local vendors and suppliers (Detroit Edison 2011a). Assuming expenditures for Fermi 3 will be similar to those for Fermi 2, the review team has estimated that Detroit Edison would expend approximately $13.9 million annually for the local purchase of material and supplies for operation and maintenance of Fermi 3. A detailed analysis of the sources for these materials and supplies has not been conducted.

For purposes of analysis, the review team has assumed that 60 percent of the locally purchased materials and supplies would be purchased from within the State of Michigan (e.g., $8.3 million) and 40 percent from within the State of Ohio (e.g., $5.6 million). Based on a state sales tax rate in Michigan of 6 percent, an estimated $0.5 million in sales tax revenue would be received by the State of Michigan annually. Based on a state sales tax rate in Ohio of 5.5 percent, an estimated $0.3 million in sales tax revenue would be received by the State of Ohio annually from the purchase of materials and supplies for operation and maintenance of Fermi 3.

The review team determines that the impact of additional sales tax revenue from the purchase of materials and supplies for operation and maintenance of Fermi 3 would be beneficial but minimal – less than 1 percent of each State's total annual sales tax revenue.

In Michigan, local jurisdictions have taxing authority for selected sales revenue (i.e., hotel accommodations and stadium and convention facilities), and counties in Ohio may levy a general sales tax revenue. Therefore, local jurisdictions would also benefit from purchases of good and supplies for operation and maintenance of Fermi 3.

State Sales Taxes on Purchases of Electricity

The State of Michigan would benefit from increased sales taxes on consumer purchases of electricity generated by Fermi 3. As discussed in Section 2.5, the State of Michigan receives an estimated $208 million in sales tax revenue based on 2009 residential, industrial, and commercial purchases of electricity from Detroit Edison's ten electrical generating facilities in Michigan (DOE/EIA 2009). The review team estimates that sales tax revenue from purchase of electricity from Fermi 3 would be proportional to one-tenth the total sales tax revenue of the ten operating facilities, which would be an estimated $21 million annually.

Business Taxes

In 2007, Detroit Edison paid $149 million in combined federal and state corporate income tax (Detroit Edison 2008c). With increased income from the sale of electricity from Fermi 3, the review team expects Detroit Edison to pay additional beneficial but minimal corporate income taxes.

Local Property Taxes

The assessed value of the Fermi plant site would increase in value with the completion of the Fermi 3 plant for operation. Local jurisdictions would benefit from the increased property value with the corresponding increased property tax revenue. For purposes of analysis, the review team recognizes that the full estimated construction cost of $6.4 billion for a nuclear power plant of 1605 MW(e) as discussed in Section 4.4.3.1 may not be the actual assessed value for property tax purposes. However, for comparative purposes in the alternative sites analysis, the review team based its conclusions upon this construction cost estimate.

In 2009, the assessed value of property owned by Detroit Edison in Monroe County was $821 million (Monroe County Finance Department 2009), approximately 13.3 percent of the total county taxable assessed value. Consequently, with completion of the construction of Fermi 3, the total assessed property value in the county would be increased by about 100 percent. The review team recognizes that this would be an upper boundary to the assessed value of the property and that a fee in lieu of agreement or other considerations may significantly reduce that assessed value. However, the review team believes that the property tax impact on Monroe County would be substantial and beneficial.

The estimated annual property tax revenue in Table 5-13 is based on current millage rates and the full construction cost of Fermi 3. Therefore, the information in Table 5-13 should be considered an upper boundary to the actual property taxes that would be paid by Detroit Edison for Fermi 3.

Table 5-13. Estimated Annual Property Tax Revenue from Fermi 3 Assessed Property Value Based on 2009 Millage Rates

Jurisdiction	Millage (2009)	Total Estimated Annual Property Tax Revenue (in millions)
Monroe County – operation	4.8	$30.7
Monroe County – senior citizens	0.5	$3.2
Monroe County Community College	2.18	$14.0
Monroe County Library	1.0	$6.4
Monroe Intermediate School District	4.75	$30.4
Frenchtown Charter Township	6.8	$43.5
Jefferson schools	18.5	$118.4
State education tax	6.0	$38.4
Resort Authority	2.8	$17.9
Total millage	47.33	$302.9

5.4.3.3 Summary of Economic Impacts

Based on the information provided by Detroit Edison and the review team's evaluation, the review team concludes that the impact of operation of Fermi 3 on the economy, including tax revenues, would be LARGE and beneficial in Monroe County and SMALL and beneficial elsewhere. An estimated 270 new workers would relocate into the area, and 57 unemployed workers would be employed. Tax revenue to local jurisdictions would accrue through personal income, sales, and property taxes and would have the largest benefit on the local jurisdictions within Monroe County.

5.4.4 Infrastructure and Community Services

Infrastructure and community services include traffic, recreation, housing, public services, and education. Operation of Fermi 3 would affect the transportation network as the additional workforce uses the local roads to commute to and from work, and possibly additional truck deliveries are made to support operation of the plant. These same commuters could also potentially affect recreation in the area. As the workforce in-migrates and settles in the region, there may be impacts on housing, education, and public sector services.

5.4.4.1 Traffic

Existing transportation routes would be affected by an increase in commuter traffic to and from the Fermi site associated with the operations workforce for Fermi 3.

The interstate highways and local roadways described in Section 2.5.2.3 would be used by operations workers to commute to and from work. Traffic associated with the operations workforce would be most concentrated on local roadways near the site, lessening as workers disperse in various directions on regional interconnecting roadways and highways.

Traffic volumes associated with the Fermi site are shown in Table 5-14. Operation of Fermi 3 would result in a near doubling of the workforce at the Fermi site, with operations workers for both Fermi 2 and Fermi 3. These workers would be divided into multiple shifts such that the plant would be staffed 24 hr per day, all days of the year. However, peak traffic volumes would occur during the morning commute to the site (5:30 a.m. to 7:30 a.m.) and the afternoon commute from the site (2:30 p.m. to 5:30 p.m.) (Mannik and Smith Group, Inc. 2009).

Table 5-14. Actual (2009) and Projected (2020) Peak Traffic Volumes[(a)] – Fermi Site

Workforce	A.M. Peak (vehicles)	P.M. Peak (vehicles)
Current Fermi 2 workforce (2009)	466	418
Projected Fermi 3 workforce (2020)	441	396
Total Fermi 2 and Fermi 3 workforce	**907**	**814**
Outage workforce for Fermi 3 (2020)	732	436
Total Fermi 3 outage workforce + Fermi 2 workforce	**1198**	**854**

Source: Mannik and Smith Group 2009

(a) Traffic volumes based on an actual recorded rate at the Fermi site in 2009 of 0.49 peak hour vehicles per employee during the morning commute and 0.44 peak hour vehicles per employee during the afternoon commute.

Detroit Edison conducted a traffic study to evaluate the effect of the operations workforce on the LOS of local roadways, incorporating a traffic projection growth rate for background traffic levels that was developed by SEMCOG in its traffic forecasting model.[(a)] The analysis focused on seven local roadway intersections and three interstate (I-75) interchanges, which are listed below:

- N. Dixie Highway and Stony Creek Road

(a) LOS is a designation of operational conditions on a roadway or intersection, ranging from A (best) to F (worst). LOS categories as defined in the *Highway Capacity Manual* are listed on Table 2-40.

- N. Dixie Highway and Pointe Aux Peaux Road
- N. Dixie Highway and Leroux Road
- N. Dixie Highway and Enrico Fermi Drive
- N. Dixie Highway and Post Road
- Leroux Road and Toll Road
- Enrico Fermi Road and Leroux Road
- I-75 and N. Dixie Highway
- I-75 and Nadeau Road
- I-75 and Swan Creek Road/Newport Road

The LOS analysis was conducted in accordance with the Transportation Research Board's *Highway Capacity Manual* to evaluate the operational efficiency at each intersection and its approaching roadways(s).

The traffic analysis indicates that unsatisfactory traffic conditions (LOS of E or F) would occur at several intersections during both the peak-hour morning and afternoon commutes of the operations workforce. Some of these intersections are already operating under unsatisfactory conditions (see Tables 5-15 and 5-16) and were also determined to operate under unsatisfactory traffic conditions during the peak construction period (see Tables 4-12 and 4-13). These conditions could be alleviated primarily by roadway or traffic flow improvements, including signalization, lane use modification, and signal timing/phasing optimization, some of which may be incorporated during the construction period. The Monroe County Road Commission (MCRC) and Michigan Department of Transportation (MDOT) will be responsible for reviewing and approving site plans because the plans affect area roadways during the site plan review and approval process for a building permit within Frenchtown Charter Township (Assenmacher 2011; Ramirez 2011). At that time, these agencies may require that a traffic impact study in accordance with Traffic and Safety Note 607C, "Traffic Impact Studies" (MDOT 2009) be conducted, and improvements to local roadways may focus on those roadways that are affected during both construction and operation. Recommendations for improvements to the I-75 interchanges will require approval of MDOT. All other roadway and intersection improvements will require the approval of MCRC.

During Fermi 2 or Fermi 3 scheduled outages, unsatisfactory traffic conditions would be further exacerbated. During scheduled outages, Detroit Edison hires contract labor to carry out fuel-reloading activities, equipment maintenance, and other projects associated with the outage. Detroit Edison employs approximately 1200 to 1500 workers for 30 days during every outage, which occurs every 18 months for Fermi 2 and would occur every 24 months for Fermi 3.

Table 5-15. Impacts on Area Roadways during Peak Morning Operations Workforce Commute

Intersection	Approach/Movement	Existing (2009) Level of Service[a]	Projected (2020) Level of Service[a]	Potential Improvement Alternatives
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp left turn	F	F	• Signalization • Lane use modification
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp left turn	D	D	
Southbound I-75 ramps and Newport Rd.	Southbound approach	C	D	
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd. eastbound	C	E[b]	
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy. northeastbound	B	F	• Signal timing/phasing optimization
N. Dixie Hwy. and Enrico Fermi Dr.	N. Dixie Hwy. northbound	A	A	• Signal timing/phasing
	N. Dixie Hwy. southbound	A	F	• Northbound/southbound turn lanes on N. Dixie Hwy.
	Enrico Fermi Dr. westbound	C	B	• Additional access point • Westbound lane use/storage

Source: Mannik and Smith Group, Inc. 2009

Table 5-16. Impacts on Area Roadways during Peak Afternoon Operations Workforce Commute

Intersection	Approach/Movement	Existing (2009) Level of Service[(a)]	Projected (2020) Level of Service[(a)]	Potential Improvement Alternatives
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp left turn	F	F	• Signalization • Lane use modification
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp left turn	E	E	• Signalization • Lane use modification
Southbound I-75 ramps and Newport Rd.	Southbound I-75 ramp northbound approach	E	F	• Signalization • Lane use modification
	southbound approach	D	E	
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd. eastbound	C	E	• Signalization • Eastbound Stony Creek left/right turn lanes
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy. southwestbound	C	F	• Signal timing/phasing optimization
N. Dixie Hwy. and Enrico Fermi Dr.	N. Dixie Hwy. northbound	A	B	• Signal timing/phasing optimization
	N. Dixie Hwy. southbound	B	B	
	Enrico Fermi Dr. westbound	B	E	• Northbound/southbound turn lanes on N. Dixie Hwy. • Additional access point • Westbound lane use/storage

Source: Mannik and Smith Group, Inc. 2009

Estimated traffic generated by the Fermi site during scheduled outages is shown in Table 5.4-7. However, these conditions would exist only for the length of the outage (approximately 30 days); they would not represent normal conditions. Detroit Edison will not schedule an outage for Fermi 3 during the same time as an outage for Fermi 2.

Overall, with the exception of a few intersections/interchanges, impacts on area roadways associated with the operations workforce for Fermi 3 would be minor, because the existing traffic volumes on local roadways in the vicinity of the Fermi site are generally below the capacity of the roads, and beyond the local roadways, the traffic associated with the operations workforce would be widely dispersed on a widely developed regional roadway network.

During Fermi 3 outages an additional 1200–1500 workers would be commuting to the site, in addition to the 1627 operations workers (727 for Fermi 2 and 900 for Fermi 3), for a total of about 3127 workers on local roadways each day. This number is similar to the maximum number of workers on local roadways during the peak employment period of construction (3627), which formed the basis of the review team's MODERATE impact on traffic near the plant. Therefore, the review team concludes from the information provided by Detroit Edison, interviews with local planners and officials, and the review team's independent evaluation that the offsite impacts on road traffic from operation of Fermi 3 would be minor during normal operations and noticeable but not destabilizing during outages. Detroit Edison has committed in the ER to working with MDOT and MCRC to determine possible mitigation measures closer to the time of operation (Detroit Edison 2011a).

5.4.4.2 Recreation

Recreational resources in Monroe, Wayne, and Lucas Counties may be affected by operations of Fermi 3. Impacts may include increased user demand associated with the projected increase in population with the in-migrating workforce and their families, an impaired recreational experience associated with the views of the proposed 600-ft cooling tower and steam plume, or access delays associated with increased traffic from the operations workforce on local roadways.

Impacts associated with the increased use of the recreational resources in the vicinity and region would be minimal. Based on an operations workforce of 900 workers, an estimated 270 workers are expected to relocate from outside the region, primarily to Monroe, Wayne, and Lucas Counties, as discussed in Section 5.4.2. The projected increase in population in Monroe, Wayne, and Lucas Counties associated with in-migrating workers and their families is less than 1 percent of the projected 2020 population for any of these counties and would not affect the availability and use of recreational resources in the area, especially considering that Wayne and Lucas Counties have experienced and are projected to continue to experience population losses through 2020.

Operational Impacts at the Proposed Site

Additional demand on recreational resources would occur during the scheduled outage periods that would occur every 24 months. Workers who do not currently reside in the region would be housed in temporary, short-term accommodations for the duration of the scheduled outage period. Detroit Edison identified the number of short-term accommodations within 50 mi of the City of Monroe. These accommodations would be used by people using recreational areas and by other visitors/tourists to the region, and may also be used by a portion of the outage workforce over the 30 days during scheduled outage periods. More than 375 establishments, including hotels and motels, bed and breakfasts, cabins and cottages, condominiums, historic inns, and recreational vehicle (RV) parks and campgrounds, are located within 50 mi of the City of Monroe. With the large number of establishments and the expectations that only a portion of the outage workers would be from outside the region and that the need for housing would be short term, the review team expects that the availability and use of recreational accommodations for other visitors/tourists in the region would be minimally affected.

Users of recreational resources in the immediate vicinity of the Fermi site may have a diminished recreational experience due to the view of the 600-ft cooling tower and a steam plume that would exist during operation of Fermi 3. Several small beach communities are located along the Lake Erie shoreline within 5 mi of the Fermi site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. Several public and private beaches are located along the Lake Erie shoreline in Monroe and Wayne Counties. Many small marinas and docks also are located along the Lake Erie shoreline within the vicinity of the Fermi site. The cooling tower would also be visible from Point Mouille State Game Area (3.1 mi to the northeast), Sterling State Park (4.8 mi to the south-southwest), and Lake Erie. Although taller than the existing cooling towers, the new 600-ft cooling tower and associated steam plume would be consistent with the existing views of the Fermi site, and the review team determines there would be no discernible adverse impacts on recreational users from the operation of the Fermi 3 cooling tower.

People using recreational facilities near the site may experience traffic congestion on the roads during the morning and afternoon commutes of the operations workforce and during the scheduled outages. However, measures to mitigate traffic delays at selected intersections and I-75 interchanges have been recommended following a traffic analysis of local roadways, which would alleviate impacts on users of recreational facilities as well as on members of the general public using local roadways. Given the high capacity of local roadways and the limited times when Fermi 3-related traffic would compete for access, along with the presence of traffic-mitigating measures implemented to facilitate building-related traffic during the construction phase, the review team expects that the accessibility of recreational accommodations for other visitors/tourists in the region would be minimally affected.

5.4.4.3 Housing

As discussed in Section 2.5, the review team expects that approximately 70 percent of the operations workforce would be local workers who currently reside within approximately 50 mi of the Fermi site. The majority of these workers would commute from their homes to the project site and would not be expected to affect the housing market. The review team expects the remaining 30 percent of the operations workforce, or approximately 270 workers, to relocate into the region, primarily into Monroe, Wayne, and Lucas Counties, and to rent or purchase housing. The review team expects that the residential distribution of the in-migrating workforce will be similar to the residential distribution of the current Fermi 2 workforce. Table 5-17 compares the available housing to the number of in-migrating operations workers.

Table 5-17. Impact on Housing Availability within Monroe, Wayne, and Lucas Counties

	Monroe	Wayne	Lucas
Workforce relocating from outside the region[(a)]	155	51	29
Vacant housing units[(b)]	4944	149,601	23,105
Estimated demand for housing as percentage of housing availability	0.3	0.03	0.1

(a) Approximately 35 workers would choose to relocate elsewhere in the 50-mi region and would not be expected to affect housing availability because of the large metropolitan area from which housing could be selected.
(b) As of the 2008 Census estimate (USCB 2009b, c).

Given the relatively large size of the regional housing market, the increased demand for housing by relocating workers and their families would have no noticeable impact on the availability or price of housing. As presented in Section 2.5, the U.S. Census Bureau (USCB) estimates that more than 1 million housing units were located in Monroe, Wayne, and Lucas Counties in 2008, of which more than 300,000 were rental units. The vacancy rate within the three counties ranged from 1.8 percent to 6.4 percent for owner-occupied housing and from 5.6 percent to 12.0 percent for rental units; approximately 178,000 housing units were vacant. SEMCOG reported 68 mobile home parks and 15,835 mobile home sites in Wayne County, and 29 mobile home parks and 7452 mobile home sites in Monroe County (SEMCOG 2008), of which 17.2 percent surveyed in Monroe County were vacant in 2006.

Substandard housing units are being demolished by Wayne and Monroe County, and this has resulted in a net loss of housing units in Wayne County. However, the review team has also considered that a large number of housing units are in foreclosure, population in the local area is declining, and additional housing units also are being approved for construction, and these factors have resulted in a net gain in housing units in Monroe County. Despite the changes that are expected to occur in the housing market, the review team expects that the overall number of housing units will be more than sufficient to accommodate workers relocating from outside the local area.

Given the large supply of housing and the size of the Detroit and Toledo metropolitan areas relative to the 270 in-migrating families, the review team expects sufficient housing to be available for workers relocating to the area without affecting the housing supply or prices in the local area or stimulating new housing construction.

Demand for short-term housing would occur during the scheduled outages that would occur every 24 months. Workers who do not currently reside in the region would be housed in temporary, short-term accommodations for the duration of the scheduled outages.

Detroit Edison identified the number of short-term accommodations within 50 mi of the City of Monroe. These accommodations would be occupied by people using recreational areas and by other visitors/tourists to the region (as discussed above) and also by a portion of the outage workforce over the 30 days when scheduled outages occur. More than 375 establishments, including hotels and motels, bed and breakfasts, cabins and cottages, condominiums, historic inns, and RV parks and campgrounds, are located within 50 mi of the City of Monroe. With the large number of establishments and the expectation that only a portion of the outage workers would be from outside the region and that the need for housing would be short term, the availability of short-term accommodations would be minimally affected.

The operation of Fermi 3 could affect housing values in the vicinity of the Fermi site. Based on previous studies that have been done (Bezdek and Wendling 2006; Clark et al. 1997; and Farber 1998), and as discussed in Section 4.4.4.3, the review team determined that the impact on housing values from the operations of Fermi 3 would be minor.

5.4.4.4 Public Services

This section discusses the impacts on existing water supply and wastewater treatment and police, fire response, and health care services in Monroe, Wayne, and Lucas Counties.

Water Supply and Wastewater Treatment Services

The in-migrating operations workforce for Fermi 3 would increase the demand for water supply and wastewater treatment services within the communities where they choose to reside; the size of the total operations workforce would increase the demand for water supply and wastewater treatment services at the Fermi site.

The review team expects that approximately 70 percent of the operations workforce would be local workers who currently reside within the 50-mi radius of the Fermi site. The review team expects the majority of these workers would commute from their homes to Fermi 3 and would not relocate. Therefore, the majority of workers are currently served by water supply and wastewater treatment services within the communities in which they reside.

The review expects the remaining 30 percent of the operations workforce, or approximately 270 workers, to relocate with their families into the region, primarily Monroe, Wayne, and Lucas Counties. These relocating workers would increase demand on water supply and wastewater treatment services within the communities in which they choose to reside.

Given that 270 workers and their families would relocate from outside the area into a large housing market, the review team expects these workers would obtain housing within the existing housing market rather than stimulate new housing construction. Therefore the in-migrating operations workers would not expand existing water supply or wastewater treatment services to new areas. Potable water is available to the existing housing market through wells or municipal water supplies, as discussed in Section 2.5.2.6, and residents have access to municipal wastewater collection and treatment systems or have individually owned onsite wastewater disposal (septic) systems.

The estimated demand for water supply and wastewater treatment services in Monroe, Wayne, and Lucas Counties is shown in Table 5-18.

Table 5-18. Estimated Increase in Demand for Water Supply and Wastewater Treatment Services in Monroe, Wayne, and Lucas Counties from In-Migrating Operations Workforce

Factor	Monroe	Wayne	Lucas
Estimated increase in population[(a)]	403	133	75
Estimated increase in residential daily water demand[(b)]	0.05 MGD	0.02 MGD	0.01 MGD
Estimated increase in residential daily wastewater flow[(c)]	0.03 MGD	0.01 MGD	0.01 MGD

(a) Approximately 35 workers would choose to relocate elsewhere in the 50-mi region, which would result in a total increase of 91 persons in the population outside of Monroe, Wayne, and Lucas Counties. An increase of 91 persons is not expected to affect water supply or wastewater treatment services, because the metropolitan area in which these persons would settle is large.
(b) Average daily water use per person is estimated to be 135 gal per day, based on the planning criteria used by the Detroit Water and Sewerage Department (DWSD) in June 2004 (DWSD 2004).
(c) Average daily wastewater flow per person is estimated to be 77 gal per day based on the planning criteria used by the DWSD in October 2003 (DWSD 2003).

The increase in demand for water supply from in-migrating workers and their families is expected to have a minor impact on municipal water suppliers in the local area because the projected increase in population is small and the in-migrating population would be served by a number of municipalities and jurisdictions.

In Monroe County, the largest municipal water supplier is the City of Monroe. The treatment plant in the City of Monroe is designed to treat 18 MGD, and its average daily water demand is 7.8 MGD (Monroe County Planning Department and Commission 2010). Other municipal water suppliers in Monroe County may also provide water supply to the in-migrating population, including the Frenchtown Charter Township; the City of Milan, Michigan; the City of Toledo, Ohio; and the Detroit Water and Sewerage Department (DWSD), which also serves portions of Monroe County. Therefore, the estimated water demand of 0.05 MGD for the additional people choosing to reside in Monroe County would have a minor impact on water suppliers.

Wayne County is serviced by DWSD, which has a treatment capacity of 1720 MGD. The average daily water demand for DWSD is 622 MGD (Ellenwood 2010). Therefore, the estimated water demand of 0.02 MGD for the additional people choosing to reside in Wayne County would have a minor impact on DWSD.

The largest municipal water supplier in Lucas County is the City of Toledo, which also services the northeastern portion of the county, where workers are more likely to settle. Its plant has a treatment capacity of 120 MGD, with an average daily demand of 73 MGD (Leffler 2010). Therefore, the estimated water demand of 0.01 MGD for the additional people choosing to reside in Lucas County is expected to have a minor impact on the municipal water suppliers in Lucas County.

The review team expects the increase in demand for wastewater treatment to have a minor impact on wastewater treatment plants in the local area because of the number of jurisdictions providing wastewater collection and treatment services in the local area compares favorably to the size of the population increase associated with Fermi 3.

In Monroe County, the largest wastewater treatment plant is operated by the City of Monroe. It is designed to treat 24 MGD wastewater flows, and its average daily wastewater flow is 15.9 MGD (MDEQ 2011). In addition, wastewater treatment services are provided by a number of municipalities in Monroe County, including the townships of Bedford, Berlin, Ida and Raisinville; the cities of Milan, Petersburg, and Luna Pier; and the villages of Dundee, Carleton, and Maybee. Therefore, the review team expects that the estimated wastewater treatment flows of 0.03 MGD for the additional people choosing to reside in Monroe County would have a minor impact on wastewater treatment capability.

Wayne County is served by two large wastewater treatment facilities: the DWSD, which has a treatment capacity of 930 MGD and treats an average wastewater flow of 727 MGD (Ellenwood 2010), and the Downriver Treatment Plant, which has a treatment capacity of 125 MGD and treats an average wastewater flow of 52 MGD. In addition, Gross Ile Township, City of Rockwood, and City of Trenton maintain wastewater treatment facilities. Therefore, the estimated wastewater treatment flows of 0.01 MGD for the population choosing to reside in Wayne County would have a minor impact on wastewater treatment capability.

The City of Toledo’s wastewater treatment plant is the largest in Lucas County. The plant has a treatment capacity of 195 MGD, with an average daily demand of 71 MGD (McGibbeny 2010). Therefore, the estimated wastewater treatment flows of 0.01 MGD for the population choosing to reside in Lucas County are expected to have a minor impact on wastewater treatment capability.

The operations workforce would place additional demands on the municipal potable water supply to the Fermi site and on wastewater treatment services provided for the site. Detroit Edison plans to connect to the City of Monroe Township municipal water system and to the City of Monroe's wastewater treatment facility.

Surface water withdrawn directly from Lake Erie would provide the water supply for cooling and other operational uses. Wastewater from operation of the plant would be treated at an onsite wastewater treatment facility, and treated nonradiological wastewater would be discharged to Lake Erie. Impacts associated with the surface water withdrawal and discharge are discussed in Section 5.2.

For a full-time and contract workforce of 900 at Fermi 3, the potable water demand onsite would increase by an estimated 0.09 MGD, based on a standard institutional water consumption planning rate of 100 gal/person/day (Metcalf and Eddy, Inc. 1972). During a scheduled outage, with a temporary workforce of 1200 to 1500, potable water demand onsite would increase by an estimated 0.12 to 0.15 MGD over the 30-day outage period. The average daily and maximum daily water demands for Frenchtown Charter Township in 2005 were 2.1 MGD and 3.9 MGD, respectively. The plant doubled its capacity from 4 MGD to 8 MGD in 2006, which is projected to be sufficient for a minimum of 20 years (Monroe County Planning Department and Commission 2010). Therefore, the review team expects operation of Fermi 3 to have a minimal impact on the Frenchtown Township municipal water supply service.

For a full-time and contract workforce of 900 at Fermi 3, the review team estimates the sanitary wastewater flow onsite would increase by 0.07 MGD, or 80 percent of the estimated water consumption (Metcalf and Eddy, Inc. 1972). The City of Monroe's wastewater treatment plant is designed to treat 24 MGD wastewater flows, and its average daily wastewater flow is 15.9 MGD (MDEQ 2011). Therefore, the review team expects that operation of Fermi 3 would have a minimal impact on the wastewater treatment capabilities of the City of Monroe wastewater treatment plant.

The review team concludes from the information provided by Detroit Edison, interviews with local planners and officials, and the review team's independent evaluation that the operation of Fermi 3 would have minimal impacts on local water supply and wastewater treatment facilities.

Police, Fire Response, and Health Care Services

The operations workforce for Fermi 3 would increase the demand for police, fire response, and health care services within the communities where they reside and at the Fermi site.

Operational Impacts at the Proposed Site

The review team expects that approximately 70 percent of the operations workforce would be local workers who currently reside within an approximately 50-mi radius of the Fermi site. The majority of these workers would commute from their homes to Fermi 3 and would not be expected to relocate, and thus are currently served by the police, fire response, and health care services within the communities in which they reside. Although the commute from residence to place of work would change, demand for police, fire response, or health care services in any one jurisdiction associated with new commuting patterns cannot be estimated and would not be appreciably different from that of the baseline population served by any one jurisdiction.

The review team expects that the remaining 30 percent of the operations workforce, or approximately 270 workers, would relocate into the region, primarily in Monroe, Wayne, and Lucas Counties. These relocating workers would increase the demand on police, fire response, and health care services within the communities in which they chose to reside.

As discussed in Section 5.4.2, the projected population increase associated with in-migrating workers, based on an average household size of 2.6 persons, is 702 persons. Based on the existing distribution pattern of the Fermi 2 operational workforce, an estimated 403 persons would relocate to Monroe County; an estimated 133 persons would relocate to Wayne County; and an estimated 75 persons would relocate to Lucas County. Approximately 91 persons would relocate elsewhere in the region. As shown on Table 5-19, the projected increase in population would have no measurable effect on the ratio of police officers, firefighters, or health care workers per 1000 residents in Monroe, Wayne, or Lucas Counties.

Fermi 3 operations may result in an increase in demand for police, fire response, or health care services onsite, especially in the event of workplace injury or accidents. Police, fire response, and other emergency response personnel may encounter traffic congestion on local roadways when responding to calls during the commutes of the operations workforce (and temporarily, during the scheduled outages) to the site. However, the area around the Fermi site is sparsely populated, and the review team does not expect that there would be a high demand for police, fire response, or other emergency response personnel. In addition, measures to mitigate traffic delays at selected intersections and I-75 interchanges that are being considered would reduce the impacts on emergency responders as well as members of the general public using local roadways. During the site plan review and approval process, Frenchtown Charter Township will require, as necessary, that the project be reviewed by MCRC and MDOT. These agencies may require that a traffic impact study in accordance with Traffic and Safety Note 607C (MDOT 2009) be conducted, and improvements to local roadways would be considered by Detroit Edison at that time.

Fire suppression equipment and a first aid station are available onsite, and Detroit Edison has existing agreements with local emergency response organizations (Detroit Edison 2011aa). Because of these offsite and onsite safety strategies, the review team expects the impact of operations on the demand for local emergency room service personnel would be minimal.

Table 5-19. Changes Associated with Fermi 3 Operations in Population Served by Law Enforcement Personnel, Firefighters, and Health Care Workers in Monroe, Wayne, and Lucas Counties

Public Service	Number of Officers/Firefighters/ HealthCare Workers	Existing Conditions: Population Served[a]	Existing Conditions: Officers/Firefighters/ Health Care Workers per 1000 Residents	Conditions with In-Migrating Operations Workers and Families: Population Served[b]	Conditions with In-Migrating Operations Workers and Families: Officers/Firefighters/ Health Care Workers per 1000 Residents
County Sheriff and Municipal Law Enforcement Personnel					
Monroe	277	152,945	1.8	153,348	1.8
Wayne	6957	1,949,929	3.6	1,950,062	3.6
Lucas	973	440,456	2.2	440,531	2.2
Firefighters					
Monroe	606	152,949	4.0	153,348	4.0
Wayne	3407	1,949,929	1.7	1,950,062	1.7
Lucas	1195	440,456	2.7	440,531	2.7
Health Care Workers[c]					
Monroe, Michigan MSA	2770	152,949	18.1	153,348	18.1
Detroit-Livonia-Dearborn Metropolitan Division	69,030	1,949,929	35.4	1,950,062	35.4
Toledo, Ohio MSA	34,600	649,104	53.3	649,179	53.3

Sources: FBI 2009; FEMA 2010; USBLS 2008

(a) 2008 population estimate from the USCB (2009b, c).

(b) Population served includes the 2008 population estimate plus the projected population increase associated with relocating workers and their families. Normal population increases or decreases and any associated changes in the public services provided are not considered here.

(c) Occupational employment and corresponding population served is provided for the metropolitan area in which the county is located.

5.4.4.5 Education

The in-migrating operations workforce for Fermi 3 would increase the demand for educational services.

The review team expects that approximately 70 percent of the operations workforce would be local workers who currently reside within 50 mi of the Fermi site. Therefore, most of the operations workers would commute from their homes to the project site and would not be expected to relocate or make any additional demands on educational services in Monroe, Wayne, and Lucas Counties.

As described in Section 5.4.2, the review team expects 30 percent of the operations workforce, or approximately 270 workers, to relocate into the region, primarily Monroe, Wayne, and Lucas Counties. If the in-migrating operations workforce relocates with families and settles in the same distribution pattern as the current Fermi 2 workforce, school enrollments would increase by an estimated 82 school-age children in Monroe County, 27 school-age children in Wayne County, and 15 school-age children in Lucas County (Table 5-19).

During the 2008–2009 school year, enrollment in 9 public school districts in Monroe County was 23,283, and enrollment in 35 public school districts was 276,862 in Wayne County. During the same year, enrollment in 8 school districts in Lucas County was 57,263 (Table 5-20). The review team determines that the impact of the projected increase in population associated with the operations workforce for Fermi 3 on local schools would be negligible because the households associated with the relocated workers would be dispersed in numerous public schools throughout these school districts, as well as among numerous private, parochial, charter, and alternative schools (Table 5-21).

Table 5-20. Estimated Number of School-Age Children Associated with In-Migrating Workforce for Fermi 3 Operations

Factor	Monroe	Wayne	Lucas
Estimated number of operations workers in-migrating to county	155	51	29
Estimated increase in population[(a)]	403	133	75
Estimated increase in number of school-age children[(b)]	82	27	15

(a) Based on 2.6 persons per household (USCB 2009a).
(b) Based on the 2008 Census estimate for the country, which shows that 20.4 percent of the population is between the ages of 5 and 19 years (USCB 2009a).

Table 5-21. Changes Associated with Fermi 3 Operations in Student/Teacher Ratio for School Districts in Monroe, Wayne, and Lucas Counties

	Existing Conditions			Conditions with In-Migrating Workers and Families	
County	**Total Countywide Number of Teachers**	**Total Countywide Student Enrollment**	**Student/ Teacher Ratio throughout County**	**Total Countywide Student Enrollment[(a)]**	**Student/ Teacher Ratio throughout County**
Monroe	1254	23,283	18.6	23,995	18.8
Wayne	15,853	276,862	17.5	292,552	17.8
Lucas	3716	57,263	15.4	58,883	15.8

Source: U.S. Department of Education 2010

(a) Population served includes the 2008–2009 countywide school enrollment plus the projected number of school-age children associated with in-migrating workers. Normal population increases or decreases and any associated changes in the educational services provided are not considered here.

5.4.4.6 Summary of Infrastructure and Community Services

Based on information supplied by Detroit Edison, review team interviews conducted with and information solicited from public officials, and the review team evaluation of data concerning the current availability of services, the review team concludes that the impacts of Fermi 3 operations on regional infrastructure and community services, including recreation, housing, water and wastewater facilities, police, fire and medical facilities, and education, would be SMALL and mitigation would not be warranted (Peven 2010). Although the traffic associated with the operations workforce would result in a SMALL impact on area roadways, the traffic associated with Fermi 3 outages would result in a MODERATE impact.

5.4.5 Summary of Socioeconomic Impacts

The review team has assessed the activities related to operation of Fermi 3 and the potential socioeconomic impacts in the region and local area. Physical impacts on workers and the general public include those on noise levels, air quality, existing buildings, roads, and aesthetics. The review team concludes that all physical impacts from operation of Fermi 3 would be SMALL.

On the basis of information supplied by Detroit Edison and the review team interviews conducted with public officials, the review team concludes that impacts from operation of Fermi 3 on the demographics of the entire 50-mi region would be beneficial and SMALL. Economic impacts, including impacts on tax revenues, would be beneficial and LARGE in Monroe County and beneficial and SMALL elsewhere.

Infrastructure and community services impacts span issues associated with traffic, recreation, housing, public services, and education. Impacts from operation of Fermi 3 on recreation, housing, public services, and education would be SMALL. Traffic-related impacts on local roadways near the Fermi site would be SMALL during normal operations and MODERATE during outages. Impacts on traffic would be mitigated by implementation of roadway improvements either during the construction period or as recommended by MCRC or MDOT following a review of the site development plan.

5.5 Environmental Justice Impacts

Environmental justice refers to a Federal policy under which each Federal agency identifies and addresses disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations of interest. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (69 FR 52040). Section 2.6 discusses the locations of minority or low-income populations of interest within 50 mi of the site.

The review team evaluated whether minority or low-income populations of interest could experience disproportionately high and adverse impacts from operation of a new reactor at the proposed site. To perform this assessment, the review team used the process described in Section 4.5.[(a)]

5.5.1 Health Impacts

The results of normal operation dose assessments (see Section 5.9) indicate that the maximum individual radiation dose was found to be insignificant, that is, well below the NRC and EPA regulatory guidelines in Appendix I of 10 CFR Part 50 and the regulatory standards of 10 CFR Part 20.

Section 5.9 further concludes that radiological health impacts on the operational staff and the public for the proposed Units 2 and 3 would be SMALL. Section 5.8 of this EIS assesses the nonradiological health effects on the public from operation of the cooling system, noise generated by Fermi 3 operations, EMFs, and transporting of operations and outage workers. In Section 5.8, the review team concludes that the potential impacts of nonradiological effects resulting from the operation of the proposed Fermi 3 would be SMALL. The review team did not

(a) During the preparation of this draft EIS, the results of the mandated U.S. decadal census for 2010 were being released in topical and regional data sets. While the USCB has not issued all the data sets in final form, some of the preliminary information was considered by the review team. While some of the final data sets were released for National scale information, most of the fine-scale information is still under review by the DOC and other Federal agencies. The review team is not aware of information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier census.

identify evidence of unique characteristics or practices in minority or low-income population that may result in different radiological or nonradiological health impacts compared to the general population. Therefore, there would be no disproportionately high and adverse impact on minority or low-income members of the operational staff or the general public as a result of operations.

5.5.2 Physical and Environmental Impacts

For the physical and environmental considerations described in Section 2.6.1, the review team determined through literature searches and consultations that (1) the impacts on the natural or physical environment would not be significant or result in any significant impacts on any population of interest; (2) there would be no disproportionately high and adverse impacts on minority or low-income populations of interest; and (3) the environmental effects would not occur on any minority or low-income populations that are already being affected by cumulative or multiple adverse exposures from environmental hazards. Sections 5.5.2.1 through 5.5.2.4 summarize the physical and environmental effects on the general population, and Section 5.5.2.5 provides an assessment of the potential for disproportionately high and adverse physical and environmental impacts on minority or low-income populations of interest.

The review team determined that the physical and environmental impacts from operation of Fermi 3 would attenuate rapidly with distance, intervening foliage, and terrain. There are four primary pathways in the environment: soil, water, air, and noise. The following four subsections discuss each of these pathways in greater detail.

5.5.2.1 Soil

The review team did not identify any pathway by which operations-related impacts on soils at the Fermi site would impose a disproportionately high and adverse impact on any population of interest. The review team considers the risk of soil salinization from cooling towers to be low and limited to a distance less than the nearest population of interest. Maintenance of the transmission lines would require some vehicular traffic in the transmission line corridor. However, impacts on soils along the transmission line corridors would be minimal and are not expected to affect any offsite communities. The review team identified no other environmental pathways related to soils.

5.5.2.2 Water

Operation of Fermi 3 would affect the water quality in Swan Creek and Lake Erie and water use of Lake Erie. Water quality impacts would result from increased stormwater runoff from the impervious surfaces of Fermi 3, thermal and chemical constituents in the cooling water discharges, and maintenance dredging of the intake canal. As discussed in Sections 5.2 and 5.3.2, operation of Fermi 3 would generate a small thermal plume from cooling water discharge piping into Lake Erie. Solutes in the effluent discharged would be diluted by the large water volume of the western basin of Lake Erie. In addition, discharges would be required to comply with limits imposed by permits. Consequently, the increase in temperature and concentration of these chemicals in Lake Erie would be negligible outside of the mixing zone of the discharge plume, and would have a negligible impact on aquatic biota or the general public (see Section 5.3.2.1). The discharge would be in a restricted area that would not be used for recreational activities such as swimming, diving, and other water sports.

Operation of Fermi 3 would require a withdrawal of approximately 34,000 gpm from Lake Erie, and approximately 17,000 gpm would be discharged to Lake Erie. As discussed in Section 5.2, the consumptive losses of water during normal Fermi 3 plant operations would result in no measurable effect on other users.

5.5.2.3 Air

Air emissions sources associated with operation of Fermi 3 would include two SDGs, two ADGs, an auxiliary boiler, and two diesel-driven FPs. These emissions sources would be small, would be used infrequently, and would be permitted for use by MDEQ. The cooling tower would emit small amounts of particulate matter, which would be further minimized by drift eliminators. Emissions from worker vehicles, onsite support vehicles and heavy equipment, and vehicles used in delivery or materials and fuels would also occur (Detroit Edison 2011a). However, emissions from these sources would be expected to minimally affect ambient air quality in offsite communities in the region. Therefore, the review team determines there is no air-related pathway by which minority or low-income populations of interest could receive a disproportionately high and adverse impact.

5.5.2.4 Noise

Primary noise sources associated with operation of Fermi 3 would be transformers, the cooling towers, and transmission lines. As noted in Section 5.8.2, noise from the transformers and cooling tower would be buffered by the distance of the plant from residences such that the ambient sound level should not increase appreciably. Day-night noise levels from the Fermi 3 cooling towers are anticipated to be less than 65 dBA at the nearest noise-sensitive receptor. Noise along the transmission lines would be very low, except possibly directly below the line on a quiet, humid day (Detroit Edison 2011a).Therefore, the review team determines there is no noise-related pathway by which minority or low-income populations of interest could receive a disproportionately high and adverse impact.

5.5.2.5 Summary of Physical and Environmental Impacts on Minority or Low-Income Populations

The review team's investigation and outreach did not reveal any unique characteristics or practices among minority or low-income populations that could result in physical or environmental impacts different from impacts on the general population.

As discussed in Section 2.6, most of the census block groups classified as minority or low-income lie to the north and south of the Fermi site, in Wayne and Lucas Counties, within and near Detroit and Toledo. One census block group located approximately 8 mi from the Fermi site within Monroe County qualifies as both a minority and a low-income population of interest. This census block group would not be affected by any physical or environmental impact because of the distance of this area from the site. No impacts would be expected on migrant farm workers if they were to be employed in transient farming activity near the Fermi site, and no subsistence activities are known to occur near the Fermi site.

Based on information provided by Detroit Edison and the review team's independent review, the review team finds no pathways from soil, water, air, and noise that would lead to disproportionately high and adverse impacts on minority or low-income populations of interest.

5.5.3 Socioeconomic Impacts

Socioeconomic impacts (discussed in Section 5.4) were reviewed to evaluate whether any operational activities could have a disproportionately high and adverse effect on minority or low-income populations of interest. With the exception of traffic, any adverse socioeconomic impacts associated with the operation of Fermi 3 are expected to be SMALL. While there likely would be adverse MODERATE impacts on traffic during outages, these impacts are not expected to be disproportionately high for low-income and minority populations of interest.

5.5.4 Subsistence and Special Conditions

The NRC's environmental justice evaluation methodology includes an assessment of populations of particular interest or unusual circumstances, such as minority communities exceptionally dependent on subsistence resources or identifiable in compact locations, such as Native American settlements.

As discussed in Section 2.6.3, access to the Fermi site is restricted, which reduces any impact on plant-gathering, hunting, and fishing activities at the site. Detroit Edison and the review team interviewed community leaders in Monroe County with regard to subsistence practices, and no such practices were identified in the vicinity of the Fermi site. There is no documented subsistence fishing in Lake Erie, Swan Creek, or Stony Creek, and no documented subsistence plant-gathering or hunting in the vicinity of the Fermi site. The review team determines there are no operational activities that would have a disproportionately high and adverse impact on minority or low-income populations of interest related to subsistence activities.

5.5.5 Summary of Environmental Justice Impacts

The review team has evaluated the proposed Fermi 3 operational activities and the potential environmental justice impacts in the vicinity and region. The review team determines there are no environmental pathways by which the identified minority or low-income populations in the 50-mi region would be likely to experience disproportionately high and adverse human health, environmental, physical, or socioeconomic effects as a result of operation of Fermi 3; therefore, environmental justice impacts would be SMALL.

5.6 Historic and Cultural Resource Impacts from Operation

The National Environmental Policy Act of 1969 as amended (NEPA) requires Federal agencies to take into account the potential effects of their undertakings on the cultural environment, which includes archaeological sites, historic buildings, and traditional places important to local populations. The National Historic Preservation Act of 1966 as amended (NHPA) also requires Federal agencies to consider impacts on those resources if they are eligible for listing on the *National Register of Historic Places* (NRHP) (such resources are referred to as "Historic Properties" in NHPA). As outlined in 36 CFR 800.8, "Coordination with the National Environmental Policy Act of 1969," the NRC is coordinating compliance with Section 106 of the NHPA in meeting the requirements of NEPA. For specific historic and cultural resources on the Fermi site, see Section 2.7.

Operating a new nuclear unit can affect either known or undiscovered cultural resources and/or historic properties. In accordance with the provisions of NHPA and NEPA, the NRC and the USACE are required to make a reasonable and good faith effort to identify historic properties in the area of potential effects (APE) and permit area, respectively, and, if historic properties are present, determine whether significant impacts are likely to occur. Identification of historic properties is to occur in consultation with the State Historic Preservation Officer (SHPO), American Indian Tribes, interested parties, and the public. If significant impacts are possible, then efforts should be made to mitigate them. As part of the NEPA/NHPA integration, even if no historic properties (i.e., places listed or eligible for listing on the NRHP) are present or affected, the NRC and the USACE are still required to notify the SHPO before proceeding. If it is determined that historic properties are present, the NRC and the USACE are required to assess and resolve adverse effects of their respective authorized activities for the undertaking.

During the operation of Fermi 3, the cooling tower vapor plume would be visible within the visual setting of the other 21 architectural resources that have been determined or recommended eligible for listing in the NRHP. The existing visual setting of these properties, which are all located offsite but within the indirect APE, currently includes existing vapor plumes from the active Fermi 2 power plant facilities on the Fermi property and from the active Monroe County coal-fired power plant to the south along the Lake Erie shoreline. Therefore, the Fermi 3 cooling tower plume would be consistent with the existing visual settings and views from these 21 architectural resources, and there would be no new significant visual impacts that would affect their NRHP eligibility determination or recommendations for their eligibility (Demeter et al. 2008). As such, indirect visual impacts resulting from operating Fermi 3 would be consistent with, and would not result in significant changes to, offsite historic properties within the indirect APE.

For the purposes of NHPA Section 106 consultation (36 CFR 800.8), based on (1) the measures that Detroit Edison would take to avoid or limit adverse impacts on significant cultural resources, (2) the review team's cultural resource analysis and consultation, and (3) Detroit Edison's commitment to follow its procedures should ground-disturbing activities discover cultural and historic resources, the review team concludes with a finding of no historic properties affected by operation. Section 4.6 concludes with a finding of historic properties affected from construction activities.

For the purposes of the review team's NEPA analysis of the operation of Fermi 3, based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the impacts of Fermi 3 operation on historic and cultural resources within the Fermi 3 APE would be SMALL, because indirect visual impacts resulting from operating Fermi 3 would be consistent with, and would not result in significant changes to, offsite historic properties within the indirect APE.

The review team has considered impacts related to operation of the proposed transmission lines. Detroit Edison has indicated that operation of the transmission lines would be the responsibility of ITC*Transmission*, an intrastate transmission company. As such, any further investigations to identify the presence of cultural and historic resources and to evaluate the NRHP eligibility of such resources would be the responsibility of ITC*Transmission*, which would conduct such investigations in accordance with applicable regulatory and industry standards to assess impacts of operation (Detroit Edison 2011a).

According to 10 CFR 50.10(a)(2)(vii), transmission lines are not included in NRC's definition of construction and are not an NRC-authorized activity. Therefore, the NRC considers the offsite proposed transmission lines to be outside the NRC's APE and therefore not part of the NRC's consultation.

For the purposes of the review team's NEPA analysis, based on the review team's cultural resources analysis, operational impacts associated with proposed transmission lines are likely to be limited to maintenance of transmission lines, corridors, and access roads, and are not likely to result in new significant impacts on cultural resources or historic properties, once the transmission lines have been built. Impacts from operating the proposed transmission lines would be SMALL if there are no new significant alterations to the cultural environment. If these operating activities result in significant alterations to the cultural environment, the impacts could be greater.

5.7 Meteorological and Air Quality Impacts

The primary impacts of operation of the proposed Fermi 3 on local meteorology and air quality would be from releases to the environment of heat and moisture from the primary cooling system, operation of auxiliary equipment (e.g., generators and a boiler), and mobile emissions (e.g., worker vehicles) (Detroit Edison 2011a). The potential impacts of releases from operation of the cooling system are discussed in Section 5.7.1. Section 5.7.2 discusses potential air quality impacts from nonradioactive effluent releases from Fermi 3, and Section 5.7.3 discusses the potential air quality impacts associated with transmission lines during plant operation.

5.7.1 Cooling System Impacts

The proposed cooling system for Fermi 3 is a NDCT. The proposed NDCT removes excess heat by evaporating water. Upon exiting the tower, water vapor would mix with the surrounding air, and this process would generally lead to condensation and formation of a visible plume, which would have aesthetic impacts. Other meteorological and atmospheric impacts include fogging, icing, drift deposition from dissolved salts and chemicals found in the cooling water, cloud formation, plume shadowing, additional precipitation, and increased humidity. In addition, plumes from the NDCT could interact cumulatively with emissions from other sources and the Fermi 2 cooling towers. Two four-cell mechanical draft cooling towers (MDCTs) will be used to dissipate heat from the Plant Service Water System usually during plant shutdown (Detroit Edison 2011a). The heat dissipated by the MDCTs is orders of magnitude less than that dissipated by the NDCT, and its impacts are bounded by the impacts of the NDCT and are not discussed further.

The Electric Power Research Institute's SACTI (Seasonal/Annual Cooling Tower Impact) prediction computer code was used by Detroit Edison to estimate impacts associated with operating the NDCT. Site-specific, tower-specific, and circulating water-specific engineering data were used as input to the SACTI model. Five years (2003–2007) of onsite meteorological data combined with meteorological data from the Detroit Metropolitan Airport and mixing height data from White Lake, Michigan, were used (Detroit Edison 2011a). The NDCT was simulated by using a height of 600 ft and a top exit diameter of 292 ft.

5.7.1.1 Visible Plumes

Results from the SACTI analysis, as reported in the ER (Detroit Edison 2011a), indicated that, on average, the longest plumes would occur in the winter and the shortest in the summer. The model predicts an average plume length of about 1.5 mi in the winter and 0.24 mi in the summer. On an annual basis, SACTI predicts the plume lengths from the NDCT will be less than 3281 ft about half the time. For comparison, the nearest plant boundary is 2766 ft from the NDCT. The highest probability of a visible plume at the distance of the nearest plant boundary is 7.33 percent in any particular direction. The frequency of occurrence of long cooling tower plumes from the NDCT in a given direction is expected to be low and does not warrant mitigation.

Ground-level fogging occurs when a visible plume from a cooling tower contacts the ground. As noted in the ER (Detroit Edison 2011a), the SACTI model, based on studies of actual NDCTs, assumes that the occurrence of fogging is an insignificant event due to the height of the NDCTs and does not estimate their occurrence. However, meteorological conditions favoring natural fogs also favor cooling tower fogging. Natural fogging in the Fermi region occurs about 18 days per year on average (NCDC 2010). Any plume-induced event would thus be infrequent and likely to occur concurrently with a natural fog. Thus, the impacts of plume-induced fogging from the NDCT are expected to be negligible and would not warrant mitigation.

5.7.1.2 Icing

Icing may occur when the cooling tower plume comes in contact with the ground (i.e., fogging occurs) at below-freezing temperatures. There are about 130 days per year with a minimum temperature at or below freezing in the area (NCDC 2010). Icing would thus be less frequent than fogging because about one-third of fogging occurs in nonfreezing months. Thus, the impacts of plume-induced icing from the NDCT are expected to be negligible and would not warrant mitigation.

5.7.1.3 Drift Deposition

The NDCT would use drift eliminators to minimize the loss of cooling water from the tower via drift, but some droplets would still escape from the tower along with the moving airstream and would be deposited on the ground. Cooling water is also treated prior to discharge to reduce salt concentration. The SACTI model predicted maximum deposition rates of 0.0001 kg/ha/mo annually between 13,779 and 30,840 ft and 0.0002 kg/ha/mo during the winter between 14,436 and 30,840 ft east-northeast of the NDCT (Detroit Edison 2011a). These maximum impacts are well below the levels considered acceptable in NUREG-1555 (NRC 2000a) (i.e., deposition of salt drift at rates of 1 to 2 kg/ha/mo), which are generally not damaging to plants. Thus, the impacts of salt deposition on vegetation are expected to be negligible, and no further mitigation is warranted.

5.7.1.4 Cloud Formation and Plume Shadowing

Cloud formation due to NDCTs has been observed is several power plants (Detroit Edison 2011a). Plume shadowing from cloud development or from the cooling tower plume itself is predicted by the SACTI model by calculating the average number of hours the visible plume would shadow the ground. Maximum shadowing would occur 656 ft north of the NDCT for an average of 348 hr per year. Beyond the nearest property boundary, the average hours of plume shadowing would be about 92 hr per year, 2.1 percent of the annual daylight hours, which would be insignificant in terms of effects on agricultural production. Thus, the impacts of plume shadowing are expected to be minimal and would not require mitigation.

5.7.1.5 Additional Precipitation

Occasional light drizzle and snow have been observed within a few hundred meters of cooling towers. These events are localized and should have no effect beyond the plant boundaries (Detroit Edison 2011a). The SACTI model assesses additional precipitation as water deposition. The SACTI model predicted maximum water deposition of 5.9 $kg/km^2/mo$ between 15,000 ft and 31,000 ft east-northeast of the Fermi 3 NDCT with an average deposition of 2.2 $kg/km^2/mo$] within the 31,000-ft distance (considering all wind directions of plume travel). This maximum deposition is about 0.0001 percent of the average driest monthly rainfall and at most 0.000003 hundredths of an inch of additional ice accumulation in the Fermi area.

Meteorological conditions conducive to induced snowfall can occur at the Fermi site. Observed snowfall accumulations associated with operating cooling towers have been less than 1 in. of very light, fluffy snow and have been only a small fraction of the snowfalls (about 44 in.) typical for the area (NCDC 2010). Thus, impacts of additional precipitation from the Fermi 3 NDCT are expected to be minimal and would not require mitigation.

5.7.1.6 Humidity Increases

Both the absolute and relative humidity aloft would increase in the vicinity of the NDCT vapor plume, as shown by the presence of a visible plume predicted by the SACTI model (Detroit Edison 2011a). However, ground-level increases in absolute humidity would be smaller. Increases in relative humidity could be larger in colder weather due to relatively low moisture-bearing capacities of cold air. Any increases in humidity should be localized and short-lived as the plume disperses and mixes with the far larger volume of surrounding air. Thus, increases in ground-level humidity are expected to be minimal and would not warrant mitigation.

5.7.1.7 Interaction with Other Pollutant Sources

The existing Fermi 2 NDCTs are located about 0.58 and 0.73 mi northeast of the planned location of the Fermi 3 NDCT (Detroit Edison 2011a). The plumes would usually travel in parallel, rather than in intersecting directions. Potential cumulative interaction of existing and new cooling tower plumes is expected to be insignificant, given the large separation distance and the fact that the plumes would travel along nonintersecting paths most of the time.

Existing combustion sources such as diesel generators and boilers currently operate infrequently at the Fermi site (not typically during normal plant operations); combustion sources that would be associated with Fermi 3 would similarly operate for limited periods. With the exception of particulates, these combustion sources emit pollutants (such as nitrogen oxides [NO_x], sulfur dioxide [SO_2], and carbon monoxide [CO]) that are different from those produced by cooling towers (i.e., small amounts of particulate matter as drift). Interaction among pollutants emitted from these sources and the cooling tower plumes would be intermittent and would not have a significant impact on air quality. Based on the above considerations and the assumption that cooling towers associated with Fermi 3 would be similar to existing cooling towers used at other nuclear sites, the review team concludes that the cooling tower impacts on air quality would be minimal and additional mitigation of air quality impacts would not be warranted.

5.7.1.8 Summary of Cooling System Impacts

On the basis of the analysis presented by Detroit Edison in the ER and the review team's independent evaluation of that analysis, the review team concludes that atmospheric impacts of cooling tower operation would be minor and that no further mitigation is warranted.

5.7.2 Air Quality Impacts

Section 2.9 describes the meteorological characteristics and air quality of the Fermi site. Sources of air emissions (Detroit Edison 2011a) include stationary combustion sources (two SDGs, two ADGs, two diesel-driven FPs, and an auxiliary boiler), cooling towers (an NDCT and two MDCTs), and mobile sources (worker vehicles, onsite heavy equipment and support vehicles, and delivery of materials and disposal of wastes). Stationary combustion sources would operate only for limited periods, often for periodic maintenance testing. The NDCT would operate for the entire year, while the two four-cell MDCTs would operate during limited operating scenarios and during shutdown.

5.7.2.1 Criteria Pollutants

Air pollutants emitted from stationary combustion sources (e.g., particulates, sulphur oxides, carbon monoxide, hydrocarbons, and nitrogen oxides) and from cooling towers (particulates as drift) associated with Fermi 3 operations would be permitted in accordance with MDEQ and Federal regulatory requirements. Shown in Table 5-22 are Detroit Edison's estimated annual emissions for stationary combustion sources during operation of Fermi 3, which are based on the anticipated number of units, power rating, and hours of operation: 48 hr per year for two

Table 5-22. Estimated Annual Emissions of $PM_{2.5}$, NO_x, VOC, SO_2, and CO_2 Associated with Operation of Fermi 3

Source Category	Annual Emissions (tons/yr)				
	$PM_{2.5}$	**NO_x**	**VOC**	**SO_2**	**CO_2**
Stationary combustion sources[(a)]	0.85	9.91	0.94	0.11	7734
NDCT[(b)]	6.63	NA[(c)]	NA	NA	NA
MDCT[(b)]	1.84	NA	NA	NA	NA
Worker vehicles[(d)]	0.18	5.63	6.47	0.13	14,419
Onsite heavy equipment and support vehicles	0.01	0.19	0.17	0.00[(e)]	228
Delivery of materials and disposal of wastes[(g)]	0.00	0.18	0.03	0.00	32
Total	**9.51**	**15.9**	**7.61**	**0.24**	**22,413**

Source: Detroit Edison 2011a, c

(a) Includes emissions from two SDGs, two ADGs, two diesel-driven FPs, and an auxiliary boiler.

(b) It is conservatively assumed that the NDCT and one of the two MDCTs would continuously operate for the entire year at the maximum water flow rate. Typically, the two MDCTs would operate during plant shutdown conditions only, which normally last one month.

(c) NA = Not applicable.

(d) It is assumed that operation workers would travel through the nonattainment/maintenance area to and from the Fermi site with a roundtrip distance of 39.3 mi.

(e) 0.00 denotes less than 0.005.

(g) It is assumed that delivery trucks would travel from the Fermi site to the farthest point within the nonattainment/maintenance area with a roundtrip distance of 184 mi.

SDGs and two diesel-driven FPs; 8 hr per year for two ADGs; and 720 hr per year for an auxiliary boiler. In addition, $PM_{2.5}$ emissions for cooling towers were estimated based on continuous operation for the entire year at the maximum water flow rate.

Monroe County has been designated nonattainment for $PM_{2.5}$ (particulate matter with an aerodynamic diameter of less than or equal to 2.5 micrometers) and maintenance for 8-hr ozone (EPA 2010a). In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). This request is based, in part, on air quality monitoring data collected in the 2007-2010 period showing all seven counties in southeast Michigan in attainment for the $PM_{2.5}$ NAAQS. If this request is eventually approved, Monroe County would then become a maintenance area for $PM_{2.5}$. In either case, facility operations for Fermi 3 are subject to conformity analysis. Thus, Detroit Edison provided estimates for project-related direct and precursor emissions of $PM_{2.5}$ and ozone ($PM_{2.5}$, NO_x, volatile organic carbon [VOC], and SO_2). PM_{10} (particulate matter with an aerodynamic diameter of less than or equal to 10 micrometers) emissions from operation were not estimated to determine the applicability of conformity requirements for operations because the area is designated as an attainment area for PM_{10}.

Table 5-22 presents Detroit Edison's estimated annual emissions associated with operations of Fermi 3. Annual emissions from operation of Fermi 3 would be up to about 0.15 percent (for $PM_{2.5}$) of total emissions in Monroe County and up to 0.03 percent (for $PM_{2.5}$) of total emissions in all neighboring counties that are currently designated as $PM_{2.5}$ nonattainment or as an ozone maintenance area (EPA 2010b).

All the estimated annual emissions shown in Table 5-22 are well below the 100 tons/yr conformity determination thresholds for direct and precursor emissions for $PM_{2.5}$ and ozone. Therefore, a general conformity determination is unlikely to be needed for facility operations of the Fermi 3 based on Detroit Edison's emissions estimate.

New or modified sources of air pollution are considered to be a major source and need to undergo a new source review (NSR) before construction if they emit or have the potential to emit (PTE)[a] 100 tons/yr or more of any criteria air pollutant. The review team has estimated the Fermi 3 PTE for NO_x to be about 116 tons/yr (EPA 1995; MDEQ 2005), which exceeds the major source threshold. To avoid being a major source, Fermi 2 and Fermi 3 would need to limit their combined PTE to be eligible as a "synthetic minor" (or "opt-out") source.[b] Fermi 2 has a synthetic minor permit with a NO_x limit of 89.4 tons/yr based on a 12-month rolling time period, a limit that is met by monitoring monthly fuel usage and calculating the associated NO_x emissions. Detroit Edison has not initiated an application to the Air Quality Division of MDEQ for a Permit to Install for the proposed Fermi 3.

The SDGs, ADGs, and FPs would be required to comply with the requirements of the "National Emission Standards for Hazardous Air Pollutants" given in 40 CFR 63.6603 and 63.6604. These regulations specify emission limits and, for nonemergency diesels, performance tests, limitations on fuel sulphur content, and operating limitations. In addition, depending on when the engines are built and installed, there may be additional requirements under the "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines" (40 CFR Part 60, Subpart IIII). These Federal requirements would be administered by the State and included in the Permit to Install. No open burning would occur during operations.

(a) PTE is defined as the maximum capacity of a stationary source to emit a pollutant under its physical and operation design. Typically, PTE is the maximum amount of air pollutants that the facility could emit if it continuously operates 24 hr/day and 365 days/yr at its full design capacity with air pollution control equipment being turned off (but only if the operation of the device is required by a legally enforceable permit condition, rule, or compliance/enforcement document) (MDEQ 2005). To estimate PTE in this analysis, it is assumed that SDGs, ADGs, and diesel-driven FPs would operate 500 hr/yr each and an auxiliary boiler would operate 8760 hr/yr (EPA 1995; MDEQ 2005).

(b) A synthetic minor source is a facility that can operate as a major source, but for which the applicant is voluntarily requesting a Federally enforceable limit on one or more parameters (e.g., throughput or operating time) such that the PTE of the facility remains below major source thresholds. The legally enforceable permit conditions should contain a monitoring/recordkeeping requirement that can be used to demonstrate compliance with the permit.

Given the small size and infrequent operation of combustion equipment, their impact on offsite air quality is expected to be minimal. The NDCT, which emits particulate matter only as drift, would be equipped with drift eliminators to limit drift to 0.001 percent or less of total water flow. The tabulated $PM_{2.5}$ emissions from the NDCT and MDCTs would account for about 89 percent of total emissions from Fermi 3 operations, but potential particulate matter (PM) impacts at the ground level outside the Fermi property would be minimal due to the tall height of the tower, which allows for good dispersion of the drift.

There are no mandatory Class I Federal areas where visibility is an important value within a 275-mi radius of the Fermi 3 site. Considering the distance to the Class I areas and the minor nature of air emissions from the Fermi 3 site, there is little likelihood that activities at the Fermi 3 site could adversely affect air quality and air quality-related values (e.g., visibility or acid deposition) in any of the Class I areas.

Given the significant distance between the operations area and offsite sensitive receptors, no offsite impacts from fugitive dust are expected during operation (Detroit Edison 2011a). However, Detroit Edison notes that watering, reseeding, or paving of areas used for construction could be used if fugitive dust problems develop. Commitments to using these measures are expected to be included in the application for the Permit to Install submitted to MDEQ.

Based on the information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the air quality impacts of criteria pollutants would not be noticeable and additional mitigation would not be warranted, given Detroit Edison's commitment to manage and mitigate emissions in accordance with applicable regulations.

5.7.2.2 Greenhouse Gases

The operation of a nuclear power plant involves emissions of some greenhouse gases (GHG), primarily CO_2. Table 5-22 shows Detroit Edison's site-specific estimates of 22,413 tons/yr of CO_2 during operations of Fermi 3, about 7734 tons/yr from combustion sources and 14,679 tons/yr from mobile sources (Detroit Edison 2011a, c). This amounts to about 0.008 percent of the total projected GHG emissions in Michigan during 2010 at 253,800,000 metric tons of gross[(a)] CO_2 equivalent (CO_2e)[(b)] in 2010 (CCS 2008). This also equates to about 0.0004 percent of total CO_2 emissions in the United States during 2009, at 5.5 billion metric tons (EPA 2011). Workforce transportation accounts for about 64 percent of

(a) Excluding GHG emissions removed due to forestry and other land uses and excluding GHG emissions associated with exported electricity.

(b) A measure to compare the emissions from various GHGs on the basis of their global warming potential (GWP), defined as the ratio of heat trapped by 1 unit mass of the GHG to that of 1 unit mass of CO_2 over a specific time period.

the total CO_2 emissions shown in Table 5-22. Measures to mitigate transportation impacts, such as encouraging car pooling, would reduce CO_2 emissions.

Another estimate of the relative size of the Fermi 3 operation emissions can be made based on the information in Appendix L, which provides the review team's estimate of emissions for a generic 1000-MW(e) nuclear power plant. Plant operations and operation workforce emissions for the generic 1000-MW(e) nuclear power plant totaled about 353,000 tons (320,000 metric tons) over 40 years, or about 8800 tons/yr. The NRC staff used a scaling factor of 1.535 to adjust the differences in power generation capacity [1000 MW(e) versus 1535 MW(e)] between the reference plant and Fermi 3. Scaled plant operations and operations workforce emission estimates equate to about 13,500 tons/yr for Fermi 3. This also amounts to a small percentage of projected GHG emissions for Michigan and the United States.

Based on the small amount of Fermi 3 CO_2 emissions compared to the total Michigan and United States GHG emissions, the review team concludes that the atmospheric impacts of GHG emissions from plant operations would not be noticeable and additional mitigation would not be warranted.

EPA promulgated the Prevention of Significant Deterioration (PSD) requirements and Title V GHG Tailoring Rule on June 3, 2010 (75 FR 31514). This rule states that, among other items, new and existing sources not already subject to a Title V permit, or that have the potential to emit at least 100,000 tons/yr (or 75,000 tons/yr for modifications at existing facilities) CO_2e, will become subject to the PSD and Title V requirements effective July 1, 2011. The rule also states that sources with emissions (PTE) below 50,000 tons/yr CO_2e will not be subject to PSD or Title V permitting before April 30, 2016. Note that using the emission factors presented in ER Section 3.6.3.1 and assuming the SDGs, ADGs, and FPs operate 500 hr/yr each and the auxiliary boiler operates 8760 hr/yr, a combined CO_2 PTE of about 92,900 tons/yr was estimated. However, as discussed in Section 5.7.2.1, Fermi 3 could be exempted from GHG-related PSD or a Title V permit if it is eligible and chooses to be considered a “synthetic minor” source, which could significantly reduce the PTE emissions.

5.7.2.3 Summary of Air Quality Impacts

The review team has considered the timing and magnitude of atmospheric releases related to operation of Fermi 3, the existing air quality at the Fermi site, the distance to the closest Class I area, and the Detroit Edison commitment to manage and mitigate emissions in accordance with applicable regulations. On these bases, the review team concludes that the air quality impacts of operation of Fermi 3 would not be noticeable. Based on its assessment of the carbon footprint of plant operations, the review team concludes that the atmospheric impacts of GHGs from plant operations would not be noticeable.

5.7.3 Transmission Line Impacts

Impacts of existing transmission lines on air quality are addressed in the GEIS (NRC 1996). Small amounts of ozone and even smaller amounts of oxides of nitrogen are produced by transmission lines. The production of these gases was found to be insignificant for 745-kV transmission lines (the largest lines in operation) and for a prototype 1200-kV transmission line. In addition, it was determined that potential mitigation measures, such as burying transmission lines, would be very costly and would not be warranted.

Three new 345-kV transmission lines would be constructed between the Fermi 3 switchyard and the Milan Substation to accommodate the new power generating capacity (Detroit Edison 2011a). This size is well within the range of transmission lines evaluated in NUREG-1437 (NRC 1996). The review team therefore concludes that air quality impacts from the transmission lines would not be noticeable and mitigation would not be warranted.

5.7.4 Summary of Meteorological and Air Quality Impacts

The review team evaluated potential impacts on air quality associated with criteria pollutants and GHG emissions from operating Fermi 3. The review team also evaluated potential impacts of cooling system emissions and transmission lines. In each case, the review team determined that the impacts would be minimal. On this basis, the review team concludes that the impacts of operation of Fermi 3 on air quality from emissions of criteria pollutants, CO_2 emissions, and cooling system emissions would be SMALL and that no additional mitigation is warranted.

5.8 Nonradiological Health Impacts

This section addresses the nonradiological health impacts of operating the proposed new Fermi 3 at the Fermi site. Health impacts on the public from operation of the cooling system, noise generated by operations, EMFs, transport operations, and transport of outage workers are discussed. Health impacts from these same sources on workers at Fermi 3 are also evaluated. Health impacts from radiological sources during operations are discussed in Section 5.9.

5.8.1 Etiological Agents

Operation of the proposed Fermi 3 would result in a thermal discharge to Lake Erie (Detroit Edison 2011a). Such discharges have the potential to increase the growth of etiological agents, both in the circulating water system and the lake. Etiological agents include enteric pathogens (such as *Salmonella* spp.), *Pseudomonas aeruginosa*, thermophilic fungi, bacteria (such as *Legionella* spp.), and free-living amoeba (such as *Naegleria fowleri* and *Acanthamoeba* spp.). These microorganisms could result in potentially serious human health concerns, particularly at high exposure levels.

The proposed discharge pipe from Fermi 3 would be located southeast of Fermi 2, extend approximately 1300 ft into Lake Erie, and include a high-rate effluent diffuser for enhanced mixing of the thermal effluent with the receiving waters (Detroit Edison 2011a). On the basis of a thermal plume analysis for the worst-case scenario, it is estimated that the total plume surface area would be only approximately 55,300 ft^2 (Detroit Edison 2011a). The heated effluent discharge from Fermi 3 would be in a restricted industrial area that would not be used for recreation activities, such as boating, swimming, diving, and other water sports. The thermal plume would be approximately 1291 ft from the shoreline (Detroit Edison 2011a) and thus offer only a very limited chance that people on the shoreline would contact the warm water that could support etiological agents. The NRC staff conducted an independent analysis of the thermal discharge (see Section 5.2.3.1), and that analysis demonstrated that all State of Michigan requirements for thermal discharge would be met.

Available data assembled by the U.S. Centers for Disease Control and Prevention (CDC) for the years 2000 to 2008 (CDC 2002, 2003, 2004, 2005, 2006, 2007, 2008a, 2009, 2010) were reviewed for outbreaks of Legionellosis, Salmonellosis, or Shigellosis. Outbreaks that occurred in Michigan were within the range of national trends in terms of cases per populations of 100,000 and in terms of total cases per year, and the outbreaks were associated with pools, spas, or lakes. According to the Detroit Edison correspondence with Michigan Department of Community Health (MDCH) in April 2008, the department did not record any major waterborne disease outbreaks within Michigan in the last 10 years (Detroit Edison 2010d). The CDC Council of State and Territorial Epidemiologists Naegleria Work Group, after reviewing the data from different sources, identified 121 fatal cases of primary amebic meningoencephalitis (PAM, caused by *Naegleria fowleri*) in the United States from 1937 to 2007. Most cases occurred in southern States during the months of July and September (CDC 2008b).

Detroit Edison would use biocides to reduce the levels of microbial populations in the cooling tower and condenser and would comply with OSHA standards for Fermi 3 operational workers, as is currently done for Fermi 2 (Detroit Edison 2011a). No outbreaks of Legionnaires' disease, PAM, or any other waterborne disease associated with Fermi 2 operations have been reported in the past. The use of biocides would likely minimize the exposure of personnel to Legionella in the cooling water system.

Because of the historical low incidence of diseases from etiological agents in Michigan (Detroit Edison 2010d), the small and limited increase in temperature in Lake Erie expected as a result of operating Fermi 3, the currents around the proposed discharge structure, the distance of the discharge structure from the shore, and the relative absence of swimming or other activities that result in water immersion in the vicinity of the proposed discharge structures, the review team concludes that the impacts on human health would be SMALL and that further mitigation is not be warranted.

5.8.2 Noise

In NUREG-1437 (NRC 1996), the NRC staff discusses the environmental impacts of noise at existing nuclear power plants. Common sources of noise from plant operation include cooling towers and transformers, with intermittent contributions from loud speakers and auxiliary equipment such as diesel generators and vehicle traffic.

The existing Fermi 2 at the Fermi site uses primarily two NDCTs. Fermi 3 would use one NDCT to reject the waste heat from the system. Addition of the proposed cooling system could increase the noise level over the existing cooling system, which is considered in the noise study (Detroit Edison 2011a) as part of the ambient noise level. The ER (Detroit Edison 2011a) presented noise modeling results that included the noise sources from normal station operation, including cooling systems, transformers, and onsite and nearby offsite transmission lines. The switchyard was not modeled because it is not a significant noise source, and equipment in enclosures, such as diesel generators were not modeled, either. Predicted noise levels were compared with existing L_{90} values (i.e., noise levels that are exceeded 90 percent of the time and commonly used as the background level) with Fermi 2 in operation at the seven noise-sensitive receptor locations (residences) within 1.5 mi of the site. Noise levels resulting only from Fermi 3 operation are predicted to be relatively low, with a maximum of 37 dBA at the nearest residence, which is about 1900 ft north-northeast of the proposed Fermi 3 switchyard and 3200 ft north-northwest of the proposed Fermi 3 cooling tower. Sound-level increases over existing L_{90} values due to Fermi 3 operation would range between 0 and 2 dBA at six residences, a range that is lower than a barely discernable increase of about 3 dB (NWCC 2002). One exception is an expected 6-dB increase over the existing L_{90} value at the same nearest residence. This increase would occur during a small portion of nighttime hours and would be a noticeable change over existing L_{90} levels. However, combined (including background) day-night average sound levels (L_{dn}) modeled at three residences ranged between 54 and 63 dBA, indicating there was no increase over existing L_{dn} levels.

According to NUREG-1437 (NRC 1996), noise levels below 60 to 65 dBA as the day-night average noise level (DNL or L_{dn}) are considered to be of small significance. More recently, the impacts of noise were considered in NUREG-0586, Supplement 1 (NRC 2002). The criterion for assessing the level of significance was not expressed in terms of sound levels but based on the effect of noise on human activities and on threatened and endangered species. The criterion in NUREG-0586, Supplement 1, is stated as follows:

> The noise impacts [...] are considered detectable if sound levels are sufficiently high to disrupt normal human activities on a regular basis. The noise impacts [...] are considered destabilizing if sound levels are sufficiently high that the affected area is essentially unsuitable for normal human activities, or if the behavior or breeding of a threatened and endangered species is affected.

For Fermi 3 operations, the maximum predicted noise increase of 6 dBA over the existing L_{90} would occur at the nearest residence during a small portion of nighttime hours. However, during other times of day and night and at other nearby residences, predicted noise levels would not represent a significant increase over existing L_{90} levels. In addition, no increases of the day-night average level (L_{dn}) would be expected at any of the noise-sensitive residences. Given the postulated noise levels for Fermi 3, the review team concludes that the noise increases would be SMALL and that mitigation would not be warranted.

5.8.3 Acute Effects of Electromagnetic Fields

Electric shock resulting from either direct access to energized conductors or induced charges in metallic structures is an example of an acute effect from EMFs associated with transmission lines (NRC 1996). In the ER, Detroit Edison (2011a) stated that three new transmission lines and a separate switchyard would be required to connect Fermi 3 to the existing transmission system. Onsite transmission lines that would connect Fermi 3 to the proposed new Fermi 3 switchyard would be constructed and owned by Detroit Edison (Detroit Edison 2011a). Transmission lines that serve Fermi 3 offsite would be created and operated by ITC*Transmission* (Detroit Edison 2011a), which also operates and manages the existing Fermi 2 transmission system at the Fermi site (Detroit Edison 2011a). The existing ITC*Transmission* system meets National Electric Safety Code (NESC) criteria for induced currents (Detroit Edison 2011a). Detroit Edison stated that all transmission lines would comply with applicable regulatory standards and that the design and construction of the proposed Fermi 3 substation and transmission circuits would comply with NESC provisions (Detroit Edison 2011a). ITC*Transmission* would ensure that the electric field strength under the new transmission lines would conform to NESC guidelines (less than 7.5 kV/m maximum within the ROW and less than 2.6 kV/m maximum at the edge of the ROW) (Detroit Edison 2011a).

Knowing that Detroit Edison is committed to ensuring that the design of new transmission lines meet NESC criteria, the review team concludes that the impact on the public from the acute effects of EMFs would be SMALL and that additional mitigation is not be warranted.

5.8.4 Chronic Effects of Electromagnetic Fields

Power transmission lines in the United States operate at 60 Hz. The EMFs resulting from 60-Hz power transmission lines fall under the category of nonionizing radiation and are considered to be extremely low frequency (ELF) EMFs. Research on the potential for chronic effects from 60-Hz EMFs from energized transmission lines was reviewed by the NRC and is addressed in NUREG-1437 (NRC 1996). At the time of that review, research results were not conclusive. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the DOE. An NIEHS report (NIEHS 1999) contains the following conclusion:

> The NIEHS concludes that ELF-EMF (extremely low frequency-electromagnetic field) exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

The staff reviewed available scientific literature on chronic effects to human health from ELF-EMFs published since the NIEHS report and found that several other organizations reached the same conclusions (AGNIR 2006; WHO 2007a). Additional work under the auspices of the World Health Organization (WHO) updated the assessments of a number of scientific groups that reflected the potential for transmission line EMFs to cause adverse health impacts in humans. The monograph summarized the potential for ELF-EMFs to cause diseases such as cancers in children and adults; depression; suicide; reproductive dysfunction; developmental disorders; immunological modifications; and neurological disease. The results of the review by WHO (2007b) found that the extent of scientific evidence linking these diseases to EMF exposure is not conclusive.

These conclusions by four national and international groups are in agreement. The current scientific evidence regarding the chronic effect of ELF-EMFs does not conclusively link ELF-EMFs to adverse health impacts. The staff will continue to follow developments in this area.

5.8.5 Occupational Health

In general, occupational health risks for new units are expected to be dominated by occupational injuries (e.g., falls, electric shock, asphyxiation) to workers engaged in activities such as maintenance, testing, and plant modifications. The 2008 annual incidence rates (the number of injuries and illnesses per 100 full-time workers) for electrical power generation, transmission, and distribution workers for the State of Michigan and the United States are 3.7 and 3.2, respectively (USBLS 2009a, b). Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates, with a 2008 average incidence rate of 0.7 per hundred workers (USBLS 2009a). Based on the assumption of a total operations workforce of 900 (Detroit Edison 2011a), these rates suggest that operation of Fermi 3 would be associated with approximately 6 occupational injuries and illnesses per year. However, these are gross estimates and do not take into account risks workers would face if they are employed somewhere other than the Fermi 3. Occupational injury and fatality risks are reduced by strict adherence to NRC and OSHA safety standards (29 CFR Part 1910), practices, and procedures. Appropriate State and local statutes must also be considered when the occupational hazards and health risks associated with new nuclear unit operation are being assessed. The staff assumes adherence to NRC, OSHA, and State safety standards, practices, and procedures during Fermi 3 operations.

Additional occupational health impacts may result from exposure to hazards such as noise, toxic or oxygen-replacing gases, etiological agents in the condenser bays, and caustic agents. Detroit Edison (2011a) reports that it maintains a health and safety program to protect workers from industrial safety risks at the operating units and would implement the program for the proposed new units. Health impacts on workers from nonradiological emissions, noise, and EMFs would be monitored and controlled in accordance with the applicable OSHA regulations and would be SMALL.

5.8.6 Impacts of Transporting Operations Personnel to the Proposed Site

The general approach used to calculate nonradiological impacts from fuel and waste shipments was the same as that used to calculate the impacts from transport of operations and outage personnel to and from the Fermi site. However, the only data available for estimating these impacts were from preliminary estimates. The assumptions made to provide reasonable estimates of the parameters needed to calculate nonradiological impacts are discussed below.

- The average number of workers needed for operations was given as 900 in the ER (Detroit Edison 2011a), which also stated that a peak refueling staff of 1200 to 1500 temporary workers was required every 24 months. It was assumed that no sharing of personnel with Fermi 2 operations staff would occur. With approximately 10 percent of the workforce expected to carpool (Detroit Edison 2011a), there would be about 855 vehicle roundtrips per day for operations workers if two persons shared a ride for those who carpooled. For refueling outages, it was assumed that there would be an additional 1425 vehicle roundtrips per day during an outage because of the extra 1500 temporary workers estimated by using the same carpooling assumption.
- The average commute distance for operations and outage workers was assumed to be 23.5 mi one way (Detroit Edison 2011a).
- To develop representative commuter traffic impacts, a source was located that provided Michigan-specific accident, injury, and fatality rates for all traffic in the surrounding counties (Lenawee, Monroe, Washtenaw, and Wayne) for the years 2004 to 2008 (MDSP 2005, 2006, 2007, 2008, 2009).

The estimated impacts of transporting permanent operations personnel and temporary outage workers to and from the Fermi 3 site are shown in Table 5-23. The total annual traffic fatalities during operations, including both operations and outage personnel, represents about a 0.7 percent increase above the average 23 traffic fatalities/yr that occurred in Monroe County, Michigan, from 2004 to 2008 (MDSP 2005, 2006, 2007, 2008, 2009). This represents a small

Table 5-23. Nonradiological Impacts of Transporting Workers to and from the Fermi 3 Site

Type of Workers	Accidents per Year	Injuries per Year	Fatalities per Year
Permanent	4.3	12	0.14
Outage	3.0	0.85	0.0094

increase relative to the current traffic fatality risk in the area surrounding the proposed Fermi 3 site.

On the basis of the information provided by Detroit Edison, the review team's independent evaluation, and the fact that this increase would be small relative to the number of current traffic fatalities in the surrounding area, the review team concludes that the nonradiological impacts of transporting personnel to the Fermi 3 site would be minimal and that mitigation is not warranted.

5.8.7 Summary of Nonradiological Health Impacts

The staff evaluated health impacts on the public and workers from operation of the Fermi 3 cooling system, noise generated by Fermi 3 operations, acute and chronic impacts of EMFs from transmission lines, transport operations, and the transport of outage workers to and from Fermi 3. Health risks to workers are expected to be dominated by occupational injuries at rates below the average U.S. industrial rates. Health impacts on the public and workers from etiological agents, noise generated by Fermi 3 operations, and acute impacts of EMF are expected to be minimal. On the basis of the information provided by Detroit Edison and the review team's independent review, the review team concludes that the potential nonradiological health impacts resulting from the operation of Fermi 3 would be SMALL and that mitigation would not be warranted. Scientific evidence regarding the chronic impacts of EMFs on public health is inconclusive.

5.9 Radiological Impacts of Normal Operations

This section addresses the radiological impacts from normal operations of the proposed Fermi 3, including a discussion of the estimated radiation dose to a member of the public and to the biota inhabiting the area around the Fermi site. Estimated doses to workers from Fermi 3 operations are also discussed. The determination of radiological impacts was based on the General Electric-Hitachi Nuclear Energy Americas, LLC (GEH) Economic Simplified Boiling Water Reactor (ESBWR) design and the liquid and gaseous radiological effluent rates discussed in Section 3.4.2.3.

Revision 2 of Detroit Edison's ER incorporates Revision 7 of the Design Control Document (DCD); therefore, the COL application and evaluation of radiological impacts of normal operations presented here are based on Revision 7 of the DCD (GEH 2010a). Subsequently, GEH has submitted Revision 9 of the ESBWR DCD. However, in the new DCD, liquid and gaseous effluent rates have not changed (GEH 2010f).

5.9.1 Exposure Pathways

The public and biota would be exposed to increased ambient background radiation from Fermi 3 via the liquid effluent, gaseous effluent, and direct radiation pathways. Detroit Edison estimated the potential exposures to the public and biota by evaluating exposure pathways typical of those surrounding a nuclear unit at the Fermi site. Detroit Edison considered pathways that could cause the highest calculated radiological dose on the basis of the use of the environment by the residents located around the site (Detroit Edison 2011a). For example, factors such as the location of homes in the area, consumption of meat, fish, and shellfish from the area, and consumption of vegetables grown in area gardens were considered.

For the liquid effluent release pathway, Detroit Edison (2011a) considered the following exposure pathways in evaluating the dose to the maximally exposed individual (MEI): ingestion of aquatic food (i.e., fish and invertebrates); ingestion of drinking water; ingestion of meats, vegetables, and milk (using irrigation water contaminated by liquid effluent); and direct radiation exposure from shoreline activities, swimming, and boating (Figure 5-2). The analysis for population dose considered the same exposure pathways as those used for the individual dose assessment.

As discussed in the Final Safety Analysis Report (FSAR), the design of Fermi 3 includes a number of features to prevent and mitigate leakage from system components such as pipes and tanks that may contain radioactive material (Detroit Edison 2011b). In addition, Detroit Edison (2011b) committed to use the guidance in the *Generic FSAR Template Guidance for Life-Cycle Minimization of Contamination*, developed by the Nuclear Energy Institute (NEI 2009), to the extent practicable in the development of operating programs and procedures. However, the potential still exists for leaks of radioactive material such as tritium into the ground. Based on the discussion above, the NRC staff expects that the impacts from such potential leakage from Fermi 3 would be minimal.

For the gaseous effluent release pathway, Detroit Edison (2011a) considered the following exposure pathways in evaluating the dose to the individual: immersion in the radioactive plume, direct radiation exposure from deposited radioactivity, inhalation of airborne activity, ingestion of garden fruit and vegetables, and ingestion of meat and milk. For population doses from gaseous effluents, Detroit Edison (2011a) used the same exposure pathways as those used for the individual dose assessment. For calculations of the population dose, it was assumed that all agricultural products grown within 50 mi of Fermi 3 would be consumed by the population within 50 mi of Fermi 3.

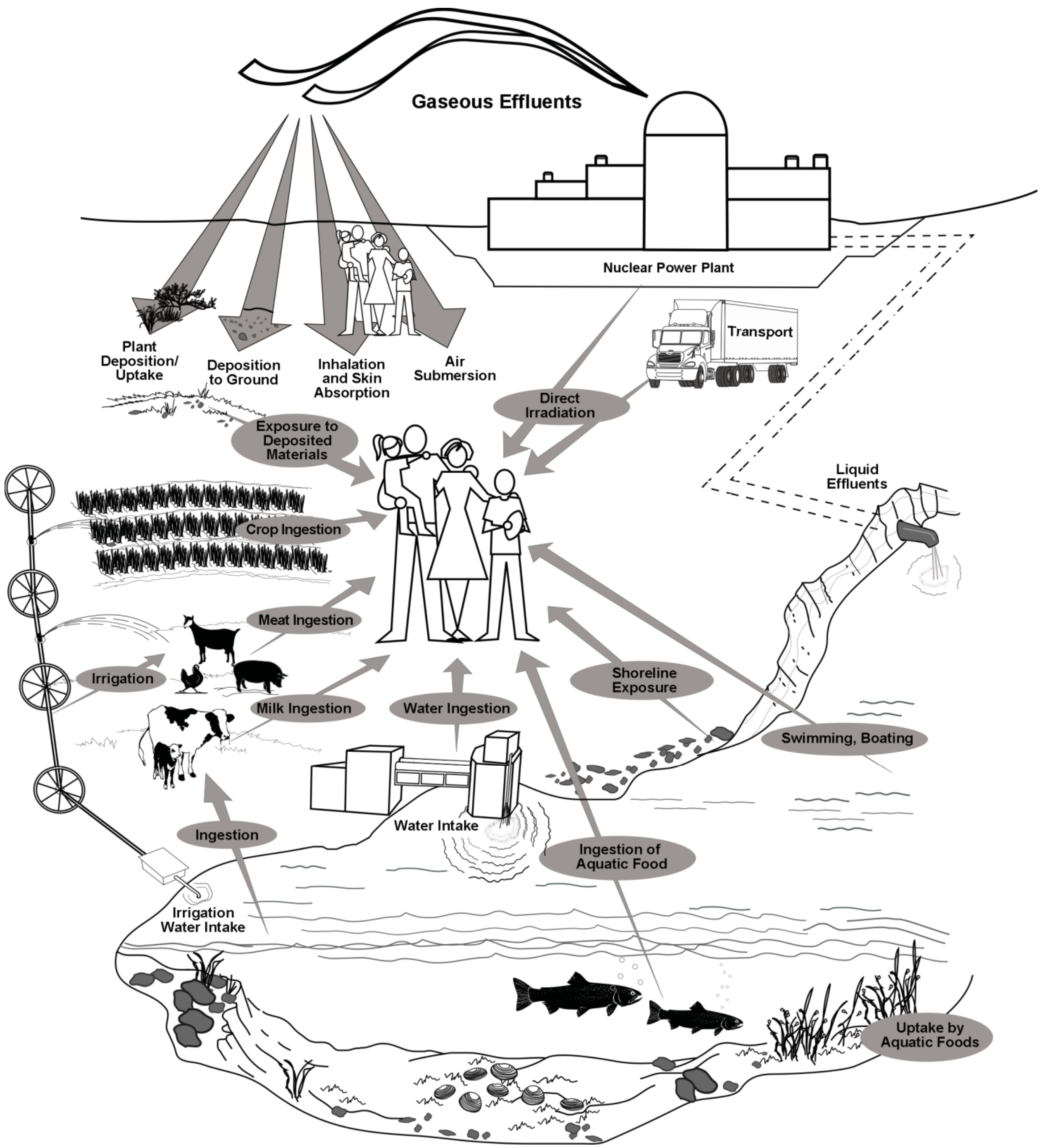

Figure 5-2 Exposure Pathways to Man (adapted from Soldat et al. 1974)

Detroit Edison (2011a) states that the reactor buildings would be the primary sources of direct radiation exposure to the public from Fermi 3. However, Detroit Edison asserts that contained sources of radiation at Fermi 3 would be shielded and would not contribute significantly to the external dose to the MEI or the population. This assumption of a negligible contribution from direct radiation beyond the site boundary is supported by the DCD (GEH 2010a).

Exposure pathways considered by Detroit Edison in the ER (Detroit Edison 2011a) in evaluating the dose to the biota are shown in Figure 5-3 and include:

- ingestion of aquatic foods
- external exposure from water immersion and shoreline sediments
- inhalation of airborne radionuclides
- external exposure to immersion in gaseous effluent plumes
- surface exposure from deposition of iodine and particulates from gaseous effluents (NRC 1977).

The NRC staff reviewed the exposure pathways for the public and nonhuman biota identified by Detroit Edison (2011a) and, on the basis of a documentation review, a tour of the site and surrounding areas, and interviews with Detroit Edison staff and contractors during a site visit in February 2009, found them to be appropriate.

5.9.2 Radiation Doses to Members of the Public

Detroit Edison calculated the dose to the MEI and the population living within a 50-mi radius of the site from both the liquid and gaseous effluent release pathways (Detroit Edison 2010a). As discussed in the Section 5.9.1, direct radiation exposure to the MEI from sources of radiation at Fermi 3 would be negligible.

5.9.2.1 Liquid Effluent Pathway

Liquid pathway doses to the MEI were calculated by using the LADTAP II computer program (Strenge et al. 1986). The following activities were considered in the dose calculations: (1) consumption of drinking water contaminated by liquid effluents; (2) consumption of fish, shellfish, or other aquatic organisms from water sources contaminated by liquid effluents; and (3) direct radiation from swimming in, boating on, and shoreline use of water bodies contaminated by liquid effluents. Detroit Edison stated that water from Lake Erie is not used for irrigation in the vicinity of Fermi 3 (Detroit Edison 2011a).

The liquid effluent releases used in the estimates of dose are found in Table 12.2-19b of the DCD (GEH 2010a). Other parameters used as inputs to the LADTAP II program – including the

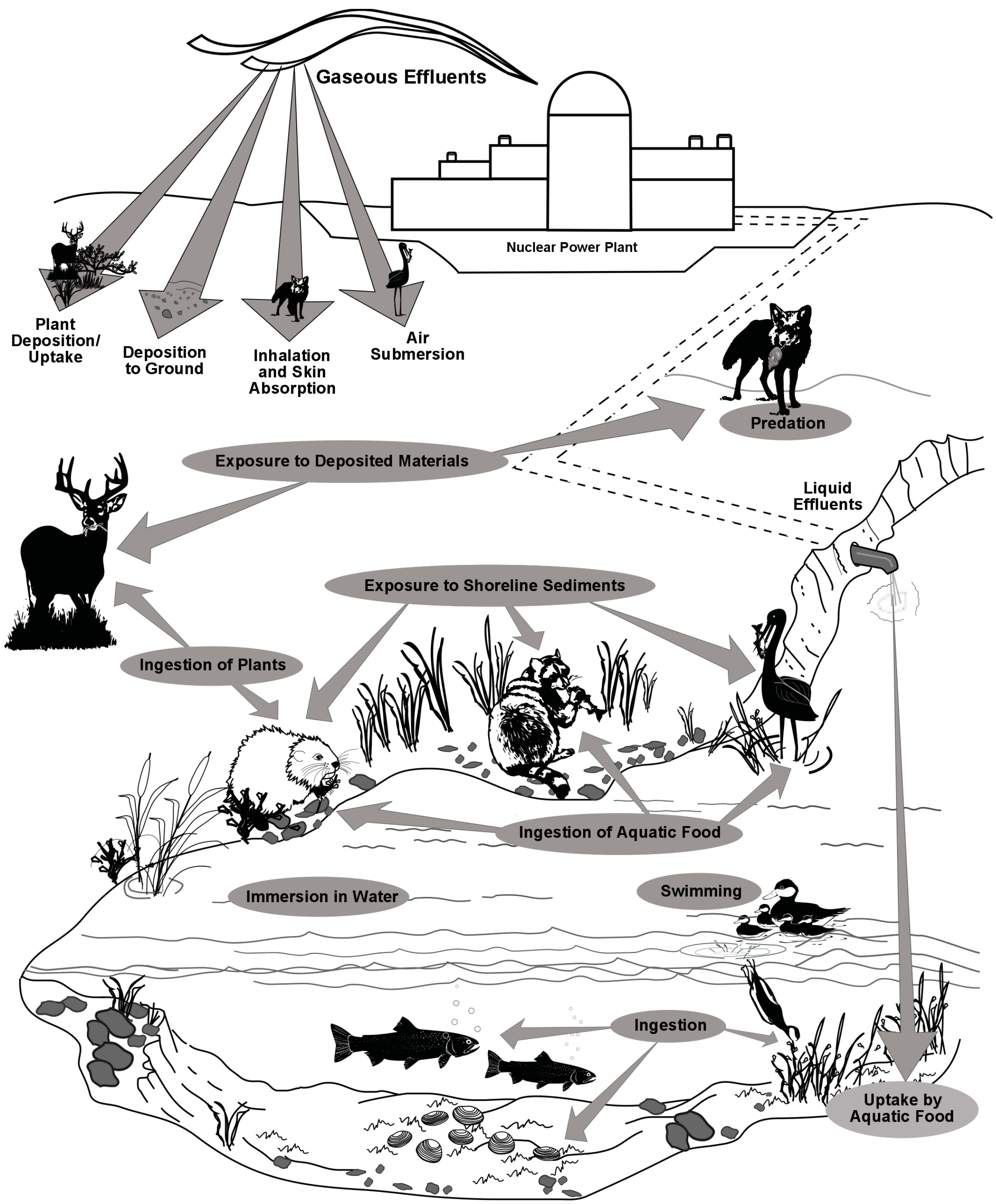

Figure 5-3. Exposure Pathways to Biota Other than Man (adapted from Soldat et al. 1974)

effluent discharge rate, dilution factor for discharge, transit time to receptor, and liquid pathway consumption and usage factors (i.e., shoreline usage, fish consumption, and drinking water consumption) – are found in Tables 5.4-1 and 5.4-2 of the ER (Detroit Edison 2011a).

Detroit Edison calculated liquid pathway doses to the MEI; these dose estimates are shown in Table 5-24. The MEI is an adult for whom the majority of the dose comes from fish ingestion.

Table 5-24. Doses to the MEI for Liquid Effluent Releases from Fermi 3

Pathway	Total Body (mrem/yr)	Thyroid (mrem/yr)	Bone (mrem/yr)
Drinking water	0.000605	0.0263	0.000592
Fish	0.00541	0.00219	0.0827
Invertebrate	0.000571	0.000188	0.00449
Shoreline (includes water recreation)	0.000101	0.000101	0.000101
Total	0.00648	0.0263	0.0877
Age group receiving maximum dose	Adult	Infant	Child

Source: Table 12.2-20bR in Detroit Edison (2011b) and Table 5.4-4 in Detroit Edison (2011a).

The maximally exposed organ is the bone of a child, and the majority of the dose is from fish ingestion.

The NRC staff recognizes the LADTAP II computer program as being an appropriate method for calculating the dose to the MEI for liquid effluent releases. The staff performed an independent evaluation of liquid pathway doses by using input parameters from the ER, and results were similar to those in the ER. The NRC staff judged all input parameters used in Detroit Edison's calculations to be appropriate. Results of the staff's independent evaluation are presented in Appendix G.

5.9.2.2 Gaseous Effluent Pathway

Gaseous pathway doses to the MEI were calculated by Detroit Edison by using the GASPAR II computer program (Strenge et al. 1987) at the nearest individual receptors in various directions (residence, garden, milk- and meat-producing animals, and the exclusion area boundary). The GASPAR II computer program was also used to calculate annual population doses. The following activities were considered in the dose calculations: (1) direct radiation from immersion in the gaseous effluent cloud and from particulates deposited on the ground, (2) inhalation of gases and particulates, (3) ingestion of contaminated meat and milk from animals eating contaminated grass, and (4) ingestion of garden vegetables contaminated by gases and particulates. The gaseous effluent releases used in the estimate of dose to the MEI and population are found in Table 12.2-16 of the DCD (GEH 2010a) for noble gases and other fission products and in Table 12.2-206 of the FSAR (Detroit Edison 2011b) for iodines. Other parameters used as inputs to the GASPAR II program – including population data, atmospheric dispersion factors, ground deposition factors, receptor locations, and consumption factors – are found in Tables 5.4-2 and 5.4-3 of the ER (Detroit Edison 2011a). Gaseous pathway doses to the MEI calculated by Detroit Edison are found in Table 5-25.

Table 5-25. Doses to the MEI for Gaseous Effluent Releases from Fermi 3

Pathway and Location	Age Group	Total Body Dose (mrem/yr)	Thyroid Dose (mrem/yr)	Bone Dose (mrem/yr)	Skin Dose (mrem/yr)
Plume (0.48 mi NNW)	All	1.42×10^{-1}	1.42×10^{-1}	1.42×10^{-1}	3.35×10^{-1}
Ground (0.59 mi NW)	All	4.95×10^{-1}	4.95×10^{-1}	4.95×10^{-1}	5.81×10^{-1}
Inhalation (0.59 mi NW)	Adult	2.81×10^{-3}	1.85×10^{-1}	1.74×10^{-3}	1.14×10^{-3}
	Teen	2.72×10^{-3}	2.40×10^{-1}	2.41×10^{-3}	1.16×10^{-3}
	Child	2.23×10^{-3}	2.93×10^{-1}	3.23×10^{-3}	1.02×10^{-3}
	Infant	1.29×10^{-3}	2.68×10^{-1}	2.20×10^{-3}	5.87×10^{-4}
Vegetable[(a)] (0.60 mi NW)	Adult	1.73×10^{-1}	3.89	4.81×10^{-1}	5.38×10^{-2}
	Teen	2.07×10^{-1}	5.41	6.96×10^{-1}	9.03×10^{-2}
	Child	3.37×10^{-1}	10.5	1.68	2.20×10^{-1}
Meat[(a)] (2.95 mi NNW)	Adult	1.61×10^{-3}	4.93×10^{-3}	6.67×10^{-3}	1.29×10^{-3}
	Teen	1.27×10^{-3}	3.72×10^{-3}	5.62×10^{-3}	1.09×10^{-3}
	Child	2.22×10^{-3}	6.02×10^{-3}	1.05×10^{-2}	2.05×10^{-3}
Goat milk (2.21 mi WNW)	Adult	1.68×10^{-2}	3.48×10^{-1}	2.38×10^{-2}	2.39×10^{-3}
	Teen	1.86×10^{-2}	5.53×10^{-1}	4.32×10^{-2}	4.34×10^{-3}
	Child	2.24×10^{-2}	1.10	1.05×10^{-1}	1.05×10^{-2}
	Infant	3.48×10^{-2}	2.67	1.88×10^{-1}	2.19×10^{-2}
Cow milk (2.09 mi WNW)	Adult	8.56×10^{-3}	2.84×10^{-1}	1.76×10^{-2}	2.53×10^{-3}
	Teen	1.13×10^{-2}	4.52×10^{-1}	3.22×10^{-2}	4.64×10^{-3}
	Child	1.86×10^{-2}	9.00×10^{-1}	7.80×10^{-2}	1.13×10^{-2}
	Infant	3.28×10^{-2}	2.18	1.46×10^{-1}	2.37×10^{-2}

Source: Detroit Edison 2011b

(a) No infant doses were calculated for the vegetable or meat pathway because the doses that infants receive from this diet would be bounded by the dose calculated for the child.

The NRC staff recognizes the GASPAR II computer program as an appropriate tool for calculating dose to the MEI and population from gaseous effluent releases. The staff performed an independent evaluation of gaseous pathway doses and obtained similar results to those in the ER. All input parameters used in Detroit Edison's calculations were judged by the staff to be appropriate. Results of the staff's independent evaluation are found in Appendix G.

5.9.3 Impacts on Members of the Public

This section describes the Detroit Edison's evaluation of the estimated impacts from radiological releases and direct radiation from Fermi 3. The evaluation addresses the dose from operations to the MEI located at the Fermi site boundary and the population dose (collective dose to the population within 50 mi) around Fermi 3.

5.9.3.1 Maximally Exposed Individual

Detroit Edison (2011a) states that total body and organ dose estimates to the MEI from liquid and gaseous effluents from Fermi 3 would be within the dose design objectives of 10 CFR Part 50, Appendix I. Total body doses and maximum organ doses at Lake Erie from liquid effluents were well within the Appendix I dose design objectives of 3 mrem/yr and 10 mrem/yr, respectively. Doses at the exclusion area boundary from gaseous effluents were well within the Appendix I dose design objectives of 10 mrad/yr air dose from gamma radiation, 20 mrad/yr air dose from beta radiation, 5 mrem/yr to the total body, and 15 mrem/yr to the skin. In addition, the dose to the thyroid was within the 15-mrem/yr Appendix I dose design objective. Table 5-26 compares the dose estimates for Fermi 3 to the Appendix I dose design objectives. The NRC staff completed an independent evaluation of the doses for comparison with Appendix I dose design objectives and found similar results, as shown in Appendix G.

Table 5-26. Comparisons of MEI Annual Dose Estimates from Liquid and Gaseous Effluents to 10 CFR Part 50, Appendix I, Dose Design Objectives

Radionuclide Releases/Doses	Detroit Edison Assessment	Appendix I Dose Design Objectives
Liquid effluents[(a)]		
Total body dose	0.006 mrem	3 mrem
Maximum organ dose (child bone)	0.088 mrem	10 mrem
Gaseous effluents (noble gases only)		
Beta air dose	0.26 mrad	20 mrad
Gamma air dose	0.22 mrad	10 mrad
Total body dose	0.98 mrem	5 mrem
Skin dose	1.15 mrem	15 mrem
Gaseous effluents (radioiodines and particulates)		
Maximum organ dose (child thyroid)	11.3 mrem	15 mrem

Source: Detroit Edison 2011a

(a) Total body dose is for an adult and maximum organ dose is for a child.

Detroit Edison (2011a) compared the combined dose estimates from direct radiation and gaseous and liquid effluents from the existing Fermi 2 and the proposed Fermi 3 against the 40 CFR Part 190 standards (Detroit Edison 2011a). Detroit Edison (2011a) states that the total body and organ dose estimates to the MEI from liquid and gaseous effluents for Fermi 3 are below the design objectives of 10 CFR Part 50, Appendix I. As stated in Section 5.9.2, exposure at the site boundary from direct radiation sources at Fermi 3 would not contribute significantly to the MEI dose. The routine thermoluminescent dosimeter (TLD) measurements (representative of direct radiation exposure) from operation of Fermi 2 at the site boundary are at background levels (Detroit Edison 2011a). Table 5-27 shows Detroit Edison's assessment that the total doses to the MEI from liquid and gaseous effluents at the Fermi site are well below the 40 CFR Part 190 standards. The staff completed an independent evaluation of the site total dose (cumulative dose) for comparison with 40 CFR Part 190 standards and found similar results, as shown in Appendix G.

Table 5-27. Comparison of MEI Doses (mrem/yr) to 40 CFR Part 190 Dose Standards

Dose Site	Fermi 2	Fermi 3			Fermi Site Total	40 CFR Part 190 Standards
	Combined Liquid and Gaseous	Liquid	Gaseous	Combined		
Total body	4.68	0.006	0.976	0.98	5.66	25
Thyroid	2.66	0.026	11.3	11.33	13.99	75
Other organ – child bone	0.05	0.088	2.18	2.27	2.32	25

Source: Detroit Edison 2011a

5.9.3.2 Population Dose

Detroit Edison estimated the collective total body dose within a 50-mi radius of the Fermi 3 site to be 14.9 person-rem from liquid effluents (Detroit Edison 2011a) and 6.7 person-rem/yr from gaseous effluents (Detroit Edison 2011a). The estimated collective dose to the same population from natural background radiation is estimated to be 2,400,000 person-rem/yr. The dose from natural background radiation was calculated by multiplying the 50-mi population estimate for 2060 of approximately 7,710,000 people by the annual background dose rate of 311 mrem/yr (NCRP 2009).

The collective dose from the gaseous and liquid effluent pathways was estimated by using the GASPAR II and LADTAP II computer codes, respectively. The staff performed an independent evaluation of population doses and obtained similar results (see Appendix G).

Radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments, such as cancer induction. The recent BEIR VII report by the National Research Council (2006) reconfirms the linear, no-threshold dose response model. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, though it recognizes that the model probably overestimates those risks. On the basis of this method, the NRC staff estimated the risk to the public from radiation exposure by using the nominal probability coefficient for total detriment. The value of this coefficient is 570 fatal cancers, nonfatal cancers, and severe hereditary effects per 1,000,000 person-rem (10,000 person-Sv), which is equal to 0.00057 effect per person-rem. The coefficient is taken from International Commission on Radiological Protection (ICRP) Publication 103 (ICRP 2007).

Both the National Council on Radiation Protection and Measurements (NCRP) and ICRP suggest that when the collective effective dose is smaller than the reciprocal of the relevant risk detriment (i.e., less than 1/0.00057, which is less than 1754 person-rem), the risk assessment should note that the most likely number of excess health effects is zero (NCRP 1995; ICRP 2007). The estimated collective whole body dose to the population living within 50 mi of Fermi 3 is 19.4 person-rem/yr (Detroit Edison 2011a), which is less than the value of 1754 person-rem that the ICRP and NCRP suggest would most likely result in zero excess health effects (NCRP 1995; ICRP 2007).

In addition, at the request of the U.S. Congress, the National Cancer Institute (NCI) conducted a study and published the results in *Cancer in Populations Living near Nuclear Facilities* (NCI 1990). This report included an evaluation of health statistics around all nuclear power plants as well as several other nuclear-fuel-cycle facilities in operation in the United States in 1981. It found “no evidence that an excess occurrence of cancer has resulted from living near nuclear facilities” (NCI 1990).

5.9.3.3 Summary of Radiological Impacts on Members of the Public

The NRC staff evaluated the health impacts from routine gaseous and liquid radiological effluent releases from Fermi 3. On the basis of the information provided by Detroit Edison and NRC’s independent evaluation, the NRC staff concludes there would be no observable health impacts on the public from normal operation of Fermi 3, the health impacts would be SMALL, and additional mitigation is not warranted.

5.9.4 Occupational Doses to Workers

At the Fermi site, the annual occupational collective dose for 2005 through 2008 averaged 118 person-rem for the existing Fermi 2 (Lewis and Hagemeyer 2010). The estimated annual occupational collective dose for advanced reactor designs, including the GE-Hitachi ESBWR at the Fermi 3 site, was 84.52 person-rem (GEH 2010a), which is less than the annual occupational collective dose of 88 person-rem for current light-water reactors (LWRs) for calendar year 2008 (Lewis and Hagemeyer 2010).

The licensee of a new plant would need to maintain individual doses to workers within 0.05 Sv (5 rem) annually, as specified in 10 CFR 20.1201, and incorporate as low as is reasonably achievable (ALARA) provisions to maintain doses below this limit.

The NRC staff concludes that the health impacts from occupational radiation exposure would be SMALL based on individual worker doses being maintained within 10 CFR 20.1201 limits and collective occupational doses being typical of doses found in current operating LWRs. Additional mitigation would not be warranted because the operating plant would be required to maintain doses ALARA.

5.9.5 Impacts on Biota Other than Humans

Detroit Edison estimated doses to biota in the environs of Fermi 3 by using surrogate species. The surrogates used in the ER are well-defined and provide an acceptable method for evaluating doses to the biota. Surrogate analyses were performed for aquatic species, such as fish, invertebrates, and algae, and for terrestrial species, such as muskrats, raccoons, herons, and ducks. Aquatic species on the site are represented by surrogates as follows: (1) various mussel and mollusk species and crayfish are represented by invertebrates; (2) darter, shiner, catfish, whitefish, yellow perch, largemouth bass, and striped bass are represented by fish; and (3) aquatic plants are represented by algae. Terrestrial species on the site are represented by surrogates as follows: (1) white-tailed deer, raccoon, gray squirrel, red squirrel, eastern cottontail rabbit, coyotes, red fox, striped skunk, prairie deer mouse, meadow vole, and muskrat are represented by raccoon and muskrat; (2) ducks and geese are represented by duck; and (3) bald eagle, shorebirds, and wading birds are represented by heron. Exposure pathways considered in evaluating dose to the biota were discussed in Section 5.9.1 and shown in Figure 5-3. The NRC staff reviewed the Detroit Edison (2011a) calculations and performed an independent evaluation of fish, invertebrates, algae, muskrat, raccoon, duck, and heron. The staff's independent evaluation found similar results, as shown in Appendix G.

5.9.5.1 Liquid Effluent Pathway

Detroit Edison (2011a) used the LADTAP II computer code to calculate doses to the biota from the liquid effluent pathway. In estimating the concentration of radioactive effluents in Lake Erie, Detroit Edison (2011a) used a transit dilution model. Liquid pathway doses were higher for biota than humans because of the bioaccumulation of radionuclides, ingestion of aquatic plants, ingestion of invertebrates, and increased time spent in water and shoreline associated with biota. The liquid effluent releases used in estimating the biota dose are given in Table 12.2-19b of the DCD (GEH 2010a). Estimates of the total body doses to the surrogate species from the liquid pathway are shown in Table 5-28.

Table 5-28. Detroit Edison Estimates of the Annual Dose (mrad/yr) to Biota from Fermi 3

	Detroit Edison Biota Dose Estimates		
Biota	**Liquid Pathway**	**Gaseous Pathway**	**Total Body Biota Dose All Pathways**
Fish	2.31	0	2.31
Invertebrate	7.65	0	7.65
Algae	11.9	0	11.9
Muskrat	14.8	11.2	26.0
Raccoon	0.43	11.2	11.6
Heron	6.87	11.2	18.0
Duck	14.8	11.2	26.0

Source: Detroit Edison 2011a

5.9.5.2 Gaseous Effluent Pathway

Gaseous effluents would contribute to the total body dose of the terrestrial surrogate species (i.e., muskrat, raccoon, heron, and duck). The exposure pathways include inhalation of airborne radionuclides, external exposure because of immersion in gaseous effluent plumes, and surface exposure from deposition of iodine and particulates from gaseous effluents. The dose calculated to the MEI from gaseous effluent releases in Table 5-25 would also be applicable to terrestrial surrogate species, but with a doubling of the ground deposition factor because terrestrial species are closer to the ground than humans. The gaseous effluent releases used in estimating the dose are found in Table 12.2-16 of the DCD (GEH 2010a) for noble gases and other fission products and in Table 12.2-206 of the FSAR (Detroit Edison 2011b) for iodines. Detroit Edison used doses calculated by the GASPAR II code at 0.25 mi from the proposed Fermi 3 site in estimating terrestrial species doses (Detroit Edison 2011a). Estimates of the total body doses to the surrogate species from the gaseous pathway are shown in Table 5-28.

5.9.5.3 Impact on Biota Other Than Humans

Radiological doses to nonhuman biota are expressed in units of absorbed dose (mrad) because the dose equivalent (mrem) applies only to human radiological doses. The ICRP (ICRP 1977, 1991, 2007) states that if humans are adequately protected, other living things are also likely to be sufficiently protected. The International Atomic Energy Agency (IAEA 1992) and the NCRP (1991) reported that a chronic dose rate of no more than 10 mGy/day (1000 mrad/day) to the MEI in a population of aquatic organisms would ensure protection of the population. IAEA (1992) also concluded that chronic dose rates of 1 mGy/day (100 mrad/day) or less do not appear to cause observable changes in terrestrial animal populations.

Table 5-29 compares estimated the total body dose rates to surrogate biota species that would be produced by releases from Fermi 3 to the IAEA/NCRP biota dose guidelines (IAEA 1992; NCRP 1991). None of the surrogate species had daily dose rates that exceeded the IAEA guidelines. Moreover, the biota dose estimates for Fermi 3 are conservative, because they do not consider decay of liquid effluents during transit. Actual doses to the biota are likely to be much less.

Table 5-29. Comparison of Biota Doses from Fermi 3 to IAEA/NCRP Guidelines for Biota Protection

Biota	Detroit Edison Estimate of Dose to Biota (mrad/day)[(a)]	IAEA/NCRP Guideline for Protection of Biota Populations (mrad/day)[(b)]
Fish	0.0063	1000
Invertebrate	0.021	1000
Algae	0.033	1000
Muskrat	0.071	100
Raccoon	0.032	100
Heron	0.049	100
Duck	0.071	100

Source: IAEA 1992

(a) Total dose from liquid and gaseous effluents in Table 5-25. For comparison purposes, Detroit Edison's reported dose in mrad/yr was converted to mrad/day by dividing by 365 days/yr. Published guidelines reported doses in mGy/day (1 mGy = 100 mrad).

(b) Guidelines in IAEA and NCRP reports expressed in Gy/day (1 mGy = 100 mrad).

The maximum total dose from both liquid and gaseous pathways from the bounding calculation is about 26.0 mrad/yr, or about 0.07 mrad/day. Thus, doses to biota calculated by Detroit Edison are far below the IAEA (1992) guidelines of 100 mrad/day (0.1 rad/day) for terrestrial biota and 1 rad/day for aquatic biota.

On the basis of the information provided by Detroit Edison and the NRC's independent evaluation, the NRC staff concludes that the radiological impact on biota from the routine operation of the proposed Fermi 3 would be SMALL and additional mitigation is not warranted.

5.9.6 Radiological Monitoring

An REMP has been in place for the Fermi site since Fermi 2 operations began in 1985, with preoperational sample collection activities beginning in 1978 (Detroit Edison 2011a). The REMP includes monitoring of the airborne exposure pathway, direct exposure pathway, water exposure pathway, aquatic exposure pathway from Lake Erie, and ingestion exposure pathway in a 5-mi radius of the station, with indicator locations near the plant perimeter and control locations at distances greater than 10 mi. An annual survey is conducted for the area surrounding the site to verify the accuracy of the assumptions used in the analyses. The REMP program includes the collection and analysis of samples of air particulates, precipitation, crops, milk, soil, well water, surface water, fish, and silt as well as the measurement of ambient gamma radiation. Radiological releases are summarized in an annual report, the most recent of which is *Fermi 2 – 2010 Radioactive Effluent Release Report* (Detroit Edison 2011d). The limits for all radiological releases are specified in the Offsite Dose Calculation Manual (ODCM) for Fermi 2, which is also provided in this report (Detroit Edison 2011d).

Fermi 3 construction would include a new protected area fence enclosing Fermi 2 and 3. Depending on the location of the new protected area fence, new near-field thermoluminescent dosimeter locations would be established to provide adequate monitoring for both Fermi 2 and Fermi 3 (Detroit Edison 2011a). To the greatest extent practical for other monitoring, the REMP for Fermi 3 would use the procedures and sampling locations used for Fermi 2. The staff reviewed the documentation for the existing REMP, the ODCM, and recent monitoring reports from the Fermi site and determined that the current operational monitoring program is adequate to establish the radiological baseline for comparison with the environmental impacts expected from the construction and operation of Fermi 3.

The annual radioactive effluent release report for 2010 summarized the results of the groundwater sampling performed by Detroit Edison in various locations around the plant under the NEI groundwater protection initiative (Detroit Edison 2011d). The sporadic and variable trace quantities of tritium (maximum concentration observed was 1950 pCi/L) were detected in the few shallow groundwater wells downwind from the Fermi 2 stack. Detroit Edison attributed this to the recapture of tritium in precipitation from the plant's gaseous effluent (Detroit Edison 2009c). The detected tritium concentrations were far below the EPA drinking water standard of 20,000 pCi/L (41 FR 28402). Detroit Edison has indicated that any proposed changes in groundwater monitoring to support the NEI initiative for operation of Fermi 3 (see Section 2.11 for a description of the initiative) would be made prior to fuel loading for Fermi 3 (Detroit Edison 2009c).

5.10 Nonradioactive Waste Impacts

This section describes the potential impacts on the environment that could result from the generation, handling, and disposal of nonradioactive waste and mixed waste during the operation of Fermi 3. As discussed in Section 3.4.4, the types of nonradioactive waste that would be generated, handled, and disposed of during operational activities at Fermi 3 include solid wastes, liquid effluents, and air emissions. Solid wastes include municipal waste, dredge spoils, sewage treatment sludge, and industrial wastes. Liquid waste includes NPDES-permitted discharges (such as effluents that contain chemicals or biocides), wastewater effluents, site stormwater runoff, and other liquid wastes (such as used oils, paints, and solvents that require offsite disposal). Air emissions would primarily be generated by vehicles, diesel generators, and combustion generators. In addition, small quantities of hazardous waste and of mixed waste, which is waste that has both hazardous and radioactive characteristics, may be generated during plant operations. The assessment of potential impacts resulting from these types of wastes is presented in the following subsections.

5.10.1 Impacts on Land

The operation of Fermi 3 would generate solid and liquid wastes similar to those already generated by the current operation of Fermi 2. Although the total volume of solid and liquid wastes would increase at the Fermi site, no new solid or liquid waste types are expected to result from the operation of the new Fermi 3 (Detroit Edison 2011a).

Detroit Edison has indicated it would continue to use recycling and waste minimization practices in place at the Fermi site for the nonradioactive solid waste that would be generated from the operation of Fermi 3. Solid wastes – such as used oils, antifreeze, scrap metal, lead-acid batteries, and paper – that could be recycled or reused would be managed through the approved and licensed contractor. The solid waste that could not be recycled or reused would be transported to the licensed offsite commercial disposal sites (Detroit Edison 2011a). Spoils from maintenance dredging of the water intake canal and cleaning of the pump house intakes would be accumulated in the onsite Spoils Disposal Pond. Subject to MDEQ and USACE review, dredged material from the disposal pond could be used as fill material or sold for use as topsoil (Detroit Edison 2011a). Debris collected on trash screens at the water intake structure would be disposed of offsite in accordance with State regulations.

The wastewater generated from the operation of Fermi 3 would be treated in a manner similar to that for the wastewater from existing Fermi 2 (Detroit Edison 2011a). Sanitary waste generated from the operation of Fermi 3 would be collected onsite and discharged to the Frenchtown Charter Township Sewage Treatment Facility for treatment under the site sanitary industrial use permit (Detroit Edison 2011a). Because effective practices for recycling and minimizing waste are already in place for Fermi 2 and because the plans are to manage Fermi 3 solid and liquid wastes in a similar manner in accordance with applicable Federal, State, and local requirements and standards, the review team expects that impacts on land from nonradioactive wastes generated during the operation of Fermi 3 would be minimal and that no further mitigation is warranted.

5.10.2 Impacts on Water

Effluents containing chemicals or biocides from the operation of Fermi 3 would be discharged mainly to Lake Erie. Discharge sources would include cooling tower blowdown, chemical and nonchemical metal-cleaning wastes, service water screen backwash, stormwater runoff, settled water from the Spoils Disposal Pond, and chemicals used to control zebra mussels (Detroit Edison 2011a).

Detroit Edison anticipates that it may be necessary to revise or apply for a new NPDES permit to accommodate increased discharges to Lake Erie resulting from the operation of Fermi 3 (Detroit Edison 2011a). In either case, discharges would be subject to limitations contained in the site's NPDES permit.

To properly manage stormwater flow, Detroit Edison would update its existing SWPPP to reflect the increase in impervious surfaces and changes in onsite drainage patterns (Detroit Edison 2011a). Sections 5.2.3.1 and 5.2.3.2 discuss impacts on the quality of the surface water and groundwater from operation of Fermi 3. Nonradioactive liquid effluents that would be discharged to Lake Erie would be regulated by MDEQ and subject to limitations contained in the site's NPDES permit.

Because there are regulated practices for managing liquid discharges containing chemicals or biocide and other wastewater and because there are plans for managing stormwater, the review team concludes that impacts on water from nonradioactive effluents during the operation of Fermi 3 would be minimal and that no further mitigation is warranted.

5.10.3 Impacts on Air

Operations of Fermi 3 would result in gaseous emissions from the intermittent operation of emergency diesel generators, an auxiliary boiler, and diesel fire pumps. In addition, increased vehicular traffic associated with the personnel needed to operate Fermi 3 would increase vehicle emissions in the area. Impacts on air quality are discussed in detail in Section 5.7.2. Increases in air emissions from operation of Fermi 3 would be in accordance with permits issued by MDEQ that would ensure compliance with the Federal, State, and local air quality control laws and regulations. Because there are regulated practices for managing air emissions from stationary sources, the review team concludes that impacts on air from nonradioactive emissions during the operation of Fermi 3 would be minor and that no further mitigation is warranted.

5.10.4 Mixed Waste Impacts

Mixed waste contains both low-level radioactive waste and hazardous waste. The generation, storage, treatment, and disposal of mixed waste is regulated by the Atomic Energy Act, the Solid Waste Disposal Act of 1965 as amended by the Resource, Conservation, and Recovery Act (RCRA) in 1976, and the Hazardous and Solid Waste Amendments (which amended RCRA in 1984).

Each reactor at the Fermi site is expected to produce on the order of 0.5 m^3/yr of mixed waste. Mixed waste generated at Fermi 2 in the last few years ranged from 200 to 2000 lb/yr (Detroit Edison 2011a). Mixed waste can be reduced through decay, stabilization, neutralization, filtration, or chemical decontamination or treatment. Detroit Edison stated that the mixed waste that cannot be treated onsite will be temporarily stored at a remote monitored structure until it is shipped for offsite disposal at an approved facility. Existing Detroit Edison procedures for the storage of mixed wastes would be used to limit any occupational exposure or accidental spill (Detroit Edison 2011a). Fermi 3 would also claim an exemption under a state of Michigan low-level mixed waste exemption (Fermi 2 currently operates under this exemption) that would allow Detroit Edison to store an unlimited quantity of mixed waste for a long time if the mixed waste exemption conditions are met.

Because effective practices for minimizing waste are already in place for Fermi 2 and because the plans are to manage Fermi 3 mixed wastes in a similar manner in accordance with all applicable Federal, State, and local requirements and standards, the review team concludes that impacts from the generation of mixed waste at Fermi 3 would be minimal and that no further mitigation is warranted.

5.10.5 Summary of Waste Impacts

Solid, liquid, gaseous, and mixed wastes generated during the operation of Fermi 3 would be handled according to county, State, and Federal regulations. Required county, State, and Federal permits for the handling and disposal of dredged material and solid waste would be obtained. A revised SWPPP for surface-water runoff and NPDES permits for permitted releases of cooling and auxiliary system effluents would ensure compliance with the Federal Water Pollution Control Act (Clean Water Act) and MDEQ water quality standards. Wastewater discharge would be required to comply with NPDES limitations. Air emissions from Fermi 3 operations would be compliant with air quality standards as permitted by MDEQ. Impacts from the generation, storage, and disposal of mixed waste during operation of Fermi 3 would be compliant with requirements and standards. On the basis of (1) information provided by Detroit Edison, (2) effective practices for recycling, minimizing, managing, and disposing of wastes already in use at the Fermi site, (3) the review team's expectation that regulatory approvals will be obtained to regulate the additional waste that would be generated during Fermi 3 operations, and (4) the review team's independent evaluation, the review team concludes that the potential impacts from nonradioactive waste resulting from the operation of Fermi 3 would be SMALL and further mitigation is not warranted.

Cumulative impacts on water and air from nonradioactive emissions and effluents are discussed in Sections 7.2.2.1 and 7.5, respectively. For the purposes of Chapter 9, the staff concludes that (1) there would be no substantive differences between the impacts from nonradioactive waste at the Fermi site and those at the alternative sites, and (2) no substantive cumulative impacts warrant further discussion beyond those discussed for the alternative sites in Section 9.3.

5.11 Environmental Impacts of Postulated Accidents

The NRC staff considered the radiological consequences on the environment from potential accidents at the proposed Fermi 3. Detroit Edison based its COL application on the proposed installation of an ESBWR design for the proposed Fermi 3. Detroit Edison's application references Revision 9 of ESBWR DCD. The NRC staff issued a final design approval for the ESBWR on March 9, 2011 (76 FR 14437) and has begun the process of design certification rulemaking for the ESBWR (76 FR 16549).

The term "accident" as used in this section refers to any off-normal event not addressed in Section 5.9 that results in release of radioactive materials into the environment. This review focuses on events that could lead to releases substantially in excess of permissible limits for normal operations. Normal release limits are specified in 10 CFR Part 20, Appendix B, Table 2.

Numerous features combine to reduce the risk associated with accidents at nuclear power plants. Safety features in the design, construction, and operation of the plants, which make up the first line of defense, are intended to prevent the release of radioactive materials from the plant. The design objectives and the measures for keeping levels of radioactive materials in effluents to unrestricted areas ALARA are specified in 10 CFR Part 50, Appendix I. Additional measures are designed to mitigate the consequences of failures in the first line of defense. These measures include the NRC's reactor site criteria in 10 CFR Part 100, which require the site to have certain characteristics that reduce the risk to the public and reduce the potential impacts of an accident, and emergency preparedness plans and protective action measures for the site and environs, as set forth in 10 CFR 50.47, 10 CFR Part 50, Appendix E, and NUREG-0654/FEMA-REP-1 (NRC 1980). All these safety features, measures, and plans make up the defense-in-depth philosophy to protect the health and safety of the public and the environment.

On March 11, 2011, and for an extended period thereafter, several nuclear power plants in Japan experienced the loss of important equipment necessary to maintain reactor cooling after the combined effects of severe natural phenomena: an earthquake followed by a tsunami. In response to these events, the Commission established a task force to review the current regulatory framework in place in the United States and to make recommendations for improvements. On July 12, 2011, the task force reported the results of its review (NRC 2011) and presented the recommendations to the Commission on July 19, 2011. As part of the short-term review, the task force concluded that, while improvements are expected to be made as a result of the lessons learned, the continued operation of nuclear power plants and licensing activities for new plants do not pose an imminent risk to public health and safety. In addition, a number of areas were recommended to the Commission for long-term consideration.

Collectively, these recommendations are intended to clarify and strengthen the regulatory framework for protection against severe natural phenomena, for mitigation of the effects of such events, for coping with emergencies, and for improving the effectiveness of NRC programs. After it determines the strategy to implement changes, the results of the direction by the Commission will be reflected in NRC staff evaluations.

This section discusses the (1) types of radioactive materials, (2) paths to the environment, (3) relationship between radiation dose and health effects, and (4) environmental impacts of reactor accidents – both design-basis accidents (DBAs) and severe accidents. The environmental impacts from accidents during the transportation of spent fuel are discussed in Chapter 6.

The potential for dispersion of radioactive materials in the environment depends on the mechanical forces that physically transport the materials and on the physical and chemical forms of the material. Radioactive material exists in a variety of physical and chemical forms. The majority of the material in the fuel is in the form of nonvolatile solids. However, there is a significant amount of material that is in the form of volatile solids or gases. The gaseous radioactive materials include the chemically inert noble gases (e.g., krypton and xenon), which have a high potential for release. Radioactive forms of iodine, which are created in substantial quantities in the fuel by fission, are volatile. Other radioactive materials formed during the operation of a nuclear power plant have lower volatilities and therefore have lower tendencies to escape from the fuel than do the noble gases and isotopes of iodine.

Radiation dose to individuals is determined by their proximity to radioactive material, the duration of their exposure, the extent to which they are shielded from the radiation, and the extent to which radioactive material is ingested or inhaled. Pathways that lead to radiation dose include (1) external radiation from radioactive material in the air, on the ground, and in the water; (2) inhalation of radioactive material; and (3) ingestion of food or water containing material initially deposited on the ground and in water.

Radiation protection experts assume that any amount of radiation exposure may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold response model is used to describe the relationship between radiation dose and detriments such as cancer induction. The recent BEIR VII report (National Research Council 2006) supports the linear, no-threshold dose response model as a basis for estimating the risks from low doses. This approach is accepted by the NRC as a conservative method for estimating health risks from radiation exposure, while it also recognizes that the model may overestimate those risks.

Physiological effects are clinically detectable if individuals receive radiation exposure resulting in a dose of more than about 25 rem over a short period of time (hours). Untreated doses of about

250 to 500 rem received over a relatively short period (hours to a few days) can be expected to cause some fatalities.

5.11.1 Design-Basis Accidents

Detroit Edison evaluated the potential consequences of postulated accidents to demonstrate that an ESBWR could be constructed and operated at the Fermi site without undue risk to the health and safety of the public (Detroit Edison 2011a). These evaluations used DBAs for the ESBWR design being considered for the Fermi site and site-specific meteorological data. The set of accidents covers events that range from those having a relatively high probability of occurrence with relatively low consequences to those having a relatively low probability of occurrence with high consequences.

The DBA review focuses on the ESBWR design at the Fermi site. The bases for analyses of postulated accidents for this design are well established because they have been considered as part of the NRC's reactor design certification process. Potential consequences of DBAs are evaluated following procedures outlined in regulatory guides and standard review plans. The potential consequences of accidental releases depend on the specific radionuclides released, amount of each radionuclide released, and meteorological conditions. The source terms for the ESBWR and methods for evaluating potential accidents are based on guidance in Regulatory Guide 1.183 (NRC 2000b).

For environmental reviews, consequences are evaluated by assuming realistic meteorological conditions. Meteorological conditions are represented in these consequence analyses by an atmospheric dispersion factor, which is also referred to as χ/Q. Acceptable methods of calculating χ/Q for DBAs from meteorological data are set forth in Regulatory Guide 1.145 (NRC 1983).

Table 5-30 lists χ/Q values pertinent to the environmental review of DBAs for the Fermi 3 site (Detroit Edison 2011a). Smaller χ/Q values are associated with greater dilution capability. The first column lists the time periods and boundaries for which χ/Q and dose estimates are needed. For the exclusion area boundary, the postulated DBA dose and its atmospheric dispersion factor are calculated for a short term (i.e., 2 hr). For the low-population zone, they are calculated for the course of the accident (i.e., 30 days, composed of four time periods). The second column lists the χ/Q values for the Fermi site, using the site-specific meteorological information discussed in ER Section 2.7.4-4, and the exclusion area boundary and low-population zone distances (Detroit Edison 2011a). In ER Section 2.7.6.1, Detroit Edison calculated the χ/Q values listed in Table 5-30 by using 6 years of onsite meteorological data (2002 through 2007) for the Fermi site and assuming the release point is located at ground level.

Table 5-30. Atmospheric Dispersion Factors for Fermi 3 Site DBA Calculations

Time Period and Boundary	χ/Q (s/m^3) (a)
0 to 2 hr or worst 2-hr period, exclusion area boundary	5.7×10^{-5}
0 to 8 hr, low-population zone	3.1×10^{-6}
8 to 24 hr, low-population zone	2.7×10^{-6}
1 to 4 days, low-population zone	2.0×10^{-6}
4 to 30 days, low-population zone	1.3×10^{-6}

Source: Detroit Edison (2011a).
(a) Values are rounded to two significant digits

The NRC staff reviewed the meteorological data used by Detroit Edison and the method used to calculate the atmospheric dispersion factors. Based on these reviews, the staff concludes that the atmospheric dispersion factors for the Fermi site are acceptable for use in evaluating potential environmental consequences of postulated DBAs for the ESBWR design at the Fermi site.

Detroit Edison calculated site-specific consequences of DBAs in the ER on the basis of analyses performed for design certification of an ESBWR design with adjustment for Fermi 3 site-specific χ/Q characteristics. Table 5-31 presents the list of DBAs considered by Detroit Edison and the estimate of the environmental consequences of each accident in terms of the total effective dose equivalent (TEDE). TEDE is estimated by the sum of the committed effective dose equivalent from inhalation and the effective dose equivalent from external exposure. Dose conversion factors from Federal Guidance Report 11 (Eckerman et al. 1988) were used to calculate the committed effective dose equivalent. Similarly, dose conversion factors from Federal Guidance Report 12 (Eckerman and Ryman 1993) were used to calculate the effective dose equivalent.

The staff reviewed Detroit Edison's selection of DBAs by comparing the accidents listed in the COL application with the DBAs considered in the ESBWR DCD (GEH 2010e), which has been reviewed and approved in the design certification process. The staff confirmed that the DBAs in the ER are the same as those considered in the design certification; therefore, the staff concluded that the set of DBAs is appropriate. In addition, the staff reviewed the calculation of the site-specific consequences of the DBAs and found the results of the calculations to be reasonable for use in the evaluation of environmental consequences of DBAs.

There are no environmental criteria related to the potential consequences of DBAs. Consequently, the review criteria used in the staff's safety review of DBA doses are included in Table 5-31 to illustrate the magnitude of the calculated environmental consequences (TEDE). In all cases, the calculated TEDE values are considerably smaller than the TEDE limits used as safety review criteria.

Table 5-31. Design-Basis Accident Doses for an ESBWR at Fermi Site

Accident	Standard Review Plan Section[(b)]	Total Effective Dose Equivalent (rem)[(a)] Exclusion Area Boundary	Low Population Zone	Review Criterion
Main steam line break	15.6.4			
Pre-incident iodine spike		0.074	0.0032	25 [(c)]
Equilibrium iodine spike		0.0057	0.0016	2.5[(d)]
Loss-of-coolant accident	15.6.5	0.64	0.89	2.5 [(c)]
Feedwater line break	15.2.8			
Pre-incident iodine spike		0.51	0.027	25[(c)]
Equilibrium iodine spike		0.031	0.0016	2.5 [d)]
Reactor water cleanup water line break				
Pre-incident iodine spike		0.20	0.011	25 [(c),]
Equilibrium iodine spike		0.011	0.0016	2.5 [(d)]
Failure of small lines carrying primary coolant outside containment	15.6.2			
Pre-incident iodine spike		0.0097	0.0043	2.5 [(c)]
Equilibrium iodine spike		0.0028	0.0043	2.5 [(d)]
Fuel handling	15.7.4	0.12	0.0064	6.3 [(d)]

(a) To convert rem to Sv, divide by 100. Values are rounded to two significant digits.
(b) NUREG-0800 (NRC 2007b).
(c) 10 CFR 52.79(a)(1), and 10 CFR 100.21 criteria.
(d) SRP criteria, Table 1 in SRP Section 15.0.3.

The NRC staff reviewed the Detroit Edison DBA analysis in the ER, which is based on analyses performed for design certification of the ESBWR design with adjustment for Fermi site-specific characteristics. The NRC staff also performed an independent DBA analysis. The results of the Detroit Edison and the NRC staff analyses indicate that the environmental consequences associated with DBAs, if an ESBWR design were to be located at the Fermi site, would be small. On this basis, the staff concluded that the environmental consequences of DBAs at the Fermi site would be SMALL for an ESBWR.

5.11.2 Severe Accidents

Section 7.2 of the ER (Detroit Edison 2010b, 2011a) considers the potential consequences of severe accidents for single ESBWR at the Fermi site. Three pathways are considered: (1) atmospheric pathway, in which radioactive material is released to the air; (2) surface-water pathway, in which airborne radioactive material falls out on open bodies of water; and (3) groundwater pathway, in which groundwater is contaminated by a basemat melt-through, with subsequent contamination of the surface water by the groundwater.

Detroit Edison's consequence assessment is based on the Revision 4 of the probabilistic risk assessment (PRA) for the ESBWR design (GEH 2009). GEH subsequently updated the PRA model to Revision 6 (GEH 2010c); however, the reported results and insights remain valid for Revision 4. The NRC staff evaluated the current PRA model and its results, and concluded that the Revision 6 results are an acceptable basis for evaluating severe accidents and strategies for mitigating them. Detroit Edison is required by regulation to upgrade and update the PRA before initial fuel loading. At that time, the NRC staff expects that the PRA will be site-specific and that it will no longer use the bounding assumptions of the design-specific PRA.

Detroit Edison's evaluation of the potential environmental consequences for the atmospheric and surface-water pathways incorporates the results of the MELCOR Accident Consequence Code System (MACCS2) computer code (Chanin et al. 1990; Chanin and Young 1998; Jow et al. 1990) run that used ESBWR source term information and site-specific meteorology, population, and land use data. Detroit Edison provided copies of the input and output files for the MACCS2 code runs (Detroit Edison 2011a). The NRC staff reviewed Detroit Edison's input and output files, made confirmatory calculations, and determined that Detroit Edison's results were reasonable.

The MACCS computer code was developed to evaluate the potential offsite consequences of severe accidents for the sites covered by NUREG-1150 (NRC 1990). The MACCS2 code evaluates the consequences of atmospheric releases of material following a severe accident. The pathways modeled include exposure to the passing plume, exposure to material deposited on the ground and skin, inhalation of material in the passing plume and resuspended from the ground, and ingestion of contaminated food and surface water.

Three types of severe accident consequences were assessed in the MACCS2 analysis: (1) human health, (2) economic costs, and (3) land area affected by contamination. Human health effects are expressed in terms of the number of early fatalities, latent cancers, and other diseases that might be expected if a severe accident were to occur. These effects are directly related to the cumulative radiation dose received by the general population. MACCS2 estimates both early fatalities and latent cancer fatalities. Early fatalities are related to high doses or dose rates and expected to occur within a year of exposure (Jow et al. 1990).

Latent fatalities are related to exposure of a large number of people to low doses and dose rates and expected to occur after a latent period of several (2 to 15) years. Population health-risk estimates are based on the population distribution within a 50-mi radius of the site. Economic costs of a severe accident include the costs associated with short-term relocation of people; decontamination of property and equipment; interdiction of food supplies, land, and equipment use; and condemnation of property. The affected land area is a measure of the areal extent of the residual contamination following a severe accident. Farm land decontamination is an estimate of the area that has an average whole body dose rate for the 4-year period following the release that would be more than 0.5 rem/yr if not reduced by decontamination and that would have a dose rate following decontamination of less than 0.5 rem/yr. Decontaminated land is not necessarily suitable for farming.

Risk is the product of the frequency and the consequences of an accident. For example, the probability of a severe accident without loss of containment for an ESBWR design at the Fermi site is estimated to be 1.5×10^{-8} per reactor-year (Ryr) (see Table 5-32). The cumulative population dose associated with a severe accident without loss of containment at the Fermi site is calculated to be about 146,700 person-rem (Detroit Edison 2011a). The population dose risk for this class of accidents is the product of 1.5×10^{-8} per Ryr and 146,700 person-rem, or 2.2×10^{-2} person-rem/Ryr (see Table 5-32).

The following sections discuss the estimated risks associated with each pathway. The risks presented in the tables that follow are risks per year of reactor operation.

5.11.2.1 Air Pathway

The MACCS2 code directly estimates consequences associated with releases to the air pathway. Detroit Edison used the MACCS2 code to estimate consequences to a projected population in 2060 on the basis of meteorological data for calendar years 2002 through 2007. The results of the MACCS2 runs are presented in Tables 5-32 through 5-34 for an ESBWR at the Fermi site (Detroit Edison 2011a). The values presented in these tables are based on using the 2002 meteorological data that resulted in the highest consequences. The core damage frequencies (CDFs) given in these tables are for internally initiated accident sequences while the plant is at power. Internally initiated accident sequences include sequences that are initiated by human error, equipment failures, loss of offsite power, etc. The CDFs used by Detroit Edison are those from Revision 4 of the ESBWR PRA submitted as part of the application for certification of the ESBWR design (GEH 2009). GEH has updated these frequencies in the ESBWR PRA Revision 6 (GEH 2010c). The core damage frequencies in ESBWR PRA Revision 6 are similar to those in Revision 4.

Core damage frequencies for other at-power events (external events) and lower power or shutdown are discussed in the ESBWR PRA (GEH 2010c) and summarized in Section 19.2.3.2 of the ESBWR DCD (GEH 2010d). Detroit Edison incorporates by reference these analyses in the Fermi 3 COL application. Section 19.3.2.3.2.4 of the DCD discusses a seismic margins analysis in which PRA-based methods are used to identify potential vulnerabilities in the design so corrective measures can be taken to reduce risk. Similarly, Sections 19.2.3.2.1 through 19.2.3.3.3 address risks associated with external fires, external flooding, and high winds. Similar to the risks from internally initiated events, risks associated with these events are considered to be small. The total CDF for events occurring while the reactor is at low power or shutdown is estimated to be about the same order of magnitude of the CDF at power.

Table 5-32. Mean Environmental Risks from ESBWR Severe Accidents at the Fermi Site

Release Category Description (Accident Class)		Core Damage (frequency/Ryr)[a]	Environmental Risk					
			Population Dose (person-rem/Ryr)[b]	Fatalities per Ryr: Early[c]	Fatalities per Ryr: Latent[d]	Cost[e] ($/Ryr)	Land Requiring Decontamination[f] (ac/Ryr)	Population Dose from Water Ingestion (person-rem/Ryr)[b]
TSL	Containment leakage at technical specification limit	1.5×10^{-8}	2.2×10^{-3}	0.0	1.3×10^{-6}	0.50	4.2×10^{-6}	4.8×10^{-3}
CCIW	Containment fails due to core concrete interaction; lower drywell debris bed covered	2.9×10^{-12}	2.5×10^{-5}	1.3×10^{-13}	1.5×10^{-8}	0.071	3.2×10^{-7}	3.9×10^{-7}
EVE	Ex-vessel steam explosion fails containment	1.1×10^{-9}	2.5×10^{-2}	3.4×10^{-9}	1.5×10^{-5}	92.0	2.2×10^{-4}	1.2×10^{-3}
FR	Release through controlled (filtered) venting from suppression chamber	9.2×10^{-11}	4.2×10^{-4}	1.5×10^{-14}	2.5×10^{-7}	0.47	3.3×10^{-6}	2.1×10^{-6}
CCID	Containment fails due to core concrete interaction; lower drywell debris bed uncovered	1.5×10^{-12}	3.2×10^{-5}	3.7×10^{-12}	2.0×10^{-8}	0.12	3.2×10^{-7}	3.9×10^{-7}
OPW2	Containment fails due to late (>24 hr) loss of containment heat removal	8.5×10^{-12}	1.2×10^{-5}	0.0	7.0×10^{-9}	0.0021	1.8×10^{-8}	3.6×10^{-8}
BOC	Break outside of containment	7.9×10^{-11}	2.6×10^{-3}	2.3×10^{-9}	1.8×10^{-6}	8.7	1.5×10^{-5}	1.5×10^{-4}
BYP	Containment bypassed because of containment isolation system failure with large (>12 in. hole) opening; lower drywell debris bed covered	5.7×10^{-11}	1.7×10^{-3}	5.4×10^{-10}	1.4×10^{-6}	3.5	9.9×10^{-6}	1.9×10^{-5}
OPVB	Containment fails due to failure of vapor suppression system (vacuum breaker) function	2.1×10^{-12}	1.3×10^{-5}	2.6×10^{-14}	7.6×10^{-9}	0.030	1.5×10^{-7}	1.2×10^{-7}
OPW1	Containment fails due to early (<24 hr) loss of containment heat removal	2.0×10^{-12}	1.2×10^{-5}	7.6×10^{-17}	7.3×10^{-9}	0.030	1.5×10^{-7}	1.3×10^{-7}
Total		1.7×10^{-8}	3.2×10^{-2}	6.3×10^{-9}	2.0×10^{-5}	1.1×10^{2}	2.6×10^{-4}	1.3×10^{-3}

Source: Detroit Edison 2011a

(a) Detroit Edison used core damage frequencies from ESBWR PRA Revision 4 (GEH 2009). GEH has updated these frequencies in the ESBWR PRA Revision 6 (GEH 2010c). The core damage frequencies in ESBWR Revision 6 are similar to those of Revision 4 values.

(b) To convert rem to Sv, divide rem by 100.

(c) Early fatalities are fatalities related to high doses or dose rates that generally can be expected to occur within a year of the exposure (Jow et al. 1990).

(d) Latent fatalities are fatalities related to low doses or dose rates that could occur after a latent period of several (2 to 15) years.

(e) Cost risk includes costs associated with short-term relocation of people, decontamination, interdiction, and condemnation. It does not include costs associated with health effects (Jow et al. 1990).

(f) Land risk is the area where the average whole body dose rate for the 4-year period following the accident exceeds 0.5 rem/yr but can be reduced to less than 0.5 rem/yr by decontamination. To convert acres to hectares, divide by 2.47.

Table 5-33. Comparison of Environmental Risks for an ESBWR at the Fermi 3 Site with Risks for Current-Generation Reactors at Five Sites Evaluated in NUREG-1150[(a)]

	Core Damage (frequency/Ryr)	50-mi Population Dose Risk (person-rem/Ryr)[(b)]	Fatalities per Ryr		Average Individual Fatality Risk per Ryr	
			Early	Latent	Early	Latent Cancer
Grand Gulf[(c)]	4.0×10^{-6}	$5 \times 10^{+1}$	8×10^{-9}	9×10^{-4}	3×10^{-11}	3×10^{-10}
Peach Bottom[(c)]	4.5×10^{-6}	$7 \times 10^{+2}$	2×10^{-8}	5×10^{-3}	5×10^{-11}	4×10^{-10}
Sequoyah[(c)]	5.7×10^{-5}	$1 \times 10^{+3}$	3×10^{-5}	1×10^{-2}	1×10^{-8}	1×10^{-8}
Surry[(c)]	4.0×10^{-5}	$5 \times 10^{+2}$	2×10^{-6}	5×10^{-3}	2×10^{-8}	2×10^{-9}
Zion[(c)]	3.4×10^{-4}	$5 \times 10^{+3}$	4×10^{-5}	2×10^{-2}	9×10^{-9}	1×10^{-8}
ESBWR[(d)] at Fermi 3 site	1.7×10^{-8}	3.2×10^{-2}	6.3×10^{-9}	2.0×10^{-5}	4.1×10^{-12}	5.8×10^{-12}

(a) Source: NRC 1990
(b) To convert rem to Sv, divide by 100.
(c) Risks were calculated using the MACCS code presented in NUREG-1150 (NRC 1990).
(d) Calculated with MACCS2 code by using Fermi site-specific input (Detroit Edison 2011a).

Table 5-34. Comparison of Environmental Risks from Severe Accidents Initiated by Internal Events for an ESBWR at the Fermi Site with Risks Initiated by Internal Events for Current Plants Undergoing Operating License Renewal Review

Risk	Core Damage (frequency per Ryr)	50-mi Population Dose Risk (person-rem per Ryr)[a]
Current reactor maximum[b]	2.4×10^{-4}	$6.9 \times 10^{+1}$
Current reactor mean[b]	2.7×10^{-5}	$1.6 \times 10^{+1}$
Current reactor median[b]	1.6×10^{-5}	$1.3 \times 10^{+1}$
Current reactor minimum[b]	1.9×10^{-6}	3.4×10^{-1}
ESBWR[c] at Fermi	1.7×10^{-8}	3.2×10^{-2}

(a) To convert person-rem to person-Sv, divide by 100.
(b) Based on MACCS and MACCS2 calculations for 76 current plants at 44 sites.
(c) Calculated with MACCS2 code using Fermi site-specific input (Detroit Edison 2011a).

Table 5-32 presents the probability-weighted consequences (i.e., the risks of severe accidents) for an ESBWR located on the Fermi site. This table shows the risks are small for all risk categories considered. The presented risks are for a projected population in calendar year 2060 in the surrounding 50-mi of the Fermi site. For perspective, Tables 5-33 and 5-34 compare the health risks from severe accidents for an ESBWR at the Fermi site with the risks for current-generation reactors at various sites.

In Table 5-33, the health risks estimated for an ESBWR at the Fermi site are compared with health risk estimates for the five reactors considered in NUREG-1150 (NRC 1990). Although risks associated with both internally and externally initiated events were considered for the Peach Bottom and Surry reactors in NUREG-1150, only risks associated with internally initiated events are presented in Table 5-33. The health risks shown for an ESBWR at the Fermi site are significantly lower than the risks associated with current-generation reactors presented in NUREG-1150.

The last two columns of Table 5-33 provide average individual fatality risk estimates. To put these estimated fatality risks into context for the environmental analysis, the NRC staff compared these estimates to the safety goals. The Commission has set safety goals for average individual early fatality and latent cancer fatality risks from reactor accidents in the Safety Goal Policy Statement (51 FR 30028). These goals are presented here solely to provide a point of reference for the environmental analysis and do not serve the purpose of a safety analysis. This statement expressed the Commission's policy regarding the acceptance level of radiological risk from nuclear power plant operation as follows:

- Individual members of the public should be provided a level of protection from the consequences of nuclear power plant operation such that individuals bear no significant additional risk to life and health.
- Societal risks to life and health from nuclear power plant operation should be comparable to or less than the risks of generating electricity by viable competing technologies and should not be a significant addition to other societal risks.

The following quantitative health objectives are used to determine whether the safety goals are achieved:

- The risk to an average individual in the vicinity of a nuclear power plant of prompt fatalities that might result from reactor accidents should not exceed one-tenth of 1 percent (0.1 percent) of the sum of prompt fatality risks resulting from other accidents to which members of the U.S. population are generally exposed.
- The risk to the population in the area near a nuclear power plant of cancer fatalities that might result from nuclear power plant operation should not exceed one-tenth of 1 percent (0.1 percent) of the sum of cancer fatality risks resulting from all other causes.

These quantitative health objectives are translated into two numerical objectives as follows:

- The individual risk of a prompt fatality from all “other accidents to which members of the U.S. population are generally exposed,” is about 4×10^{-4} per year, including a risk of 1.3×10^{-4} per year associated with transportation accidents (NSC 2010). One-tenth of 1 percent of these figures implies that the individual risk of prompt fatality from a reactor accident should be less than 4×10^{-7} per Ryr.
- “The sum of cancer fatality risks from all other causes” for an individual is taken to be the cancer fatality rate in the United States, which is about 1 in 500 or 2×10^{-3} per year (ACS 2008). One-tenth of 1 percent of this implies that the risk of cancer to the population in the area near a nuclear power plant because of its operation should be limited to 2×10^{-6} per Ryr.

MACCS2 calculates average individual early fatality and latent cancer fatality risks. The average individual early fatality risk is calculated by using the population distribution within 1 mi of the plant boundary. The average individual latent cancer fatality risk is calculated by using the population distribution within 10 mi of the plant. For the plants considered in NUREG-1150, these risks were well below the Commission’s safety goals. Risks calculated for the ESBWR design at the Fermi site are lower than the risks associated with the current-generation reactors considered in NUREG-1150 and are well below the Commission’s safety goals.

The NRC staff compared the CDF and population dose risk estimate for an ESBWR at the Fermi site with statistics summarizing the results of contemporary severe accident analyses performed for 76 reactors at 44 sites. The results of these analyses are included in the final site-specific Supplements 1 through 37 to the GEIS, NUREG-1437 (NRC 1996) and in the ERs included with license renewal applications for those plants for which supplements have not been published. All of the analyses were completed after publication of NUREG-1150 (NRC 1990), and the analyses for 72 of the reactors used MACCS2, which was released in 1997. Table 5-34 shows that the CDFs estimated for the ESBWR are significantly lower than those of current-generation reactors. Similarly, the population doses estimated for an ESBWR at the Fermi site are well below the mean and median values for current-generation reactors undergoing license renewal.

Finally, the population dose risk (3.2×10^{-2} person-rem per Ryr) from a severe accident for an ESBWR at the Fermi site may be compared with its dose risk for normal operation at the site (see Section 5.9.3.2). The population dose risk from normal operation (doses from liquid and gaseous effluents) of an ESBWR at Fermi is about 22 person-rem/Ryr (see Subsection 5.9.3.2 of this EIS). Thus, the population dose risk associated with a severe accident is about two orders of magnitude lower than the risk from the liquid and gaseous effluents during normal operations. Comparatively, the population dose risk for a severe accident is small.

5.11.2.2 Surface Water Pathways

Surface-water pathways are an extension of the air pathway. These pathways cover the effects of radioactive material deposited on open bodies of water and include ingestion of water, and aquatic foods as well as external radiation from submersion in water and activities occurring near the water. Of these surface-water pathways, the MACCS2 code evaluates only the ingestion of contaminated water. The risks associated with this surface-water pathway calculated for the Fermi site are included in the last column of Table 5-32. The water-ingestion dose risk of about 1.3×10^{-3} person-rem per Ryr is small compared with the total dose risk of 3.2×10^{-2} person-rem per Ryr.

Environmental consequences of potential surface-water pathways related to swimming and shoreline activities and aquatic food consumptions are not evaluated by MACCS2. Detroit Edison relied on generic analyses in NUREG-1437 (NRC 1996) for these pathways. NUREG-1437 reiterates the conclusions set forth in the final EIS for Fermi 2 operations, NUREG-0769 (NRC 1981), which indicate that doses from shoreline activities and swimming are much smaller than either water ingestion doses or aquatic food ingestion doses.

Surface-water bodies within the 50-mi region of the Fermi site that are accessible to the public include Lake Erie, River Raisin, Huron River, Maumee River, Lake St. Clair, Detroit River, and other smaller water bodies. In NUREG–1437, the NRC evaluated doses from the aquatic food pathway (fishing) for the current fleet of nuclear reactors, including Fermi 2 (NRC 1996). The aquatic food pathway dose for Fermi 2 was 1400 person-rem per Ryr.

If a severe accident occurred at a reactor located at the Fermi site, it is likely that Federal, State, and local officials would take various measures, including limiting access to contaminated areas and interdiction of drinking water and fishing to reduce exposures. Actual dose-risk values would be expected to be significantly reduced due to these actions (NRC 1996). Considering the likelihood of interdiction, NRC staff concluded that the population dose risk from the surface water pathways at the Fermi site would likely be small compared to air pathway dose risk.

5.11.2.3 Groundwater Pathway

The groundwater pathway involves a reactor core melt, reactor vessel failure, and penetration of the floor (basemat) below the reactor vessel. Ultimately, core debris reaches the groundwater where soluble radionuclides are transported with the groundwater. MACCS2 does not evaluate the environmental risks associated with severe accident releases of radioactive material to groundwater. In the NUREG-1437, NRC staff assumed that the probability of occurrence of a severe accident with a basemat penetration was 1×10^{-4} per Ryr and concluded that the groundwater contribution to risk is generally a small fraction of the risk attributable to the atmospheric pathway. The Detroit Edison ER (Detroit Edison 2011a) summarizes the discussion in NUREG–1437 and reaches the same conclusion.

NRC staff has reevaluated its assumption of a 1×10^{-4} per Ryr probability of a basemat melt-through. The staff believes that the 1×10^{-4} probability is too large for new reactor designs. New reactor designs include features to minimize the potential for core debris to reach groundwater in the event of a core melt accident. The ESBWR design includes a basemat internal melt arrest and coolability (BiMAC) device to cool the core debris and prevent basemat melt-through. Furthermore, the probability of core melt with basemat melt-through should be no larger than the total CDF estimate for the reactor.

Table 5-32 gives a total CDF estimate of 1.7×10^{-8} per Ryr for an ESBWR design. NUREG-1150 (NRC 1990) indicates that the conditional probability of a basemat melt-through ranges from 0.05 to 0.25 for current-generation reactors. The ESBWR severe-accident release sequences that might be expected to involve core-concrete interactions have frequencies on the order of 1×10^{-12} per Ryr. GEH has estimated a failure probability of 0.0003 for the BiMAC to function. On this basis, the NRC staff determined that a basemat melt-through probability on the order of 1×10^{-10} per Ryr is reasonable and still conservative.

The groundwater pathway is more tortuous and affords more time for implementing protective actions; it thus results in a lower risk to the public. As a result, the NRC staff concludes that the risks associated with releases to groundwater are sufficiently small that they would not have a significant effect on the overall plant risk.

5.11.2.4 Summary of Severe Accident Impacts

The NRC staff has reviewed the severe accident risk analysis in the ER and conducted a confirmatory analysis of the probability-weighted consequences of severe accidents for the proposed Fermi 3 using the MACCS2 code. The results of both Detroit Edison's analysis and the NRC staff's analysis indicate that the environmental risks associated with severe accidents if an ESBWR were to be located at the Fermi site would be small when compared with the risks associated with operation of the current-generation reactors at other sites. These risks are well within the NRC safety goals. On these bases, the staff concludes that the probability-weighted consequences of severe accidents at the Fermi site would be SMALL for an ESBWR reactor.

5.11.3 Severe Accident Mitigation Alternatives

Detroit Edison has applied for a license to construct and operate an ESBWR at the Fermi site. The ESBWR design incorporates many features intended to reduce severe accident CDFs and the risks associated with severe accidents. The effectiveness of ESBWR design features in reducing risk is evident in Tables 5-33 and 5-34, which compare CDFs and severe accident risks for the ESBWR with CDFs and risks for current-generation reactors. CDFs and risks have generally been reduced by a factor of 100 or more when compared to the currently operating nuclear power units.

The purpose of the evaluation of severe accident mitigation alternatives (SAMAs) is to determine whether there are severe accident mitigation design alternatives (SAMDAs) or procedural modifications or training activities that can be justified to further reduce the risks of severe accidents (NRC 2000b). Consistent with the direction from the Commission to consider the SAMDAs at the time of certification, GEH has considered 177 design alternatives for an ESBWR at a generic site (GEH 2010b).

The ESBWR design already has numerous plant features designed to reduce CDF and risk. As a result, the benefits and risk reduction potential of any additional plant improvements are significantly reduced from those of existing reactors. This is true for both internally and externally initiated events. The NRC staff does not expect that improvements in either modeling or data would change the conclusions.

In Section 7.3 of the ER, Detroit Edison references the SAMDAs that were considered in the ESBWR (GEH 2007).[(a)] Detroit Edison reasserts the reactor vendor's claim that there are no SAMDAs that will be cost-beneficial. In order to reassess this claim, Detroit Edison reevaluated the potential monetary values for averted costs of eliminating total CDF by using the Fermi site-specific dose and consequence risk information. Using procedures set forth in NUREG/BR-0184 (NRC 1997), Detroit Edison determined that the maximum averted cost risk

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(a) The conclusion remained unchanged in the ESBWR SAMDA Report Revision 4 (GEH 2010b).

for a single ESBWR reactor at the Fermi site is so low that none of the SAMDAs are cost-beneficial. A more realistic assessment would show that the potential reductions in cost risk are substantially less than the maximum averted cost risk because no single SAMDA can reduce the remaining risk to zero.

SAMDAs are a subset of the SAMA review. The other attributes of the SAMA review – namely, procedural modifications and training activities – have not been addressed by Detroit Edison or the GEH for design certification (GEH 2010b). However, Detroit Edison is committed (COM ER-7.3-002) to addressing these procedural modifications as stated below (Detroit Edison 2011a):

> A SAMA analysis to comply with 40 CFR 1502.16(h) shall be conducted of the administrative and procedural measures applicable to Fermi 3 and considered for implementation prior to fuel load if the associated cost does not exceed the maximum value associated with averting all risk of severe accidents.

Appendix I contains a detailed review of the GEH and Detroit Edison's SAMA analyses, and it presents the NRC staff's conclusions related to Fermi's site-specific analysis. After reviewing the Detroit Edison analysis (Detroit Edison 2011a), the NRC staff concluded that there are no ESBWR SAMDAs that would be cost-beneficial at the Fermi site.

As discussed in Appendix I, because the maximum attainable benefit is so low, a SAMA based on procedures or training for an ESBWR at the Fermi site would have to reduce the CDF or risk to near zero to become cost-beneficial. Based on its evaluation, the NRC staff concludes that it is unlikely that any of the SAMAs based on procedures or training would reduce the CDF or risk that much. Therefore, the NRC staff further concludes it is unlikely that these SAMAs would be cost-effective. In addition, based on statements by Detroit Edison (Detroit Edison 2011a), the NRC staff expects that the applicant will consider risk insights in the development of procedures and training. However, this expectation is not crucial to the NRC staff's conclusions because the staff already concluded procedural and training SAMAs would be unlikely to be cost effective. Therefore, the NRC staff concludes that SAMAs have been appropriately considered.

5.11.4 Summary of Postulated Accident Impacts

The NRC staff evaluated the environmental impacts from DBAs and severe accidents for an ESBWR design at the Fermi site. On the basis of the information provided by GEH, Detroit Edison, and NRC's own independent review, the staff concluded that the potential environmental impacts (risks) from a postulated accident from the operation of the proposed Fermi 3 would be SMALL and that no further mitigation is warranted.

5.12 Measures and Controls to Limit Adverse Impacts during Operation

In its evaluation of the environmental impacts of operating the proposed Fermi 3 reactor at the Fermi site, the review team relied on Detroit Edison's compliance with the following measures and controls that would limit adverse environmental impacts:

- compliance with applicable Federal, State, and local laws, ordinances, and regulations intended to prevent or minimize adverse environmental impacts (e.g., solid waste management, erosion and sediment control, air emissions, noise control, stormwater management, spill response and cleanup, and hazardous material management)
- compliance with applicable requirements of permits or licenses required for operation of Fermi 3 (e.g., Section 10 of the Rivers and Harbors Appropriation Act of 1899 (RHAA) and CWA Section 404 permits, NPDES permit)
- compliance with existing Fermi 2 processes and/or procedures applicable to Fermi 3 operational environmental compliance activities for the Fermi site (e.g., solid waste management, hazardous waste management, and spill prevention and response)
- incorporation of environmental requirements into construction contracts
- implementation of BMPs.

Table 5-35 summarizes the measures and controls for limiting adverse impacts during operation of Fermi 3 at the Fermi site, based on the table supplied by Detroit Edison (2011a), as adjusted by the review team when considered to be appropriate. Some measures apply to more than one impact category. Fuel cycle impacts, including the radioactive waste system impacts, transportation of radioactive materials, and decommissioning, are discussed in Chapter 6 of this EIS.

5.13 Summary of Operational Impacts

The staff's evaluation of the environmental impacts of operations is summarized in Table 5-36. Impact level categories are denoted in the table as SMALL, MODERATE, or LARGE as a measure of their expected adverse impacts, if any. The bases for these determinations are provided in detail in Sections 5.1 through 5.11 of this EIS; a brief statement explaining the basis for the impact level for each major resource category is provided in the table. Some impacts, such as the addition of tax revenue from Detroit Edison for the local economies, are likely to be beneficial to the community.

Table 5-35. Summary of Measures and Controls Proposed by Detroit Edison to Limit Adverse Impacts When Operating Fermi 3

Affected Environment/Resource Area	Specific Measures and Control
Land Use Impacts	
The site and vicinity	• Adhere to all applicable land use and zoning regulations of Monroe County and Frenchtown Charter Township as well as regional and State land use plans. • Minimize potential impacts through use of BMPs and compliance with SWPPP requirements. • Use existing roads to minimize traffic impacts on land use. Heavy traffic during plant outage shift changes would be a short-term duration activity. • Incorporate drift eliminators into the design of the cooling towers to minimize the potential for salt deposition, especially on nearby agricultural lands. Salt drift mitigation beyond the proposed drift eliminators is not required. • Monitor natural draft and mechanical draft cooling towers and the heat dissipation system during operation under rules and regulations governing these systems.
Transmission line corridors and offsite areas	• The 345-kV transmission system and associated corridors would be exclusively owned and operated by ITC*Transmission*. Detroit Edison has no control over the construction or operation of the transmission system. The operational impacts are based on publicly available information and reasonable expectations on the configurations and practices that ITC*Transmission* is likely to use based on standard industry practice. Such efforts are assumed to include industry-standard BMPs that would minimize the operational effects on land use.
Water-Related Impacts	
Hydrologic alterations	• Develop and implement the SWPPP to manage stormwater runoff and prevent erosion. Surface water would be routed away from the nuclear plant through subgrade storm drains and off the slopes of the elevated area, as needed.
Water use and quality	• Comply with MDEQ Large Quantity Water Withdrawal Permit requirements. • Use Best Available Technology to reduce evaporative losses from cooling towers. • Develop and implement the SWPPP to manage stormwater runoff and prevent erosion. • Develop and implement a PIPP.

Table 5-35. (contd)

Affected Environment/Resource Area	Specific Measures and Control
	• Comply with requirements of CWA Section 404 permit, Section 402(p) NPDES permit, RHAA Section 10 permit, and MDEQ Act 451 Section 325. • Obtain CWA Section 401 water quality certification and Coastal Zone Management Act certification. • Design cooling water discharge diffuser to minimize the size of the thermal mixing zone, in both lateral and vertical extent. • Design the cooling water discharge diffuser to minimize bottom scour and associated turbidity. Riprap may be required to reduce bottom scour. • Locate and orient the discharge structure to minimize siltation resulting from turbidity at the diffuser ports. Diffuser design would reduce concentrated silt buildup through discharge points spaced approximately 17 ft apart. • Treat cooling tower blowdown water prior to discharge to reduce salt concentration.
Ecological Impacts	
Terrestrial and wetland resources	• In consultation with MDNR, develop and implement a Habitat and Species Conservation Plan to mitigate operational impacts on the eastern fox snake, including measures to reduce traffic-induced mortality. • Comply with requirements of permits for RHAA Section 10, CWA Section 404, and MDEQ Act 451 Section 325 to minimize and mitigate impacts on aquatic resources, including jurisdictional wetlands. Wetland mitigation would be developed in consultation with MDEQ and USACE. • Develop and implement the SWPPP to manage stormwater runoff and prevent erosion. • Develop and implement a PIPP. • Use drift eliminators to keep solids deposition (assumed as salt) from cooling towers below NUREG-1555 significance level. • Although not under Detroit Edison's control, ITC*Transmission* would be expected to conform to industry-standard BMPs for transmission ROW maintenance to reduce impacts on terrestrial and wetland systems.
Aquatic resources	• Implement measures in the SWPPP, PIPP, and permits for RHAA Section 10, CWA Section 404, and MDEQ Act 451 Section 325. • Use a closed cycle cooling system to reduce impingement and entrainment of aquatic organisms. • Maintain a low intake velocity ($\leq$0.5 fps).

Table 5-35. (contd)

Affected Environment/Resource Area	Specific Measures and Control
	• Design intake screens with appropriate mesh size and include a trash rack. Regular washing of the intake screens will minimize impingement mortality. • Use a backwash system that would remove impinged organisms from intake screens and return them using a fish return system to Lake Erie outside the intake bay area. • If a shutdown of the proposed facility is planned during winter months, reduce the discharge of cooling water gradually in order to reduce the potential for cold shock to aquatic organisms. • Design cooling water discharge diffuser to minimize the size of the thermal mixing zone in both lateral and vertical extent. • Compliance with NPDES permit effluent limits and use of one Lake Erie outfall for Fermi 3 would minimize chemical impacts. • Avoid the use of phosphorus-containing corrosion and scale inhibitors in order to reduce nutrient loading that could contribute to algal blooms. • Minimize scouring through the use of riprap around the submerged discharge port, if necessary, and use an upward orientation of discharge ports. • Although not under Detroit Edison's control, ITC*Transmission* would be expected to conform to industry-standard BMPs that are protective of aquatic systems for transmission ROW maintenance. • Design transmission lines to avoid wetlands or other water bodies to the maximum extent possible. Any unavoidable impacts would be subject to regulatory permit conditions.
Socioeconomic Impacts	
	• Sound attenuation measures as part of the standard mechanical draft cooling tower should be sufficient to limit the noise impact. Infrequent operation of the mechanical draft cooling towers would further reduce noise impacts. • Although most operational noise is expected to be similar to ambient noise levels, employees would be trained and appropriately protected to reduce their risk of noise exposure. Comply with all relevant OSHA regulations during operations of Fermi 3
Environmental Justice	• No mitigating measures or controls required.

Table 5-35. (contd)

Affected Environment/Resource Area	Specific Measures and Control
Historic Properties and Cultural Resources	• Operations are unlikely to affect archaeological sites. Appropriate controls would be used during post-construction excavation activities to ensure compliance with the National Historic Preservation Act. • The closest offsite above-ground historic resource in the indirect area of potential effect is located approximately 1 mi from the proposed location of Fermi 3, and all others are located approximately 1.5 to 4.5 mi distant. Visual impacts are not substantial, and no measures or controls are necessary. • The Fermi site contains an existing power plant with two cooling towers. Operations would not introduce a new element that would contribute to the loss of historic integrity of historic above-ground resources in the site vicinity, and no measures or controls are necessary. • Although not under Detroit Edison's control, ITC*Transmission* would be expected to conform to regulatory requirements pertaining to historic and cultural resources that could be affected by transmission line operations.
Air Quality and Meteorology	• Comply with Federal, State, and local air permits; use cooling-tower drift eliminators; water, reseed, or pave areas used for construction. • Treat cooling water prior to discharge to reduce salt released into the atmosphere.
Nonradiological Health	• Use of biocides to reduce the levels of microbial populations in the cooling tower and condenser. • Comply with OSHA standards for Fermi 3 operational workers. • Control vehicle emissions by regularly scheduled maintenance. • Use standard sound attenuation measures for mechanical draft cooling towers. These should be sufficient to limit the noise impact. Infrequent operation of the mechanical draft cooling towers would further reduce noise impacts. • Monitor the release of nonradiological waste emissions and effluents.
Radiological Impacts of Normal Operations	
Radiation doses to members of the public	• Calculated radiation doses to members of the public within NRC and EPA standards (10 CFR Part 20, Appendix I of 10 CFR Part 50, and 40 CFR Part 190). • Radiological effluent and environmental monitoring programs would be implemented.

Table 5-35. (contd)

Affected Environment/Resource Area	Specific Measures and Control
Occupational radiation doses	• Estimated occupational doses are within NRC standards (10 CFR Part 20) • Program would be implemented to maintain occupational doses ALARA (10 CFR Part 20).
Radiation doses to biota other than humans	• Calculated doses to biota are well within NCRP and IAEA guidelines. • Radiological environmental monitoring program would be implemented.
Impacts of Postulated Accidents	
Design-basis accidents	• Calculated dose consequences of design-basis accidents for the ESBWR at the Fermi site were found to be within regulatory limits.
Severe accidents	• Calculated probability-weighted consequences of severe accidents for the ESBWR at the Fermi site were found to be lower than the probability-weighted consequences for currently operating reactors.
Nonradioactive Wastes	• All releases from Fermi 3 including discharges to waste and discharges to air would be in compliance with applicable regulations, permits, and procedures. • All wastes transferred offsite would be managed in licensed facilities in compliance with applicable regulations, permits, and procedures. • All hazardous wastes would be accumulated onsite in accordance with all applicable regulations and transferred offsite to licensed/permitted facilities in compliance with applicable regulations, permits, and procedures. • Implement recycling and waste minimization program.

Source: Detroit Edison 2011a

1 **Table 5-36**. Summary of Fermi 3 Operational Impacts

Resource Area	Comments	Impact Level
Land Use		
Site and vicinity	Operation of one new onsite unit. Possible new housing and retail space in the vicinity.	SMALL
Offsite transmission line corridors	Approximately 40 percent of a 29.4-mi-transmission line corridor would be along an undeveloped ROW.	SMALL
Water Resources		
Water use		
Surface water	Average consumptive use of approximately 7.6 billion gal/yr from Lake Erie.	SMALL
Groundwater	No groundwater use or dewatering during operations.	SMALL
Water quality		
Surface water	Discharge of thermal, chemical, and radiological wastes from normal operations. Physical changes in Lake Erie resulting from stormwater runoff, blowdown discharge, and maintenance dredging.	SMALL
Groundwater	No unavoidable adverse impacts on groundwater quality are anticipated during operations.	SMALL
Ecological Resources		
Terrestrial and wetlands resources	Potential impact on eastern fox snake (State-listed as threatened) from vehicle-related mortality. Long-term maintenance of former terrestrial and wetland habitat as developed facilities on the Fermi site. Long-term maintenance of transmission line ROWs as early successional habitat.	MODERATE
Aquatic resources	Cooling system impacts on Lake Erie related to thermal discharges, impingement, and entrainment.	SMALL
Socioeconomics		
Physical impacts	Small increase in noise levels, cooling tower and associated condensate plume would be visible offsite.	SMALL
Demography	Minor increase in population resulting from in-migrating operations workforce.	SMALL beneficial

Table 5-36 (contd)

Resource Area	Comments	Impact Level
Economy and taxes	Economic impact would be beneficial but SMALL in all areas in the 50-mi region except for Monroe County, where economic and property tax impacts would be LARGE and beneficial.	SMALL beneficial in the region to LARGE beneficial in Monroe County
Infrastructure and community services	Minor impacts on traffic, recreation, housing, public services, and education associated with population increase offset by increase in tax revenue. Local traffic would increase during operations resulting in increased congestion especially during outages.	SMALL (during normal operations) to MODERATE (outages)
Environmental Justice	No environmental pathways or preconditions exist that could lead to disproportionately high and adverse impacts on minorities or low-income populations.	SMALL
Historic and Cultural Resources	Minor impacts on offsite historic properties associated with visible condensate plume from cooling towers. Impacts from operating the proposed transmission lines would be minor if there are no new significant alterations to the cultural environment.	SMALL
Air Quality and Meteorology	Slight increase in certain criteria pollutants and CO_2 from plant auxiliary combustion equipment (e.g., diesel generators); plumes and drift from cooling towers.	SMALL
Nonradiological Health	Operational activities would not have significant nonradiological health impacts on the public and workers.	SMALL
Radiological Impacts of Normal Operations		
Members of the public	Doses to members of the public would be below NRC and EPA standards, and there would be no observable health impacts (10 CFR Part 20, Appendix I to 10 CFR Part 50, 40 CFR Part 190).	SMALL
Plant workers	Occupational doses to plant workers would be below NRC standards, and program to maintain doses ALARA would be implemented.	SMALL
Biota other than humans	Dose to biota other than humans would be below NCRP and IAEA guidelines.	SMALL

Table 5-36 (contd)

Resource Area	Comments	Impact Level
Impacts of Postulated Accidents		
Design-basis accidents	Impacts of design-basis accidents would be well below regulatory criteria.	SMALL
Severe accidents	Probability-weighted consequences of severe accidents would be lower than the Commission's safety goals and probability-weighted consequences for currently operating reactors.	SMALL
Nonradioactive Wastes	Solid, liquid, gaseous, and mixed wastes generated during operations would be handled according to county, State, and Federal regulations.	SMALL

5.14 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection against Radiation."

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy,* Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site Criteria.

29 CFR Part 1910. Code of Federal Regulations, Title 29, *Labor*, Part 1910, "Occupational Safety and Health Standards."

33 CFR Part 165. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 165, "Regulated Navigation Areas and Limited Access Areas."

36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties."

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

40 CFR Part 63. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 63, "National Emission Standards for Hazardous Air Pollutants for Source Categories."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

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6.0 Fuel Cycle, Transportation, and Decommissioning

This chapter addresses the environmental impacts from (1) the uranium fuel cycle and solid waste management, (2) the transportation of radioactive material, and (3) the decommissioning of the proposed new nuclear unit Enrico Fermi Unit 3 (Fermi 3) at the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site.

In its evaluation of uranium fuel cycle impacts from the new unit at the Fermi site, Detroit Edison used the Economic Simplified Boiling Water Reactor (ESBWR) advanced light-water reactor (LWR) design, assuming a capacity factor of 93 percent (Detroit Edison 2011) for the ESBWR reactor design.

This chapter presents the U.S. Nuclear Regulatory Commission (NRC) staff's assessment of the environmental impacts from fuel cycle, transportation, and decommissioning activities in relation to the GE-Hitachi ESBWR design that Detroit Edison is proposing for Fermi 3.

6.1 Fuel Cycle Impacts and Solid Waste Management

This section discusses the environmental impacts from the uranium fuel cycle and solid waste management for the ESBWR reactor design. The environmental impacts of this design are evaluated against specific criteria for LWR designs in Title 10 of the Code of Federal Regulations (CFR) 51.51.

The regulations in 10 CFR 51.51(a) state the following:

> "Under 10 CFR 51.50, every environmental report prepared for the construction permit stage or early site permit stage or combined license stage of a light-water-cooled nuclear power reactor, and submitted on or after September 4, 1979, shall take Table S-3, Table of Uranium Fuel Cycle Environmental Data, as the basis for evaluating the contribution of the environmental effects of uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials and management of low-level wastes and high-level wastes related to uranium fuel cycle activities to the environmental costs of licensing the nuclear power reactor. Table S-3 shall be included in the environmental report and may be supplemented by a discussion of the environmental significance of the data set forth in the table as weighed in the analysis for the proposed facility."

The ESBWR proposed for Unit 3 at the Fermi site is an LWR that would use uranium dioxide (UO_2) fuel; therefore, Table S-3 (10 CFR 51.51(b)) can be used to assess the environmental impacts of the uranium fuel cycle. Table S-3 values are normalized for a reference

1000-megawatt electrical (MW(e)) LWR at an 80 percent capacity factor. The 10 CFR 51.51(a) Table S-3 values are reproduced in Table 6-1. The power rating for the proposed Fermi 3 ESBWR is 4500 megawatts thermal (MW(t)) (Detroit Edison 2011). With a capacity factor of 93 percent, Fermi 3 would produce an average of 1428 MW(e) (Detroit Edison 2011).

Specific categories of environmental considerations are included in Table S-3 (see Table 6-1). These categories relate to land use, water consumption and thermal effluents, radioactive releases, burial of transuranic and high-level waste (HLW) and low-level waste (LLW), and radiation doses from transportation and occupational exposures. In developing Table S-3, the NRC staff considered two fuel cycle options that differed in the treatment of spent fuel removed from a reactor. The “no-recycle” option treats all spent fuel as waste to be stored at a Federal waste repository, whereas the “uranium-only recycle” option involves reprocessing spent fuel to recover unused uranium and return it to the system. Neither cycle involves the recovery of plutonium. The contributions in Table S-3 resulting from reprocessing, waste management, and transportation of wastes are maximized for both of the two fuel cycles (uranium-only and no-recycle); that is, the identified environmental impacts are based on the cycle that results in the greater impact. The uranium fuel cycle is defined as the total of those operations and processes associated with provision, utilization, and ultimate disposition of fuel for nuclear power reactors.

The Nuclear Nonproliferation Act of 1978 (22 USC 3201 *et seq*.) significantly affected the disposition of spent nuclear fuel by deferring indefinitely the commercial reprocessing and recycling of spent fuel produced in the U.S. commercial nuclear power program. While the ban on the reprocessing of spent fuel was lifted during the Reagan administration, economic circumstances changed, reserves of uranium ore increased, and the stagnation of the nuclear power industry in the United States provided little incentive for industry to resume reprocessing. During the 109th Congress, the Energy Policy Act of 2005 (119 Statute 594) was enacted. It authorized the U.S. Department of Energy (DOE) to conduct an advanced fuel recycling technology research and development program to evaluate proliferation-resistant fuel recycling and transmutation technologies that minimize environmental or public health and safety impacts. Consequently, while Federal policy does not prohibit reprocessing, additional DOE efforts would be needed before commercial reprocessing and recycling of spent fuel produced in the U.S. commercial nuclear power plants could commence.

The no-recycle option is presented schematically in Figure 6-1. Natural uranium is mined in either open-pit or underground mines or by an in situ leach solution mining process. In situ leach mining, presently the primary form of mining in the United States, involves injecting a lixiviant solution into the uranium ore body to dissolve uranium, and then pumping the solution to the surface for further processing. The ore or in situ leach solution is transferred to mills where it is processed to produce “yellowcake” uranium oxide (U_3O_8). A conversion facility prepares the U_3O_8 by converting it to uranium hexafluoride (UF_6), which is then processed by an

Table 6-1. Uranium Fuel Cycle Environmental Data[a]

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Natural Resource Use		
Land (acres)		
Temporarily committed[b]	100	
Undisturbed area	79	
Disturbed area	22	Equivalent to a 100-MW(e) coal-fired power plant.
Permanently committed	13	
Overburden moved (millions of MT)	2.8	Equivalent to a 95-MW(e) coal-fired power plant.
Water (millions of gallons)		
Discharged to air	160	Equal to 2 percent of model 1000-MW(e) LWR with cooling tower.
Discharged to water bodies	11,090	
Discharged to ground	127	
Total	11,377	Less than 4 percent of model 1000 MW(e) with once-through cooling.
Fossil fuel		
Electrical energy (thousands of MW-hr)	323	Less than 5 percent of model 1000-MW(e) LWR output.
Equivalent coal (thousands of MT)	118	Equivalent to the consumption of a 45-MW(e) coal-fired power plant.
Natural gas (millions of standard cubic feet)	135	Less than 0.4 percent of model 1000 MW(e) energy output.
Effluents – Chemical (MT)		
Gases (including entrainment)[c]		
SO_x	4400	
NO_x[d]	1190	Equivalent to emissions from a 45-MW(e) coal-fired plant for a year.
Hydrocarbons	14	
CO	29.6	
Particulates	1154	
Other gases:		
F	0.67	Principally from uranium hexafluoride (UF_6) production, enrichment, and reprocessing. The concentration is within the range of State standards – below level that has effects on human health.
HCl	0.014	

Table 6-1. (contd)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Liquids		
SO_4^-	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are: NH_3 – 600 cfs, NO_3 – 20 cfs, Fluoride – 70 cfs.
NO_3^-	25.8	
Fluoride	12.9	
Ca^{++}	5.4	
Cl^-	8.5	
Na^+	12.1	
NH_3	10	
Fe	0.4	
Tailings solutions (thousands of MT)	240	From mills only – no significant effluents to environment.
Solids	91,000	Principally from mills – no significant effluents to environment.
Effluents – Radiological (curies)		
Gases (including entrainment)		
Rn-222		Presently under reconsideration by the Commission.
Ra-226	0.02	
Th-230	0.02	
Uranium	0.034	
Tritium (thousands)	18.1	
C-14	24	
Kr-85 (thousands)	400	
Ru-106	0.14	Principally from fuel reprocessing plants.
I-129	1.3	
I-131	0.83	
Tc-99		Presently under consideration by the Commission.
Fission products and transuranics	0.203	
Liquids		
Uranium and daughters	2.1	Principally from milling – included tailings liquor and returned to ground – no effluents; therefore, no effect on environment.
Ra-226	0.0034	From UF_6 production.
Th-230	0.0015	
Th-234	0.01	From fuel fabrication plants – concentration 10 percent of 10 CFR Part 20 for total processing 26 annual fuel requirements for model LWR.
Fission and activation products	5.9×10^{-6}	

Table 6-1. (contd)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Solids (buried onsite)		
Other than high-level (shallow)	11,300	9100 Ci comes from low-level reactor wastes and 1500 Ci comes from reactor decontamination and decommissioning – buried at land burial facilities. 600 Ci comes from mills – included in tailings returned to ground. Approximately 60 Ci comes from conversion and spent fuel storage. No significant effluent to the environment.
TRU and HLW (deep)	1.1×10^7	Buried at Federal Repository.
Effluents – thermal (billions of Btus)	4063	Less than 5 percent of model1000-MW(e) LWR.
Transportation (person-rem):		
Exposure of workers and general public	2.5	
Occupational exposure (person-rem)	22.6	From reprocessing and waste management.

(a) In some cases where no entry appears, it is clear from the background documents that the matter was addressed and that, in effect, the table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the table. Table S-3 does not include health effects from the effluents described in the table, or estimates of releases of radon-222 from the uranium fuel cycle or estimates of technetium-99 released from waste management or reprocessing activities. These issues may be the subject of litigation in the individual licensing proceedings.

Data supporting this table are given in the "Environmental Survey of the Uranium Fuel Cycle," WASH-1248 (AEC 1974); the "Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle," NUREG-0116 (Supp.1 to WASH-1248) (NRC 1976); the "Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle," NUREG-0216 (Supp. 2 to WASH-1248) (NRC 1977b); and in the record of the final rulemaking pertaining to Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management, Docket RM-50-3. The contributions from reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor, which are considered in Table S-4 of Sec. 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A–E of Table S-3A of WASH-1248.

(b) The contributions to temporarily committed land from reprocessing are not prorated over 30 years, because the complete temporary impact accrues regardless of whether the plant services 1 reactor for 1 year or 57 reactors for 30 years.

(c) Estimated effluents based upon combustion of equivalent coal for power generation.

(d) 1.2 percent from natural gas use and process.

enrichment facility to increase the percentage of the more fissile isotope uranium-235 and decrease the percentage of the non-fissile isotope uranium-238. At a fuel fabrication facility, the enriched uranium, which is approximately 5 percent uranium-235, is then converted to UO_2. The UO_2 is pelletized, sintered, and inserted into tubes to form fuel assemblies, which are placed in a reactor to produce power. When the content of the uranium-235 reaches a point where the nuclear reactor has become inefficient with respect to neutron economy, the fuel assemblies are withdrawn from the reactor. After onsite storage for sufficient time to allow for short-lived fission product decay and to reduce the heat generation rate, the fuel assemblies would be transferred to a waste repository for internment. Disposal of spent fuel elements in a repository constitutes the final step in the no-recycle option.

The following assessment of the environmental impacts of the fuel cycle as related to the operation of the proposed project is based on the values given in Table S-3 (Table 6-1) and the NRC staff's analysis of the radiological impact from radon-222 and technetium-99. In NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*

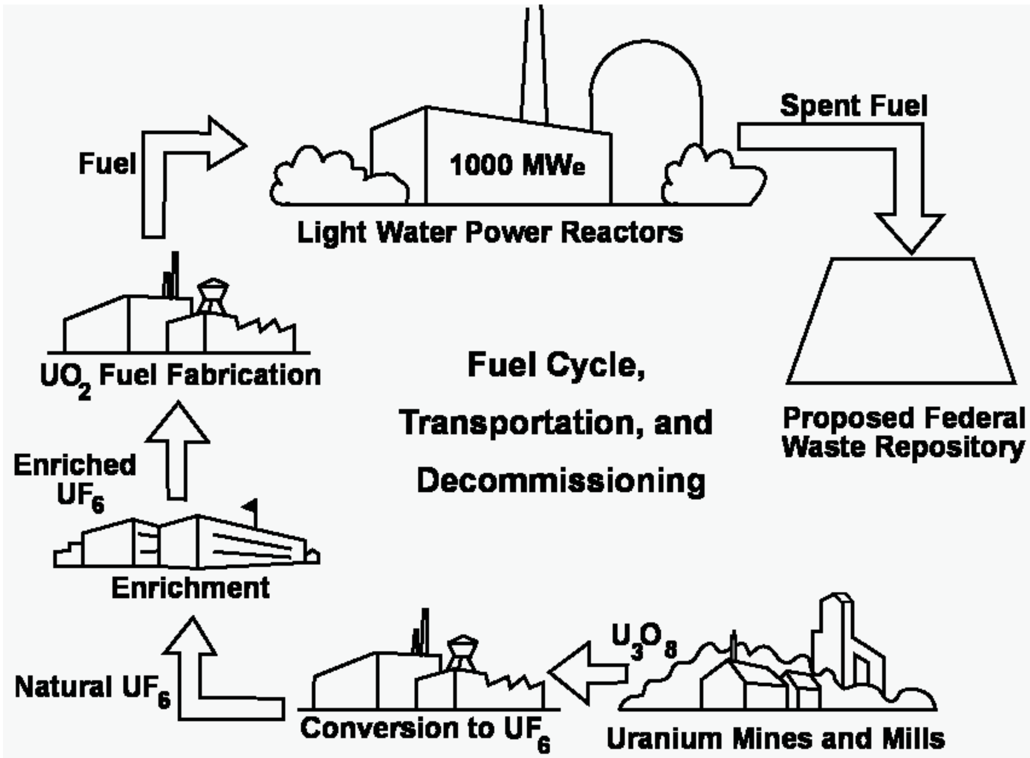

Figure 6-1. The Uranium Fuel Cycle: No-Recycle Option (derived from NRC 1996)

(GEIS) (NRC 1996, 1999),[(a)] the NRC staff provides a detailed analysis of the environmental impacts from the uranium fuel cycle. Although NUREG-1437 is specific to the impacts related to license renewal, the information is relevant to this review, because the advanced LWR design considered here uses the same type of fuel; the NRC staff's analyses in Section 6.2.3 of NUREG-1437 are summarized and set forth here.

The fuel cycle impacts in Table S-3 are based on a reference 1000-MW(e) LWR operating at an annual capacity factor of 80 percent for a net electric output of 800 MW(e). As explained above, the total net electric output from Fermi 3 is 1428 MW(e), which is about 1.79 times (i.e., 1428 MW(e) divided by 800 MW(e) yields 1.79) the impact values in Table S-3 (see Table 6-1). For simplicity and added conservatism in its review and evaluation of the environmental impacts of the fuel cycle, the NRC staff multiplied the impact values in Table S-3 by a factor of 2, rather than 1.79, thus scaling the impacts upward to account for the increased electric generation of the proposed unit. Throughout this chapter, scaling by a factor of 2 will be referred to as the 1000-MW(e) LWR-scaled model.

(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999. Hereafter, all references to NUREG-1437 include NUREG-1437 and its Addendum 1.

Recent changes in the fuel cycle may have some bearing on environmental impacts; however, as discussed below, the NRC staff is confident that the contemporary fuel cycle impacts are below those identified in Table S-3. This is especially true in light of the following recent fuel cycle trends in the United States:

- Increasing use of in situ leach uranium mining, which does not produce mine tailings.
- Transitioning of U.S. uranium enrichment technology from gaseous diffusion (GD) to gas centrifuge (GC). The latter centrifuge process uses only a small fraction of the electrical energy per separation unit compared to GD. (U.S. GD plants relied on electricity derived mainly from the burning of coal.)
- Current LWRs use nuclear fuel more efficiently due to higher fuel burnup. Therefore, less uranium fuel per year of reactor operation is required than in the past to generate the same amount of electricity.
- Fewer spent fuel assemblies per reactor-year are discharged; hence, the waste storage/repository impact is lessened.

The values in Table S-3 were calculated from industry averages for the performance of each type of facility or operation within the fuel cycle. Recognizing that this approach meant that there would be a range of reasonable values for each estimate, the NRC staff followed the policy of choosing the assumptions or factors to be applied so that the calculated values would not be underestimated. This approach was intended to ensure that the actual environmental impacts would be smaller than the quantities shown in Table S-3 for all LWR nuclear power plants within the widest range of operating conditions. The NRC staff recognizes that many of the fuel cycle parameters and interactions vary in small ways from the estimates in Table S-3; the staff concludes that these variations would have no impacts on the Table S-3 calculations.

For example, to determine the quantity of fuel required for a year's operation of a nuclear power plant in Table S-3, the NRC staff defined the model reactor as a 1000-MW(e) LWR operating at 80 percent capacity with a 12-month fuel reloading cycle and an average fuel burnup of 33,000 megawatt-days per metric ton of uranium (MWd/MTU). This is a "reactor reference year" or "reference reactor-year" depending on the source (either Table S-3 or NUREG-1437), but it has the same meaning.

If approved, the combined license (COL) for Fermi 3 would allow 40 years of operation. In NUREG-1437, the sum of the initial fuel loading plus all of the reloads for the lifetime of the reactor can be divided by the 60-year lifetime (40-year initial license term and 20-year license renewal term) to obtain an average annual fuel requirement. This approach was followed in NUREG-1437 for both boiling water reactors and pressurized water reactors; the higher annual requirement, 35 metric tons (MT) of uranium made into fuel for a boiling water reactor, was chosen in NUREG-1437 as the basis for the reference reactor-year (NRC 1996). The average annual fuel requirement presented in NUREG-1437 would only be increased by 2 percent if a 40-year lifetime was evaluated. However, a number of fuel management improvements have been adopted by nuclear power plants to achieve higher performance and to reduce fuel and separative-work (enrichment) requirements. Since Table S-3 was promulgated, these improvements have reduced the annual fuel requirement, which means the Table S-3 assumptions remain bounding as applied to the proposed unit.

Another change supporting the bounding nature of the Table S-3 assumptions is the elimination of U.S. restrictions on the importation of foreign uranium. Until recently, the economic conditions in the uranium market favored utilization of foreign uranium at the expense of the domestic uranium industry. From the mid-1980s to 2004, the price of U_3O_8 remained below $20 per pound. These market conditions forced the closing of most U.S. uranium mines and mills, substantially reducing the environmental impacts in the United States from uranium-mining activities. However, the spot price of uranium increased dramatically, from $24 per pound in April 2005 to $135 per pound in July 2007, and has decreased to near $52 per pound as of July 2011 (UxC 2011). As a result, there is a renewed interest in uranium mining and milling in the United States, and the NRC anticipates receiving multiple license applications for uranium mining and milling in the next several years. The majority of these applications are expected to be for in situ leach solution mining that does not produce tailings. Factoring in changes to the fuel cycle suggests that the environmental impacts of mining and tail millings could drop to levels below those given in Table S-3; however, Table S-3 estimates remain bounding for the proposed unit.

In summation, these reasons highlight why Table S-3 is likely to overestimate impacts from Fermi 3 and, therefore, remains a bounding approach for this analysis.

Section 6.2 of NUREG-1437 discusses, in greater detail, the sensitivity to changes in the fuel cycle since issuance of Table S-3 on the environmental impacts.

6.1.1 Land Use

The total annual land requirement for the fuel cycle supporting the 1000-MW(e) LWR-scaled model is about 230 ac. Approximately 26 ac are permanently committed land, and 200 ac are temporarily committed. A “temporary” land commitment is a commitment for the life of the specific fuel cycle plant (e.g., a mill, enrichment plant, or succeeding plants). Following completion of decommissioning, such land can be released for unrestricted use. “Permanent” commitments represent land that may not be released for use after plant shutdown and decommissioning because decommissioning activities do not result in removal of sufficient radioactive material to meet the limits in 10 CFR Part 20, Subpart E, for release of that area for unrestricted use. Of the 200 ac of temporarily committed land, 160 ac are undisturbed and 44 ac are disturbed. In comparison, a coal-fired power plant using the same MW(e) output as the LWR-scaled model and using strip-mined coal requires the disturbance of about 360 ac/yr for fuel alone. The NRC staff concludes that the impacts on land use to support the 1000-MW(e) LWR-scaled model would be SMALL.

6.1.2 Water Use

The principal water use for the fuel cycle supporting a 1000-MW(e) LWR-scaled model is that required to remove waste heat from the power stations supplying electrical energy for the enrichment step of this cycle. Scaling from Table S-3, of the total annual water use of 2.3×10^{10} gal, about 2.2×10^{10} gal are required for the removal of waste heat, assuming that a new unit uses once-through cooling. Also, scaling from Table S-3, other water uses involve the discharge to air (e.g., evaporation losses in process cooling) of about 3.2×10^{8} gal/yr and water discharged to the ground (e.g., mine drainage) of about 3.0×10^{8} gal/yr.

On a thermal-effluent basis, annual discharges from the nuclear fuel cycle are about 4 percent of the 1000-MW(e) LWR-scaled model using once-through cooling. The consumptive water use is about 2 percent of the 1000-MW(e) LWR-scaled model using cooling towers. The maximum consumptive water use (assuming that all plants supplying electrical energy to the nuclear fuel cycle use cooling towers) would be about 4 percent of the 1000-MW(e) LWR-scaled model using cooling towers. Under this condition, thermal effluents would be negligible. The NRC staff concludes that the impacts on water use for these combinations of thermal loadings and water consumption would be SMALL.

6.1.3 Fossil Fuel Impacts

Electric energy and process heat are required during various phases of the fuel cycle process. The electric energy is usually produced by the combustion of fossil fuel at conventional power plants. Electric energy associated with the fuel cycle represents about 5 percent of the annual electric power production of the reference 1000-MW(e) LWR. Process heat is generated primarily by the combustion of natural gas. This gas consumption, if used to generate electricity, would be less than 0.4 percent of the electrical output from the model plant. The NRC staff concludes that the fossil fuel impacts from the direct and indirect consumption of electric energy for fuel cycle operations would be SMALL relative to the net power production of the proposed project.

The largest use of electricity in the fuel cycle comes from the enrichment process. It appears that GC technology is likely to eventually replace GD technology for uranium enrichment in the United States. The same amount of enrichment from a GC facility uses less electricity and therefore results in lower amounts of air emissions such as carbon dioxide (CO_2) than a GD facility. Therefore, the NRC staff concludes that the values for electricity use and air emissions in Table S-3 continue to be appropriately bounding values.

As indicated in Appendix L, the largest source of carbon dioxide (CO_2) emissions associated with nuclear power is from the fuel cycle, not operation of the plant. The largest source of CO_2 in the fuel cycle is production of electric energy from the combustion of fossil fuel in conventional power plants. This energy is used to power components of the fuel cycle such as the enrichment process. The CO_2 emissions from the fuel cycle are about 5 percent of the CO_2 emissions from an equivalent fossil-fuel-fired plant.

In Appendix L, the NRC staff estimates that the carbon footprint of the fuel cycle to support a reference 1000-MW(e) LWR operating at an 80 percent capacity factor for a 40-year plant life is on the order of 17,000,000 MT of CO_2, including a very small contribution from other greenhouse gases (GHGs). Scaling this footprint to the power level of Fermi 3 using the scaling factor of 2 discussed earlier, the NRC staff estimates the carbon footprint for 40 years of fuel cycle emissions to be 34,000,000 MT of CO_2 (average annual emissions rate of 850,000 MT, averaged over the period of operation) as compared to a total United States annual emission rate of 5.5 billion MT of CO_2 (EPA 2011).

On this basis, the NRC staff concludes that the fossil fuel impacts, including GHG emissions, from the direct and indirect consumption of electric energy for fuel cycle operations, would be SMALL.

6.1.4 Chemical Effluents

The quantities of gaseous and particulate effluents from fuel cycle processes are given in Table S-3 (Table 6-1) for the reference 1000-MW(e) LWR and, according to WASH-1248 (AEC 1974), result from the generation of electricity for fuel cycle operations. The principal effluents are sulfur oxides, nitrogen oxides, and particulates. Table S-3 states that the fuel cycle for the reference 1000-MW(e) LWR requires 323,000 MW-hr of electricity. The fuel cycle for the 1000-MW(e) LWR-scaled model would therefore require 6.5×10^5 MW-hr of electricity, or 0.016 percent of the 4.1 billion MW-hr of electricity generated in the United States in 2008 (DOE/EIA 2009). Therefore, the gaseous and particulate emissions would add about 0.016 percent to the national gaseous and particulate chemical effluents for electricity generation.

Liquid chemical effluents produced in fuel cycle processes are related to fuel enrichment and fabrication and may be released to receiving waters. These effluents are usually present in dilute concentrations, such that only small amounts of dilution water are required to reach levels of concentration that are within established standards. Table S-3 (Table 6-1) specifies the amount of dilution water required for specific constituents. In addition, all liquid discharges into the navigable waters of the United States from plants associated with the fuel cycle operations would be subject to requirements and limitations set by the appropriate Federal, State, Tribal, and local agencies.

Tailings solutions and solids are generated during the milling process, but as Table S-3 indicates, effluents are not released in quantities sufficient to have a significant impact on the environment.

On the basis of the discussions above, the NRC staff concludes that the impacts of these chemical effluents would be SMALL.

6.1.5 Radiological Effluents

Radioactive effluents estimated to be released to the environment from waste management activities and certain other phases of the fuel cycle process are set forth in Table S-3 (Table 6-1). NUREG-1437 (NRC 1996) provides the 100-year environmental dose commitment to the U.S. population from fuel cycle activities for 1 year of operation of the model 1000-MW(e) LWR using the radioactive effluents in Table S-3. Excluding reactor releases and dose commitments because of exposure to radon-222 and technetium-99, the total overall whole body gaseous dose commitment and whole body liquid dose commitment from the fuel cycle were calculated to be approximately 400 person-rem and 200 person-rem, respectively. Scaling these dose commitments by a factor of 2 for the 1000-MW(e) LWR-scaled model results in whole body dose commitment estimates of 800 person-rem for gaseous releases and 400 person-rem for liquid releases. For both pathways, the estimated 100-year environmental dose commitment to the U.S. population would be approximately 1,200 person-rem for the 1000-MW(e) LWR-scaled model.

Currently, the radiological impacts associated with radon-222 and technetium-99 releases are not addressed in Table S-3. Principal radon releases occur during mining and milling operations and as emissions from mill tailings, whereas principal technetium-99 releases occur from GD facilities. Detroit Edison provided an assessment of radon-222 and technetium-99 in its Environmental Review (ER) (Detroit Edison 2011). This evaluation relied on the information discussed in NUREG-1437 (NRC 1996).

In Section 6.2 of NUREG-1437 (NRC 1996), the NRC staff estimated the radon-222 releases from mining and milling operations and from mill tailings for each year of operations of the reference 1000-MW(e) LWR. The estimated releases of radon-222 for the reference reactor year for the 1000-MW(e) LWR-scaled model are approximately 10,400 curies (Ci). Of this total, about 78 percent would be from mining, 15 percent from milling operations, and 7 percent from inactive tails before stabilization. For radon releases from stabilized tailings, the NRC staff assumed that the LWR-scaled model would result in emissions of 2 Ci per site year (i.e., 2 times the NUREG-1437 [NRC 1996] estimate for the reference reactor year). The major risks from radon-222 are from exposure to the bone and the lungs, although there is a small risk from exposure to the whole body. The organ-specific dose-weighting factors from 10 CFR Part 20 were applied to the bone and lung doses to estimate the 100-year dose commitment from radon-222 to the whole body. The estimated 100-year environmental dose commitment from mining, milling, and tailings before stabilization for each reactor-year (assuming the 1000-MW(e) LWR-scaled model) would be approximately 1,840 person-rem to the whole body. From stabilized tailings piles, the estimated 100-year environmental dose commitment would be approximately 36 person-rem to the whole body. Additional insights regarding Federal policy/resource perspectives concerning institutional controls comparisons with routine radon-222 exposure and risk and long-term releases from stabilized tailing piles are discussed in NUREG-1437 (NRC 1996).

Also as discussed in NUREG-1437, the NRC staff considered the potential doses associated with the releases of technetium-99. The estimated releases of technetium-99 for the reference reactor year for the 1000-MW(e) LWR-scaled model are 14 millicuries (mCi) from chemical processing of recycled UF_6 before it enters the isotope enrichment cascade, and 10 mCi into the groundwater from a HLW repository. The major risks from technetium-99 are from exposure to the gastrointestinal tract and kidney, although there is a small risk from exposure to the whole body. Applying the organ-specific dose-weighting factors from 10 CFR Part 20 to the gastrointestinal tract and kidney doses, the total-body 100-year dose commitment from technetium-99 to the whole body was estimated to be 200 person-rem for the 1000-MW(e) LWR-scaled model.

Radiation protection experts assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect, and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose-response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report by the National Research Council (2006), the Biological Effects of Ionizing Radiation (BEIR) VII report, uses the linear, no-threshold dose-response model as a basis for estimating the risks from low doses. This approach is accepted by the NRC as a conservative method for estimating health risks from radiation exposure, recognizing that the model may overestimate those risks. Based on this method, the NRC staff estimated the risk to the public from radiation exposure using the nominal probability coefficient for total detriment. This coefficient has the value of 570 fatal cancers, nonfatal cancers, and severe hereditary effects per 1,000,000 person-rem (10,000 person-sievert [Sv]), equal to 0.00057 effect per person-rem. The coefficient is taken from Publication 103 of the International Commission on Radiological Protection (ICRP) (ICRP 2007).

The nominal probability coefficient was multiplied by the sum of the estimated whole body population doses from gaseous effluents, liquid effluents, radon-222, and technetium-99 discussed above (approximately 3300 person-rem/yr) to calculate that the U.S. population would incur a total of approximately 1.9 fatal cancers, nonfatal cancers, and severe hereditary effects annually.

Radon-222 releases from tailings are indistinguishable from background radiation levels at a few miles distance from the tailings pile (at less than 0.6 mi in some cases) (NRC 1996). The public dose limit issued by the U.S. Environmental Protection Agency (EPA) (40 CFR Part 190) is 25 millirem per year (mrem/yr) to the whole body from the entire fuel cycle, but most NRC licensees have airborne effluents resulting in doses of less than 1 mrem/yr (61 FR 65120).

In addition, at the request of the U.S. Congress, the National Cancer Institute (NCI) conducted a study and published *Cancer in Populations Living Near Nuclear Facilities* in 1990 (Jablon et al. 1990). This report included an evaluation of health statistics around all nuclear power plants, as well as several other nuclear fuel cycle facilities, in operation in the United States in 1981, and found “no evidence that an excess occurrence of cancer has resulted from living near nuclear facilities.” The contribution to the annual average dose received by an individual from fuel-cycle-related radiation and other sources as reported in a report published by the National Council on Radiation Protection and Measurements (NCRP) (NCRP 2009) is listed in Table 6-2. The contribution from the nuclear fuel cycle to an individual’s annual average radiation dose is extremely small (less than 0.1 mrem/yr) compared to the annual average background radiation dose (311 mrem/yr).

Based on the analyses presented above, the NRC staff concludes that the environmental impacts of radioactive effluents from the fuel cycle are SMALL.

Table 6-2. Comparison of Annual Average Dose Received by an Individual from All Sources

Source		Dose (mrem/yr)[a]	Percent of Total
Ubiquitous background	Radon and thoron	228	37
	Space	33	5
	Terrestrial	21	3
	Internal (body)	29	5
	Total background sources	**311**	**50**
Medical	Computed tomography	147	24
	Medical x-ray	76	12
	Nuclear medicine	77	12
	Total medical sources	**300**	**48**
Consumer	Construction materials, smoking, air travel, mining, agriculture, fossil fuel combustion	13	2
Other	Occupational	0.5[b]	0.1
	Nuclear fuel cycle	0.05[c]	0.01
Total		**624**	**100**

Source: NCRP 2009
(a) NCRP Report 160 expresses doses in mSv/yr (1 mSv/yr equals 100 mrem/yr).
(b) Occupational dose is regulated separately from public dose and is provided here for informational purposes.
(c) Calculated using 153 person-Sv/yr from Table 6.1 of NCRP 160 and a 2006 U.S. population of 300 million.

6.1.6 Radiological Wastes

The quantities of buried radioactive waste material (low-level, high-level, and transuranic wastes) generated by the reference 1000-MW(e) LWR are specified in Table S-3 (Table 6-1). For LLW disposal at land burial facilities, the Commission notes in Table S-3 that there would be no significant radioactive releases to the environment.

Detroit Edison can currently ship Class A LLW to the Energy Solutions site in Clive, Utah; however, it cannot dispose of Class B and C LLW at the Energy Solutions site in Barnwell, South Carolina. The Waste Control Specialists, LLC, site in Andrews County, Texas, is licensed to accept Class A, B, and C LLW from the Texas Compact (Texas and Vermont). As of May 2011, Waste Control Specialists, LLC, may accept Class A, B, and C LLW from outside the Texas Compact for disposal, subject to established criteria, conditions, and approval processes. Michigan is not currently affiliated with any compact. Other disposal sites may also be available by the time Fermi 3 could become operational.

Detroit Edison has committed to implementing a waste minimization program for Fermi 3 (Detroit Edison 2011); however, additional waste minimization measures could be implemented by the licensee to specifically reduce or eliminate the generation of Class B and C waste. These measures could include reducing the service run length for resin beds, short-loading media volumes in ion-exchange vessels, and other techniques discussed in the Electric Power Research Institute (EPRI) *Class B/C Waste Reduction Guide* (EPRI 2007a) and *EPRI Operational Strategies to Reduce Class B/C Wastes* (EPRI 2007b). These measures would provide time for offsite disposal capability to be developed or onsite interim storage capacity to be added. Measures to reduce the generation of Class B and C wastes, such as reducing the service run length of resin beds, could increase the volume of LLW, but would not increase the total activity (in curies) of radioactive material in the waste. The volume of waste would still be bounded by or very similar to the estimates in Table S-3, and the environmental impacts would not be significantly different.

Detroit Edison has proposed a Solid Waste Management System for Fermi 3 that provides enough storage space to hold the total combined volume of 3 months of packaged Class A and 10 years of packaged Class B and Class C LLW generated during plant operations. If additional storage capacity for Class B and C LLW is required, Detroit Edison could elect to construct additional temporary storage facilities. Detroit Edison could also enter into an agreement with a third-party contractor to process, store, own, and ultimately dispose of LLW from Fermi 3.

The NRC staff anticipates that licensees would temporarily store Class B and C LLW onsite until offsite storage locations are available. Several operating nuclear power plants have successfully increased onsite storage capacity in the past in accordance with existing NRC regulations. This extended waste storage onsite resulted in no significant increase in dose to the public. In addition, the NRC issued Regulatory Issue Summary 2008-12 (NRC 2008), which included guidance for the extended onsite interim storage of LLW. This guidance addressed the storage of waste in a manner that minimizes potential exposure to workers, which may require adding shielding and storing waste in packaging compatible with the waste composition (e.g., chemical and thermal properties).

In most circumstances, the NRC's regulations (10 CFR 50.59) allow licensees operating nuclear power plants to construct and operate additional onsite LLW storage facilities without seeking approval from the NRC. Licensees are required to evaluate the safety and environmental impacts before constructing the facility and make those evaluations available to NRC inspectors. A number of nuclear power plant licensees have constructed and currently operate such facilities in the United States. Typically, these additional facilities are constructed near the power block inside the security fence, on land that has already been disturbed during initial plant construction. Therefore, the impacts on environmental resources (e.g., land use and aquatic and terrestrial biota) would be very small. All of the NRC (10 CFR Part 20) and EPA (40 CFR Part 190) dose limits would apply both for public and occupational radiation exposure.

In addition, NUREG-1437 assessed the impacts of LLW storage onsite at currently operating nuclear power plants and concluded that the radiation doses to offsite individuals from interim LLW storage are insignificant (NRC 1996). The radiological environmental monitoring programs around nuclear power plants that operate such facilities show that the increase in radiation dose at the site boundary is not significant; the doses continue to be below 25 mrem/yr, the dose limit of 40 CFR Part 190. The types and amounts of LLW generated during operations of the proposed Fermi 3 reactor would be very similar to those generated by currently operating nuclear power plants, and the construction and operation of these interim LLW storage facilities would be very similar to the construction and operation of the currently operating facilities. Additionally, in NUREG-1437 (Section 6.4.4.2), the NRC staff concluded that there should be no significant issues or environmental impacts associated with interim storage of LLW generated by nuclear power plants. Interim storage facilities would be used until these wastes could be shipped safely to licensed disposal facilities. Detroit Edison's resolution of LLW disposal issues for the existing Fermi 2 facility could also be implemented for the proposed Fermi 3 facility.

Current national policy, as found in the Nuclear Waste Policy Act (42 USC 10101 *et seq.*), mandates that high-level and transuranic wastes be buried at a deep geologic repository, such as the proposed repository at Yucca Mountain, Nevada. No release to the environment is expected to be associated with deep geologic disposal because it has been assumed that all of the gaseous and volatile radionuclides contained in the spent fuel are released to the atmosphere before the disposal of the waste. In NUREG-0116 (NRC 1976), which provides background and context for the Table S-3 values established by the Commission, the NRC staff indicates that these high-level and transuranic wastes will be buried and will not be released to the environment.

As part of the Table S-3 rulemaking, the NRC staff evaluated, along with more conservative assumptions, this zero-release assumption associated with waste burial in a repository, and the NRC reached an overall generic determination that fuel cycle impacts would not be significant. In 1983, the Supreme Court affirmed the NRC's position that the zero-release assumption was reasonable in the context of the Table S-3 rulemaking to address generically the impacts of the uranium fuel cycle in individual reactor licensing proceedings (Baltimore Gas & Electric v. National Resources Defense Council, 462 U.S. 87(1983)).

Further, in the Commission's Waste Confidence Decision and rule (10 CFR 51.23(a)) (75 FR 81032), the Commission has made the generic determination that "if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor in a combination of storage in its spent fuel storage basin and at either onsite or offsite independent spent fuel storage installations. Further, the Commission believes there is reasonable assurance that sufficient mined geologic repository capacity will be available to dispose of the commercial high-level radioactive waste and spent fuel generated in any reactor when necessary." In addition, 10 CFR 51.23(b) applies the generic determination in Section 51.23(a) to provide that "no discussion of any environmental impact of spent fuel storage in reactor facility storage pools or independent spent fuel storage installations (ISFSI) for the period following the term of the [. . .] reactor combined license or amendment [. . .] is required in any [. . .] environmental impact statement [. . .] prepared in connection with [. . .] the issuance or amendment of a combined license for a nuclear power reactors under parts 52 or 54 of this chapter."

In early 2010, the Secretary of Energy announced the formation of the Blue Ribbon Commission on America's Nuclear Future (BRC). The BRC's charter was to provide recommendations for developing a safe, long-term solution to managing the Nation's used nuclear fuel and nuclear waste. The BRC began releasing draft subcommittee reports in May 2011, and issued a draft report dated July 29, 2011, to the Secretary of Energy. The draft reports acknowledge that the methods of currently storing spent fuel at nuclear power plants are safe, but to ensure safety in the long term, the BRC recommends development of centralized interim spent fuel storage facilities and geologic repositories for ultimate disposal of spent fuel and high-level radioactive waste. The NRC is aware of the BRC's work, has reviewed the BRC draft reports issued to date, and has concluded that these reports do not conflict with the conclusions in this EIS regarding the environmental impact of high-level radioactive waste disposal based on the assessment in Table S-3.

In the context of operating license renewal, Sections 6.2 and 6.4 of NUREG-1437 (NRC 1996) provide additional description of the generation, storage, and ultimate disposal of LLW, mixed waste, and HLW, including spent fuel from power reactors, concluding that environmental impacts from these activities are small. For the reasons stated above, the NRC staff concludes that the environmental impacts of radioactive waste storage and disposal associated with Fermi 3 would be SMALL.

6.1.7 Occupational Dose

The annual occupational dose attributable to all phases of the fuel cycle for the 1000-MW(e) LWR-scaled model is about 1200 person-rem. This is based on a 600 person-rem occupational dose estimate attributable to all phases of the fuel cycle for the model 1000-MW(e) LWR (NRC 1996). The NRC staff concludes that the environmental impact from this occupational dose is SMALL because the dose to any individual worker is maintained within the limits of 10 CFR Part 20, which is 5 rem/yr.

6.1.8 Transportation

The transportation dose to workers and the public related to the uranium fuel cycle is about 2.5 person-rem annually for the reference 1000-MW(e) LWR per Table S-3 (Table 6-1). This corresponds to a dose of 5.0 person-rem for the 1000-MW(e) LWR-scaled model. For purposes of comparison, the population within 50 mi of the Fermi 3 site is estimated to be 7,713,709 people (Detroit Edison 2011). Using 0.311 rem/yr as the average dose to a U.S. resident from natural background radiation (NCRP 2009), the collective dose to that population is estimated to be 2.4×10^6 person-rem/yr. On the basis of this comparison, the NRC staff concludes that environmental impacts of transportation would be SMALL.

6.1.9 Conclusions

The NRC staff evaluated the environmental impacts of the uranium fuel cycle, as given in Table S-3 (Table 6-1), considered the effects of radon-222 and technetium-99, and appropriately scaled the impacts for the 1000-MW(e) LWR-scaled model. The NRC staff also evaluated the environmental impacts of GHG emissions from the uranium fuel cycle and appropriately scaled the impacts for the 1000-MW(e) LWR-scaled model. Based on this evaluation, the NRC staff concludes that the impacts would be SMALL.

6.2 Transportation Impacts

This section addresses both the radiological and nonradiological environmental impacts during normal operating and accident conditions resulting from (1) shipment of unirradiated fuel to the Fermi 3 site and alternative sites, (2) shipment of irradiated (spent) fuel to a monitored retrievable storage facility or a permanent repository, and (3) shipment of low-level radioactive waste and mixed waste to offsite disposal facilities. Alternative sites evaluated in this EIS include the existing Fermi site (proposed site), Petersburg, South Britton, Greenwood Energy Center, and Belle River (see Section 9.3). There is no meaningful differentiation among the proposed and the alternative sites regarding the radiological and nonradiological environmental impacts from normal operations and accident conditions, and thus such impacts are not discussed further in Chapter 9.

The NRC performed a generic analysis of the environmental effects of transportation of fuel and waste to and from LWRs in the *Environmental Survey of the Transportation of Radioactive Materials to and from Nuclear Power Plants*, WASH-1238 (AEC 1972) and in a supplement to WASH-1238, NUREG-75/038 (NRC 1975), and found the impact to be SMALL. These documents provided the basis for Table S-4 in 10 CFR 51.52 that summarizes the environmental impacts of transportation of fuel and waste to and from one LWR of 3000 to 5000 MW(t) (1000 to 1500 MW(e)). Impacts are provided for normal conditions of transport and accidents in transport for a reference 1100-MW(e) LWR. The transportation impacts associated with the Fermi 3 site were normalized for a reference 1100-MW(e) LWR at an 80 percent capacity factor for comparisons to Table S-4.[a] Dose to transportation workers during normal transportation operations was estimated to result in a collective dose of 4 person-rem per reference reactor-year. The combined dose to the public along the route and dose to onlookers were estimated to result in a collective dose of 3 person-rem per reference reactor-year.

Environmental risks of radiological effects during accident conditions, as stated in Table S-4, are small. Nonradiological impacts from postulated accidents were estimated as 1 fatal injury in 100 reactor-years and 1 nonfatal injury in 10 reference reactor-years. Subsequent reviews of transportation impacts in NUREG-0170 (NRC 1977a) and NUREG/CR-6672 (Sprung et al. 2000) concluded that impacts were bounded by Table S-4 in 10 CFR 51.52.

In accordance with 10 CFR 51.52(a), a full description and detailed analysis of transportation impacts are not required when licensing an LWR (i.e., impacts are assumed bounded by Table S-4) if the reactor meets the following criteria:

- The reactor has a core thermal power level not exceeding 3800 MW(t).
- Fuel is in the form of sintered U_3O_8 pellets having a uranium-235 enrichment not exceeding 4 percent by weight; and pellets are encapsulated in zircalloy-clad fuel rods.
- Average level of irradiation of the fuel from the reactor does not exceed 33,000 MWd/MTU, and no irradiated fuel assembly is shipped until at least 90 days after it is discharged from the reactor.
- With the exception of irradiated fuel, all radioactive waste shipped from the reactor is packaged and in solid form.

(a) Note that the basis for Table S-4 is an 1100-MW(e) LWR at an 80 percent capacity factor (AEC 1972; NRC 1975). The basis for Table S-3 in 10 CFR 51.51(b), which was discussed in Section 6.1 of this EIS, is a 1000-MW(e) LWR with an 80 percent capacity factor (NRC 1976). However, because fuel cycle and transportation impacts are evaluated separately, this difference does not affect the results and conclusions in this EIS.

- Unirradiated fuel is shipped to the reactor by truck; irradiated (spent) fuel is shipped from the reactor by truck, rail, or barge; and radioactive waste other than irradiated fuel is shipped from the reactor by truck or rail.

The environmental impacts of the transportation of fuel and radioactive wastes to and from nuclear power facilities were resolved generically in 10 CFR 51.52, provided that the specific conditions in the rule (see above) are met; if not, then a full description and detailed analysis is required for initial licensing. The NRC may consider requests for licensed plants to operate at conditions above those in the facility's licensing basis; for example, higher burnups (above 33,000 MWd/MTU), enrichments (above 4 percent uranium-235), or thermal power levels (above 3800 MW(t)). Departures from the conditions itemized in 10 CFR 51.52(a) must be supported by a full description and detailed analysis of the environmental effects, as specified in 10 CFR 51.52(b). Departures found to be acceptable for licensed facilities cannot serve as the basis for initial licensing for new reactors.

In its application, Detroit Edison requested a COL for an additional reactor at its Fermi site in Monroe County, Michigan. The proposed new reactor would be a GE-Hitachi ESBWR. The ESBWR has a thermal power rating of 4500 MW(t), with a gross electrical rating of 1605 MW(e). This thermal power rating exceeds the 3800-MW(t) limit considered in 10 CFR 51.52. The net electrical output is expected to be approximately 1535 MW(e) as the Fermi 3 power consumption is expected to be 70 MW(e) (Detroit Edison 2011). Fuel for the plants would be enriched up to about 4.6 weight percent uranium-235, which exceeds the 10 CFR 51.52(a) condition. In addition, the expected irradiation level of about 46,000 MWd/MTU exceeds the 10 CFR 51.52(a) condition. Therefore, a full description and detailed analysis of transportation impacts is required.

In its ER (Detroit Edison 2011), Detroit Edison provided a full description and detailed analyses of transportation impacts. In these analyses, radiological impacts of transporting fuel and waste to and from the Fermi site and alternative sites were calculated by Detroit Edison using the RADTRAN 5.6 computer code (Weiner et al. 2008). For this EIS, the NRC staff estimated the radiological impacts of transporting fuel and waste to and from the Fermi site and alternative sites using the RADTRAN 5.6 computer code. RADTRAN 5.6 is the most commonly used transportation impact analysis computer code in the nuclear industry, and the NRC staff concludes that the code is an acceptable analysis method.

Based on comments on previous nuclear power plant EISs, an explicit analysis of the nonradiological impacts of transporting workers and construction materials to/from the Fermi site and alternative sites is now included. Nonradiological impacts of transporting construction workers and materials and operations workers are addressed in Sections 4.8.3 and 5.8.6, respectively. Publicly available information about traffic accidents, injury, and fatality rates was used to estimate nonradiological impacts. In addition, the radiological impacts on maximally exposed individuals (MEIs) are evaluated.

6.2.1 Transportation of Unirradiated Fuel

The NRC staff performed an independent analysis of the environmental impacts of transporting unirradiated (i.e., fresh) fuel to the Fermi site and alternative sites. Radiological impacts of normal operating conditions and transportation accidents as well as nonradiological impacts are discussed in this section. Radiological impacts on populations and MEIs are presented. Because the specific fuel fabrication plant for Fermi 3 unirradiated fuel is not known at this time, the staff's analysis assumes a "representative" route between the fuel fabrication facility and the Fermi site or alternative sites. This means that one analysis was done using a "representative" route with one set of route characteristics (distances and population distributions), and that analysis was used to conclude that the impact from radiation dose would be small for the Fermi site and each of the alternative sites. Once the location of the fuel fabrication site is known, there would likely be small differences in the route and dose estimates for the Fermi site and the alternative sites. However, the radiation doses from transporting unirradiated fuel to the Fermi site and alternative sites would still be small.

6.2.1.1 Normal Conditions

Normal conditions, sometimes referred to as "incident-free" transportation, are transportation activities in which shipments reach their destination without releasing any radioactive material to the environment. Impacts from these shipments would be from the low levels of radiation that penetrate the unirradiated fuel shipping containers. Radiation exposures at some level would occur to the following individuals: (1) persons residing along the transportation corridors between the fuel fabrication facility and the Fermi site; (2) persons in vehicles traveling on the same route as an unirradiated fuel shipment; (3) persons at vehicle stops for refueling, rest, and vehicle inspections; and (4) transportation crew workers.

Truck Shipments

Table 6-3 provides the NRC staff's estimate of the number of truck shipments of unirradiated fuel for the ESBWR compared to those of the reference 1100-MW(e) reactor specified in WASH-1238 (AEC 1972) operating at 80 percent capacity (880 MW(e)). After normalization, the number of truck shipments of unirradiated fuel to the proposed Fermi site is slightly smaller (about 15 percent) than the number of truck shipments of unirradiated fuel estimated for the reference LWR in WASH-1238.

Table 6-3. Numbers of Truck Shipments of Unirradiated Fuel for the Reference LWR and the ESBWR

Reactor Type	Number of Shipments per Reactor Unit			Unit Electric Generation, MW(e)[(c)]	Capacity Factor[(c)]	Normalized, Shipments per 1100 MW(e)[(d)]
	Initial Core[(a)]	Annual Reload[(a)]	Total[(a, b)]			
Reference LWR (WASH-1238)	18	6	252	1100	0.8	252
Fermi 3 ESBWR	38	8.5	361	1605	0.93	213

(a) Shipments of the initial core and for every 2-year refueling period have been rounded up to the next highest whole number.
(b) Total shipments of unirradiated fuel over a 40-year plant lifetime (i.e., initial core load plus 38 years of average annual reload quantities). Refueling occurs every 24 months. No unirradiated fuel shipments anticipated during the last 2 years of operation.
(c) Unit capacities and capacity factors were taken from WASH-1238 for the reference LWR and the ER (Detroit Edison 2011) for the ESBWR.
(d) Normalized to net electric output for WASH-1238 reference LWR (i.e., 1100-MW(e) plant at 80 percent or net electrical output of 880 MW(e)).

Shipping Mode and Weight Limits

In 10 CFR 51.52(a)(5), a condition is identified that states all unirradiated fuel is shipped to the reactor by truck. Detroit Edison specifies that unirradiated fuel would be shipped to the proposed reactor site by truck (Detroit Edison 2011). Section 10 CFR 51.52 includes a condition that the truck shipments not exceed 73,000 lb as governed by Federal or State gross vehicle weight restrictions. Detroit Edison states in its ER that the unirradiated fuel shipments to the proposed Fermi site would comply with applicable weight restrictions (Detroit Edison 2011).

Radiological Doses to Transport Workers and the Public

Table S-4 includes conditions related to radiological dose to transport workers and members of the public along transport routes. These doses are a function of many variables, including the radiation dose rate emitted from the unirradiated fuel shipments, the number of exposed individuals and their locations relative to the shipment, the time in transit (including travel and stop times), and number of shipments to which the individuals are exposed. For this EIS, the NRC staff independently calculated the radiological dose impacts to transport workers and the public from the transportation of unirradiated fuel using the RADTRAN 5.6 computer code (Weiner et al. 2008).

One of the key assumptions in WASH-1238 (AEC 1972) for the reference LWR unirradiated fuel shipments is that the radiation dose rate at 3.3 ft from the transport vehicle is about 0.1 mrem/hr, which is one percent of the regulatory limit. This assumption was also used in the NRC staff's analysis of the ESBWR unirradiated fuel shipments. This assumption is reasonable because the ESBWR fuel materials would be low-dose-rate uranium radionuclides and would be

Table 6-4. RADTRAN 5.6 Input Parameters for Unirradiated Fuel Shipments

Parameter	RADTRAN 5.6 Input Value	Source
Shipping distance (km)	3600	AEC (1972).[(a)]
Travel fraction – rural	0.90	NRC (1977a).
Travel fraction – suburban	0.05	
Travel fraction – urban	0.05	
Population density – rural (persons/km^2)	10	DOE (2002a).
Population density – suburban (persons/km^2)	349	
Population density – urban (persons/km^2)	2260	
Vehicle speed (km/hr)	88.49	Conservative in transit speed of 55 mph assumed; predominantly interstate highways used.
Traffic count – rural (vehicles/hr)	530	DOE (2002a).
Traffic count – suburban (vehicles/hr)	760	
Traffic count – urban (vehicles/hr)	2400	
Dose rate at 1 m from vehicle (mrem/hr)	0.1	AEC (1972).
Shipment length (m)	7.3	Approximate length of two LWR fuel assemblies placed end to end.
Number of truck crew	2	AEC (1972), NRC (1977a), and DOE (2002a).
Stop time (hr/trip)	4.5	Based on one 30-minute stop per 4 hr of driving time (Johnson and Michelhaugh 2003).
Population density at stops (persons/km^2)	See Table 6-8 for truck stop parameters.	

(a) AEC (1972) provides a range of shipping distances between 25 and 3000 mi for unirradiated fuel shipments. A 2240-mi “representative” shipping distance was assumed in this EIS. While Detroit Edison intends to obtain its fresh fuel from the GE-Hitachi fuel fabrication facility in Wilmington, NC (Detroit Edison 2011), a distance of approximately 771 mi, the analysis in this EIS bounds the potential shipping distance from other fuel fabrication facilities in the United States.

packaged similarly to that described in WASH-1238 (i.e., inside a metal container that provides little radiation shielding). The numbers of shipments per year were obtained by dividing the normalized shipments in Table 6-3 by 40 years of reactor operation. Other key input parameters used in the radiation dose analysis for unirradiated fuel are shown in Table 6-4.

The RADTRAN 5.6 results for this “generic” unirradiated fuel shipment are as follows:

- worker dose: 1.92×10^{-3} person-rem/shipment

- general public dose (onlookers/persons at stops and sharing the highway): 3.29×10^{-3} person-rem/shipment
- general public dose (along route/persons living near a highway or truck stop): 3.36×10^{-5} person-rem/shipment.

These values were combined with the number of average annual shipments of unirradiated fuel for the ESBWR to calculate annual doses to the public and workers. Table 6-5 presents the annual radiological impacts calculated by the NRC staff to workers, public onlookers (persons at stops and sharing the road), and members of the public along the route (i.e., residents within 0.5 mi of the highway) for transporting unirradiated fuel to the Fermi site and alternative sites. The cumulative annual dose estimates in Table 6-5 were normalized to 1100 MW(e) (880 MW(e) net electrical output). The NRC staff performed an independent review and determined that all dose estimates are bounded by the Table S-4 conditions of 4 person-rem/yr to transportation workers, 3 person-rem/yr to onlookers, and 3 person-rem/yr to members of the public along the route.

Table 6-5. Radiological Impacts under Normal Conditions of Transporting Unirradiated Fuel to the Fermi Site and Alternative Sites

Plant Type	Normalized Average Annual Shipments	Cumulative Annual Dose; person-rem/yr per 1100 MW(e)[(a)] (880 MW(e) net)		
		Workers	Public – Onlookers	Public – Along Route
Reference LWR (WASH-1238)	6.3	1.2×10^{-2}	2.1×10^{-2}	2.1×10^{-4}
Fermi 3 ESBWR	5.3	1.0×10^{-2}	1.8×10^{-2}	1.8×10^{-4}
10 CFR 51.52, Table S-4 condition	<1 per day	4	3	3

(a) Multiply person-rem/yr times 0.01 to obtain doses in person-Sv/yr.

Radiation protection experts assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report by the National Research Council (2006), the BEIR VII report, uses the linear, no-threshold dose response model as a basis for estimating the risks from low doses. This approach is accepted by the NRC as a conservative method for estimating health risks from radiation exposure, recognizing that the model may overestimate those risks. Based on this method, the NRC staff estimated the risk to the public from radiation exposure using the nominal probability coefficient for total detriment. This coefficient has the value of 570 fatal cancers, nonfatal cancers, and severe hereditary effects per 1,000,000 person-rem (10,000 person-Sv), equal to 0.00057 effects per person-rem. The coefficient is taken from ICRP Publication 103 (ICRP 2007).

Both the NCRP and ICRP suggest that when the collective effective dose is smaller than the reciprocal of the relevant risk detriment (i.e., less than 1/0.00057, which is less than 1754 person-rem), the risk assessment should note that the most likely number of excess health effects is zero (NCRP 1995; ICRP 2007). The largest annual collective dose estimate for transporting unirradiated fuel to the Fermi site and alternative sites was 1.8×10^{-2} person-rem, which is less than the 1754 person-rem value that the ICRP and NCRP suggest would most likely result in zero excess health effects.

To place these impacts in perspective, the average U.S. resident receives about 311 mrem/yr effective dose equivalent from natural background radiation (i.e., exposures from cosmic radiation, naturally occurring radioactive materials such as radon, and global fallout from testing of nuclear explosive devices) (NCRP 2009). Using this average effective dose, the collective population dose from natural background radiation to the population along this representative route would be about 2.5×10^{5} person-rem. Therefore, the radiation doses from transporting unirradiated fuel to the proposed Fermi site and alternative sites are minimal compared to the collective population dose to the same population from exposure to natural sources of radiation.

Maximally Exposed Individuals under Normal Transport Conditions

The NRC staff conducted a scenario-based analysis to develop estimates of incident-free radiation doses to MEIs for fuel and waste shipments to and from the Fermi site. An MEI is a person who may receive the highest radiation dose from a shipment to and/or from the Fermi site. The following discussion also applies to shipments of unirradiated fuel, spent fuel, and radioactive waste to and from any of the alternative sites. The analysis is based on data in DOE (2002b) and incorporates data about exposure times, dose rates, and the number of times an individual may be exposed to an offsite shipment. Adjustments were made where necessary to reflect the normalized fuel and waste shipments addressed in this EIS. In all cases, the NRC staff assumed that the dose rate emitted from the shipping containers is 10 mrem/hr at 6.6 ft from the side of the transport vehicle. This assumption is conservative, in that the assumed dose rate is the maximum dose rate allowed by U.S. Department of Transportation (DOT) regulations (49 CFR 173.441). Most unirradiated fuel and radioactive waste shipments would have much lower dose rates than the regulations allow (AEC 1972; DOE 2002a). The analysis is described below.

<u>Truck Crew Member</u>

Truck crew members would receive the highest radiation doses during incident-free transport because of their proximity to the loaded shipping container for an extended period. The NRC staff's analysis assumed that crew member doses are limited to 2 rem/yr, which is the DOE administrative control level presented in DOE-STD-1098-2008, *DOE Standard, Radiological Control*, Chapter 2, Article 211 (DOE 2009). This limit is anticipated to apply to spent nuclear fuel shipments to a disposal facility, because DOE would take title to the spent fuel at the reactor site. There will be more shipments of spent nuclear fuel from the Fermi site and alternative sites than there will be shipments of unirradiated fuel and radioactive waste other than spent fuel from these sites. This is because the capacities of spent fuel shipping casks are limited due to their substantial radiation shielding and accident-resistance requirements. Spent fuel shipments also have significantly higher radiation dose rates than unirradiated fuel and radioactive waste (DOE 2002b). As a result, crew doses from unirradiated fuel and radioactive waste shipments would be lower than the doses from spent nuclear fuel shipments. The DOE administrative limit of 2 rem/yr (DOE 2009) is less than the NRC limit for occupational exposures of 5 rem/yr (10 CFR Part 20).

The DOT does not regulate annual occupational exposures. It does recognize that air crews are exposed to elevated cosmic radiation levels and recommends dose limits to air crew members from cosmic radiation (DOT 2003). Air passengers are less of a concern because they do not fly as frequently as air crew members. The recommended limits are a 5-year effective dose of 2 rem/yr, with no more than 5 rem in a single year (DOT 2003). As a result, a 2-rem/yr MEI dose to truck crews is a reasonable estimate to apply to shipments of fuel and waste from the Fermi site and alternative sites.

Inspectors

Radioactive shipments are inspected by Federal or State vehicle inspectors, for example, at State ports of entry. The Yucca Mountain Final EIS (DOE 2002b) assumed that inspectors would be exposed for 1 hr at a distance of 3.3 ft from the shipping containers. The dose rate at 3.3 ft is conservatively assumed to be at the regulatory limit, and equivalent to about 14 mrem/hr; therefore, the dose per shipment is about 14 mrem. This is independent of the location of the reactor site. Based on this conservative value and the assumption that the same person inspects all shipments of fuel and waste to and from the proposed Fermi site and alternative sites, the annual doses to vehicle inspectors were calculated to be about 2.2 rem/yr, based on a combined total of 160 shipments of unirradiated fuel, spent fuel, and radioactive waste per year. This value is greater than the DOE administrative control level (DOE 2009) on individual doses and is less than the 5-rem/yr NRC occupational dose limit.

Resident

The analysis assumed that a resident lives adjacent to a highway where a shipment would pass and would be exposed to all shipments along a particular route. Exposures to residents on a per-shipment basis were obtained from the NRC staff's RADTRAN 5.6 output files. These dose estimates are based on an individual located 100 ft from the shipments that are traveling 15 mph. The potential radiation dose to the maximally exposed resident is about 0.095 mrem/yr for shipments of fuel and waste to and from the proposed Fermi site and alternative sites.

Individual Stuck in Traffic

This scenario addresses potential traffic interruptions that could lead to a person being exposed to a loaded shipment for 1 hr at a distance of 4 ft. The NRC staff's analysis assumed this exposure scenario would occur only one time to any individual, and the dose rate was at the regulatory limit of 10 mrem/hr at 6.6 ft from the shipment. The dose to the MEI was calculated to be 16 mrem in DOE's Yucca Mountain Final EIS (DOE 2002b).

Person at a Truck Service Station

This scenario estimates doses to an employee at a service station where all truck shipments to and from the proposed Fermi site and alternative sites are assumed to stop. The NRC staff's analysis assumed this person would be exposed for 49 minutes at a distance of 52 ft from the loaded shipping container (DOE 2002b). The exposure time and distance were based on the observations discussed by Griego et al. (1996). This results in a dose of about 0.34 mrem/shipment and an annual dose of about 54 mrem/yr for the Fermi site and alternative sites, assuming that a single individual services all unirradiated fuel, spent fuel, and radioactive waste shipments to and from the Fermi site and alternative sites.

6.2.1.2 Radiological Impacts of Transportation Accidents

Accident risks are a combination of accident frequency and consequence. Accident frequencies for transportation of unirradiated fuel to the proposed Fermi site and alternative sites are expected to be lower than those used in the analysis in WASH-1238 (AEC 1972), which forms the basis for Table S-4 of 10 CFR 51.52, because of improvements in highway safety and security, and an overall reduction in traffic accident, injury, and fatality rates since WASH-1238 was published. There is no significant difference between the ESBWR and current-generation LWRs in the consequences of transportation accidents severe enough to result in a release of unirradiated fuel particles to the environment because fuel form, cladding, and packaging are similar to those analyzed in WASH-1238. Consequently, consistent with the conclusions of WASH-1238 (AEC 1972), the impacts of accidents during transport of unirradiated fuel for the ESBWR on the Fermi site and alternative sites are expected to be smaller than those listed in Table S–4 for current-generation LWRs.

6.2.1.3 Nonradiological Impacts of Transportation Accidents

Nonradiological impacts are the human health impacts projected to result from traffic accidents involving shipments of unirradiated fuel to the Fermi site and alternative sites; the analysis does not consider radiological or hazardous characteristics of the cargo. Nonradiological impacts include the projected number of traffic accidents, injuries, and fatalities that could result from shipments of unirradiated fuel to the site and return shipments of empty containers from the site.

Nonradiological impacts are calculated using accident, injury, and fatality rates from published sources. The rates (i.e., impacts per vehicle-km traveled) are then multiplied by estimated travel distances for workers and materials. The general formula for calculating nonradiological impacts is:

Impacts = (unit rate) × (roundtrip shipping distance) × (annual number of shipments)

In this formula, impacts are presented in units of the number of accidents, number of injuries, and number of fatalities per year. Corresponding unit rates (i.e., impacts per vehicle-km traveled) are used in the calculations.

Accident, injury, and fatality rates were taken from Table 4 in ANL/ESD/TM-150, *State-Level Accident Rates for Surface Freight Transportation: A Reexamination* (Saricks and Tompkins 1999). Nationwide median rates were used for shipments of unirradiated fuel to the site. The data are representative of traffic accident, injury, and fatality rates for heavy truck shipments similar to shipments of unirradiated fuel to the Fermi site and alternative sites. In addition, the DOT Federal Motor Carrier Safety Administration evaluated the data underlying the Saricks and Tompkins (1999) rates, which were taken from the Motor Carrier Management Information System, and determined that the rates were underreported. Therefore, the accident, injury, and fatality rates in Saricks and Tompkins (1999) were adjusted using factors derived from data provided by the University of Michigan Transportation Research Institute (UMTRI) (UMTRI 2003). The UMTRI data indicate that accident rates for 1994 to 1996, the same data used by Saricks and Tompkins (1999), were underreported by about 39 percent. Injury and fatality rates were underreported by 16 and 36 percent, respectively. As a result, the accident, injury, and fatality rates were increased by factors of 1.64, 1.20, and 1.57, respectively, to account for the underreporting.

The nonradiological accident impacts calculated by the NRC staff for transporting unirradiated fuel to (and empty shipping containers from) the Fermi site and alternative sites are shown in Table 6-6. The nonradiological impacts associated with the WASH-1238 reference LWR are also shown for comparison. Note that there are only small differences between the impacts calculated for an ESBWR at the Fermi site and alternative sites and the reference LWR in WASH-1238, due entirely to the estimated annual number of shipments.

6.2.2 Transportation of Spent Fuel

The NRC staff performed an independent analysis of the environmental impacts of transporting spent fuel from the proposed Fermi site and alternative sites to a spent fuel disposal repository. For the purposes of these analyses, the staff considered the proposed geologic HLW repository at the Yucca Mountain site in Nevada as a surrogate destination. Currently, the NRC has not made a decision on the DOE application for the geologic HLW repository at Yucca Mountain. However, the NRC staff considers an estimate of the impacts of the transportation of spent fuel

Table 6-6. Nonradiological Impacts of Transporting Unirradiated Fuel to the Proposed Fermi Site and Alternative Sites, Normalized to Reference LWR

Plant Type	Annual Shipments Normalized to Reference LWR	One-Way Shipping Distance, km	Roundtrip Distance, km per Year	Annual Impacts: Accidents per Year	Annual Impacts: Injuries per Year	Annual Impacts: Fatalities per Year
Reference LWR (WASH-1238)	6.3	3600	4.5×10^4	2.1×10^{-2}	1.1×10^{-2}	6.5×10^{-4}
Fermi and alternative sites ESBWR	5.3	3600	3.8×10^4	1.8×10^{-2}	8.9×10^{-3}	5.5×10^{-4}

to a possible repository in Nevada to be a reasonable bounding estimate of the transportation impacts on a storage or disposal facility because of the distances involved and the representativeness of the distribution of members of the public in urban, suburban, and rural areas (i.e., population distributions) along the shipping routes. Radiological and nonradiological environmental impacts of normal operating conditions and transportation accidents, as well as nonradiological impacts, are discussed in this section. Note, on March 3, 2010, DOE (2010) submitted a motion to the Atomic Safety and Licensing Board to withdraw with prejudice its application for a permanent geologic repository at Yucca Mountain, Nevada. Regardless of the outcome of this motion, the NRC staff concludes that transportation impacts are roughly proportional to the distance from the reactor site to the repository site, in this case Michigan to Nevada.

This NRC staff analysis is based on shipment of spent fuel by legal-weight trucks in shipping casks with characteristics similar to casks currently available (i.e., massive, heavily shielded, cylindrical metal pressure vessels). Because of the large size and weight of spent fuel shipping casks, each shipment is assumed to consist of a single shipping cask loaded on a modified trailer. These assumptions are consistent with those made in the evaluation of the environmental impacts of transportation of spent fuel in Addendum 1 to NUREG-1437 (NRC 1999). Because the alternative transportation methods involve rail transportation or heavy-haul trucks, which would reduce the overall number of spent fuel shipments (NRC 1999), thereby reducing impacts, these assumptions are conservative. In addition, the use of current shipping cask designs for this analysis results in conservative impact estimates because the current designs are based on transporting short-cooled spent fuel (approximately 120 days out of reactor). Future shipping casks would be designed to transport longer-cooled fuel (more than 5 years out of reactor) and would require much less shielding to meet external dose limitations. Therefore, future shipping casks are expected to have higher cargo capacities, thus reducing the numbers of shipments and associated impacts.

The NRC staff calculated the radiological impacts of transportation of spent fuel using the RADTRAN 5.6 computer code (Weiner et al. 2008). Routing and population data used in RADTRAN 5.6 for truck shipments were obtained from the Transportation Routing Analysis Geographic Information System (TRAGIS) routing code (Johnson and Michelhaugh 2003). The population data in the TRAGIS code are based on the 2000 Census. Nonradiological impacts were calculated using published traffic accident, injury, and fatality data (Saricks and Tompkins 1999), in addition to route information from TRAGIS. Traffic accident rates input to RADTRAN 5.6 and nonradiological impact calculations were adjusted to account for underreporting, as discussed in Section 6.2.1.3.

6.2.2.1 Normal Conditions

Normal conditions, sometimes referred to as "incident-free" conditions, are transportation activities in which shipments reach their destination without an accident occurring en route. Impacts from these shipments would be from the low levels of radiation that penetrate the heavily shielded spent fuel-shipping cask. Radiation exposures would occur to the following populations: (1) persons residing along the transportation corridors between the Fermi site and alternative sites and the proposed repository location; (2) persons in vehicles traveling on the same route as a spent fuel shipment; (3) persons at vehicle stops for refueling, rest, and vehicle inspections; and (4) transportation crew workers (drivers). For the purposes of this analysis, the NRC staff assumed that the destination for the spent fuel shipments is the proposed geologic HLW repository at Yucca Mountain in Nevada. This assumption is conservative because it tends to maximize the shipping distance from the Fermi site and alternative sites.

Shipping casks have not been designed for the spent fuel from advanced reactor designs such as the ESBWR. Information in *Early Site Permit Environmental Report Sections and Supporting Documentation* (INEEL 2003) indicated that advanced LWR fuel designs would not be significantly different from existing LWR designs; therefore, current shipping cask designs were used for the analysis of ESBWR spent fuel shipments. The NRC staff assumed that the capacity of a truck shipment of ESBWR spent fuel was 0.5 MTU/shipment, the same capacity as that used in WASH-1238 (AEC 1972). In its ER (Detroit Edison 2011), Detroit Edison assumed a shipping cask capacity of 0.5 MTU/shipment.

Input to RADTRAN 5.6 includes the total shipping distance between the origin and destination sites and the population distributions along the routes. This information was obtained by running the TRAGIS computer code (Johnson and Michelhaugh 2003) for highway routes from the Fermi site and alternative sites to the proposed geologic HLW repository at Yucca Mountain. The resulting route characteristics information, generated by the NRC staff, is shown in Table 6-7. Note that for truck shipments, all the spent fuel is assumed to be shipped to the proposed geologic HLW repository at Yucca Mountain over designated highway-route controlled quantity routes. In addition, TRAGIS data were loaded into RADTRAN 5.6 on a State-by-State basis, which increases precision and allows results to be presented for each State along the

Table 6-7. Transportation Route Information for Shipments from the Fermi Site and Alternative Sites to the Proposed Geologic HLW Repository at Yucca Mountain, Nevada[(a)]

	One-way Shipping Distance, km				Population Density, Persons/km^2			Stop Time per Trip, hr
Alternative Site	**Total**	**Rural**	**Suburban**	**Urban**	**Rural**	**Suburban**	**Urban**	
Fermi 3 Site	3480	2843	558	79	10.2	311.6	2384	4.5
Petersburg	3457	2829	549	79	10.1	314.5	2368	4.5
South Britton	3510	2864	564	82	10.2	312.7	2382	4.5
Greenwood Energy Center	3564	2860	630	74	10.3	309.0	2362	4.5
Belle River	3585	2827	652	106	10.2	328.0	2393	4.5

Source: Johnson and Michelhaugh 2003

(a) This table presents aggregated route characteristics provided by TRAGIS (Johnson and Michelhaugh 2003), including estimated distances from the alternative sites to the nearest TRAGIS highway node. Input to the RADTRAN 5.6 computer code was disaggregated to a State-by-State level.

route between the Fermi site or alternative sites and the proposed geologic HLW repository at Yucca Mountain, if desired.

Radiation doses are a function of many parameters, including vehicle speed, traffic count, dose rate, packaging dimensions, number in the truck crew, stop time, and population density at stops. The values for these parameters and others used in the NRC staff's analysis and the sources of the information are provided in Table 6-8.

For this analysis, the transportation crew for spent fuel shipments delivered by truck is assumed to consist of two drivers. Escort vehicles and drivers were considered, but they were not included in the analysis because their distance from the shipping cask would reduce the dose rates to levels well below the dose rates experienced by the drivers and would be negligible. Stop times for refueling and rest were assumed to accrue at the rate of 30 minutes per four hours driving time. TRAGIS outputs were used to estimate the number of stops. Doses to the public at truck stops have been significant contributors to the doses calculated in previous RADTRAN 5.6 analyses. For this analysis, doses to the public at refueling and rest stops ("stop doses") are the sum of the doses to individuals located in two annular rings centered at the stopped vehicle, as illustrated in Figure 6-2. The inner ring represents persons who may be at the truck stop at the same time as a spent fuel shipment and extends 1 to 10 m from the edge of the vehicle. The outer ring represents persons who reside near a truck stop and extends from 10 to 800 m from the vehicle. This scheme is similar to that used in Sprung et al. (2000). Population densities and shielding factors were also taken from those of Sprung et al. (2000), which were based on the observations of Griego et al. (1996).

Table 6-8. RADTRAN 5.6 Normal (Incident-free) Exposure Parameters

Parameter	RADTRAN 5.6 Input Value	Source
Vehicle speed (km/hr)	88.49	Based on average speed in rural areas given in DOE (2002a). Conservative in-transit speed of 55 mph assumed; predominantly interstate highways used.
Traffic count – rural (vehicles/hr)	530	DOE (2002a).
Traffic count – suburban (vehicles/hr)	760	
Traffic count – urban (vehicles/hr)	2400	
Vehicle occupancy (persons/vehicle)	1.5	DOE (2002a).
Dose rate at 1 m from vehicle (mrem/hr)	14	DOE (2002a, b) – approximate dose rate at 1 m that is equivalent to maximum dose rate allowed by Federal regulations (i.e., 10 mrem/hr at 2 m from the side of a transport vehicle).
Packaging dimensions (m)	Length – 5.2 Diameter – 1.0	DOE (2002b).
Number of truck crew	2	AEC (1972), NRC (1977a), and DOE (2002a, b).
Stop time (hr/trip)	Route-specific	See Table 6-7.
Population density at stops (persons/km^2)	30,000	Sprung et al. (2000). Equivalent to nine persons within 10 m of vehicle. See Figure 6-1.
Min/max radii of annular area around vehicle at stops (m)	1 to 10	Sprung et al. (2000).
Shielding factor applied to annular area surrounding vehicle at stops (dimensionless)	1 (no shielding)	Sprung et al. (2000).
Population density surrounding truck stops, persons/km^2	340	Sprung et al. (2000).
Min/max radius of annular area surrounding truck stop (m)	10 to 800	Sprung et al. (2000).
Shielding factor applied to annular area surrounding truck stop (dimensionless)	0.2	Sprung et al. (2000).

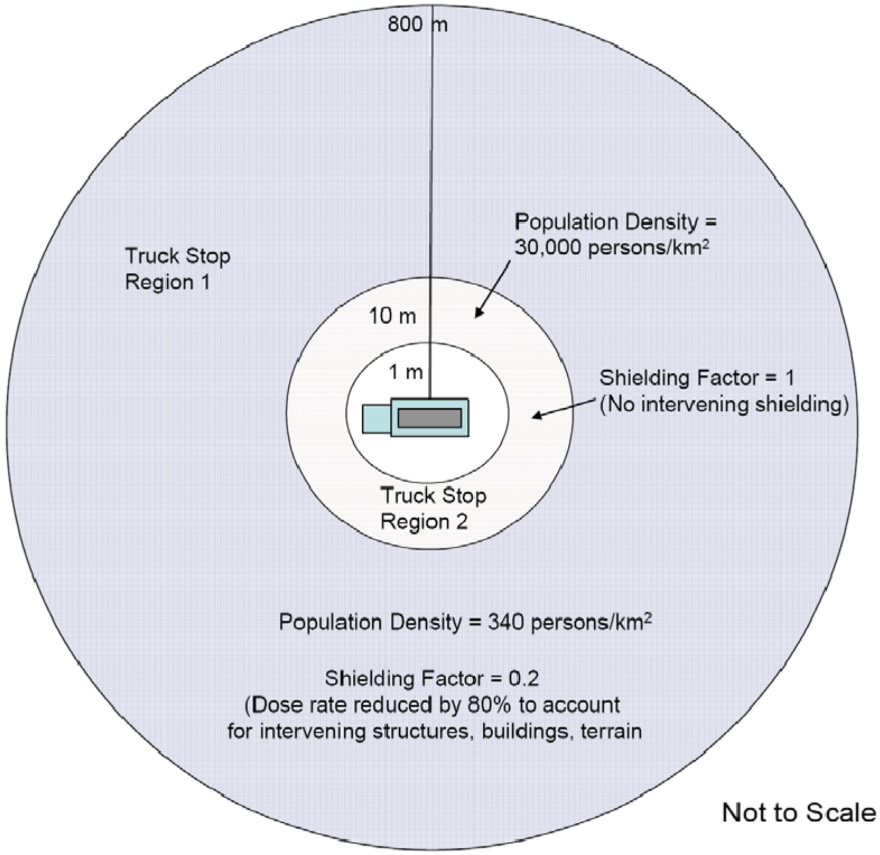

Figure 6-2. Illustration of Truck Stop Model

The results calculated by the NRC staff for these normal (incident-free) exposure calculations are shown in Table 6-9 for the proposed Fermi site and alternative sites. Population dose estimates are given for workers (i.e., truck crew members), onlookers (doses to persons at stops and persons on highways exposed to the spent fuel shipment), and persons along the route (persons living near the highway). Shipping schedules for spent fuel generated by Fermi 3 have not been determined. The NRC staff concluded it to be reasonable to calculate annual doses assuming the annual number of spent fuel shipments is equivalent to the annual refueling requirements. Each refuel cycle is anticipated to reload 68.2 MTU of fresh fuel (Detroit Edison 2011) every 2 yr. It was assumed that the same corresponding amount of spent fuel was to be removed from the reactor and sent to a spent fuel storage facility or repository. With a truck capacity of 0.5 MTU/shipment, a minimum of 137 shipments would be required for transport of spent fuel after each refuel cycle. This level of activity would lead to an annual average of 68.5 spent fuel shipments.

Table 6-9. Normal (Incident-Free) Radiation Doses to Transport Workers and the Public from Shipping Spent Fuel from the Fermi Site and Alternative Sites to the Proposed Geologic HLW Repository at Yucca Mountain

	Worker (Crew)	Along Route	Onlookers
Reference LWR (WASH-1238) (person-rem/yr)[(a)]	9.5	0.37	19
ESBWR at Fermi site (person-rem/yr)	6.4	0.25	13
Petersburg (person-rem/yr)	6.3	0.25	13
South Britton (person-rem/yr)	6.5	0.26	13
Greenwood Energy Center (person-rem/yr)	6.5	0.28	13
Belle River	6.6	0.30	13
Table S-4 condition (person-rem/yr)	4	3	3

(a) To convert person-rem to person-Sv, divide by 100.

Population doses were normalized to the reference LWR in WASH-1238 (880 net MW(e)). This corresponds to an 1100-MW(e) LWR operating at 80 percent capacity. The normalized number of annual spent fuel shipments is 40.3, compared to 60 for the reference LWR. This difference in annual shipment numbers is solely responsible for the differences in the radiation doses for the reference LWR and the ESBWR at the proposed Fermi site as reported in Table 6-9.

There are only small differences in transportation impacts among the Fermi site and the four alternative sites. In general, the proposed Fermi site has the same impacts as the alternative sites, primarily because all routes have approximately the same shipping distance to the proposed geologic HLW repository at Yucca Mountain. However, the differences among sites are minor and are less than the uncertainty in the analytical results.

The bounding cumulative doses to the exposed population given in Table S-4 are:

- 4 person-rem/reactor-year to transport workers
- 3 person-rem/reactor-year) to general public (onlookers) and members of the public along the route.

The calculated population doses to the crew and onlookers for the reference LWR and the Fermi and alternative site shipments exceed Table S-4 values. A key reason for the higher population doses relative to Table S-4 is the longer shipping distances assumed for this analysis (i.e., to a repository in Nevada) than the distances used in WASH-1238. WASH-1238 assumed that each spent fuel shipment would travel a distance of 1000 mi, whereas the shipping distances used in this assessment were about 2150 to 2230 mi. If the shorter distance was used to calculate the impacts for the Fermi spent fuel shipments, the doses could be reduced by more than 50 percent. Other important differences are the model related to vehicle stops described above and the additional precision that results from incorporating State-specific route characteristics.

Where necessary, the NRC staff made conservative assumptions to calculate impacts associated with the transportation of spent fuel. Some of the key conservative assumptions are as follows.

- ***Use of the regulatory maximum dose rate (10 mrem/hr at 2 m) in the RADTRAN 5.6 calculations***. The shipping casks assumed in the EIS prepared by DOE in support of the application for the proposed geologic HLW repository at Yucca Mountain (DOE 2002b) were designed to transport spent fuel that has cooled for a minimum of 5 yr (see 10 CFR 961, Subpart B). Most spent fuel would have cooled for much longer than 5 years before being shipped to a possible geologic repository. Shipments from the Fermi site and alternative sites are also expected to be cooled for longer than 5 years. Consequently, the estimated population doses in Table 6-9 could be further reduced if more realistic dose rate projections and shipping cask capacities are used.
- ***Use of 30 minutes as the average time at a truck stop in the calculations***. Many stops made for actual spent fuel shipments are of short duration (i.e., 10 minutes) for brief visual inspections of the cargo (e.g., checking the cask tie-downs). These stops typically occur in minimally populated areas, such as an overpass or freeway ramp in an unpopulated area. Furthermore, empirical data provided in Griego et al. (1996) indicate that a 30-minute duration is toward the high end of the stop-time distribution. Average stop times observed by Griego et al. (1996) are on the order of 18 minutes.

A sensitivity study was performed to demonstrate the effects of using more realistic dose rates and stop times for the incident-free population dose calculations. For this sensitivity study, the dose rate was reduced to 5 mrem/hr, the approximate 50-percent confidence interval of the dose rate distribution estimated by Sprung et al. (2000) for future spent fuel shipments. The stop time was reduced to 18 minutes per stop. All other RADTRAN 5.6 input values were unchanged. The result is that the annual crew doses were reduced to 3.7 person-rem/yr, or about 58 percent of the annual dose shown in Table 6-9. The annual onlooker doses were reduced to 3.1 person-rem/yr (24 percent), and the annual doses to persons along the route were reduced to 0.097 person-rem/yr (39 percent). The NRC staff concludes that using more realistic parameters for shipment capacities, stop times, and dose rates would reduce the annual doses in Table 6-9 to below the Table S-4 values.

In its ER (Detroit Edison 2011), Detroit Edison described the results of a RADTRAN 5.6 analysis of the impacts of incident-free transport of spent fuel to the proposed geologic HLW repository at Yucca Mountain. Although the overall approaches are the same (e.g., use of TRAGIS and RADTRAN 5.6), there are some differences in the modeling details. For example, the NRC staff's analysis used State-by-State route characteristics, whereas Detroit Edison elected to use aggregated route information). The NRC staff concludes that the results produced by Detroit Edison are similar to those calculated by the NRC staff in this EIS.

Using the linear no-threshold dose response relationship discussed in Section 6.2.1.1, the annual public dose impact for transporting spent fuel from the proposed Fermi site and alternative sites to the proposed geologic HLW repository at Yucca Mountain is about 20 person-rem, which is less than the 1754 person-rem value the ICRP (ICRP 2007) and NCRP (NCRP 1995) suggest would most likely result in zero excess health effects. This dose is very small compared to the estimated 1.6×10^5 person-rem that the same population along the route from the proposed Fermi site to Yucca Mountain would incur annually from exposure to natural sources of radiation. Note that the estimated population doses along the route from the Fermi site-to-Yucca-Mountain route from natural background radiation are different than the natural background dose calculated by the NRC staff for unirradiated fuel shipments in Section 6.2.1.1 of this EIS, because the route characteristics are different. A generic route was used in Section 6.2.1.1 for unirradiated fuel shipments, and an actual highway route was used in this section for spent fuel shipments.

Dose estimates to the MEI from transport of unirradiated fuel, spent fuel, and wastes under normal conditions are presented in Section 6.2.1.1.

6.2.2.2 Radiological Impacts of Accidents

As discussed previously, the NRC staff used the RADTRAN 5.6 computer code to estimate impacts of transportation accidents involving spent fuel shipments. RADTRAN 5.6 considers a spectrum of postulated transportation accidents, ranging from those with high frequencies and low consequences (e.g., “fender benders”) to those with low frequencies and high consequences (i.e., accidents in which the shipping container is exposed to severe mechanical and thermal conditions).

Radionuclide inventories are important parameters in the calculation of accident risks. The radionuclide inventories used in this analysis were from the applicant’s ER (Detroit Edison 2011). Spent fuel inventories used in the NRC staff analysis are presented in Table 6-10. The list of radionuclides set forth in the table includes all of the radionuclides that were included in the analysis conducted by Sprung et al. (2000). The NRC staff’s analysis also included the inventory of crud, or radioactive material deposited on the external surfaces of LWR spent fuel rods. Because crud is deposited from corrosion products generated elsewhere in the reactor cooling system and the complete reactor design and operating parameters are uncertain, the quantities and characteristics of crud deposited on ESBWR spent fuel are not available at this time. The Fermi 3 ESBWR spent fuel transportation accident impacts were calculated assuming the cobalt-60 inventory in the form of crud is 169 Ci/MTU, based on information in Sprung et al. (2000).

Robust shipping casks are used to transport spent fuel because of the radiation shielding and accident resistance required by 10 CFR Part 71. Spent fuel shipping casks must be certified Type B packaging systems, meaning they must withstand a series of severe postulated accident

Table 6-10. Radionuclide Inventories Used in Transportation Accident Risk Calculations for an ESBWR[(a)(b)]

Radionuclide	Ci/MTU	Bq/MTU	Physical-Chemical Group
Am-241	1.30×10^{3}	4.81×10^{13}	Particulate
Am-242m	2.79×10^{1}	1.03×10^{12}	Particulate
Am-243	3.26×10^{1}	1.21×10^{12}	Particulate
Ce-144	1.35×10^{4}	5.00×10^{14}	Particulate
Cm-242	4.86×10^{1}	1.80×10^{12}	Particulate
Cm-243	3.47×10^{1}	1.28×10^{12}	Particulate
Cm-244	4.96×10^{3}	1.84×10^{14}	Particulate
Cm-245	6.75×10^{-1}	2.50×10^{10}	Particulate
Co-60 (crud)[(c)]	3.38×10^{2}	1.25×10^{12}	Crud
Co-60 (activation)[(c)]	2.86×10^{3}	1.06×10^{14}	Particulate
Cs-134	5.19×10^{4}	1.92×10^{15}	Cesium
Cs-137	1.27×10^{5}	4.70×10^{15}	Cesium
Eu-154	1.04×10^{4}	3.85×10^{14}	Particulate
Eu-155	5.40×10^{3}	2.00×10^{14}	Particulate
I-129	4.24×10^{-2}	1.57×10^{9}	Cesium
Kr-85	9.27×10^{3}	3.43×10^{14}	Gas
Pm-147	3.53×10^{4}	1.31×10^{15}	Particulate
Pu-238	6.15×10^{3}	2.28×10^{14}	Particulate
Pu-239	3.86×10^{2}	1.43×10^{13}	Particulate
Pu-240	6.22×10^{2}	2.30×10^{13}	Particulate
Pu-241	1.22×10^{5}	4.51×10^{15}	Particulate
Pu-242	2.24×10^{0}	8.29×10^{10}	Particulate
Ru-106	1.86×10^{4}	6.88×10^{14}	Ruthenium
Sb-125	4.81×10^{3}	1.78×10^{14}	Particulate
Sr-90	9.08×10^{4}	3.36×10^{15}	Particulate
Y-90	9.09×10^{4}	3.36×10^{15}	Particulate

(a) Divide Becquerel (Bq) per Metric Ton Uranium (Bq/MTU) by 3.7×10^{10} to obtain curies per MTU (Ci/MTU).
(b) The source of the spent fuel inventories is Detroit Edison (2011), Table 3.8-12, except as noted in footnote (c).
(c) Co-60 exists both as an activation product in spent fuel and is the primary radioactive constituent in fuel assembly crud, or radioactive material deposited on the external surfaces of fuel assemblies. The Co-60 inventory in crud was calculated using information in NUREG/CR-6672 (Sprung et al. 2000).

conditions with essentially no loss of containment or shielding capability. These casks are also designed with fissile material controls to ensure the spent fuel remains subcritical under normal and accident conditions. According to Sprung et al. (2000), the probability of encountering accident conditions that would lead to shipping cask failure is less than 0.01 percent (i.e., more than 99.99 percent of all accidents would result in no release of radioactive material from the shipping cask). The NRC staff assumed that shipping casks approved for transportation of spent fuel from an ESBWR would provide equivalent mechanical and thermal protection of the spent fuel cargo.

Accident frequencies were calculated in RADTRAN 5.6 using user-specified accident rates and conditional shipping cask failure probabilities. State-specific accident rates were taken from Saricks and Tompkins (1999) and used in the RADTRAN 5.6 calculations. The State-specific accident rates were adjusted to account for underreporting, as described in Section 6.2.1.3. Conditional shipping cask failure probabilities (i.e., the probability of cask failure as a function of the mechanical and thermal conditions applied in an accident) were taken from Sprung et al. (2000).

The RADTRAN 5.6 accident risk calculations were performed using the radionuclide inventories given in Table 6-10. The resulting risk estimates were then multiplied by assumed annual spent fuel shipments to derive estimates of the annual accident risks associated with spent fuel shipments from the proposed Fermi site or alternative sites to the proposed geologic HLW repository at Yucca Mountain in Nevada. As was done for routine exposures, the NRC staff assumed that the numbers of shipments of spent fuel per year are equivalent to the annual discharge quantities.

For this assessment, release fractions for current-generation LWR fuel designs (Sprung et al. 2000) were used to approximate the impacts from the ESBWR spent fuel shipments. This assumes that the fuel materials and containment systems (i.e., cladding, fuel coatings) behave similarly to current LWR fuel under applied mechanical and thermal conditions.

The NRC staff used RADTRAN 5.6 to calculate the population dose from the released radioactive material from four of five possible exposure pathways.[(a)] These pathways are as follows:

- External dose from exposure to the passing cloud of radioactive material (cloudshine).
- External dose from the radionuclides deposited on the ground by the passing plume (groundshine). The NRC staff's analysis included the radiation exposure from this pathway,

(a) Internal dose from ingestion of contaminated food was not considered, because the staff assumed evacuation and subsequent interdiction of foodstuffs following a postulated transportation accident.

even though the area surrounding a potential accidental release would be evacuated and decontaminated, thus preventing long-term exposures from this pathway.

- Internal dose from inhalation of airborne radioactive contaminants (inhalation).
- Internal dose from resuspension of radioactive materials that were deposited on the ground (resuspension). The NRC staff's analysis included the radiation exposures from this pathway, even though evacuation and decontamination of the area surrounding a potential accidental release would prevent long-term exposures.

Table 6-11 presents the environmental consequences calculated by the NRC staff for transportation accidents when shipping spent fuel from the Fermi site and alternative sites to the proposed geologic HLW repository at Yucca Mountain. The shipping distances and population distribution information for the routes were the same as those used for the normal "incident-free" conditions (see Section 6.2.2.1). The results are normalized to the WASH-1238 reference reactor (880-MW(e) net electrical generation, 1100-MW(e) reactor operating at 80 percent capacity) to provide a common basis for comparison to the impacts listed in Table S-4. Note that the impacts for all site alternatives are less than the reference LWR impacts. Also, although there are slight differences in impacts among the alternative sites, none of the alternative sites would be clearly favored over the proposed Fermi site.

Table 6-11. Annual Spent Fuel Transportation Accident Impacts for an ESBWR at the Proposed Fermi Site and Alternative Sites, Normalized to Reference 1100-MW(e) LWR Net Electrical Generation

Location	Normalized Population Impacts, Person-rem/yr[(a)]
Reference LWR (WASH-1238)	4.6×10^{-6}
Fermi site	3.1×10^{-6}
Petersburg site	3.1×10^{-6}
South Britton site	3.2×10^{-6}
Greenwood site	3.2×10^{-6}
Belle River-St. Clair site	4.3×10^{-6}

(a) Multiply person-Sv/yr times 100 to obtain person-rem/yr.

Using the linear no-threshold dose response relationship discussed in Section 6.2.1.1, the annual collective public dose estimates for transporting spent fuel from the Fermi and alternative sites to the proposed geologic HLW repository at Yucca Mountain are on the order of 3×10^{-6} person-rem, which is less than the 1754 person-rem value that the ICRP (ICRP 2007) and NCRP (NCRP 1995) suggest would most likely result in zero excess health effects. This risk is very minute compared to the estimated 1.6×10^{5} person-rem that the same population along the route from the proposed Fermi site to the proposed geologic HLW repository at Yucca Mountain would incur annually from exposure to natural sources of radiation. Note that the estimated population dose to persons along the Fermi-to-Yucca-Mountain route is different than the population dose calculated by the NRC staff for unirradiated fuel shipments in Section 6.2.1.1, because the route characteristics are different.

The NRC staff performed a confirmatory evaluation of Detroit Edison's spent fuel transportation accident risk analysis. It was noted that Detroit Edison used a different, though valid, methodology for the ER calculations. The primary difference was that Detroit Edison assumed aggregated route parameters, whereas in this EIS, the NRC staff used State-by-State shipping distances and population densities. The staff concluded that Detroit Edison's analysis was reasonable and comprehensive and meets the intent of 10 CFR 51.52(b).

6.2.2.3 Nonradiological Impacts of Spent Fuel Shipments

The general approach used to calculate nonradiological impacts of spent fuel shipments is the same as that used for unirradiated fuel shipments. The main difference is that the spent fuel shipping route characteristics are better defined, so the State-level accident statistics in Saricks and Tompkins (1999) may be used. State-by-State shipping distances were obtained from the TRAGIS output file and combined with the annual number of shipments and accident, injury, and fatality rates by State from Saricks and Tompkins (1999) to calculate nonradiological impacts. In addition, the accident, injury, and fatality rates from Saricks and Tompkins (1999) were adjusted to account for underreporting (see Section 6.2.1.3). The results calculated by the NRC staff are shown in Table 6-12.

Table 6-12. Nonradiological Impacts of Transporting Spent Fuel from the Proposed Fermi Site and Alternative Sites to the Proposed Geologic HLW Repository at Yucca Mountain, Normalized to Reference LWR

Site	One-Way Shipping Distance (km)	Nonradiological Impacts per Year		
		Accidents/yr	Injuries/yr	Fatalities/yr
Fermi (proposed site)	3481	1.5×10^{-1}	6.8×10^{-2}	4.6×10^{-3}
Petersburg	3457	1.5×10^{-1}	6.7×10^{-2}	4.5×10^{-3}
South Britton	3510	1.5×10^{-1}	6.8×10^{-2}	4.6×10^{-3}
Greenwood Energy Center	3564	1.5×10^{-1}	7.3×10^{-2}	4.9×10^{-3}
Belle River	3585	1.6×10^{-1}	7.4×10^{-2}	4.9×10^{-3}

Note: The number of shipments of spent fuel assumed in the calculations is 40.3 shipments/yr after normalizing to the reference LWR. Estimates are for roundtrip travel.

6.2.3 Transportation of Radioactive Waste

This section discusses the environmental effects of transporting radioactive waste other than spent fuel from the proposed Fermi site and alternative sites. The environmental conditions listed in 10 CFR 51.52 that apply to shipments of radioactive waste are as follows.

- Radioactive waste (except spent fuel) would be packaged and in solid form.

- Radioactive waste (except spent fuel) would be shipped from the reactor by truck or rail.
- The weight limitation of 73,000 lb per truck and 100 tons per cask per railcar would be met.
- Traffic density condition would be less than the one truck shipment per day or three railcars per month.

Radioactive waste (other than spent fuel from the Fermi 3 ESBWR) is expected to be capable of being shipped in compliance with Federal or State weight restrictions. Table 6-13 presents the NRC staff's estimates of annual waste volumes and annual waste shipment numbers for an ESBWR, normalized to the reference 1100-MW(e) LWR defined in WASH-1238 (AEC 1972). The expected annual waste volumes for the ESBWR are estimated at 15,900 ft^3/yr. Using the same packaging assumptions as WASH-1238 (2.34 m^3/shipment), the annual number of waste shipments was estimated at 114 shipments per year after normalization to the reference LWR in WASH-1238.

Table 6-13. Summary of Radioactive Waste Shipments from the Proposed Fermi Site and Alternative Sites

Reactor Type	Waste Generation Information	Annual Waste Volume, m^3/yr per Unit	Electrical Output, MW(e) per Unit	Normalized Rate, m^3/1100 MW(e) Unit (880 MW(e) Net)[(a)]	Shipments/ 1100 MW(e) (880 MW(e) Net) Electrical Output[(b)]
Reference LWR (WASH-1238)	3800 ft^3/yr per unit	108	1100	108	46
Fermi 3 and alternative sites ESBWR	15,859 ft^3/yr per unit[(c)]	449[(c)]	1605	265	114

Conversions: 1 m^3 = 35.31 ft^3. Drum volume = 210 liters (0.21 m^3).

(a) Capacity factors used to normalize the waste generation rates to an equivalent electrical generation output are 80 percent for the reference LWR (AEC 1972) and 93 percent for the Fermi 3 ESBWR (Detroit Edison 2011). Waste generation for the ESBWR is normalized to 880 MW(e) net electrical output (1100-MW(e) unit with an 80-percent capacity factor).

(b) The number of shipments per 1100 MW(e) was calculated by dividing the normalized rate by the assumed shipment capacity used in WASH-1238 (2.34 m^3/shipment).

(c) This value was taken from DCD Revision 9 (GEH 2010).

The annual waste volume and annual number of shipments are greater than those for the 1100-MW(e) reference reactor that was the basis for Table S-4. However, using currently available shipping packages and practices, the annual shipment estimates could be reduced below those for the reference LWR if higher shipment capacities were considered for certain types of radioactive waste from the Fermi 3 site. For example, if all of the dry active waste, approximately 12,827 ft^3 of the 15,859 ft^3/yr LLRW projected (GEH 2010) were to be shipped in standard 20-ft Sealand containers (1,000 ft^3, 1 container per truck), approximately 50 shipments per year to a disposal site would be required, assuming a shipment capacity of 2.34 m^3 of waste per shipment for the remaining waste as was assumed in WASH-1238. For comparison to the 46 annual shipments of radioactive waste for the reference reactor, the normalized number of shipments required for Fermi 3 radioactive waste would then be 30 shipments rather than the 114 shipments identified in Table 6-13.

The sum of the daily shipments of unirradiated fuel, spent fuel, and radioactive waste for an ESBWR located at the Fermi site and alternative sites is less than the one-truck-shipment-per-day condition given in 10 CFR 51.52, Table S-4.

Dose estimates to the MEI from transport of unirradiated fuel, spent fuel, and waste under normal conditions are presented in Section 6.2.1.1.

Nonradiological impacts of radioactive waste shipments were calculated using the same general approach as unirradiated and spent fuel shipments. For this EIS, the shipping distance was assumed to be 500 mi one way (AEC 1972). Because the actual destination is uncertain, national median accident, injury, and fatality rates were used in the calculations (Saricks and Tompkins 1999). These rates were adjusted to account for underreporting, as described in Section 6.2.1.3. The results are presented in Table 6-14. As shown, the calculated nonradiological impacts for transportation of radioactive waste other than spent fuel from the Fermi site and alternative sites to waste disposal facilities are greater than the impacts calculated for the reference LWR in WASH-1238. As noted above, the calculated impacts would be less than those calculated for the reference reactor, if currently available shipping packages and practices were used.

Table 6-14. Nonradiological Impacts of Radioactive Waste Shipments from an ESBWR at the Proposed Fermi Site

	Normalized Shipments per Year	One-Way Distance (km)	Accidents per Year	Injuries per Year	Fatalities per Year
Reference LWR (WASH-1238)	46	800	3.4×10^{-2}	1.7×10^{-2}	1.1×10^{-3}
Fermi 3 ESBWR	114	800	8.5×10^{-2}	4.2×10^{-2}	2.6×10^{-3}

Note: The shipments and impacts have been normalized to the reference LWR.

6.2.4 Conclusions

The NRC staff conducted a confirmatory analyses and performed independent calculations of the potential impacts under normal operating and accident conditions of transporting fuel and wastes to and from an ESBWR to be located at the Fermi site and alternative sites. To make comparisons to Table S-4, the environmental impacts were adjusted (i.e., normalized) to the environmental impacts associated with the reference LWR in WASH-1238 (AEC 1972), by multiplying the ESBWR impact estimates by the ratio of the total electric output for the reference reactor to the electric output of the proposed reactor.

Because of the conservative approaches and data used to calculate impacts, the actual environmental effects are not likely to exceed those calculated in this EIS. Thus, the NRC staff concludes that the environmental impacts of transportation of fuel and radioactive wastes to and from the Fermi site and alternative sites would be SMALL, and would be consistent with the environmental impacts associated with transportation of fuel and radioactive wastes to and from current-generation reactors presented in Table S-4 of 10 CFR 51.52.

On March 3, 2010, DOE submitted a motion to the Atomic Safety and Licensing Board to withdraw with prejudice its application for a permanent geologic repository at Yucca Mountain, Nevada (DOE 2010). Regardless of the outcome of this motion, the NRC staff concludes that transportation impacts are roughly proportional to the distance from the reactor site to the repository site, in this case Michigan to Nevada. The distance from the Fermi site or any of the alternate sites to any new planned repository in the contiguous United States would be no more than double the distance from the Michigan site to Yucca Mountain. Doubling the environmental impact estimates from the transportation of spent reactor fuel, as presented in this section, would provide a reasonable bounding estimate of the impacts for NEPA purposes. The NRC staff concludes that the environmental impacts of these doubled estimates would still be SMALL.

6.3 Decommissioning Impacts

At the end of the operating life of a power reactor, NRC regulations require that the facility be decommissioned. The NRC defines decommissioning as the safe removal of a facility from service and the reduction of residual radioactivity to a level that permits termination of the NRC license. The regulations governing decommissioning of power reactors are found in 10 CFR 50.75 and 10 CFR 50.82. The radiological criteria for termination of the NRC license are in 10 CFR Part 20, Subpart E.

An applicant for a COL is required to certify that sufficient funds will be available to provide for radiological decommissioning at the end of power operations. As part of its COL application for the Fermi 3 on the Fermi site, Detroit Edison included a Decommissioning Funding Assurance Report in its COL Application Part 1 (Detroit Edison 2010), which stated that Detroit Edison would establish an external sinking funds account to accumulate funds for decommissioning.

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*, NUREG-0586, Supplement 1 (NRC 2002) (referred to as the GEIS-DECOM). Environmental impacts of the DECON, SAFSTOR, and ENTOMB decommissioning methods are evaluated in the GEIS-DECOM. A COL applicant is not required to identify a decommissioning method at the time of the COL application. The NRC staff's evaluation of the environmental impacts of decommissioning presented in the GEIS-DECOM identifies a range of impacts for each environmental issue for a range of different reactor designs. Based on a DOE study (DOE 2004), it is expected that the ESBWR design would have lower physical plant inventories, less accumulated radioactivity, and fewer disposal and transportation costs than current operating reactors. Therefore, the NRC staff concludes that the impacts discussed in GEIS-DECOM remain bounding for reactors deployed after 2002, including the ESBWR.

The GEIS-DECOM does not specifically address the carbon footprint of decommissioning activities. However, it does list the decommissioning activities and states that the decommissioning workforce would be smaller than the operational workforce and that the decontamination and demolition activities could take up to 10 years to complete. Finally, it discusses SAFSTOR, in which decontamination and dismantlement are delayed for a number of years. Given this information, the NRC staff estimated the CO_2 footprint of decommissioning to be approximately 70,000 MT without SAFSTOR. This footprint is about equally split between decommissioning workforce transportation and equipment usage. The details of the estimate are presented in Appendix L. A 40-year SAFSTOR period would increase the footprint of decommissioning by about 40 percent. These CO_2 footprints are roughly three orders of magnitude lower than the CO_2 footprint presented in Section 6.1.3 for the uranium fuel cycle.

Therefore, the NRC staff relies upon the bases established in GEIS-DECOM and concludes the following with respect to the decommissioning of proposed Fermi 3:

1. Doses to the public would be well below applicable regulatory standards, regardless of which decommissioning method considered in the GEIS-DECOM is used.
2. Occupational doses would be well below applicable regulatory standards during the license term.
3. The quantities of Class C or greater than Class C wastes generated would be comparable or less than the amounts of solid waste generated by reactors licensed before 2002.
4. Air quality impacts of decommissioning are expected to be negligible at the end of the operating term.
5. Measures are readily available to avoid potential significant water quality impacts from erosion or spills. The liquid radioactive waste system design includes features to limit the release of radioactive material to the environment, such as pipe chases and tank collection basins. These features will minimize the amount of radioactive material in spills and leakage that would have to be addressed at decommissioning.
6. Ecological impacts of decommissioning are expected to be negligible.
7. Socioeconomic impacts would be short term and could be offset by decreases in population and economic diversification.

On the basis of the GEIS-DECOM and the evaluation of air quality impacts from GHG emissions above, the NRC staff concludes that, as long as the regulatory requirements on decommissioning activities to limit the impacts of decommissioning are met, the decommissioning activities would result in a SMALL impact.

6.4 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy,* Part 20, "Standards for Protection against Radiation."

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 71. Code of Federal Regulations, Title 10, *Energy*, Part 71, "Packaging and Transportation of Radioactive Material."

10 CFR Part 961. Code of Federal Regulations, Title 10, *Energy*, Part 961, "Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

49 CFR Part 173. Code of Federal Regulations, Title 49, *Protection of Environment*, Part 173, "Shippers-General Requirements for Shipments and Packagings."

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7.0 Cumulative Impacts

The National Environmental Policy Act of 1969, as amended (NEPA), requires Federal agencies to consider the cumulative impacts of proposals under its review. Cumulative impacts may result when the environmental effects associated with the proposed action are overlain on or added to temporary or permanent impacts associated with past, present, and reasonably foreseeable future projects.

Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. In its proposal for a new nuclear unit at the Enrico Fermi Atomic Power Plant (Fermi) site, Detroit Edison Company (Detroit Edison) submitted a combined license (COL) application, including an Environmental Report (ER), to the U.S. Nuclear Regulatory Commission (NRC). When evaluating the potential impacts of building and operating a new unit (Fermi 3), the NRC and the U.S. Army Corps of Engineers (USACE) review team considered potential cumulative impacts on resources that could be affected by the preconstruction, construction, and operation of one General Electric-Hitachi, LLC (GEH) Economic Simplified Boiling Water Reactor (ESBWR) at the Fermi site located on the western shore of Lake Erie approximately 30 mi southwest of Detroit, Michigan, and 7 mi from the United States-Canada border.

Cumulative impacts result when the effects of an action are added to or interact with other past, present, and reasonably foreseeable future effects on the same resources. For the purposes of this analysis, past actions are those that occurred prior to receipt of the COL application. Present actions are those related to resources and taken from the time of receipt of the COL application until the start of NRC-authorized construction of Fermi 3. Future actions are those that are reasonably foreseeable throughout the building and operating of Fermi 3, including its decommissioning. The geographical area over which the past, present, and future actions could contribute to cumulative impacts depends on the type of resource considered and is described individually for each resource. The review team considered, among other actions, the cumulative effects of Fermi 3 with current operations of Fermi Unit 2 (Fermi 2) on the Fermi site.

The approach for this environmental impact statement (EIS) is outlined in the following discussion. To guide its assessment of the environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on guidance developed by the Council on Environmental Quality (CEQ); see Title 40 of the Code of Federal Regulations (specifically, 40 CFR 1508.27). The three significance levels established by the NRC – SMALL, MODERATE, and LARGE – are defined 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.

The impacts of the proposed action, as described in Chapters 4 and 5, are combined in this chapter with those of other past, present, and reasonably foreseeable future actions in the general area surrounding the Fermi site that would affect the same resources as those affected by the proposed Fermi 3, regardless of what agency (Federal or non-Federal) or person undertakes such actions. These combined impacts are defined by the CEQ as “cumulative” in 40 CFR 1508.7 and include individually minor but collectively significant actions taking place over a period of time. It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the resource’s overall decline.

The description of the affected environment in Chapter 2 serves as the baseline for the cumulative impacts analysis, including the effects of past actions. The incremental impacts related to construction activities that require NRC authorization (10 CFR 50.10(a)) are described and characterized in Chapter 4, and those related to operations are described and characterized in Chapter 5. These impacts are summarized for each resource area in the sections that follow. The level of detail is commensurate with the significance of the impact for each resource area.

This chapter includes an overall cumulative impact assessment for each resource area. NRC staff performed the cumulative impact analysis according to guidance provided in the staff memorandum “Addressing Construction and Preconstruction Activities, Greenhouse Gas Issues, General Conformity Determinations, Environmental Justice, Need for Power, Cumulative Impact Analysis, and Cultural/Historical Resources Analysis Issues In Environmental Impact Statements” (NRC 2011a). The specific resources and components that could be affected by the incremental effects of the proposed action and other actions in the same geographical area are assessed. This assessment includes the impacts of construction and operations for the proposed new unit as described in Chapters 4 and 5; impacts of preconstruction activities as described in Chapter 4; impacts of fuel cycle, transportation, and decommissioning as described in Chapter 6; and impacts from past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could affect the same resources as those affected by the proposed actions.

The team used information provided by Detroit Edison in the ER, Detroit Edison’s responses to requests for additional information (RAIs) issued by the NRC and USACE staff, information from other Federal and State agencies, and information gathered during the scoping period and visits by the staff to the Fermi site to evaluate the cumulative impacts on resources affected by building and operating a new nuclear power plant at the site. To inform the cumulative analysis, the review team researched U.S. Environmental Protection Agency (EPA) databases for recent EISs within the region, used an EPA database of permits for water discharges (NEPAssist) in the geographic area, and used the www.recovery.gov Web site to identify projects in the area funded by the American Recovery and Reinvestment Act of 2009 (Public Law 111-5). Other actions and projects that were identified during this review and considered in the review team's independent analysis of the potential cumulative effects are described in Table 7-1.

7.1 Land Use

The description of the affected environment in Section 2.2 serves as a baseline for the cumulative impacts assessment in this resource area. As described in Section 4.1, the impacts of NRC-authorized construction on land use would be SMALL, and no further mitigation would be warranted. As described in Section 5.1, the review team concludes that the effects of operations on land use would be SMALL, and no further mitigation would be warranted.

The combined impacts from preconstruction and construction activities on land use are described in Section 4.1 and were determined to be SMALL. In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis also considers other past, present, and reasonably foreseeable future projects in the geographical area of interest that could affect land use (Table 7-1). For this cumulative analysis, the geographic area of interest is the area within 15 mi of the Fermi site. This geographic area of interest includes the primary communities, such as Frenchtown Township, that would be affected by the proposed Fermi 3 and its transmission lines.

Although mostly agricultural land surrounds the Fermi site, there are areas of residential development in the City of Monroe to the southwest of the plant, in the Stony Point area directly southeast of the Fermi site, along the Lake Erie shoreline, and to the north of the Fermi site near Swan Creek (Monroe County Planning Department and Commission 2010). The majority of the land west of the Fermi site is zoned for agricultural use. There are a number of industrial areas to the southwest of the site along the Lake Erie shoreline and in the City of Monroe, including the Detroit Edison Monroe Power Plant, the Automotive Components Holdings plant, and the Port of Monroe (Monroe County Planning Department and Commission 2010). Although land to the south of the site is anticipated to remain a low- and medium-density residential area, it is expected that the site will continue to be surrounded primarily by agricultural lands, open areas, and woodlands to the west and north for the foreseeable future (James D. Anulewicz Associates, Inc., and McKenna Associates, Inc. 2003). A farmland preservation and conservation program in Monroe County may prevent additional residential and other

Table 7-1. Past, Present, and Reasonably Foreseeable Future Projects and Other Actions Considered in the Cumulative Analysis (closest to furthest from the Fermi site)

Project Name	Summary of Project	Location	Status
Energy Projects			
Fermi Nuclear Power Plant Unit 2	1098-MW nuclear power plant	On Fermi site	Operational; current license expires March 20, 2025. On July 18, 2011, NRC received a notice of intent to submit a license renewal application for Fermi Unit 2 in 2014.[(a)]
Fermi Nuclear Power Plant Unit 1	Decommissioning and demolition of shutdown nuclear power plant	On Fermi site	In progress[(b)]
Independent Spent Fuel Storage Installation	Dry spent-fuel storage	On Fermi site	Proposed[(c)]
Detroit Edison Monroe Power Plant	3280-MW coal-fired plant	6 mi southwest of Fermi site on Lake Erie	Operational, includes recent and planned refurbishment[(d)]
J.R. Whiting Power Plant, Luna Pier, Michigan	328-MW coal-fired plant	14 mi south-southwest of Fermi site on Lake Erie	Operational[(e)]
Bayshore Power Plant	499-MW coal-fired plant	20 mi south-southwest of Fermi site on Lake Erie in Maumee Bay	Operational[(f)]
Davis-Besse Nuclear Power Station Unit 1	925-MW nuclear power plant	27 mi southeast of Fermi site on Lake Erie	Operational[(g)]
Davis-Besse Independent Spent Fuel Storage Installation	Dry spent fuel storage	On Davis-Besse site	Operational[(h)]
Mining Projects			
Rockwood Quarry	Crushed and broken limestone quarry	2.5 mi north-northeast of Fermi site	Operational[(i)]
Stoneco Newport	Crushed and broken limestone quarry	2.5 mi north-northeast of Fermi site	Operational[(j)]

Table 7-1. (contd)

Project Name	Summary of Project	Location	Status
Mining Projects (contd)			
Sylvania Minerals	Crushed and broken limestone and crushed silica quarry	6 mi north-northwest of Fermi site	Operational[k]
Sora Limestone	Crushed and broken limestone quarry	6 mi north-northeast of Fermi site	Operational[l]
Stoneco Denniston	Crushed and broken limestone quarry	9 mi southwest of Fermi site	Operational[m]
Stoneco Maybee	Crushed and broken limestone quarry	13 mi west-northwest of Fermi site	Operational[n]
Sibley Quarry	Crushed and broken limestone quarry	14 mi north-northeast of Fermi site	Operational[o]
Transportation Projects			
Cleveland-Toledo-Detroit Passenger Rail Line	Addition to regional transportation hub with rail lines connecting Cleveland, Buffalo, Toronto, Pittsburgh, Cincinnati, and Detroit	Rail line would pass through Monroe County on its way to Detroit	Proposed; schedule undetermined[p]
Other Actions/Projects			
Berlin Township Wastewater Treatment Plant	Wastewater treatment plant that discharges to Swan Creek near its confluence with Lake Erie	1.1 mi northwest of Fermi site	Operational[q]
Frenchtown Township Water Plant	Water treatment plant that withdraws water from Lake Erie	2 mi southwest of Fermi site	Operational[r]
Monroe Metro Wastewater Treatment Plant	Wastewater treatment plant that discharges to Lake Erie–Plum Creek–Levee Channel	6 mi southwest of Fermi site	Operational[s]
Ventower Industries	Wind turbine tower manufacturing facility	6 mi southwest of Fermi site in Monroe, Michigan	Operational[t]
Monroe Water Filtration Plant	Water treatment plant that withdraws water from Lake Erie	7 mi southwest of Fermi site	Operational
Carleton Wastewater Treatment	Wastewater treatment plant that discharges to Swan Creek	9 mi northwest of Fermi site	Operational[u]
Lazy Oak Sub Wastewater Treatment	Wastewater treatment plant that discharges to Swan Creek	9 mi northwest of Fermi site	Operational[v]
Guardian Industries Glass Plant	Manufacturing facility that discharges into Swan Creek	10 mi north-northwest of Fermi site	Operational[w]

Table 7-1. (contd)

Project Name	Summary of Project	Location	Status
Other Actions/Projects (contd)			
Luna Pier Wastewater Treatment	Wastewater treatment plant that discharges to La Pointe Drain	14 mi south-southwest of Fermi site	Operational[(x)]
Rawsonville Woods Mobile Estates	Mobile home community with National Pollutant Discharge Elimination System (NPDES) permit	18 mi northwest of Fermi site	Operational[(y)]
Oil Refineries	Plants that refine crude oil for other applications	Various throughout region	Operational
Future Urbanization	Construction of housing units and associated commercial buildings, roads, bridges, and rail; construction of water and/or wastewater treatment and distribution facilities and associated pipelines, as described in local land use planning documents (no specific data found on development and expansion of towns within 20 mi of site)	Throughout region	Construction would occur in the future, as described in State and local land use planning documents
Great Lakes Restoration Initiative	Restoration activities to address toxic substances, invasive species, nearshore health and nonpoint source pollution, and habitat and wildlife protection	Great Lakes watershed	Began in FY 2011[(z)]
Global Climate Change/ Natural Environmental Stressors	Short- or long-term changes in precipitation or temperature	Throughout region	Impacts would occur in the future

Sources:
(a) Detroit Edison 2011d
(b) NRC 2010a
(c) Detroit Edison 2007
(d) EPA 2011c
(e) Consumers Energy 2011
(f) EPA 2011d
(g) NRC 2011b
(h) NRC 2010b
(i) EPA 2011e
(j) EPA 2011f
(k) Our Good Neighbors 2011

Table 7-1. (contd)

(l) EPA 2011g
(m) EPA 2011h
(n) EPA 2011i
(o) EPA 2011j
(p) MHR 2011
(q) EPA 2011k
(r) Frenchtown Charter Township 2010
(s) EPA 2011l
(t) Ventower 2011
(u) EPA 2011m
(v) EPA 2011n
(w) EPA 2011o
(x) EPA 2011p
(y) EPA 2011q
(z) EPA 2011a

development from occurring on undeveloped land used for agriculture that is close to the Fermi site (Monroe County Planning Department and Commission 2010).

Most undeveloped lands on the site are managed as part of the Detroit River International Wildlife Refuge (DRIWR), which extends along the shore of Lake Erie from the River Raisin in the south to the Detroit River in the north and contains habitat for wildlife, including some wetland and water-dependent species (FWS 2010). There are proposals to add to the land included in the DRIWR; these additions to recreational and conservation land uses in the vicinity of the Fermi site would be small and would not be constrained by development and operation of Fermi 3. There are currently no plans to remove land elsewhere from the DRIWR.

As described in Sections 4.1 and 4.3, building Fermi 3 would affect more than 301 ac of land, including conversion of approximately 189 ac of open and forested land to industrial/utility land, at the site and could also indirectly result in some conversions of offsite land to residential areas, roads, and businesses in order to accommodate growth, new workers, and services related to the proposed nuclear facility. Other reasonably foreseeable future projects in the geographic area of interest (see Table 7-1) – such as anticipated commercial waterfront development – would also contribute to reductions in the amount of open, forested, and wetland areas and to increases in residential areas, roads, and business; however, these projects are expected to be consistent with Monroe County's land use plans. Cumulative land use impacts within the 15-mi geographic area of interest are generally expected to be consistent with existing land use plans and zoning.

Detroit Edison anticipates that three new 345-kV transmission lines would be needed to serve Fermi 3. These lines would connect Fermi 3 to the Milan Substation and would likely follow a single 29.4-mi route in Monroe County, southwest Wayne County, and southeast Washtenaw County (Detroit Edison 2011a). Approximately 18.6 mi of the route would follow an established transmission line corridor, and approximately 10.8 mi of the route would cross undeveloped rural land. The applicant also expects to have to expand the Milan Substation. Assuming that a 300-ft-wide right-of-way (ROW) would be required, approximately 1069 ac would be used for the proposed lines, approximately 21 ac would be needed to expand the Milan Substation, and additional acreage would be needed for laydown and other activities (Detroit Edison 2011a). Land use impacts resulting from these activities are expected to be minimal. Although the precise areas of impact are not yet known, these activities would result in the loss of small areas of forests, agricultural lands, wetlands, and streams. Once the lines were installed, only the land around the transmission tower bases would be unavailable for future agricultural use, and any forested areas that are cleared to establish the corridor would have to remain cleared over the operation life of the transmission lines. At this time, it is not known whether other utility transmission lines might be developed in the area that could contribute to cumulative impacts.

Climate change could increase precipitation and lake storm surges in the geographic area of interest (USGCRP 2009), thus changing land use as a result of the inundation of low-lying areas along the lakeshore. The rate of forest growth and growth of other vegetation may increase as a result of more carbon dioxide in the atmosphere (USGCRP 2009). In addition, climate change could change crop yields and livestock productivity (USGCRP 2009), which might alter the characteristics of land used for agriculture in the geographic area of interest. Changes resulting from climate change could cause minor shifts in land use in the geographic area of interest, which might be exacerbated by the operation of Fermi 3.

Over the expected operational life of Fermi 3, few reasonably foreseeable future land use changes, other than gradually continuing urbanization and minor changes resulting from climate change, are anticipated, including the impacts from building and operating Fermi 3. Therefore, the review team concludes that the cumulative land use impacts would be SMALL, and no mitigation would be warranted.

7.2 Water Use and Quality

This section analyzes the potential cumulative impacts of the proposed Fermi 3 in addition to other past, present, and reasonably foreseeable future projects on water use and water quality.

7.2.1 Surface Water Use

The description of the affected environment in Section 2.3 of this document serves as the baseline for the cumulative impact assessments in this resource area. As described in Section 4.2, the NRC staff concludes that the impacts of NRC-authorized construction activities on surface water use would be SMALL, and no further mitigation would be warranted. The combined surface water use impacts from preconstruction and construction activities are described in Section 4.2.2.1 and were determined by the review team to be SMALL. As described in Section 5.2, the review team concludes that the impacts of operations on surface water use would also be SMALL, and no further mitigation would be warranted.

In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis for surface water use also considers other past, present, and reasonably foreseeable future actions that could potentially affect this resource (Table 7-1). For the cumulative analysis of impacts on surface water, the geographic area of interest is considered to be within a 15-mi radius surrounding the intake and discharge structures, as it is a bounding estimate of the geographical extent of potential impacts of Fermi 3 on surface water due to the significant water supply available in Lake Erie.

As described in Section 5.2.2.1, the review team determined that the annual consumptive use of surface water from the operation of Fermi 3 would not be significant compared to the relative volume of water in Lake Erie (0.006 percent), and it would also remain a small portion of the average annual consumptive water use of all users in the Lake Erie basin (4.1 percent). The impacts would be minor within the geographic area of interest's 15-mi radius. The predominant surface water user within a 15-mi radius of the Fermi site is Fermi 2, and its withdrawals would not noticeably alter surface water availability. There are also two water intakes on Lake Erie and in the vicinity of the Fermi site for public water supply: the Frenchtown Water Plant, which uses 8 million gallons per day (MGD), and the Monroe County Water Plant, which uses 7.5 MGD (Frenchtown Charter Township 2010; AWWA 2009). The impacts of these two water plants and the other projects listed in Table 7-1 are considered in the analysis in Sections 4.2 and 5.2 and would not be detectable or would be so minor that they would not affect surface water use.

The review team also evaluated the impact of potential climate changes on water availability, as well as the cumulative impact that climate change and reactor operations could have on the availability of water resources for other uses. A recent compilation of the state of the knowledge on climate change (USGCRP 2009) was considered during the preparation of this EIS. The USGCRP report and a related study for the Great Lakes (Hayhoe et al. 2010) discuss projected changes in the climate for the region during the operating license period for Fermi 3 (estimated to be from 2020 to 2060) based on a range of CO_2 emissions scenarios simulated using the NOAA Great Lakes model. The lowest of these potential emission scenarios (B1) predicts a maximum CO_2 air concentration of 550 ppm by 2100 (roughly double pre-industrial levels), resulting in a slight increase in average air temperature but little to no significant change in Lake Erie water levels due to a corresponding increase in precipitation. The highest-emissions scenario (A1Fi) predicts a maximum CO_2 air concentration of 940 ppm by 2100 (about four times pre-industrial levels), resulting in noticeable impacts on both average air temperature and lake volume.

The predicted impacts of the highest emissions scenario include an increase in average temperature of at least 3–4°F by the end of the operating license period of Fermi 3 (about 2060) and a slight increase in precipitation in the winter and spring. Rainstorms are anticipated to be more intense throughout the year. Average water levels in Lake Erie could decrease as much as 1.5 ft because of increased evaporation of the lake, which would cause a decrease of up to 2 percent of the volume of Lake Erie. If the water volume in Lake Erie were to be reduced by 2 percent, its volume could noticeably decline from 128 trillion gallons to 125 trillion gallons. In addition, the increase in the average air temperature when combined with lower lake levels could result in an increase in the average monthly water temperature of Lake Erie.

The review team used projected population estimates presented in Section 2.5.1 of the ER and the reported water use in Monroe County as presented in the ER to estimate future water use in Monroe County by 2060. Assuming that per capita water use remains in the range of current amounts and population increases by 76 percent by 2060 (Detroit Edison 2011a) the quantity of Lake Erie water used for the public water supply in Monroe County would increase from approximately 12 MGD in 2000 to 21 MGD by 2060. The review team was not aware of studies estimating potential future water use from the Lake Erie basin between 2020 and 2060. Detroit Edison (2011a) estimates of population growth indicate an increase of approximately 40 percent by 2060 within a 50-mi radius of Fermi 3. The review team used the projected population growth estimates and assumed that per capita water use (for all uses) remains in the range of present amounts to estimate total future use of Lake Erie water by 2060. If Lake Erie water use were to increase by 40 percent above the average water use observed from 2000 through 2006, then the total water use would be approximately 75,600 MGD, with a consumptive use of approximately 702 MGD. On an annual basis, a consumptive use of 702 MGD would be approximately 0.2 percent of the Lake Erie volume, if reduced by the effects of climate change to 125 trillion gallons.

Potential increases in Lake Erie water temperature resulting from climate change could increase the amount of cooling water needed for operation of the proposed Fermi 3 and other major users. Therefore, the operations of Fermi and other thermoelectric plants on Lake Erie could be altered as a result of climate change. If the volume of Lake Erie water decreased by 2 percent as a result of climate change, then the annual consumptive water use by Fermi 3 would still be negligible (approximately 0.006 percent of the total lake volume) even if the monthly average use increased significantly. The review team considered the cumulative consumptive use of surface water from the operation of the existing Fermi 2, proposed Fermi 3, and other (existing or reasonably foreseeable) consumptive uses and the potential effects of climate change. The greatest potential future impact on Lake Erie water availability is predicted to be from climate change. The impact predicted for the lowest-emissions scenario would not be detectable or would be so minor that it would not noticeably alter the availability of water from Lake Erie. However, if CO_2 emissions follow the trend evaluated in the highest-emissions scenario, the cumulative effects on the quantity of surface water in Lake Erie may be detectable and may noticeably alter the availability of water in the lake, resulting in the potential for less water availability and more water-use restrictions. On the basis of its evaluation, the review team concludes that the potential impacts of both increased future use (assuming constant per capita use and projected population increase) and climate change on surface water quantity in Lake Erie would be SMALL to MODERATE. A SMALL impact would be expected under the condition of minimal climate change associated with the lowest-emissions scenario. A MODERATE impact would be expected under the highest-emissions scenario, which is expected to produce the highest increases in air and water temperatures. These increases in air and water temperature could noticeably alter water levels but would not do so to the point that the resource and surrounding environment become destabilized. However, the cumulative impacts of building and operating Fermi 3 would not contribute significantly to the overall cumulative impacts in the geographical area of interest. The incremental increases in water use by Fermi 3 and other present and foreseeable future uses (other than the effects of climate change) should not noticeably reduce the quantity of water within Lake Erie. The potentially increased water temperature in Lake Erie that may result from climate change could also increase the amount of cooling water needed for operation of the proposed Fermi 3 and other major users, although these effects are not expected to be significant. Therefore, the incremental impacts from NRC-authorized activities would be SMALL, and no further mitigation would be warranted.

7.2.2 Groundwater Use

The description of the affected environment in Section 2.3 of this document serves as the baseline for the cumulative impact assessments in this resource area. As described in Section 4.2, the NRC staff concludes that the impacts of NRC-authorized construction activities on groundwater use would be SMALL, and no further mitigation would be warranted. As described in Section 5.2, the review team concludes that the impacts of operations on groundwater use would also be SMALL, and no further mitigation would be warranted.

The combined groundwater use impacts from preconstruction and construction were described in Section 4.2.2 and were determined to be SMALL. In addition to the impacts from preconstruction, construction, and operation, the cumulative analysis also considers past, present, and reasonably foreseeable future actions that could affect groundwater use. For this analysis, the geographic area of interest affected by dewatering for preconstruction and construction activities is considered to be the local aquifer in the overburden unit and the Bass Islands Group aquifer in the vicinity of the Fermi site (within 15 mi). From a local standpoint, changes within the overburden unit would not affect any other groundwater users.

From a regional standpoint, the Bass Islands Group aquifer is tapped for public water supply, industrial use, thermoelectric power facilities, agricultural irrigation, golf course irrigation, and dewatering for quarry mining operations. Approximately 75 percent of groundwater withdrawn in Monroe County is for quarry dewatering operations (Reeves et al. 2004). In the past, groundwater flow within the Bass Islands Group aquifer flowed to the east toward Lake Erie; however, in the vicinity of the Fermi site, groundwater flow within the Bass Islands Group aquifer has reversed to flow toward mining quarry dewatering operations (toward Sylvania Minerals and

Stoneco Denniston Quarry listed in Table 7-1). Groundwater elevations in the vicinity of the Fermi site have declined between 10 and 15 ft since the early 1990s as a result of dewatering for offsite quarry operations elsewhere in Monroe County (Reeves et al. 2004). Detroit Edison (2011a) used U.S. Geological Survey values (from Reeves et al. 2004) for groundwater withdrawals within Monroe County and in adjacent Wayne County that will affect groundwater levels within Monroe County to estimate total freshwater groundwater withdrawals in Monroe County. It estimated that withdrawals would increase from about 28 MGD in 2000 to 49 MGD in 2060. In Monroe County, 0.8 percent of the total water use in 2000 was from groundwater.

During preconstruction and construction activities, dewatering operations would temporarily lower groundwater levels in the vicinity of the Fermi site. The overburden unit is not used at the Fermi site or the area immediately surrounding the site, because of its low yield and spatial discontinuity. The unit is assumed to be in direct contact with Lake Erie in many places; consequently, it is unlikely that there would be a noticeable drawdown in the unit outside of the construction area. In addition, slurry walls will be in place around the dewatering operation, and dewatering wells will only pump from the Bass Islands Group aquifer. Groundwater wells that could be affected by drawdown from dewatering during the building of Fermi 3 are nearby household wells, irrigation wells, and other wells (Detroit Edison 2011a). According to modeling scenarios, it is estimated that at a distance of 1.5 mi from the Fermi site, the largest drawdown would occur 1 ft below current water levels (Detroit Edison 2011a). The offsite well with the highest amount of drawdown is a domestic water supply well located about 3800 ft from the center of the power block area where drawdown would be up to 2 ft, according to modeling scenarios. In addition, groundwater dewatering activities are not expected to affect onsite wetlands, since they are hydraulically connected to Lake Erie.

Given that (1) the proposed Fermi 3 would not use groundwater for operations, (2) there would be no discharges to groundwater from Fermi 3, and (3) temporary dewatering operations during preconstruction and construction activities would have limited spatial effect and would not affect the overall productivity of the Bass Islands Group aquifer, the review team determined that the potential impacts on groundwater use from building and operating Fermi 3 would be minimal. In addition, the review team concluded that the cumulative groundwater use impacts would be SMALL. The incremental impacts from NRC-authorized activities would be SMALL, and no further mitigation would be warranted.

7.2.3 Surface Water Quality

The description of the affected environment in Section 2.3 serves as the baseline for the cumulative impact assessments in this resource area. As described in Section 4.2.3.1, the NRC staff concludes that the impacts of NRC-authorized construction activities on surface water quality would SMALL, and no further mitigation would be warranted. As described in Section 5.2.3.1, the review team concludes that the impacts of operations on surface water quality would also be SMALL, and no further mitigation would be warranted.

The combined surface water quality impacts from preconstruction and construction are described in Section 4.2.3.1 and were determined to be SMALL. In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis for surface water quality also considers other past, present, and reasonably foreseeable future actions that could potentially affect this resource. Because water within the western basin of Lake Erie is well mixed, water quality within the entire western basin could be affected by construction and operation of the proposed Fermi 3. Consequently, the geographic area of interest for surface water quality is the entire western basin of Lake Erie.

The western basin of Lake Erie near the proposed Fermi 3 receives input from two major streams: the Detroit River to the north and the River Raisin to the south. The Detroit River contributes approximately 80 percent of the inflows to Lake Erie. The Maumee River further south, however, is a major sediment source for Lake Erie and contributes the highest amount of suspended solids per year of any other tributary to the Great Lakes (Bridgeman 2006). Sediment carried by the Maumee River is deposited in the Toledo Harbor. This sediment is currently dredged at an average rate of 850,000 tons per year by the USACE to maintain an important shipping channel (USACE 2009). The majority of dredge spoils from this procedure are disposed of in an existing two-square-mile placement area at the western basin north of the location of the shipping channel (USACE 2009). A recently completed study found that there was no significant environmental impact of this open water disposal (USACE 2009).

The current water quality in the western basin of Lake Erie is primarily influenced by these streams but also includes the impacts from operations of industrial facilities, wastewater treatment plants, and thermoelectric energy generating facilities (including Fermi 2) in the region, which are listed in Table 7-1.

Point and non-point sources of pollution have affected the water quality of the western basin of Lake Erie. The two main water quality concerns in Lake Erie are (1) increased phosphorus loading from regional agricultural activities causing toxic algal blooms, and (2) elevated concentrations of the bioaccumulative contaminants – such as dioxin, polychlorinated biphenyls (PCBs), and mercury – occurring mostly as a result of historical industrial activities (Hartig et al. 2007; Brannan 2009).

The EPA's Great Lakes National Program Office has initiated the Great Lakes Restoration Initiative program, a consortium of 11 Federal agencies that developed an action plan to address environmental issues. These issues fall into five areas: cleaning up toxics and areas of concern, combating invasive species, promoting nearshore health by protecting watersheds from polluted run-off, restoring wetlands and other habitats, and tracking progress and working with strategic partners. The results of this long-term initiative would presumably address water quality concerns in Lake Erie.

The review team also evaluated the impact of potential climate changes on water quality as well as the cumulative impact climate change and reactor operations could have on the quality of water resources for other uses. As mentioned in Section 7.2.1, potential climate change scenarios discussed in a recent compilation of the state of the knowledge in this area (USGCRP 2009) and a related study for the Great Lakes (Hayhoe et al. 2010) were considered during the preparation of this EIS. As these studies indicate, both the lowest (B1) and highest (A1Fi) CO_2 emissions scenarios are predicted to increase air and lake temperatures, with the greatest increase predicted if CO_2 emissions rate follow the highest-emissions scenario.

By the end of the operating license period of Fermi 3 (about 2060) annual average air temperatures are projected to have increased by at least 2–3°F under the lower-emissions scenario and 3-4°F under the higher-emissions scenario.. This increase could result in a slight increase in precipitation in the winter and spring. Rainstorms are anticipated to be more intense throughout the year. Higher-intensity precipitation events could lead to increased erosion and sediment loading in Lake Erie tributaries and thus increase sediment loading in Lake Erie itself. Sediment loading, phosphorus loading, and the concentrations of bioaccumulative contaminants within Lake Erie could also be exacerbated by the lowered lake levels resulting from the highest temperature increase, given that less dilution would take place with lower lake levels. Climate change scenarios indicate that while the changes in the surface water quality of Lake Erie that result from climate change may be noticeable, they would not be destabilizing.

The size of the thermal plume created by Fermi 3 discharge would increase if lake levels were to decrease as a result of climate change (where reductions are projected to be as much as 1.5 ft). This decrease in lake levels would result in a larger mixing zone, which would be regulated by the Michigan Department of Environmental Quality (MDEQ). The thermal plume modeling discussed in Section 5.2 included a scenario with a Lake Erie water depth of 7.0 ft, which is 1.5 ft below the average depth for the month associated with the largest thermal plume (May). This scenario estimated that the plume would be 55,347 square feet, a small fraction of the western basin of Lake Erie. The thermal plume of the existing Fermi 2 would also increase with lower lake levels. The increase in the average air temperature combined with lower lake levels could lead to an increase in the average monthly temperature of Lake Erie, further leading to an increase in the average monthly use of cooling water by the proposed Fermi 3 and existing Fermi 2. Increases in cooling water use would result in a larger volume of heated water discharged back into Lake Erie and would therefore further increase the size of thermal plumes. However, the thermal impacts attributable to Fermi 3 would remain minor within the western basin of Lake Erie.

Surface water quality impacts include sediment loading, and thermal and chemical discharges from the proposed Fermi 3. Thermal and chemical (i.e., biocides, metal and organic compounds) discharges from Fermi 3 would be required to meet applicable NPDES permit requirements, health standards, regulations, and total maximum daily loads (TMDLs) mandated by MDEQ and EPA (Detroit Edison 2011a). On the basis of its evaluation, the review team concluded that the cumulative impacts on surface water quality would be MODERATE; however, the cumulative impacts of building and operating Fermi 3 would not contribute significantly to the overall cumulative impacts in the geographical area of interest. Therefore, the incremental impacts from NRC-authorized activities would be SMALL, and no further mitigation would be warranted.

7.2.4 Groundwater Quality

The description of the affected environment in Section 2.3 serves as the baseline for the cumulative impact assessments in this resource area. As described in Section 4.2, the NRC staff concludes that the impacts of NRC-authorized construction activities on groundwater quality would be SMALL, and no further mitigation would be warranted. As described in Section 5.2, the review team concludes that the impacts of operations on groundwater quality would also be SMALL, and no further mitigation would be warranted.

The combined impacts on groundwater quality from preconstruction and construction activities were described in Section 4.2.3 and determined to be SMALL. In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis also considers past, present, and reasonably foreseeable future actions that could affect groundwater quality. For this analysis, the geographic area of interest is considered to be the local aquifer in the overburden unit and the Bass Islands Group aquifer in the 15-mi region surrounding the proposed Fermi 3. As mentioned in Section 7.2.2, groundwater would not be used for operation of Fermi 3.

The overburden unit is not used at the Fermi site or the area immediately surrounding the site because of its low yield and spatial discontinuity. Any impacts on the quality of this aquifer at the Fermi site from activities associated with the preconstruction and construction of Fermi 3 would not affect this resource regionally. During site preparation, construction activities, and operation of the proposed Fermi 3, it is possible that spills could transport pollutants (e.g., gasoline) to groundwater in the overburden unit. Adherence to good housekeeping rules and best management practices described in the Pollution Incident Prevention Plan (PIPP) would reduce impacts to groundwater quality. These practices include conducting an inventory of potential sources, performing preventative maintenance and inspections, posting signs and labels, and planning for secondary containment.

It is anticipated that during construction and operations, the impacts on groundwater quality would be localized and temporary, because there are no plans to use groundwater or to discharge waste to groundwater during construction or operations. No other projects listed in Table 7-1 would affect groundwater quality in the vicinity of the Fermi site; therefore, the review team concludes that cumulative impacts on groundwater quality would be SMALL, and no further mitigation would be warranted.

7.3 Ecology

This section addresses the cumulative impacts on terrestrial, wetland, and aquatic ecological resources from proposed Fermi 3 and past, present, and reasonably foreseeable future activities.

7.3.1 Terrestrial and Wetland Resources

The description of the affected environment in Section 2.4.1 provides the baseline for the cumulative impact analysis for terrestrial ecological resources (including wetlands). As described in Section 4.3.1, the NRC staff concludes that the impacts of NRC-authorized construction on terrestrial ecological resources would be SMALL, and no further mitigation would be warranted. As described in Section 5.3.1, the review team concluded that the impacts of operations of Fermi 3 on terrestrial ecological resources would be MODERATE, because the Habitat and Species Conservation Plan does not yet include measures to protect the eastern fox snake (*Pantherophis gloydi*) from vehicle mortality during operations.

The combined impacts from preconstruction and construction of Fermi 3 on terrestrial ecological resources were described in Section 4.3.1 and determined to be SMALL. Although the extent of wetland impacts (involving approximately 34.5 ac of temporary and permanent impacts) is noticeable, the wetland impacts would be offset by an aquatic resource compensatory mitigation plan that would include restoring and enhancing onsite and offsite wetlands as required by the USACE and MDEQ. In addition to the impacts from Fermi 3 preconstruction, construction, and operation, the following cumulative analysis also considers other past, present, and reasonably foreseeable future actions that could affect the same terrestrial ecological resources. The geographic area of interest is considered to be a 50-mi radius around the Fermi 3 site (as defined in Section 2.4.1). This area is expected to encompass the ecologically relevant landscape features and species potentially affected by the proposed Fermi 3.

Current projects within the geographic area of interest that are potentially capable of affecting the same terrestrial ecological resources as Fermi 3 include the ongoing operation of Fermi 2, the ongoing decommissioning of Fermi 1, the Detroit Edison Monroe Power Plant, the Bayshore Power Plant, the J.R. Whiting Power Plant, three limestone quarries, and several wastewater treatment plants (see Table 7-1). Reasonably foreseeable future projects within the geographic area of interest that could affect the same terrestrial ecological resources include expanded regional commercial and residential development, operation of the recently constructed Ventower Industries manufacturing facility, and construction and operation of a proposed Cleveland-Toledo-Detroit passenger rail line. The Ventower facility was constructed recently on a former industrial site in the City of Monroe. Although ongoing commercial and residential development in the region would be expected to result in the loss of various habitats and wildlife, the review team is not aware of particular development proposals that may be planned.

The geographic area of interest is located primarily in the Lower Peninsula ecoregion and on the western Lake Erie shoreline. This ecoregion has been altered considerably since European settlement, primarily by agriculture and urbanization. Before settlement, most of the region was forested with a mix of oak and oak-hickory on loamy soils and a mix of black ash (*Fraxinus nigra*), white oak (*Quercus alba*), bur oak (*Q. macrocarpa*), and American basswood (*Tilia americana*) on wetter, clayey soils (Alpert 1995). The recent devastation of the ash tree population in the region because of the emerald ash borer (*Agrilus planipennis*) has also substantially altered the composition of the remaining forested habitats (Detroit Edison 2011a). Currently, the main uses for land in the area of interest are for row crops and other agricultural uses; industrial, commercial, and residential development; deciduous upland forest; and forested and emergent wetlands (Detroit Edison 2011a). Residential and commercial urbanization is ongoing within the geographic area of interest.

The geographic area of interest includes agricultural land, including row crops; open water, including part of Lake Erie and shallow lagoons within the Fermi site; developed land, especially in the Detroit metropolitan area; upland forests; and forested and emergent wetlands. As discussed in Section 2.4.1.3, none of the habitats that would be affected by Fermi 3 has been designated as “critical habitat” by the U.S. Fish and Wildlife Service.

7.3.1.1 Wildlife and Habitat

The impacts on terrestrial wildlife and habitats, including important species and wetlands, from preconstruction, construction, and operation of Fermi 3 are described in Section 4.3.1.

Operation of the recently constructed Ventower manufacturing facility on abandoned industrial land in the City of Monroe is not expected to have adverse terrestrial ecological impacts that would substantially add to impacts from building and operating Fermi 3. The proposed Cleveland-Toledo-Detroit passenger rail line would be built primarily within existing ROWs. New rail sidings and improvements to the existing ROW could potentially result in the clearing of vegetation adjoining existing trackbeds. The review team is not aware of specific design information about the project; nevertheless, impacts on ecological resources are expected to be mostly limited to areas within or adjacent to the existing ROW. Impacts from operation of the rail line are expected to be negligible. Consequently, the review team believes that cumulative impacts on terrestrial ecological resources from building and operating the rail line would be minimal and would not substantially add to terrestrial ecological impacts from Fermi 3.

Among the reasonably foreseeable future actions in the geographic area of interest that could adversely affect terrestrial ecological resources, continuing regional urbanization has the greatest potential to contribute to the adverse effects from Fermi 3 on those resources. Absent specific information about the location, extent, and design of future urban development, the review team draws general conclusions about the cumulative impacts on terrestrial ecological resources within the geographic area of interest. Urbanization could result in the conversion of some agricultural land, forest land, wetlands, and other wildlife habitat to urban uses. Urbanization-related activities, which usually involve the filling and/or draining of wetlands, operation of heavy equipment, and generation of noise from construction equipment, could result in many of the same terrestrial ecological impacts – including habitat loss from the clearing and grading of land (temporary and permanent), increased human activity in natural areas, increased traffic (resulting in increased wildlife mortality), and the spread of fugitive dust – as would the proposed action of building Fermi 3. Some of the effects of these activities, such as noise and dust, would be short term and localized in nature. The impacts caused by noise and dust would be temporary if routine best management practices are followed. Other effects, such as replacing wildlife habitat with urban features, would be permanent. The impacts from land clearing and grading, filling wetlands, increased human presence, and increased traffic would likely be permanent.

As temperatures increase under anticipated climate change, a long-term northward shift of plant species now associated with the southeastern United States could occur (USGCRP 2009). This shift could result in changes in the species composition of plant communities in the geographic area of interest. Higher temperatures could cause increased evaporation rates, which, along with the greater likelihood of drought, could reduce the extent of wetlands in the area. Impacts on forests could be mixed and represent a balance in which the benefits of higher levels of carbon dioxide might be offset by more frequent droughts and increases in destructive pests (USGCRP 2009). According to USGCRP (2009), "All major groups of [terrestrial] animals […] will be affected by impacts on local populations, and by competition from other species moving into the Midwest region."

Building Fermi 3 could contribute to the impacts discussed above. However, much of the area affected by building Fermi 3 has already experienced disturbance by past site activities or would be restored after development. Disturbances to terrestrial habitats and wetlands in the proposed transmission corridor would be mostly limited to the loss of forest cover and some limited areas used for grading tower pads and access roads. Forested areas within the corridor would be converted to herbaceous or shrubby vegetation. Building Fermi 3 would permanently fill approximately 8.3 ac of wetland and temporarily affect 23.7 ac of wetland (Detroit Edison 2011b). The temporarily impacted wetlands would be restored. See Section 4.3.1 for additional discussion of wetlands impacts and mitigation.

As discussed in Section 4.3, preconstruction and construction activities would likely displace or destroy wildlife that inhabits affected areas. Other activities included in this cumulative analysis could affect wildlife in similar ways. In the case of some wildlife, including some individual State-listed eastern fox snakes and other Federally and State-listed species, displacement or mortality could occur during land clearing for any of the above projects. Local populations of wildlife would experience habitat loss, fragmentation, and competition for remaining resources. There would be a greater risk of mortality of less mobile animals, such as reptiles, amphibians, and small mammals, as a result of construction activities than there would be for more mobile animals, such as birds, many of which would be displaced to adjacent communities.

Wildlife would also be subjected to impacts from noise and traffic. Noise and traffic would result from other future development activities in the geographic area of interest, as well as from Fermi 3. The impact on wildlife from each noise-generating activity is expected to be temporary and minimal. Although the creation of new utility corridors, including but not limited to the proposed Fermi 3 transmission line corridors, could have negative effects on forest-dwelling birds, amphibians, reptiles, and other wildlife, some species might benefit, including those that inhabit early successional habitat or use forest-edge environments. Birds of prey that are more effective in hunting in open areas would likely exploit newly created hunting grounds.

The effects of the preconstruction and construction activities of Fermi 3 on wildlife would be limited to the Fermi site, transmission line corridors, and nearby areas. Because other reasonably foreseeable future projects would be widely dispersed in the geographic area of interest, the review team concludes that the cumulative impacts would be minimal, with the exception of wetland impacts discussed in Section 7.3.1.2.

As described in Section 5.3.1, potential operational impacts of Fermi 3 would include cooling-tower noise, salt drift from vapor plumes, bird collisions with tall structures, and transmission line operation and corridor maintenance. Even when combined with similar impacts from other past, present, and reasonably foreseeable future projects in the geographic area of interest, most would have only minimal impacts on wildlife and habitat, with the exception of the eastern fox snake impacts, as discussed in Section 7.3.1.2.

Among the past, present, and reasonably foreseeable future actions known to the review team, only future urbanization has the potential to substantially affect terrestrial ecological resources in a way similar to the operation of Fermi 3. Urbanization could lead to increases in noise, traffic, and human presence that could negatively affect some species, including the eastern fox snake, either indirectly by causing the species to avoid activities or directly through roadway mortality. Future urbanization in the region, however, is expected to be minimal. However, these impacts would be minor and dispersed and are not expected to be proximate enough to the Fermi site and transmission line to cumulatively affect terrestrial ecological resources on a substantial basis. The impacts of building or operating Fermi 3 are not expected to affect climate change on either an individual or cumulative basis with past, present, and reasonably foreseeable future projects in the geographic area of interest. However, the impacts on terrestrial habitats and wildlife from climate change could be detectable.

7.3.1.2 Important Species and Habitats

Important Species

Although the eastern fox snake, a State-listed species, may be adversely affected by preconstruction, construction, and/or operation of the Fermi 3 project, the project would not destabilize the regional population. Detroit Edison has prepared and plans to submit to the Michigan Department of Natural Resources (MDNR) a Habitat and Species Conservation Plan for the eastern fox snake. The plan identifies mitigation measures to protect the species and its habitat during preconstruction and construction of Fermi 3. The plan involves awareness training, education, signage, and other measures to reduce the likelihood of vehicular collisions with eastern fox snakes when using new and existing roadways on the Fermi site. Combined impacts from preconstruction and construction activities on the eastern fox snake would not be regionally noticeable because mitigation would be performed in accordance with the Habitat and Species Conservation Plan prior to conducting site preparation, preconstruction, and construction activities. The review team is not aware of other particular development proposals that may be planned and, consequently, cannot speculate on the locations, regulatory controls, and further effects on the eastern fox snake and its habitats beyond the areas covered by the Plan. However, the Plan does not address possible eastern fox snake mortality caused by vehicles during operations. Unless measures are taken to reduce the likelihood of traffic collisions with eastern fox snakes during Fermi 3 operation, the project could substantially reduce local populations.

Small patches of the State-listed American lotus may be disturbed by preconstruction activities in emergent wetlands on the site. Detroit Edison plans to develop mitigation measures in consultation with MDNR before site preparation activities are initiated (Detroit Edison 2011a). Permits from the MDNR and USACE to build in wetlands areas are not likely to be granted without consideration of measures to prevent and mitigate adverse effects on Federal and State-listed species; consequently, future urbanization and other future projects are unlikely to contribute substantially to cumulative impacts on American lotus populations in southeast Michigan.

Important Habitats

Although much of the coastal wetland areas once present on the western shore of Lake Erie, where the Fermi site is located, have already been drained or filled by agricultural, industrial, or urban development, the Fermi project would impact only a small portion of the remaining wetlands, and State and Federal wetland protection regulations are expected to prevent extensive future losses of coastal (and other) wetlands as a result of future urbanization. The wetland impacts described in Section 4.3.1 would be mitigated by restoration of temporarily disturbed wetlands, restoration and enhancement of approximately 82 ac of wetlands in the coastal zone of western Lake Erie, and restoration of approximately 21 ac of wetlands located onsite (Detroit Edison 2011b). The review team assumes that it is unlikely that the USACE and MDEQ would issue permits allowing extensive disturbance of coastal wetlands along western Lake Erie.

The transmission corridor, once exiting the Fermi site, would not traverse coastal wetlands but would cross several areas of noncoastal (inland) wetlands. The review team assumes that the 93.4 ac of "woody wetlands" identified in Table 2-6 for the proposed corridor would be cleared of trees and converted to an herbaceous or shrub condition. State and Federal wetland regulations protect inland as well as coastal wetlands, although future urban development in the area can be expected to result in some limited losses of inland wetlands from permitted and exempted activities.

The EPA's recent Great Lakes Restoration Initiative program funds a variety of restoration projects. The program's action plan covers fiscal years 2010 through 2014 and addresses five urgent focus areas, including combating invasive species and restoring wetlands and other habitats. Several projects are currently funded and under way in the geographic area of concern (EPA 2011 a), including one on the Fermi site within the DRIWR. The wetland creation and enhancement activities proposed as mitigation by Detroit Edison would complement and expand upon the benefits to the region from the EPA wetland restoration projects.

Overall, the cumulative impacts of Fermi 3 and other past, present, and reasonably foreseeable future activities in the geographic area of interest on wetlands, although they would be noticeable, are not expected to be extensive.

7.3.1.3 Summary of Terrestrial and Wetland Impacts

The analysis of the cumulative impacts on terrestrial ecology is based on information provided by Detroit Edison and the review team's independent evaluation. The review team concludes that the cumulative impacts of other past, present, and reasonably foreseeable future projects and the preconstruction, construction, and operation of Fermi 3 on terrestrial ecological resources would be MODERATE. This conclusion primarily reflects the fact that the Habitat and Species Conservation Plan does not yet include measures to protect the eastern fox snake from vehicle mortality during operations. It also reflects the possible effects of climate change. The incremental contribution of building and operating the Fermi 3 project would be significant. The significance is attributable primarily to possible eastern fox snake mortality during operations. The incremental contribution of NRC-authorized elements of the Fermi 3 project, which exclude preconstruction activities such as site preparation and building transmission lines, but which include operations, would also be significant, and would therefore be MODERATE. Again, the significance is attributable primarily to possible eastern fox snake mortality during operations.

7.3.2 Aquatic Resources

The description of the affected environment in Section 2.4.2 of this EIS provides the baseline for the cumulative impacts assessment for aquatic ecological resources. As described in Section 4.3.2, the impacts from NRC-authorized construction on aquatic ecological resources would be SMALL, provided that Detroit Edison implements the mitigation measures described in Section 4.3.2.5. The combined impacts from preconstruction and construction activities on aquatic resources of the Fermi site and transmission line corridor were described in Section 4.3.2 and were also determined to be SMALL for all aquatic species and habitats, provided that the potential mitigation measures identified in Section 4.3.2.5 are implemented.

As described in Section 5.3.2, the review team concluded that the impacts of operation of Fermi 3 and the transmission line on aquatic ecological resources would also be SMALL, provided that the mitigation measures described in Section 5.3.2.5 are implemented.

In addition to the impacts from preconstruction, construction, and operation of Fermi 3, the cumulative analysis considers other past, present, and reasonably foreseeable future actions that could affect aquatic resources within the watersheds that could be affected by construction and development of Fermi 3. The geographic area of interest for the cumulative impact analysis for aquatic resources includes primarily the lower Swan Creek watershed and the western basin of Lake Erie. This geographic area encompasses ecologically relevant aquatic habitat features and the associated populations of aquatic species that could be affected by construction and operation of the proposed Fermi 3.

Impacts on aquatic resources can result from changes in habitat availability or quality, degradation of water quality, and increased mortality of organisms. Impacts can include changes in populations or composition of communities. Activities and environmental changes that may contribute to cumulative impacts on aquatic resources within the geographic area of interest include building and operating the proposed Fermi 3, operation of other power plants (including the existing Fermi 2), discharge of treated wastewater, surface water runoff, increased urban development, agricultural activities, commercial and recreational fisheries, introduced invasive species, and global climate change. Human activities have resulted in considerable changes in the Lake Erie aquatic ecosystem during the past century (see Section 2.4.2.1 of the EIS). These changes have resulted from many causes, including overfishing, introduction and expansion of invasive exotic species, nutrient enrichment, dredging, degradation of tributary conditions and other habitat features, and introduction of contaminants.

Impacts related to building the proposed Fermi 3, associated facilities, and transmission lines on aquatic habitat and biota could result from altered hydrology, erosion, stormwater runoff of soil and contaminants, and direct disturbance or loss of aquatic habitats. In addition to having a minor potential impact on recreationally or commercially important fish species that could occur in the vicinity of the Fermi site, building Fermi 3 could also affect some Federally or State-listed aquatic species in the western basin of Lake Erie or in the lower Swan Creek watershed, including northern riffleshell (*Epioblasma torulosa rangiana*), pugnose minnow (*Opsopoeodus emeiliae*), rayed bean (*Villosa fabalis*), salamander mussel (*Simpsonaias ambigua*), sauger (*Sander canadensis*), silver chub (*Macrhybopsis storeriana*), and snuffbox (*Epioblasma triquetra*) (Section 4.3.2.3). However, the likelihood that building activities could affect these species is low and, if mitigation identified in Section 4.3.2.5 is implemented, the impacts of Fermi 3 preconstruction and construction activities, including development of associated transmission lines, would be SMALL. These effects should not measurably increase cumulative impacts on those species within the geographic area of interest. Other construction projects that occur along the shores of Lake Erie's western basin or within watersheds that drain into the western basin would contribute in similar ways to the impacts on aquatic habitats and biota within the geographic area of interest, although the overall cumulative level of impact is difficult to quantify.

The Lake Erie aquatic ecosystem is also affected by urbanization, industrialization, and agriculture. The Lake Erie basin has a greater population than do the other Great Lakes and surpasses them in the amounts of effluent received from sewage treatment plants and of sediment loading (LaMP Work Group 2008). Development of Fermi 3 and other projects in the region, such as the proposed projects identified in Table 7-1, could result in increased population and additional urbanization, with subsequent impacts on aquatic resources within the western basin of Lake Erie or in the lower Swan Creek watershed. Increased urbanization within the region could affect aquatic resources by increasing the amount of impervious surface, non-point source pollution, and water use and by altering riparian and in-stream habitat and existing hydrology patterns. Agricultural development within the basin introduces large amounts of sediment to Lake Erie (LaMP Work Group 2008).

As identified in Table 7-1, there are currently five operational power plants within the geographic area of interest, including Fermi 2 (located on the Fermi site), the Detroit Edison Monroe Power Plant (6 mi southwest of the Fermi site), the J.R. Whiting Power Plant (14 mi south-southwest of the Fermi site), the Bayshore Power Plant (20 mi south-southwest of the Fermi site), and the Davis-Besse Nuclear Power Station Unit 1 (Davis-Besse) (27 mi southeast of the Fermi site). All of these power plants withdraw cooling water from and discharge heated effluent into the western basin of Lake Erie. Fermi 2 and Davis-Besse use closed cycle cooling; the Whiting, Bayshore, and Monroe power plants employ once-through cooling.

As described for Fermi 3 in Section 5.3.2, withdrawing cooling water has a potential to affect aquatic organisms through impingement and entrainment. If the organisms being entrained or impinged at different power plants are members of the same populations, the impacts on those populations would be cumulative. Because the water intakes for Fermi 2 and Fermi 3 would be located in close proximity within the intake bay, it is estimated that the combined operation of the Fermi 2 and Fermi 3 facilities would effectively double the water intake and would likely increase entrainment and impingement rates of aquatic organisms in the immediate vicinity of the intake bay as compared to the operation of Fermi 2 alone (Detroit Edison 2011a). The mean daily entrainment of the larvae of four species of fish that are common in Lake Erie's western basin – gizzard shad (*Dorsoma cepedianum*), white bass (*Morone chrysops*), walleye (*Sander vitreus*), and freshwater drum (*Aplodinotus grunniens*) – at four power plants (i.e., the once-through Bayshore, Monroe, Acme [no longer operational], and Whiting) averaged over three seasons of production (1975–1977) ranged from nearly zero to approximately 8 percent of the larvae present within nearshore areas (Patterson 1987) and is considered to be detectable. The study suggested that the numbers of larvae surviving to reach older life stages for these species would increase substantially if the effects of power plant entrainment were removed (Patterson and Smith 1982; Patterson 1987). Cooling water intake rates for each of the four facilities (Patterson and Smith 1982; Patterson 1987) were estimated to be 4 to 15 times higher than the cooling water intake rates for the Fermi 2 facility and for the proposed Fermi 3 facility (Detroit Edison 2011a). The larval fish entrainment rates for these facilities are expected to be higher than for Fermi 3. Therefore, even though the estimated impingement and entrainment rates for Fermi 3 would be considerably lower than that reported for most of the other power stations within the western basin (Detroit Edison 2011a, Section 5.3.1.2.3.2) and individually would represent a minor incremental impact to aquatic resources (as described in Section 5.3.2 of this EIS), the cumulative impacts of impingement and entrainment from all power stations on fish populations within the western basin could have a significant impact on some aquatic species.

In addition to mortality of fish from impingement and entrainment at power plants, millions of pounds of fish are harvested annually from the western basin through recreational and commercial fishing activities (see Section 2.4.2.3), thereby contributing to cumulative mortality impacts on fish populations. The status of fish populations in the western basin are monitored by the MDNR, the Ohio Department of Natural Resources, and the Ontario Ministry of Natural Resources, and regulations and annual harvest limits for important target species are periodically adjusted by those agencies to prevent overfishing and to maintain suitable population levels. The Great Lakes Fisheries Commission, which coordinates fisheries research and facilitates cooperative fishery management among the State, Provincial, Tribal, and Federal agencies that manage fishery resources within the Great Lakes, has established a Lake Erie Committee that considers issues pertinent to Lake Erie. Therefore, the management and control of cumulative impacts on populations of harvested fish species are partially addressed through the actions of these agencies.

As described in Section 5.3.2, discharge of heated cooling water from other power plants also has the potential to affect survival and growth of organisms by altering ambient water temperatures. In most cases, thermal plumes from power plants discharging into Lake Erie would be expected to affect relatively small areas, and the plumes from Fermi 3 and the existing power plants in the western basin are not expected to overlap. Although many of the aquatic species that could be affected by the thermal plumes from different power plants are likely to belong to the same populations, the numbers of individuals that could be affected by cold shock or heat stress are expected to be small relative to the overall numbers of individuals within populations. As a consequence, the cumulative effect of thermal discharges from existing power plants and the proposed Fermi 3 on aquatic resources within the western basin of Lake Erie would be minor, and the incremental contribution of Fermi 3 would be insignificant.

Cumulative impacts on water quality associated with other projects and activities (e.g., agriculture, stormwater runoff, sewage and wastewater treatment facilities) in the western basin of Lake Erie and the lower Swan Creek watershed are significant, although the incremental contribution of Fermi 3 operations to the cumulative impact would be minor (see Section 7.2.3).

Dredging occurs in many locations within the western basin of Lake Erie and has the potential to affect aquatic biota and habitats through disturbance of benthic habitats, increased turbidity, the suspension and deposition of sediment, introduction of contaminants, and other changes in water quality. The potential for dredging to affect aquatic habitats and biota depends upon the uniqueness and sensitivity of the habitat that would be disturbed by dredging or by disposal of dredged sediments, the types of organisms present in the areas that would be affected, and the size of the area. In some cases, open-water disposal of dredged sediments occurs within the western basin. For example, portions of the sediment dredged periodically from the Toledo Harbor Federal navigation channels are disposed of within an authorized open-lake placement area of two square miles located in the western basin. Although some small areas of the Fermi site would be affected by dredging in order to build and operate Fermi 3, the dredged materials would be disposed of in onsite disposal areas, not in the open waters of Lake Erie. Although cumulative impacts of all dredging activities within the western basin of Lake Erie could have small to moderate impacts on aquatic resources, the effects of dredging for Fermi 3 on aquatic habitats and biota would be minor (see Sections 4.3.2 and 5.3.2).

The presence of invasive non-native species is one of the major stressors affecting the Lake Erie ecosystem (LaMP Work Group 2008). These species may prey on native species or compete with them for limited resources, thereby altering the structure of aquatic ecosystems. For example, invasions by quagga (*Dreissena rostriformis bugensis*) and zebra mussels (*Dreissena polymorpha*) have affected ecosystem conditions in Lake Erie by altering nutrient conditions and competing with other species that feed on phytoplankton and zooplankton. Increases in these species have been implicated in the declines of native freshwater mussels (see Section 2.4.2).

The presence of non-native invasive species is the result of intentional or unintentional introductions or range expansion and colonization. Invasive nuisance organisms that have been found or are presumed to occur in Lake Erie in the vicinity of the Fermi site include lyngbya (*Lyngbya wollei*), the fishhook water flea (*Cercopagis pengoi*), the spiny water flea (*Bythotrephes longimanus*), quagga and zebra mussels, the sea lamprey (*Petromyzon marinus*), and the round goby (*Neogobius melanostomus*) (see Section 2.4.2.3 of this EIS). Some of the above species have the potential to adversely affect the aquatic environment. For example, lyngbya can form dense algal mats on the lake bottom that could significantly affect native or introduced benthic organisms. These species are not considered abundant in the vicinity of the Fermi site. Although the cumulative impacts of invasive non-native species on the Lake Erie ecosystem are considered significant, building and operating Fermi 3 are not expected to measurably promote expansion of populations of invasive species (see Sections 4.3.2 and 5.3.2), and the incremental contribution of Fermi 3 to cumulative impacts from invasive species would be minor.

The EPA's Great Lakes National Program Office has initiated the Great Lakes Restoration Initiative to address environmental issues in five topical areas: cleaning up toxic materials and areas of concern, combating invasive species, promoting nearshore health by protecting watersheds from polluted runoff, restoring wetlands and other habitats, and tracking progress and working with strategic partners. It is expected that this long-term initiative would address some water quality and non-native species concerns that contribute to cumulative impacts of aquatic resources in the area of interest.

The review team is also aware that potential climate changes together with reactor operations could affect water quality and aquatic ecosystems. As identified in Section 7.2.3 of this EIS, a study by U.S. Global Change Research Program (USGCRP) projected that during the operating license period for Fermi 3 (estimated to be 2020 to 2060), changes in the region's climate would include a 3–4°F increase in the average temperature, slightly increased precipitation in the winter and spring, more intense rainstorms throughout the year, and a drop of 1–1.5 ft in the average water levels in Lake Erie (USGCRP 2009). These changes could lead to increased erosion and sediment loading in tributaries and in Lake Erie.

It is expected that as temperatures increase and water quality changes as a result of climate change, a long-term shift could occur in the aquatic species assemblages present within the region (USGCRP 2009). With increases in evaporation rates and longer periods between rainfalls, the likelihood of drought will increase, and water levels in rivers, streams, and wetlands are likely to decline (USGCRP 2009), thereby reducing the availability of some aquatic habitats. It is also predicted that reduced summer water levels are likely to reduce the recharge of groundwater, causing small streams to dry up and potentially reducing the habitat needed by native aquatic biota, such as freshwater mussels and fish. The size of coastal wetland areas that are important for specific life stages of many aquatic organisms within the region could also be affected. With increased water temperatures, populations of coldwater fish such as trout would be expected to decline, while populations of coolwater fish such as muskellunge (*Esox masquinongy*) and warmwater species such as smallmouth bass (*Micropterus dolomieu*) and bluegill (*Lepomis macrochirus*) would become more dominant (USGCRP 2009). Such changes in aquatic species assemblages are likely to be further affected by invasions of non-native species that could thrive under warmer conditions. USGCRP (2009) also predicts that in some lakes, increased water temperatures could lead to an earlier and longer period in summer during which mixing of the relatively warm surface lake water with the colder water below is reduced, potentially increasing the risk of developing oxygen-poor zones that could result in increased mortality of fish and other aquatic organisms. In lakes with contaminated sediment, mercury and other persistent pollutants could become more mobilized with increased temperatures, potentially increasing the quantities of contaminants entering the aquatic food chain (USGCRP 2009).

The assessment of cumulative impacts on aquatic resources is based on information provided by Detroit Edison and the review team's independent review. The building and operation of Fermi 3 would affect a small amount of aquatic habitat within the western basin of Lake Erie, including habitat used by species or taxa described in Section 2.4.2. With projected climate change, the cumulative effects of past, present, and reasonably foreseeable future actions on aquatic resources may be detectable and noticeably altered. However, it is anticipated that the incremental contributions from building and operating Fermi 3 to effects on aquatic resources – including recreational and commercially important species and Federally and State-listed species – would be minor. Therefore, the review team concludes that, with projected climate change and past, present, and reasonably foreseeable future actions in the lower Swan Creek watershed and the western basin of Lake Erie, cumulative impacts on aquatic resources would be MODERATE. The incremental contribution of impacts on aquatic resources from building and operating Fermi 3 would not contribute significantly to the overall cumulative impact to the geographical area of interest. Therefore, the incremental impacts from NRC-authorized activities would be SMALL, and no further mitigation would be warranted.

7.4 Socioeconomics and Environmental Justice

The evaluation of cumulative impacts on socioeconomics and environmental justice is presented in this section.

7.4.1 Socioeconomics

The description of the affected environment in Section 2.5 serves as the baseline for the cumulative impact assessment in this resource area. As described in Section 4.4, adverse impacts of the NRC-authorized construction activities on socioeconomics would be SMALL, with the following exceptions. The combined impacts of preconstruction and construction activities on demographics would be SMALL but beneficial. NRC-authorized construction would result in MODERATE adverse impacts on traffic, primarily during the peak construction period. NRC-authorized construction activities also would result in MODERATE beneficial economic and

LARGE beneficial tax revenue impacts in Monroe County and the local jurisdictions within Monroe County. They would result in SMALL beneficial economic and tax revenue impacts elsewhere in the region.

As described in Section 5.4, the adverse impacts of operations on socioeconomics would be SMALL, with the following exceptions. The impact on demographics would be SMALL but beneficial. Impacts on traffic would be SMALL during normal operations and MODERATE during outages. Beneficial impacts on the economy and tax revenues would occur as a result of increases in employment, wages, and tax revenues; these would be LARGE in the local jurisdictions within Monroe County and SMALL elsewhere in the region.

The combined impacts of construction and preconstruction activities were described in Section 4.4 and were determined to be the same as those described above for NRC-authorized construction. In addition to the impacts from construction, preconstruction, and operations, the cumulative analysis also considers other past, present, and reasonably foreseeable future projects that could impact socioeconomics. For this analysis, the geographic area of interest is considered to be Monroe and Wayne counties in Michigan and Lucas County in Ohio because these counties are the primary areas (1) where Fermi 3 workers would live; (2) where the economy, tax base, and infrastructure would most likely be affected; and, therefore, (3) where the socioeconomic impacts would occur.

The Fermi plant site, which is located in Monroe County, is approximately 8 mi northeast of the City of Monroe, Michigan. Wayne County is located to the north of Monroe County, and Lucas County is to the south. The region around the Fermi plant site is strongly influenced by the cities of Detroit (Wayne County) and Toledo (Lucas County) and their historic manufacturing base. Through most of the twentieth century, Detroit has been the automotive capital of the country. Manufacturers in Monroe and Lucas County have included various suppliers for three large automobile manufacturers: Ford, General Motors, and Chrysler. People migrated to southeast Michigan for the manufacturing jobs, and by 1950, Detroit was the fourth-largest city in the country. Much of the infrastructure around southeast Michigan was built to support the large population and industrial base of the area, including the transportation routes, housing, schools, and other public services. Since its population peak in the 1970 census, Wayne County has declined in population by nearly 1 million people, and Lucas County has declined in population by nearly 40,000 people. Much of this population loss occurred in urban areas, as the population either migrated to suburban communities or left the region as the manufacturing base declined.

However, although the rate of growth has declined, the population of Monroe County has continued to grow, with only a slight decline in population (of less than 1 percent) occurring between 1980 and 1990. In addition to manufacturing, the economy of Monroe County has had a strong agricultural base, and population growth has resulted in the loss of much of the county’s agricultural land. Detroit Edison is the largest employer in Monroe County, with a workforce of approximately 1500 workers at the Fermi plant site and the coal-fired Monroe County Power Plant. During outages, an additional 1200–1500 outage workers are also employed at the Fermi plant site for a period of 30 days every 18 months. Between 2009 and 2010, Detroit Edison had a construction workforce at the Monroe County Power Plant to conduct capital improvements of the air emission control equipment (Detroit Edison 2011a). Future projects involving installation of air pollution control equipment will require a workforce ranging between 100 and 550 workers. Detroit Edison expects that the work at the Monroe County Power Plant will be completed by 2014, and therefore it will be a part of the historic cumulative impacts associated with Fermi 3 but will not be a concurrent activity (Detroit Edison 2011c). The impact analyses in Chapters 4 and 5 are cumulative by nature. Past and current economic impacts associated with activities listed in Table 7-1, such as the ongoing refurbishment (e.g., installation of air pollution control equipment) at the Monroe Power Plant, have already been considered as part of the socioeconomic baseline presented in Section 2.5 or in the analyses for Sections 4.4 and 5.4. In addition, the economic impacts of existing enterprises, such as the loss of manufacturing and construction jobs and growth of health care jobs in the region, are part of the baseline used for establishing the Regional Input-Output Multiplier System (RIMS) II multipliers. Regional planning efforts and associated demographic projections formed the basis for the review team’s assessment of reasonably foreseeable future impacts. State and county plans, along with modeled demographic projections such as those used in Sections 2.5, 4.4, and 5.4, include forecasts of future development (such as the proposed Cleveland-Toledo-Detroit Passenger Rail Line) and population increases. The cumulative impacts associated with the preconstruction, construction, and operation of Fermi 3 are thus evaluated in Chapters 4 and 5. The review team did not identify any other cumulative impacts associated with building and operating Fermi 3 beyond those already evaluated in Chapters 4 and 5.

On the basis of the above considerations, Detroit Edison’s ER, and the review team's independent evaluation, the review team concludes that under some circumstances, the building of Fermi 3 could make a short-term, noticeable, and adverse contribution to the cumulative effects associated with some socioeconomic issues. Those impacts would include physical impacts (on workers and the local public, buildings, traffic, and aesthetics), and local infrastructures and community services (transportation; recreation; housing; water and wastewater facilities; police, fire, and medical services; and schools), and they would be dependent on the particular jurisdictions affected. For example, an increase in population in Wayne County would be considered a beneficial impact, since the income and expenditures from in-migrating workers would contribute to the tax base that supports a large infrastructure. The cumulative effects on regional economies and tax revenues would be beneficial and SMALL with the exception of Monroe County, where there would be a LARGE beneficial cumulative effect on taxes and a MODERATE adverse cumulative effect on local roadways near the Fermi site.

The incremental impact from NRC-authorized activities would be LARGE and beneficial on taxes and the economy in Monroe County and MODERATE and adverse on local roadways near the Fermi site. The review team concludes that the incremental cumulative impacts from NRC-authorized activities on all other socioeconomic impact categories would be SMALL.

7.4.2 Environmental Justice

The description of the affected environment in Section 2.6 serves as a baseline for the cumulative impacts assessment in this resource area. As described in Section 4.5, the NRC staff concludes that NRC-authorized construction activities would not result in disproportionately high and adverse impacts on minority or low-income populations; therefore, the environmental justice impacts would be SMALL. As described in Section 5.5, the review team concludes that operations activities would not cause disproportionately high and adverse impacts on minorities and low-income populations. Therefore, those impacts would be SMALL, and no further mitigation would be warranted.

The combined impacts from preconstruction and construction were described in Section 4.5 and determined to be SMALL.

In addition to the impacts from preconstruction, construction, and operation, the cumulative impacts analysis also considers other past, present, and reasonably foreseeable future projects that could cause disproportionately high and adverse impacts on minority and low-income populations. For this cumulative impacts analysis, the geographic area of interest is considered to be the 50-mi region described in Section 2.5.1.

There is a potential for minority and low-income populations to experience disproportionately high and adverse impacts from the activities of other past, present, and reasonably foreseeable future projects. However, the impact analyses in Chapters 4 and 5 are cumulative by nature. Environmental justice impacts associated with past and current activities listed in Table 7-1 have already been considered as part of the environmental justice baseline presented in Sections 2.6. Census block groups classified as minority or low-income lie to the north and south of the Fermi site, in Wayne and Lucas counties within and near Detroit and Toledo. One census block group in Monroe County qualifies as both minority and low-income; it is located approximately 8 mi from the Fermi site. The review team did not identify environmental pathways that could result in disproportionately high and adverse human health, environmental, physical, or socioeconomic effects beyond those identified in Sections 4.5 and 5.5 on minority or low-income populations in the 50-mi region.

On the basis of the above considerations, information provided by Detroit Edison, and the review team’s independent evaluation, the review team concludes that there would be no disproportionately high and adverse cumulative impacts on minority and low-income populations beyond those described in Chapters 4 and 5; therefore, the environmental justice impacts would be SMALL. The environmental justice impacts from NRC-authorized activities would be SMALL, and no further mitigation would be warranted.

7.5 Historic and Cultural Resources

The description of the affected environment in Section 2.7 serves as a baseline for this cumulative impacts assessment in this resource area. As described in Section 4.6, the staff concluded that the impacts on cultural resources from NRC-authorized construction would be MODERATE. As described in Section 5.6, the review team concluded that the impacts on cultural resources from operations would be SMALL. See Section 4.6 for a discussion of Detroit Edison's plan to develop the procedures or guidance necessary to address the steps that Detroit Edison and its contractors will follow for unanticipated discoveries. The review team does not expect that there would be unanticipated discoveries during operation of the plant because it is unlikely that activities would involve previously undisturbed areas.

The combined impacts from preconstruction and construction activities were described in Section 4.6 and determined to be MODERATE. If preconstruction activities associated with the offsite transmission lines resulted in significant alterations to the cultural environment, then the additional impacts could be realized. In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis also considers past, present, and reasonably foreseeable future projects that could affect historic and cultural resources. For this cumulative analysis, the geographic area of interest is considered to be the area of potential effects (APEs) defined in Section 2.7. The APEs were developed in consultation with the Michigan State Historic Preservation Office (SHPO).

Projects identified in Table 7-1 that may impact historic and cultural resources include the decommissioning and demolition of Fermi 1, construction and operation of the proposed Independent Spent Fuel Storage Installation (ISFSI) at the Fermi site, construction of a wind turbine tower manufacturing facility, construction of the Cleveland-Toledo-Detroit Passenger Rail Line (including a proposed Monroe station), operation of Fermi 2, operation of the Detroit Edison Monroe Power Plant, and future urbanization. Four of these projects – decommissioning and demolition of Fermi 1, construction and operation of the proposed ISFSI at the Fermi site, continued operation of Fermi 2, and future urbanization – are or might be within the geographic area of interest as defined above. As part of its independent evaluation, the review team reviewed the cultural and historic information available at the SHPO. The activities at Fermi 1 are the only ones in the geographic area of interest to have undergone National Historic Preservation Act Section 106 review. The review team concludes that the decommissioning of Fermi 1 has no adverse effects on historic properties (Conway 2011b). Demolition of Fermi 1 will have an adverse effect on historic properties (Conway 2011a). The NRC is consulting with the Michigan SHPO and Detroit Edison to develop measures to mitigate adverse effects, which would be included in a Memorandum of Agreement. Building and operating one additional unit at the Fermi site, in addition to the other projects identified above that could affect historic and cultural resources, would likely contribute to cumulative cultural resource impacts within the geographic area of interest for historic and cultural resources.

As described in Sections 4.6 and 5.6, the review team concludes that the incremental impacts from installation of offsite transmission lines would be minimal provided that there are no significant alterations (either physical alterations or visual intrusions) to the cultural environment. If these activities were to result in significant alterations to the cultural environment, then the additional impacts could be realized. Construction and operation of the offsite transmission lines would be the responsibility of ITC*Transmission* in consultation with the appropriate Federal and State regulatory authorities.

Historic and cultural resources are nonrenewable; therefore, the impacts on historic and cultural resources within the APEs are cumulative. Section 4.6 described how building activities for Fermi 3 would result in the demolition of one onsite property (Fermi 1) that is eligible for listing in the *National Register of Historic Places* (NRHP) and located within the associated APEs. On the basis of its evaluation, the review team concludes that the cumulative impacts on historic and cultural resources from preconstruction, construction, and operation of Fermi 3 and from other projects listed in Table 7-1 that are in the geographic area of interest would be MODERATE. If activities related to offsite transmission lines and/or urbanization within the APEs resulted in alterations to the cultural environment, then additional impacts could be realized. The review team further concludes that the incremental impacts associated with the onsite NRC-authorized activities would be MODERATE, because of the demolition of Fermi 1, and no mitigation measures would be warranted beyond those discussed in Sections 4.6 and 5.6.

7.6 Air Quality

The description of the affected environment in Section 2.9 serves as the baseline for the cumulative impact assessments for air quality. As described in Section 4.7, the NRC staff concludes that the impacts of NRC-authorized construction activities on air quality, including contribution to greenhouse gas (GHG) emissions, would be SMALL, although some mitigation may be warranted, depending on the outcome of conformity applicability analyses being performed by the NRC and USACE pursuant to the Clean Air Act Section 176 (42 USC section 7506) and 40 CFR Part 93, Subpart B (NRC 2011a). As described in Section 5.7, the review team concludes that the impacts of operations on air quality, including contribution to GHG emissions, would be SMALL, and no further mitigation would be warranted.

7.6.1 Criteria Pollutants

As was discussed in Section 2.9, the Fermi 3 site is located in an area that has been designated as being in nonattainment for the $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) and in maintenance for the 8-hour ozone NAAQS (EPA 2010a). In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011a). This request is based, in part, on air quality monitoring data collected in the 2007–2010 period showing all seven counties in southeast Michigan in attainment for the $PM_{2.5}$ NAAQS. The area around the Fermi 3 site is designated as in attainment for all other criteria pollutants.

Section 4.7 of this EIS examined air quality impacts associated with preconstruction and construction. Emissions associated with these activities would be predominately the fugitive dust from ground-disturbing activities and engine exhaust from heavy equipment and vehicles. Emissions from preconstruction and construction are expected to be temporary and limited in magnitude. Consequently, potential impacts on ambient air quality would be SMALL. Notwithstanding these minor impacts to air quality, the NRC and USACE will perform Clean Air Act Section 176 air conformity applicability analyses pursuant to 40 CFR Part 93, Subpart B, to determine whether additional mitigation may be warranted. Section 5.7 addressed air quality impacts from operations. Air emissions from operations would be primarily particulate emissions from cooling towers and criteria pollutants from worker vehicles and stationary combustion sources such as diesel generators and an auxiliary boiler. These stationary sources would be permitted and operated in accordance with State and Federal regulatory requirements, and their operation would be infrequent and mostly for maintenance testing. Therefore, potential impacts from operations would be SMALL.

In addition to the impacts from building and operations, the cumulative impact analysis considers past, present, and reasonably foreseeable future actions that could impact air quality (Table 7-1). For this cumulative impact analysis of air quality, Detroit Edison considered Monroe County as the geographic area of interest. This geographic area of interest includes the primary communities that would be affected by the proposed Fermi 3.

No major nonresidential development projects are in progress or anticipated near the Fermi site, although industrial development may increase in the near future. However, the Monroe County Comprehensive Plan update will have a focus on farmland preservation and conservation. This focus should keep development projects from being built close to the Fermi site, as a large portion of the undeveloped land near the Fermi site is used for agriculture (Detroit Edison 2011a).

In 2002, total annual emissions from stationary sources in Monroe County were 6850 tons/yr of PM_{10}, 4749 tons/yr of $PM_{2.5}$, 2761 tons/yr of volatile organic compounds (VOCs), 112,333 tons/yr of SO_2, and 47,879 tons/yr of NO_x (EPA 2010b). Two coal-fired power plants

(Detroit Edison's Monroe Power Plant and J.R. Whiting Power Plant) and Holcim Cement together accounted for most emissions of criteria pollutants and VOCs in Monroe County. In 2002, emissions from Fermi 2 operations were an insignificant portion (less than 0.1 percent on a pollutant-by-pollutant basis) of stationary source emissions in Monroe County.

On the basis of the estimates in Sections 4.7 and 5.7, emissions from construction and operation of Fermi 3 will be about 1.9 percent and 0.3 percent on a pollutant-by-pollutant basis, respectively, of the total 2002 stationary source emissions in Monroe County. These emissions will be insignificant compared to total emissions from the six neighboring counties within the $PM_{2.5}$ nonattainment area and the 8-hour ozone maintenance area. Apart from Fermi 3, the only known major construction project planned in Monroe County is the installation of pollution control equipment at the Monroe Power Plant. The Monroe Power Plant project is expected to be complete prior to initiation of major construction activities for Fermi 3 and could improve air quality in the region (Detroit Edison 2011c). Most projects listed in Table 7-1 would not increase air emissions above their current levels. Any new industrial projects would either have *de minimis* impacts or would be subject to regulation by the MDEQ. Fermi 3 is located in an area designated as being in nonattainment for $PM_{2.5}$, although the MDEQ believes it is in compliance with the current $PM_{2.5}$ standards. Given the anticipated lack of growth and new sources of air emissions in the vicinity of Fermi 3 and the minimal contribution of emissions from preconstruction, construction, and operation, the cumulative air impacts from construction and operation of the proposed Fermi 3 would be SMALL; thus, it is unlikely that ambient air quality in the region would be degraded significantly.

7.6.2 Greenhouse Gas Emissions

As discussed in the state of the science report issued by the USGCRP (2009), it is the

> "production and use of energy that is the primary cause of global warming, and in turn, climate change will eventually affect our production and use of energy. The vast majority of U.S. greenhouse gas emissions, about 87 percent, come from energy production and use."

Approximately one-third of GHG emissions are the result of generating electricity and heat (USGCRP 2009). GHG emissions associated with building, operating, and decommissioning a nuclear power plant are addressed in Sections 4.7, 5.7, 6.1.3, and 6.3. The review team concluded that the atmospheric impacts of the emissions associated with each aspect of building, operating, and decommissioning a single nuclear power plant would be minimal. The review team also concluded that the impacts of the combined emissions for the full plant life cycle would be minimal.

It is difficult to evaluate cumulative impacts of a single source or combination of GHG emission sources because:

1. The impact is global rather than local or regional.
2. The impact is not particularly sensitive to the location of the release point.
3. The magnitude of individual GHG sources related to human activity, no matter how large compared to other sources, are small when compared to the total mass of GHGs in the atmosphere.
4. The total number and variety of GHG emission sources are extremely large and are ubiquitous.

These points are illustrated by the comparison of annual carbon dioxide emission rates in Table 7-2.

Table 7-2. Comparison of Annual Carbon Dioxide Emission Rates

Source	**Metric Tons per Year**
Global emissions	30,000,000,000[a]
United States	5,500,000,000[a]
1000-MW nuclear power plant (including fuel cycle, 90 percent capacity factor)	500,000[b]
1000-MW nuclear power plant (operations only)	5000[b]
Average U.S. passenger vehicle	5[c]

(a) Source: EPA 2011b.
(b) Source: Appendix L of this EIS.
(c) Source: EPA 2005.

Evaluation of cumulative impacts of GHG emissions requires the use of a global climate model. The USGCRP report referenced above provides a synthesis of the results of numerous climate modeling studies. The review team concludes that the cumulative impacts of GHG emissions around the world as presented in the report are an appropriate basis for its evaluation of cumulative impacts. On the basis of the impacts set forth in the USGCRP report and on the CO_2 emissions criteria in the final EPA CO_2 Tailoring Rule (75 FR 31514), the review team concludes that the national and worldwide cumulative impacts of GHG emissions are noticeable but not destabilizing. The review team further concludes that the cumulative impacts would be noticeable but not destabilizing, with or without the GHG emissions of the proposed project.

Consequently, the review team recognizes that GHG emissions, including carbon dioxide, from individual stationary sources and, cumulatively, from multiple sources can contribute to climate change and that the carbon footprint is a relevant factor in evaluating energy alternatives. Section 9.2.5 contains a comparison of the carbon footprints of the viable energy alternatives.

7.6.3 Summary of Cumulative Air Quality Impacts

Cumulative impacts to air quality are estimated based on the information provided by Detroit Edison and the review team's independent evaluation. Other past, present, and reasonably foreseeable future activities exist in the geographic areas of interest (local and regional for criteria pollutants and global for GHG emissions) that could affect air quality resources. The cumulative impacts on the emissions of criteria pollutants from Fermi 3 and other projects would be minimal. The national and worldwide cumulative impacts of GHG emissions are noticeable but not destabilizing. The review team concludes that the cumulative impacts would be noticeable but not destabilizing with or without the GHG emissions from Fermi 3. The review team concludes that cumulative impacts from other past, present, and reasonably foreseeable future actions on air quality resources in the geographic areas of interest would be SMALL for criteria pollutants and MODERATE for GHGs. The incremental contribution of impacts on air quality resources from building and operating activities proposed for the Fermi 3 would be SMALL. The incremental contribution of impacts on air quality resources from the NRC-authorized activities would also be SMALL.

7.7 Nonradiological Health

The description of the affected environment in Section 2.10 serves as a baseline for the cumulative analysis for nonradiological health. As described in Section 4.8, the impacts from NRC-authorized construction on nonradiological health would be SMALL, and no further mitigation would be warranted. As described in Section 5.8, the review team concludes that the impacts of operations on nonradiological health would also be SMALL, and no further mitigation would be warranted.

As described in Section 4.8, the combined nonradiological health impacts from construction and preconstruction activities would be SMALL, and no further mitigation would be warranted beyond what is described in Detroit Edison's ER. In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis also considers other past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts on nonradiological health (see Table 7-1).

Most of the nonradiological impacts of building and operation (e.g., noise, etiological agents, occupational injuries) would be localized and would not have a significant impact at offsite locations. However, impacts such as vehicle emissions arising from the activity of transporting personnel to and from the site would encompass a larger area. Therefore, for nonradiological health impacts, the geographic area of interest for cumulative impacts analysis includes projects within a 50-mi radius of Fermi 3 based on the influence of vehicle and other air emissions sources because Fermi 3 is in a nonattainment area (Section 7.6). For cumulative impacts associated with transmission lines, the geographical area of interest is the transmission line corridor (as described in Section 2.2.2). These geographical areas of interest are expected to encompass areas where public and worker health could be influenced by the proposed project and associated transmission lines, in combination with any past, present, or reasonably foreseeable future actions.

Current projects within the geographic area of interest that could contribute to cumulative nonradiological health impacts include the energy and mining projects in Table 7-1, as well as vehicle emissions and existing urbanization-related activities. Reasonably foreseeable future projects in the geographic area of interest that could contribute to cumulative nonradiological health impacts include the construction of the proposed Cleveland-Toledo-Detroit Passenger Rail Line, future transmission line development, and future urbanization.

There are no existing or future projects that could contribute to cumulative occupational injuries to workers at Fermi 3. Existing and potential development of new transmission lines could increase nonradiological health impacts from exposure to acute electromagnetic fields (EMFs). However, as stated in Section 5.8.3, adherence to Federal criteria and State utility codes would help keep any cumulative nonradiological health impacts at the minimal level. With regard to the chronic effects of EMFs, the scientific evidence on human health does not conclusively link extremely-low-frequency EMFs to adverse health impacts. Cumulative impacts from noise and vehicle emissions associated with current urbanization, current operations of Fermi 2, and decommissioning of Fermi 1 could occur. However, as discussed in Sections 4.8 and 5.8, the Fermi 3 contribution to these impacts would be temporary and minimal, and it is expected that existing facilities would comply with local, State, and Federal regulations governing noise and emissions. Section 7.11.2 discusses cumulative nonradiological health impacts related to additional traffic on the regional and local highway networks leading to and from the Fermi site, and the review team has determined that these impacts would be minimal.

The health impacts of operating the existing Fermi 2 and the proposed Fermi 3 at the Fermi site were evaluated relative to Lake Erie and the potential propagation of etiological microorganisms. As discussed in Section 5.8, the thermal discharges from the operation of Fermi 3 would not have detrimental impacts on the concentration levels of deleterious etiological microorganisms. No recreational activity occurs in the immediate vicinity of the proposed discharge structure for Fermi 3 that would have any bearing on potential nonradiological health impacts.

The review team is also aware of the potential climate changes that could affect human health; a recent compilation of the state of knowledge in this area (USGCRP 2009) has been considered in the preparation of this EIS. Projected changes in the climate for the region during the life of proposed Fermi 3 include the following:

- reduced cooling system efficiency at Fermi 3 (and other power generation facilities), which would result in increased temperature of the cooling-tower discharge water and possible increased growth of etiological agents;
- increased incidence of diseases transmitted by food, water, and insects following heavy downpours and severe storms; and
- increased severity of water pollution associated with sediments, fertilizers, herbicides, pesticides, and thermal pollution caused by projected heavier rainfall intensity and longer periods of drought.

Although the changes that are attributed to climate change in these studies are not inconsequential, their relationship to Fermi 3 operations is not clear, and the review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or the incidence of waterborne diseases.

Cumulative nonradiological health impacts were determined on the basis of information from Detroit Edison and the review team's independent evaluation of impacts resulting from the proposed Fermi 3, along with a review of potential impacts from other past, present, and reasonably foreseeable future projects and from urbanization in the geographic areas of interest. The review team concludes that cumulative impacts on the nonradiological health of the public and workers would be SMALL, and that mitigation beyond what is discussed in Sections 4.8 and 5.8 would not be warranted. The review team acknowledges, however, that there is still uncertainty associated with the chronic effects of EMFs.

7.8 Radiological Health Impacts of Normal Operation

The description of the affected environment in Section 2.11 serves as the baseline for the cumulative impacts assessment in this resource area. As described in Section 4.9, the NRC staff concludes that the radiological impacts from NRC-authorized construction would be SMALL, and no further mitigation would be warranted. As described in Section 5.9, the NRC staff concludes that the radiological impacts from operations would be SMALL, and no further mitigation would be warranted.

The combined impacts from preconstruction and construction activities were described in Section 4.9 and determined to be SMALL. In addition to impacts from preconstruction, construction, and operations, this cumulative analysis also considers past, present, and reasonably foreseeable future actions that could contribute to cumulative radiological impacts. For the purpose of this analysis, the geographic area of interest is considered to be the area within a 50-mi radius of the proposed Fermi 3. Historically, the NRC has used the 50-mi radius as a standard bounding geographical area to evaluate population doses from routine releases from nuclear power plants. Within the 50-mi radius, there are the operating Fermi 2, Fermi 1 (going through decommissioning), and Davis-Besse. Detroit Edison also plans to construct an ISFSI on the Fermi site. In addition, within the 50-mi radius of the site, there are likely to be medical, industrial, and research facilities that use radioactive materials.

As stated in Section 2.11, Detroit Edison has conducted a radiological environmental monitoring program (REMP) around Fermi 1 and 2 since 1978. The REMP measures radiation and radioactive materials from all sources, including existing Fermi 1 and 2, Davis-Besse, area hospitals, and industrial facilities. The results of the REMP indicate that the levels of radiation and radioactive material in the environment around the Fermi site are generally not above or only a little above natural background levels. As described in Section 2.11, sporadic and variable trace quantities of tritium were detected in a few shallow groundwater wells downwind from the Fermi 2 stack as a result of the recapturing of tritium in precipitation from the plant's gaseous effluent.

As described in Section 4.9, it is estimated that the doses to construction workers during the building of the proposed Fermi 3 would be within NRC annual exposure limits (i.e., 100 mrem), which are designed to protect public health. This estimate includes exposure to doses from the operation of Fermi 2, the decommissioned Fermi 1, and the proposed ISFSI. As described in Section 5.9, the public and occupational doses predicted from the proposed operation of Fermi 3 would be below regulatory limits and standards. In addition, the site-boundary dose to the maximally exposed individual (MEI) from existing Fermi 2 and proposed Fermi 3 at the Fermi site would be well within the regulatory standard of 40 CFR Part 190.

On the basis of the results of the REMP and the estimates of doses to biota given in Section 5.9, the NRC staff concludes that the cumulative radiological impact on biota would not be significant. The results of the REMP indicate that effluents and direct radiation from area medical, industrial, and research facilities that use radioactive materials do not contribute measurably to the cumulative dose for biota in the vicinity of the Fermi site.

Currently, there are no other nuclear facilities planned within 50 mi of the Fermi site. The NRC, U.S. Department of Energy, and State of Michigan would regulate or control any reasonably foreseeable future actions in the region that could contribute to cumulative radiological impacts. Therefore, the NRC staff concludes that the cumulative radiological impacts of operation of the proposed Fermi 3 and existing Fermi 1 and 2 and the influence of other manmade sources of radiation nearby would be SMALL, and no further mitigation would be warranted.

7.9 Nonradioactive Waste

Cumulative impacts on water and air from nonradiological waste are discussed in Sections 7.2 and 7.6, respectively. The cumulative impacts of nonradioactive waste destined for land-based treatment and disposal are related to: (1) the available capacity of the area treatment and disposal facilities; and (2) the amount of solid waste generated by the proposed project and the current and reasonably foreseeable future projects in Table 7-1. The geographic area of interest for this cumulative analysis is the area within 15 mi of the Fermi site. This area includes four landfills that could potentially be used by Detroit Edison (MDEQ 2011b).

Nonradioactive wastes generated at the Fermi site, including those from Fermi 3, would be managed in accordance with applicable Federal, State, and local laws and regulations and with permit requirements. As described in the ER (Detroit Edison 2011a), nonradiological waste management practices at Fermi 3 would be similar to those implemented at Fermi 2 and would include the following:

1. Nonradioactive solid waste would be collected and stored temporarily on the Fermi site and disposed of offsite only at authorized and licensed commercial waste disposal sites or recovered at an offsite permitted recycling or recovery facility, as appropriate.
2. Sanitary waste would be delivered to the Frenchtown Township Sewage Treatment Facility for treatment.
3. Debris (e.g., vegetation) collected on trash screens at the water intake structure would be disposed of offsite as solid waste, in accordance with State regulations.
4. Dredge spoils resulting from construction and periodic maintenance of the discharge and intake areas would be disposed of in the existing onsite Spoils Disposal Pond.
5. Scrap metal, lead acid batteries, and paper on the Fermi site would be recycled.
6. Water discharges from cooling and auxiliary systems would be discharged directly and indirectly to Lake Erie through permitted outfalls.
7. Air emissions from Fermi 2 and Fermi 3 operations would be compliant with air quality standards as permitted by MDEQ.

During preconstruction and construction, offsite land-based waste treatment and disposal would be minimized by production and delivery of modular plant units; by segregation of recyclable materials; and by management of vegetative waste, excavated materials, and dredged materials onsite. As described in Section 4.10.1, the solid waste impacts from building Fermi 3 would be expected to be minimal with no additional mitigation warranted. The few reasonably foreseeable proposed projects listed in Table 7-1 generally either would not coincide with the building of Fermi 3 (e.g., demolition of Fermi 1, construction of the Fermi ISFSI) or would produce waste streams of a different nature (e.g., mining projects).

The types of nonradioactive solid waste that would be generated, handled, and disposed of during Fermi 3 operations include municipal waste, dredge spoils, sewage treatment sludge, and industrial wastes. In addition, small quantities of hazardous waste and mixed waste (waste that has both hazardous and radioactive characteristics), would be generated during Fermi 3 operations. As described in Section 5.10.1 and mentioned above, because the effective practices already in place at Fermi 2 for recycling, minimizing, and managing waste will be used, the expected impacts on land from nonradioactive wastes generated during the operation of Fermi 3 would be SMALL, and no further mitigation would be warranted. Many projects listed in Table 7-1 would generate municipal and industrial waste. However, no known capacity constraints exist for the treatment or disposal of such types of waste either within Michigan, Ohio, or the nation as a whole (EPA 2010c; MDEQ 2011b). Each reactor at the Fermi site is expected to produce about 0.5 m^3 per year of mixed waste. Detroit Edison anticipates that the Fermi 3 would claim a low-level mixed waste exemption from the State of Michigan (Fermi 2 currently operates under this exemption). Of the projects listed in Table 7-1, Fermi 2, demolition of Fermi 1, and the hospitals and industrial facilities that use radioactive materials have the potential to generate mixed waste. None of the considered projects are expected to generate mixed waste in significant quantities above the current rates, and therefore cumulative impacts would be minimal.

On the basis of the projected small quantity of nonradioactive and mixed waste that would be produced during Fermi 3 building activities and operation and the available treatment and disposal capacity, the review team concludes that cumulative impacts of nonradioactive and mixed waste would be SMALL, and additional mitigation would not be warranted.

7.10 Postulated Accidents

The following impact analysis covers radiological impacts from postulated accidents from operations of Fermi 3. The analysis also considers other past, present, and reasonably foreseeable future actions at which postulated accidents that could affect radiological health could occur, including other Federal and non-Federal projects and those projects listed in Table 7-1 within the geographic area of interest. The geographic area of interest is considered to be the area within a 50-mi radius of the proposed Fermi 3. The cumulative analysis considers the risk from potential severe accidents at all other existing and proposed nuclear power plants that have the potential to increase risks at any location within 50 mi of the proposed Fermi 3.

As described in Section 5.11.4, the NRC staff concludes that the potential environmental impacts (risk) from a postulated accident from the operation of the proposed Fermi 3 would be SMALL. Section 5.11 considers both design-basis accidents (DBAs) and severe accidents.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the Fermi site would be SMALL for an ESBWR. DBAs are addressed specifically to demonstrate that a reactor design is sufficiently robust to meet NRC safety criteria. The consequences of DBAs are bounded by the consequences of severe accidents.

As described in Section 5.11.2, the NRC staff concludes that the severe-accident probability-weighted consequences (i.e., risks) of an ESBWR at the Fermi site are SMALL when compared with the risks to which the population is generally exposed, and no further mitigation would be warranted. Existing reactors within the geographic area of interest are Fermi 2 and Davis-Besse because the 50-mi radii for Fermi 2 and Davis-Besse overlap part of the 50-mi radius for the proposed Fermi 3. No other new reactors have been proposed, within the geographic area of interest.

Tables 5.33 and 5.34 in Section 5.11.2 provide comparisons of estimated risk for the proposed Fermi 3 ESBWR and for current-generation reactors. The estimated population dose risk for the proposed ESBWR at the Fermi site is well below the mean and median values for current-generation reactors. In addition, as discussed in Section 5.11.2, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For existing plants within the geographic area of interest (i.e., Fermi 2 and Davis-Besse), the Commission has determined that the probability-weighted consequences of severe accidents are small (10 CFR Part 51, Appendix B, Table B-1). It is expected that risks for any new reactors at any other locations within the geographic area of interest of the Fermi site would be well below risks for current-generation reactors and meet the Commission's safety goals. The risk of severe accident attributable to any particular nuclear power plant becomes smaller as the distance from that plant increases. However, the combined risk at any location within 50 mi of the Fermi site would be bounded by the sum of risks for all these operating nuclear power plants. Even though two or more nuclear power plants could be included in the combined risk, it would still be low.

On the basis of these findings, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Fermi site would likely be SMALL, and no further mitigation would be warranted.

7.11 Fuel Cycle, Transportation, and Decommissioning

The cumulative impacts related to the fuel cycle, transportation of radioactive materials (fuel and waste), and facility decommissioning for the proposed site are described below.

7.11.1 Fuel Cycle (Including Radioactive Waste)

As described in Section 6.1, the NRC staff concludes that the environmental impacts of the fuel cycle from the operation of Fermi 3 would be SMALL. Fuel-cycle impacts would not only occur at the Fermi site but would also be scattered throughout other locations in the United States or, in the case of foreign-purchased uranium, in other countries, as described in Section 6.1.

In addition to fuel-cycle impacts from Fermi 3, this cumulative analysis also considers fuel-cycle impacts from existing Fermi 2 and Davis-Besse, located southeast of Toledo, Ohio. There are no other nuclear power plants, existing or proposed, within 50 mi of the Fermi site. The fuel-cycle impacts of Fermi 2 and Davis-Besse would be similar to those of the proposed Fermi 3. In accordance with 10 CFR 51.51(a), the NRC staff considers the impacts to be acceptable for a 1000-MW(e) reference reactor. The impacts of producing and disposing of nuclear fuel include those from mining the uranium ore, milling the ore, converting the uranium oxide to uranium hexafluoride, enriching the uranium hexafluoride, fabricating the fuel (in which the uranium hexafluoride is converted into uranium oxide fuel pellets), and disposing of the spent fuel in a proposed Federal waste repository. As discussed in Section 6.1, advances in reactors since the development of Table S-3 in 10 CFR 51.51 have reduced the environmental impacts relative to those of the operating reference reactor. For example, a number of fuel management improvements have been adopted by nuclear power plants to improve performance and reduce fuel and separative work (enrichment) requirements. In Section 6.1, the NRC staff multiplied the values in Table S-3 by a factor of two to scale the impacts up from the 1000-MW(e) light water reactor model to address the fuel-cycle impacts of Fermi 3. Adding the fuel-cycle impacts from Fermi 2 and Davis-Besse would increase the scaling further – but by a factor of no more than four. Therefore, the NRC staff considers the cumulative fuel-cycle impacts of operating Fermi 3 to be SMALL, and no further mitigation would be warranted.

7.11.2 Transportation

The description of the affected environment in Section 2.5.2 serves as a baseline for the cumulative impacts assessment in this resource area. As described in Sections 4.8.3 and 5.8.6, the review team concludes that impacts of transporting personnel and nonradiological materials to and from the Fermi site would be SMALL. In addition to impacts from preconstruction, construction, and operations, the cumulative analysis also considers other past, present, and reasonably foreseeable future actions that could contribute to cumulative transportation impacts. For this analysis, the geographic area of interest is the 50-mi region surrounding the Fermi site.

Nonradiological impacts from transportation would be related to the additional traffic on the regional and local highway networks leading to and from the Fermi site. Additional traffic would result from the shipments of construction materials and the movements of construction personnel to and from the site. This additional traffic would increase the risk of traffic accidents, injuries, and fatalities. The most significant cumulative nonradiological impacts in the vicinity of the Fermi site would result from major construction projects. However, as shown in Table 7-1, no major construction projects are planned in the region surrounding the Fermi site. The operation of existing facilities could also result in cumulative nonradiological impacts if traffic to and from the Fermi site interacted with traffic traveling to and from operating facilities in the region. Nearby operating facilities that could contribute to traffic hazards include the existing Fermi 2 and Stoneco Newport and Rockwood Quarry mining projects. However, the Fermi site is located on the edge of the Detroit metropolitan area, where a more constant level of traffic flow across the region over extended periods of time is expected, regardless of individual projects, thus limiting any impacts from interactions with nearby facilities. Mitigation measures designed to improve traffic flow at the Fermi site have been proposed by Detroit Edison (2011a).

In Sections 4.8.3 and 5.8.6, the review team concluded that the impacts of transporting construction material and construction and operations personnel to and from the Fermi site would be a small fraction of the existing nonradiological impacts. Because of the extent of nonradiological transportation impacts of new nuclear power plant construction and operation relative to impacts from existing traffic patterns and levels, the review team considers the cumulative nonradiological transportation impacts associated with constructing and operating the proposed new reactor at the Fermi site to be minimal, and no further mitigation would be warranted.

As described in Section 6.2, the NRC staff concludes that impacts of transporting unirradiated fuel to the Fermi site and irradiated fuel and radioactive waste from the Fermi site would be SMALL. In addition to impacts from preconstruction, construction, and operations, the cumulative analysis also considers other past, present, and reasonably foreseeable future actions that could contribute to cumulative transportation impacts. For this analysis, the geographic area of interest is the 50-mi region surrounding the Fermi site.

Historically, the radiological impacts on the public and the environment that are associated with the transportation of radioactive materials in the region surrounding the Fermi site have been dominated by shipments of fuel and waste to and from the existing Fermi 2. Davis-Besse, which is located in Oak Harbor, Ohio (21 miles east-southeast of Toledo, Ohio), is also within 50-mi of the Fermi site, and shipments of fuel and waste to the Davis-Besse site may also contribute to the cumulative radiological impacts of transportation as a result of sharing some highway links with Fermi 2 shipments. Additional cumulative impacts on the Fermi site would result from the additional fuel and waste shipments associated with the operation of the new unit. Radiological impacts from transporting radioactive materials would occur along the routes leading to and from the Fermi site and would also be scattered throughout the United States. For all of these historical, current, and potential future projects, the radiological transportation impacts are a small fraction of the impacts from natural background radiation. The impacts from transporting this fuel and radioactive waste to and from the Fermi site would be consistent with the environmental impacts associated with transporting fuel and radioactive waste from current-generation reactors presented in Table S-4 of 10 CFR 51.52. On the basis of 10 CFR 51.52, the NRC staff concludes that the impacts from the 1000-MW(e) reference reactor are acceptable. Advances in reactors since the development of Table S-4 of 10 CFR 51.52 would reduce the environmental impacts relative to those of the operating reference reactor. For example, fuel management improvements have been adopted by nuclear power plants to improve performance and reduce fuel requirements. The improvements have led to fewer unirradiated and spent fuel shipments than those estimated for the 1000-MW(e) reference reactor in 10 CFR 51.52. In addition, advances in shipping cask designs to increase their capacities would result in fewer shipments of spent fuel to offsite storage or disposal facilities.

Therefore, the NRC staff concludes that the cumulative nonradiological and radiological transportation impacts from operating the proposed new reactor at the Fermi site would be SMALL, and no further mitigation would be warranted.

7.11.3 Decommissioning

As discussed in Section 6.3 of this EIS, the NRC staff concludes that the environmental impacts from decommissioning the proposed Fermi 3 would be SMALL because the licensee would have to comply with decommissioning regulatory requirements.

In this cumulative analysis, the geographic area of interest is the area within a 50-mi radius of the Fermi site. In addition to Fermi 3, the other nuclear power plants within this area are the existing Davis-Besse, Fermi 2, and Fermi 1 (which is going through decommissioning). The impacts of decommissioning nuclear power plants are bounded by the discussion in the assessment in Supplement 1 to NUREG-0586, *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities* (NRC 2002). In that document, the NRC found that the impacts from decommissioning a nuclear plant on the radiation dose to workers and the public, waste management, water quality, air quality, ecological resources, and socioeconomics would be small. In addition, the review team concluded in Section 6.3 of this EIS that the incremental contribution of the impact of greenhouse gas emissions on air quality during decommissioning would be small. Therefore, the cumulative impacts from decommissioning would be SMALL, and further mitigation would not be warranted.

7.12 Conclusions

The review team considered the potential cumulative impacts resulting from preconstruction, construction, and operation of one additional nuclear unit at the Fermi site together with past, present, and reasonably foreseeable future actions. The specific resources that could be affected by the proposed action and other past, present, and reasonably foreseeable future actions in the same geographical area were assessed. This assessment included the impacts of preconstruction activities as described in Chapter 4; impacts of construction and operations for the proposed new unit as described in Chapters 4 and 5; impacts of fuel cycle, transportation, radiological waste, and decommissioning as described in Chapter 6; and impacts of past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could affect the same resources affected by the proposed action, as described in Table 7-1.

Table 7-3 summarizes the cumulative impacts by resource area. The cumulative impacts for the majority of resource areas would be SMALL, although there could be MODERATE and LARGE impacts for some resources, as presented below.

Cumulative land use impacts, including impacts associated with transmission line development, are anticipated to be SMALL primarily because few land use changes are anticipated from reasonably foreseeable projects, including building and operating Fermi 3, over the period of interest (i.e., approximately 2010–2060).

Table 7-3. Cumulative Impacts on Environmental Resources Including the Impacts of the Proposed Fermi 3

Resource Category	Impact Level
Land Use	SMALL
Water Resources	
Surface water use	SMALL to MODERATE
Groundwater use	SMALL
Surface water quality	MODERATE
Groundwater quality	SMALL
Ecological Resources	
Terrestrial and wetland resources	MODERATE
Aquatic resources	MODERATE
Socioeconomics	
Physical impacts	SMALL
Demography	SMALL beneficial
Economic Impacts on the Community	
Economy	SMALL to LARGE beneficial
Taxes	SMALL to LARGE beneficial
Infrastructure and Community Services Impacts	
Traffic	SMALL to MODERATE
Recreation	SMALL
Housing	SMALL
Public services	SMALL
Education	SMALL
Environmental Justice	SMALL
Historic and Cultural Resources	MODERATE
Air Quality	SMALL to MODERATE
Nonradiological Health	SMALL
Radiological Health	SMALL
Nonradioactive Waste	SMALL
Postulated Accidents	SMALL
Fuel Cycle (including radioactive waste), Transportation, and Decommissioning	SMALL

With projected climate change, the cumulative effects of past, present, and reasonably foreseeable future actions on the surface water quantity of Lake Erie would be SMALL to MODERATE, with MODERATE impacts possible under the highest predicted increases in air and water temperature. The cumulative effects of past, present, and reasonably foreseeable future actions combined with the predicted impacts of climate change on the quality of surface water in Lake Erie would be MODERATE. However, the incremental increases in water use and changes in water quality resulting from operation of Fermi 3 under projected climate change conditions should not be noticeable, and the incremental contribution of Fermi 3 would be SMALL. Cumulative impacts on groundwater use and quality would be SMALL.

Together with the impacts of past, present, and reasonably foreseeable future actions, the impacts on most terrestrial resources of building and operating Fermi 3 are expected to result in SMALL cumulative impacts. Cumulative impacts on wetlands (especially forested wetlands) and the State-listed eastern fox snake could be MODERATE. The incremental contribution from the Fermi 3 project would be substantial for all terrestrial and wetland resources.

With projected climate change, the cumulative effects on aquatic resources are expected to be MODERATE. However, the incremental contributions of Fermi 3 operations to effects on aquatic resources including recreational and commercially important species and Federally and State-listed species would be SMALL.

For socioeconomics, cumulative impacts in most categories would be SMALL and adverse. However, there would be a MODERATE to LARGE and beneficial cumulative impact to the economy of Monroe County and LARGE impact to tax revenues in Monroe County, as well as a SMALL beneficial impact to the economy and tax revenues on the rest of the 50-mi region. The entire 50-mi region would also experience a SMALL beneficial impact to demographics. The incremental impact from NRC-authorized activities would be SMALL and beneficial for the economies and taxes throughout the 50-mi region, with the exception of Monroe County, where the incremental tax revenue impact and impact on the economy from the NRC-authorized activities would be MODERATE to LARGE and beneficial. The review team also identified a short-term MODERATE and adverse impact associated with increased traffic on local roads near the Fermi site during construction and during periods of outages; during normal operations, the adverse impact on local roads would be SMALL. The incremental contribution from NRC-authorized activities on traffic would be MODERATE during construction and during periods of outages. Cumulative impacts to other socioeconomic impact categories and environmental justice would be SMALL.

The cumulative impacts on historic and cultural resources are expected to be MODERATE because NRC actions would result in the demolition, which would be mitigated, of one onsite property (Fermi 1) that has been recommended for the NRHP. The incremental impacts associated with onsite NRC-authorized construction activities are the principal contributors to the MODERATE rating of cumulative impacts.

For air quality, the cumulative impacts would be MODERATE, primarily due to national and worldwide impacts of greenhouse gas emissions, but SMALL for criteria pollutants. The incremental impacts from NRC-authorized activities would be SMALL because such impacts would be minimal.

For radiological health nonradiological health, nonradioactive waste, postulated accidents, fuel cycle (including radioactive waste), transportation, and decommissioning, cumulative impacts are expected to be SMALL.

7.13 References

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8.0 Need for Power

Chapter 8 of the U.S. Nuclear Regulatory Commission's (NRC) *Environmental Standard Review Plan* (ESRP) (NRC 2000), with additional clarification provided in NRC Staff Memorandum (NRC 2011), guides the NRC staff's review and analysis of the need for power from a proposed nuclear power plant. In addition to the ESRP guidance, the NRC addressed the need for power in a 2003 response to a petition for rulemaking (68 FR 55910). In the 2003 response, the NRC reviewed whether or not need for power should be considered in NRC environmental impact statements (EISs) prepared in conjunction with applications that could result in construction of a new nuclear power plant. The NRC (68 FR 55910) concluded that:

> The need for power must be addressed in connection with new power plant construction so that the NRC may weigh the likely benefits (e.g., electrical power) against the environmental impacts of constructing and operating a nuclear power reactor. The Commission emphasizes, however, that such an assessment should not involve burdensome attempts to precisely identify future conditions. Rather, it should be sufficient to reasonably characterize the costs and benefits associated with proposed licensing actions.

While the NRC will perform a need for power analysis for a new nuclear power plant in its EIS, the NRC also stated in its response to the petition that (1) the NRC does not supplant the States, which have traditionally been responsible for assessing the need for power-generating facilities, for their economic feasibility and for regulating rates and services; and (2) the NRC has acknowledged the primacy of State regulatory decisions regarding future energy options (68 FR 55910).

Detroit Edison Company (Detroit Edison), a wholly owned subsidiary of DTE Energy, has submitted a combined license (COL) application to the NRC for a new nuclear reactor, Enrico Fermi Unit 3 (Fermi 3), to be located at the existing Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site in Monroe County, Michigan. The proposed nuclear reactor would use the GE-Hitachi Nuclear Energy Economic Simplified Boiling Water Reactor (ESBWR) design that has a rated core thermal power of 4500 megawatts thermal (MW(t)) and a gross electrical output of approximately 1605 ± 50 megawatts electric (MW(e)). Fermi 3 would operate as a regulated investor-owned electric utility connected to the electrical grid operated by ITC*Transmission*.

In its Environmental Report (ER) (Detroit Edison 2011a), Detroit Edison identified the following purposes of the proposed reactor:

- Generate at least 1535 ± 50 MW(e) of reliable electricity to address the forecasted energy and capacity needs of Detroit Edison customers.

- Provide new baseload generation capacity as early as 2021 to compensate for the expected retirement of existing, aging baseload generating units and the diminishing availability of baseload generation capacity in the Midwest Independent System Operator (MISO) service area.
- Provide price stability by minimizing the importation of power into the Detroit Edison service area.
- Establish baseload generation technology that is less subject to price fluctuations resulting from either fuel or regulatory drivers, provides fuel diversity, and reduces reliance on fossil fuels and their resulting environmental impacts.

Section 8.1 describes the Detroit Edison service area as well as the broader power generation and transmission system in which Detroit Edison participates. Section 8.1 also introduces and describes the Michigan Public Service Commission's (MPSC) 21st Century Energy Plan (hereafter, the MPSC Plan) (MPSC 2007), the first comprehensive statewide electricity planning initiative completed in Michigan and the basis for the review team's independent need for power analysis. Section 8.2 describes the factors that could influence changes in the demand for power over the licensing period for Fermi 3 that were addressed in the MPSC Plan. Section 8.3 discusses existing and potential sources of electricity supply in the Detroit Edison service area. Section 8.4 presents the review team's projected supply and demand estimates for the Detroit Edison service area, along with the review team's conclusions regarding the need for power.

8.1 Power Systems and Power Planning in Michigan

Deregulation of the electricity markets has had a significant impact on how projected power needs are met. Because of the deregulation of bulk sales markets for electricity, the advent of independent power producers, and the increased use of purchases and exchanges of electricity among utilities, the demand for electricity by ultimate consumers and wholesale customers within a utility's service area is increasingly not being met by the utility's own generating resources. Greater degrees of collaboration among transmission balancing authorities to more efficiently accommodate renewable energy sources and plans for long-distance transfers of renewable energy-generated power to distant load centers have served to further expand the geographic area from which generation resources might be routinely drawn to meet demand. Trading of electricity is further facilitated by the Federal Energy Regulatory Commission's final rule requiring all public utilities that own, control, or operate facilities used for transmitting electricity in interstate commerce to file open access nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service. It is therefore incumbent on the review team to ensure that impacts from all of these issues are properly incorporated into its need for power analysis.

8.1.1 National and Michigan Electricity Generation and Consumption

Electricity generation in the United Stated in 2008 was 4119 million megawatt hours (MWh), a 0.9 percent decrease from the 2007 total of 4157 million MWh, using a variety of generating technologies: coal (48.2 percent), natural gas (21.4 percent), nuclear (19.6 percent), hydroelectric (6.0 percent), non-hydro renewables (3.1 percent), petroleum (1.1 percent), other gases (0.3 percent), and other sources (0.3 percent) (DOE/EIA 2010a). Electric utility plants accounted for 2475.5 million MWh (60.1 percent of the MWh produced), with combined heat and power (CHP) plants accounting for the remaining 1643.5 million MWh (39.9 percent).

Michigan's 2008 net summer electricity generating capacity stood at 30,419 MW, 21,885 MW of which were represented by electric utilities and 8534 MW provided by independent power producers and CHP facilities. In 2008, Michigan's electric utilities generated 94,503,953 MWh of electricity (down 2.4 percent from 96,785,842 MWh in 2007) of the statewide total production of 114,989,806 MWh (down 3.6 percent from the 2007 statewide total of 119,309,936 MWh) (EERE 2009; DOE/EIA 2010b).

8.1.2 The Detroit Edison Power System

The Detroit Edison power system is managed and/or overseen by four separate entities, each responsible for a different but integrated aspect of the generation, transmission, and distribution of electricity. The four entities, described below in greater detail are Detroit Edison (DTE Energy), ITC*Transmission*, MISO and PJM Interconnection (MISO/PJM), and North American Electric Reliability Council's (NERC's) Reliability*First* Corporation (RFC).

Detroit Edison

Detroit Edison was founded in 1903. It is a wholly owned subsidiary of DTE Energy, a diversified energy company incorporated in 1995 and involved in the development and management of energy-related businesses and services nationwide. Detroit Edison and the Michigan Consolidated Gas Company (MichCon), a natural gas utility serving 2.1 million customers in lower Michigan, are DTE Energy's two largest operating subsidiaries. Beside electricity production, other energy-related activities of DTE Energy include the ownership and management of natural gas storage facilities and pipelines, coal marketing and transporting, conventional and unconventional natural gas resource recovery, and energy trading.[a] The MichCon and Detroit Edison service areas are shown in Figure 8-1.

(a) Additional details regarding the activities of DTE Energy subsidiaries are available from its corporate Web site: http://www.dteenergy.com/residentialCustomers/productsPrograms/.

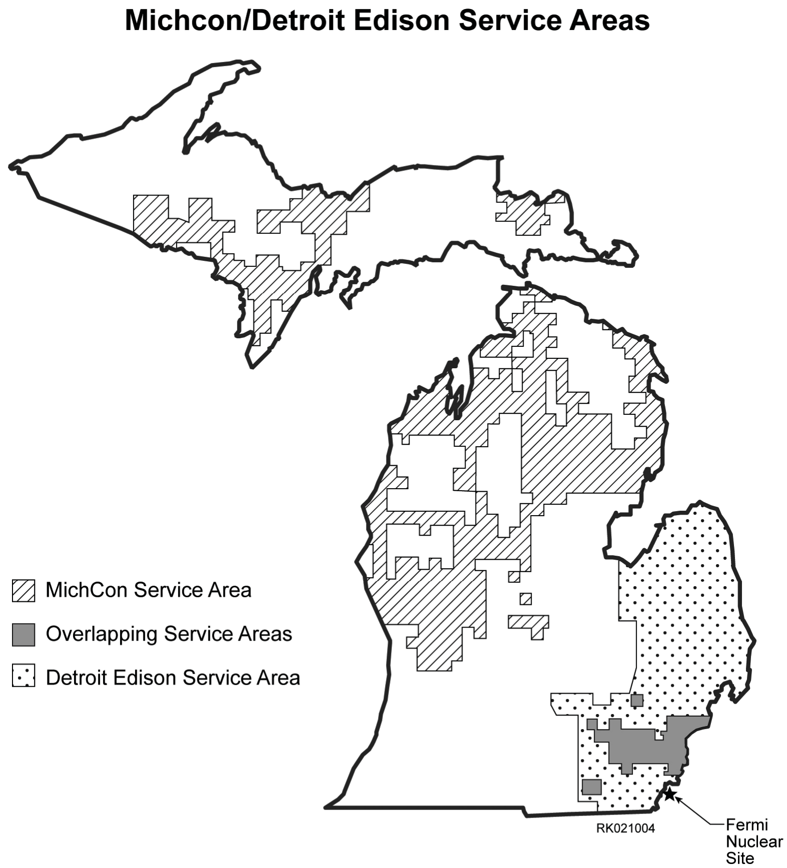

Figure 8-1. DTE Energy's MichCon and Detroit Edison Service Areas (DTE Energy 2008a)

Detroit Edison generates, transmits, and distributes electricity to 2.2 million customers throughout an 11-county area [(a)] in southeastern Michigan, an area of approximately 7600 mi^2 (DTE Energy 2008a; Detroit Edison 2010).

Detroit Edison is the largest electric utility in Michigan and the tenth largest in the country (DTE Energy 2008b). The electricity generating stations owned and operated by Detroit Edison have an overall generating capacity of 11,518 MW (DTE Energy 2008a). Detroit Edison operates nine baseload generating plants, including Fermi 2, and is co-owner of a pumped-storage hydroelectric facility in Ludington, Michigan. In 2008, Detroit Edison operated four of the State's top ten electric generating facilities (based on net summer capacity): three coal-fired

(a) Counties comprising Detroit Edison's service area include: Huron, Lenawee, Macomb, Monroe, Oakland, Sanilac, Tuscola, Lapeer, St. Clair, Washtenaw, and Wayne.

plants – Monroe (3129 MW), Belle River (1509 MW), St. Clair (1393 MW) – and Fermi 2 (1173 MW) (DOE/EIA 2010b).

Reliability of power is ensured, in part, by the mix of fuels in the Detroit Edison generating portfolio: coal, natural gas, nuclear, pumped-storage hydroelectricity, and renewable energy sources. Historically, coal has accounted for 80 to 85 percent of Detroit Edison's electricity generation with Fermi 2 accounting for the majority of the remainder of Detroit Edison's generating capacity. Of the total 11,518 MW of Detroit Edison's electricity generating capacity, 78.8 percent is provided by coal, 16.9 percent by nuclear, 2.3 percent by natural gas, 0.8 percent by oil, 0.1 percent by hydroelectric, and 1 percent by renewable sources (biomass 0.6 percent and solid waste incineration 0.4 percent) (DTE Energy 2008a). The promulgation of a State Renewable Portfolio Standard (RPS), as well as increasingly rigorous environmental regulations on fossil fuel-fired power generation[a] (including possible future regulations requiring the capture and sequestration of greenhouse gases, especially carbon dioxide) are likely to affect major changes in DTE's power portfolio going forward.

Detroit Edison testimony in Rate Case No. U-15244 provided highlights of Detroit Edison's Integrated Resource Plan (IRP) process, pointing out its similarities to the MPSC Plan, including use of the same planning model (MPSC 2008). The testimony also noted that the process by which MPSC would grant a Certificate of Need would require submission of an IRP at the time the regulated utility applied to the MPSC for certification and that Detroit Edison intended to follow that process.[b] However, Detroit Edison has not yet submitted an application to the MPSC for a Certificate of Need for Fermi 3. Fermi 3 would add approximately 1535 MW(e) of generating capacity to the Detroit Edison portfolio, should it become operational on schedule in 2020.

ITC*Transmission*

Power generated by Fermi 3 would be delivered to the high-voltage transmission system operated by ITC*Transmission* through three redundant 345-kV lines (Fermi-Milan 1, Fermi-Milan 2, and Fermi-Milan 3). The point of connection would be ITC*Transmission*'s Milan

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(a) See Sections 9.2.2.2 and 9.2.2.3 for a detailed discussion of environmental regulations applicable to coal-fired and natural gas-fired power plants, respectively.

(b) The process for obtaining a Certificate of Need that was described in the MPSC Plan has since become law. (See Michigan Compiled Laws Section 460.6s at http://www.legislature.mi.gov/(S(fg1zf0u0fjp3uhv3vgxub1m1))/mileg.aspx?page=getobject&objectname=mcl-460-6s&query=on&highlight=certificate%20AND%20of%20AND%20need). A Certificate of Need must now be obtained for energy-related capital projects costing $500 million or more, including construction of new electricity generating facilities, upgrades, or acquisition of existing facilities, investments in new generating assets, or execution of long-term power purchasing agreements. The Certificate would provide authority for cost recoveries.

substation, approximately 29.3 mi west-northwest of the Fermi site (Detroit Edison 2010). Power would be distributed to customers by the interconnected transmission networks operated by ITC*Transmission* and the Michigan Electric Transmission Company (METC), both of which are owned by ITC Holdings Corporation and which together are responsible for the majority of electric power distribution throughout southeastern Michigan, including the entirety of the traditional Detroit Edison service area. The ITC*Transmission* service area coincides with the Detroit Edison service area, covering 7600 mi^2 and including the metropolitan areas of Detroit and Ann Arbor (ITC 2010a). METC's service area covers 18,800 mi^2 and consists of more than 5400 mi of high-voltage transmission lines (ITC 2010b). The ITC*Transmission* and METC service areas are displayed in Figures 8-2 and 8-3, respectively.

MISO/PJM

In December 2000, ITC*Transmission* joined MISO. MISO is responsible for the reliability of the nearly 94,000 mi of interconnected high-voltage electric transmission grids in 15 States and the Canadian Province of Manitoba. MISO has partnered with PJM to develop and operate a wholesale market of high-voltage electric transmission that extends to 23 States, the District of Columbia, and Manitoba. The MISO and PJM service areas are displayed in Figure 8-4. Finally, the MISO and PJM service areas are part of the RFC,[(a)] one of eight Regional Reliability Entities that comprise NERC (NERC 2008). The geographic area of RFC is displayed in Figure 8-5. The eight NERC regional entities are shown in Figure 8-6.

NERC/RFC

NERC is required by the Federal Power Act of 2005 (16 USC 791a *et seq.*) to conduct annual reliability assessments. One such Long-Term Reliability Assessment (LTRA) report (including the RFC self-assessment report contained within the system-wide NERC assessment) was published by NERC in October 2008 (NERC 2008) and covered the period 2008–2017.[(b)] NERC relies upon reports created by its component regional entities for its annual reliability assessments.

8.1.3 Electricity Planning in Michigan

This section discusses the electricity planning initiatives that have been completed for Michigan and the manner in which the review team relied on those initiatives for its need for power analysis.

(a) Additional details on RFC are available on the RFC Web site at http://www.rfirst.org.
(b) Although more recent LTRAs have since been published, the review team has elected to refer to this 2008 version as the most appropriate analysis for use as independent corroboration of other need for power reports addressed in this analysis.

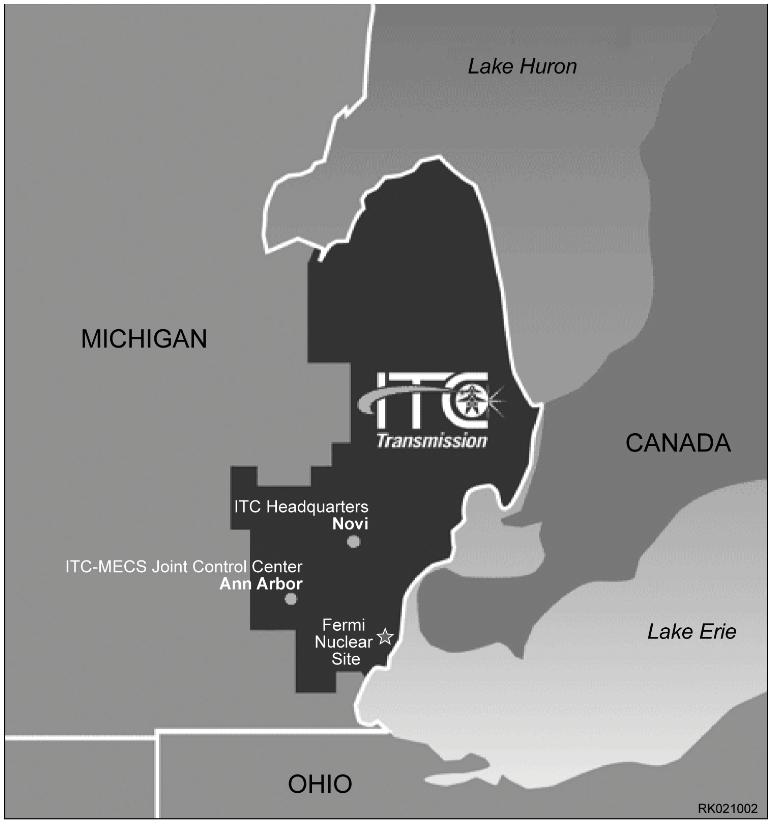

Figure 8-2. ITC*Transmission* Service Area (Detroit Edison 2011a)

8.1.3.1 The MPSC Plan

The need for power analysis provided by Detroit Edison in the ER was derived from the MPSC Plan (MPSC 2007). The MPSC Plan, the first comprehensive statewide electricity planning initiative completed in the State of Michigan, was developed in response to Executive Directive No. 2006-02 (Granholm 2006). The MPSC Plan has a geographic scope of the entire State and a planning horizon through 2025, well beyond the planned startup of Fermi 3.

To produce the MPSC Plan, various workgroups were assembled, each with an assignment to address different aspects of energy planning. Among the various workgroups, the Capacity Need Forum (CNF) Update Workgroup was most directly responsible for a determination of the need for power; consequently, its methodologies and results became the focus of the review team's assessment of the Plan. MPSC Plan projections were compiled for three regions of the State of Michigan – Southeast Michigan (the area served by ITC), the balance of the Lower Peninsula (primarily served by the Michigan Joint Zone), and the Upper Peninsula (served by American Transmission Company) – and then aggregated into the MPSC Plan. Because

Figure 8-3. METC Service Area (Detroit Edison 2011a)

Detroit Edison represents approximately 99 percent of generation capacity in the Plan's Southeast Michigan Planning Area,[a] the review team determined the MPSC Plan's "Southeast Michigan" was sufficiently close in service area and customer base to the Detroit Edison service area that it could serve as representative of the Detroit Edison service area for this need for power assessment. Therefore, the review team uses the MPSC Plan's analysis and results for the Southeast Michigan Planning Area as the basis for its independent need for power assessment.

Because the MPSC Plan was intended to serve as the primary and official long-term electricity planning document for Michigan, and because of its appropriate geographic reach and planning

(a) The City of Wyandotte, the City of Detroit, and the Lansing Board of Water and Light comprise the remainder of generating capacity in the Southeast Michigan Planning Area. See Section 5.5, MPSC Plan, Appendix Volume II, Workgroup Reports (MPSC 2007).

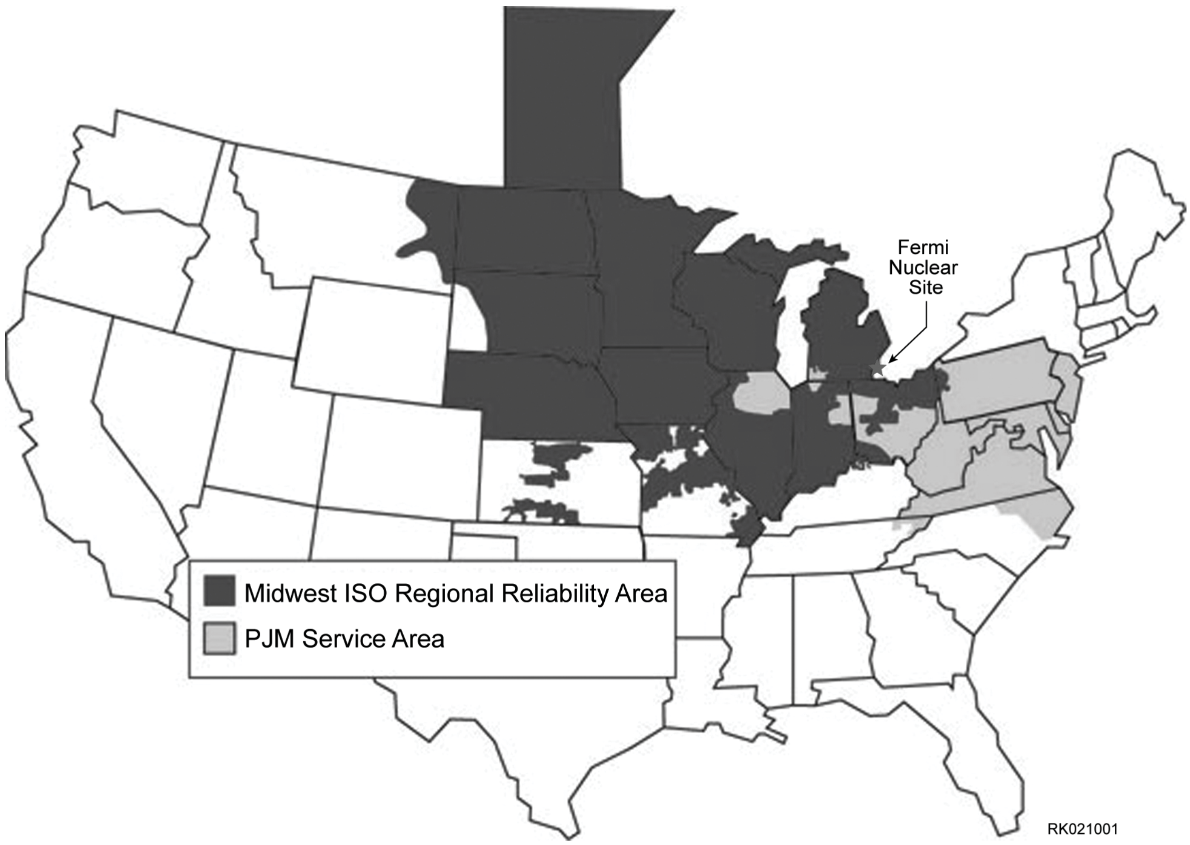

Figure 8-4. MISO (dark gray) and PJM (light gray) Service Territories (Detroit Edison 2011a)

horizon, the review team concluded that the results of that planning initiative could be accepted as a sufficient determination of the need for power in the Detroit Edison service area, provided the methodologies used in its development satisfied the ESRP acceptance criteria – that the MPSC Plan was systematic, comprehensive, subject to confirmation, and responsive to forecasting uncertainties. To confirm the adequacy of the MPSC Plan against these criteria, the review team reviewed the plan's data processing procedures and the methodologies employed by the CNF Update Working Group. These details had been provided in appendices contained in Volume II of the MPSC Plan (MPSC 2007). A summary of the salient points of the review team's assessment of the relevant appendices is provided below.

Data used as inputs to the planning process were provided by the Michigan utilities whose representatives also comprised the members of the Plan's various working groups. *Strategist*, a proprietary computer software program developed by NewEnergy Associates, LLC, was used in data processing. The program consists of five application modules: Load Forecasting

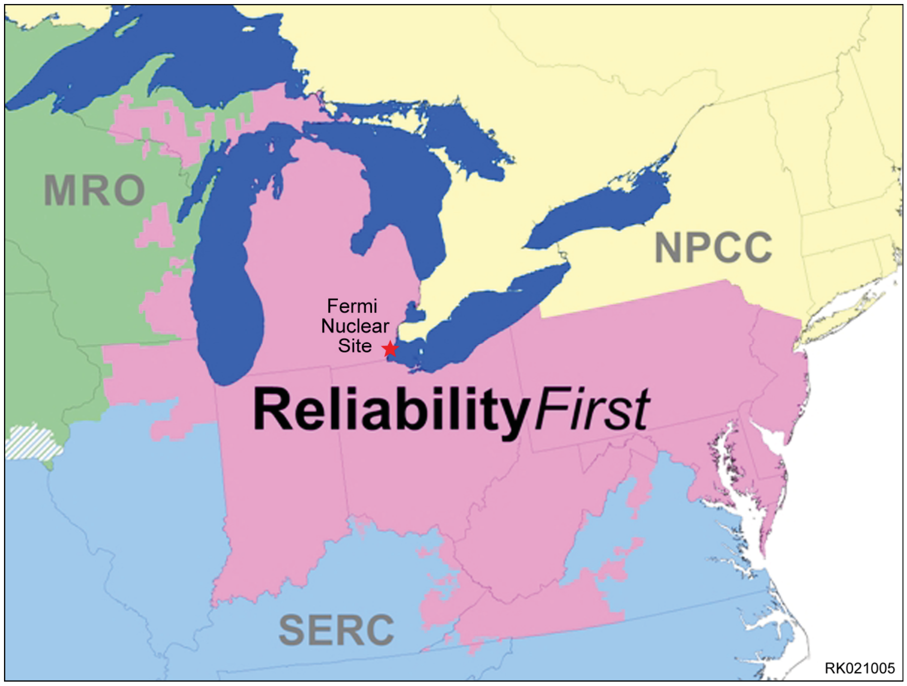

Figure 8-5. Reliability*First* Corporation Boundaries (Detroit Edison 2011a)

Adjustment (LFA), Generation and Fuel (GAF), PROVIEW, Capital Expenditure and Recovery, and Financial Reporting and Analysis. The CNF Update Working Group was responsible for updating the results of the 2005 CNF study, which had been independently produced in five planning areas, in the following respects:

- Confirm the inventory of generating plants currently operational in Michigan, including a review of investment and operating costs, performance, and emission profiles of central station generation technologies, and assess planning review requirements and siting issues, especially those relating to necessary air permits.
- Review the transmission analysis provided in the 2005 study to confirm the simultaneous, on-peak transmission capability and determine the capability availability for reliability support for the Lower Peninsula.
- Assess electric reliability for all regions of Michigan.
- Develop an updated 20-year electric sales and peak demand forecast for each of the three planning regions (Southeast Michigan, Upper Peninsula, and Balance of Lower Peninsula) for Michigan.
- Expand the model system, providing fuel and emission cost forecasts for various scenarios and sensitivities.

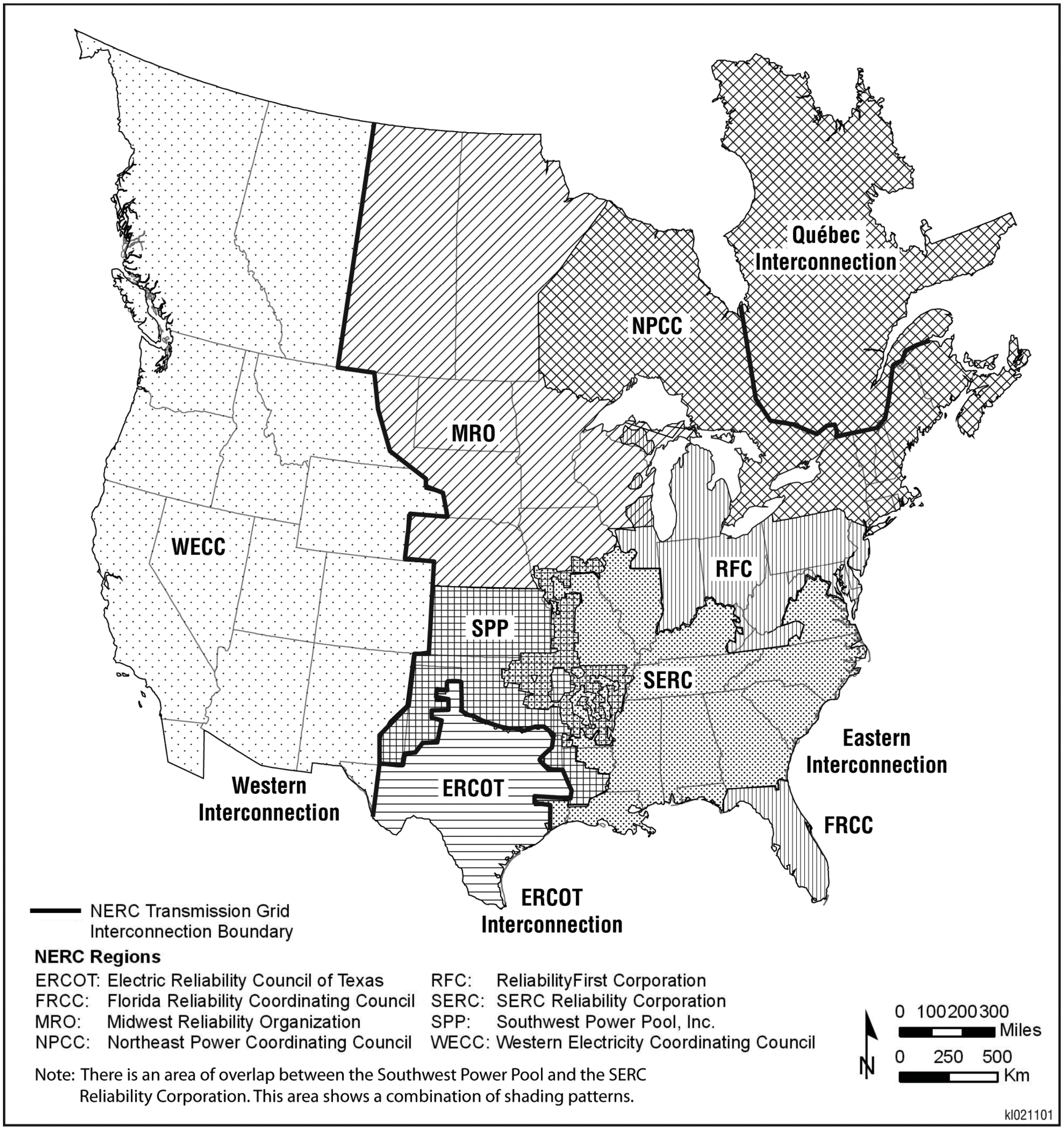

Figure 8-6. NERC Regions and Electricity Transmission Grid Interconnections (modified from NERC 2011)

The ESRP establishes four acceptance criteria for a need for power analysis. The analysis must be (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainties. The review team's evaluation of the MPSC Plan's satisfaction of these criteria is as follows:

Systematic: The architecture and operation of the *Strategist* computer program used to support development of the MPSC Plan ensure a systematic approach to data analysis. The GAF module uses probabilistic methods to simulate power system operation on an hourly basis, providing production costs and reliability estimates that are essential elements to utility supply and demand planning while providing the user with the flexibility to establish dispatch queue priorities on either a seasonal or annual basis. System load data developed by the GAF module is provided as input to the LFA module, which provides the user with additional flexibility in dispatching power, allowing non-thermal resources such as pumped storage to be dispatched before thermal resources, with imported power dispatched only after in-State resources and then only through a marginal cost-based algorithm to minimize costs. Further, the LFA module algorithm dispatches stored energy from the highest cost hour down for generation and pumps water to storage from the lowest cost hour up, thus reducing demands on other technologies at high-cost hours and increasing the load met by those other technologies at low cost hours. The LFA module also provides the user with an option of using the capacity of storage to ensure system reliability as well as for more typical economic reasons. The probabilistic methods employed by the *Strategist* software duplicate widely used production costing procedures, mimicking the typical decision-making procedures of a transmission system operator, ensuring not only the most economical dispatch of power but also that system reliability indices such as loss-of-load hours, expected emergency power, and spinning reserve margins are also satisfied. The user is also provided the flexibility to hold reliability indices constant, allowing capacity benefits that would accrue from Demand Side Management (DSM) programs to be separately calculated. Additional, more detailed evaluations of the impacts of DSM strategies are introduced through the operation of the PROVIEW module, which develops a least-cost balanced demand and supply plan for a utility system under user-prescribed sets of constraints and assumptions. The review team concludes that the data analysis methodologies contained in the *Strategist* software program are systematic, incorporating all aspects of utility planning and thus duplicating real-world decision-making procedures while providing the user with the flexibility to alter default settings to evaluate the impacts of various strategies on the Michigan power system.

Comprehensive: The CNF Update Working Group addressed all aspects of electric utility planning and strategy development, considering the existing central station generation portfolio, existing technologies, and likely future technologies such as conversion of existing coal-fired power plants to integrated gasification combined cycle or pulverized coal plants producing ultra-supercritical steam. The analysis extended into evaluations of the potential for increased efficiencies with incorporation of newer technologies as well as the costs and logistical issues associated with adoption of those new technologies. The Working Group also considered whether existing support infrastructures could support significant changes to the complexion of the State's central station generators, evaluating, for example, whether the existing natural gas pipeline infrastructure would support major shifts to natural gas combined cycle generation or whether the existing transmission system would respond to dramatic changes in central station generation or power imports without sacrificing reliability. Existing agreements and constraints that could change the effective on-peak transfer capacity of the Michigan transmission system were also considered. The review team concludes that the CNF Update Working Group's approach to meeting its responsibilities was comprehensive, addressing all major aspects of utility planning and strategy development.

Subject to Confirmation: Data used to develop the initial 2005 CNF report as well as the more recent data used by the CNF Update Working Group are subject to independent confirmation by MISO in development of statutorily prescribed annual electric system reliability assessments. Importantly, MISO's independent confirmation is for reliability purposes alone and provides no insight into the manner in which generation sources can be used to meet system reliability demands, which is the primary focus of the MPSC Plan. Nevertheless, the MISO reliability assessment still serves as an independent confirmation of the production data that are the basis for the analyses that support MPSC Plan conclusions and recommendations. Reliability modeling is performed to determine whether existing generation, together with electric transmission transfer capability and available external support, can reliably meet projected hourly peak load. The MISO staff used the MARELLI computer model to independently evaluate production data and estimate future generating reliability throughout the RFC region, which includes all of Michigan. The results of the most recent MISO analysis were incorporated into the NERC 2008 Long-Term Reliability Assessment (NERC 2008) that was discussed in Section 8.1.2 above. The MISO procedures were also determined by the review team to satisfy ESRP acceptance criteria. The review team concludes, therefore, that the annual, independent analysis of reliability performed by MISO and using the same production data as were used in the MPSC Plan constitutes an independent confirmation of the conclusions of the CNF Update Working Group and thus satisfies the ESRP criterion.

Responsive to Forecasting Uncertainties: The *Strategist* computer program used by the CNF Update Working Group has sufficient sophistication and flexibility to accommodate a variety of electric system planning scenarios. The CNF Update Working Group was responsible for updating the 20-year electric sales and peak demand forecast for Michigan provided in the initial CNF report, which at the time of the Workgroup's deliberations was less than 3 years old. With adoption of the MARELLI default value of one day's Loss-of-Load Probability (LOLP) every 10 years as an acceptable risk target to system reliability, the CNF Update Working Group acknowledged that Michigan's reliability forecasting was significantly affected by forecasting uncertainties, including changing conditions in external markets that are interconnected with the

Michigan electricity system and economic conditions in local markets served by Detroit Edison. Approximately 99 percent of the Southeast Michigan forecast that was used by the CNF Update Working Group relied on Detroit Edison's electricity projections, which are based on econometric and end-use modeling techniques and which reflected a then-current weaker economic outlook, increased conservation, and efficiency improvements over what was provided as the forecasting basis in the earlier CNF report. Because the CNF Update Working Group was directed to update the relatively recent CNF forecasts and because the Detroit Edison forecast reflected existing as well as projected local economic conditions, the review team concludes that the methodologies employed by the CNF Update Working Group were sensitive to forecasting uncertainties and that its conclusions and recommendations were based on appropriate incorporation of existing economic and market conditions. Sensitivity analyses for the LOLP risk target performed against the assumptions defining Base Case, High Load, Low Load, Expanded Transmission, and Low Imports were viewed by the review team as demonstration of the MPSC Plan's sensitivity to forecasting uncertainties.

8.2 Power Demand

This section discusses the historic and projected demand for electricity as described by the MPSC Plan. Detroit Edison identified the projected start of operations for Fermi 3 as "no earlier than 2021." Because the MPSC Plan projects supply and demand data to 2025, the review team determined that use of the 2025 projections was consistent with ESRP guidance to extend its need for power analysis "through the 3rd year of commercial operation of all proposed units" (NRC 2000). Section 8.2.1 discusses key factors that influence projected demand for electricity. Section 8.2.2 provides an overview of the projected peak summer demand for electricity in the Detroit Edison service area.

8.2.1 Factors Considered in Projecting Growth in Demand

The MPSC Plan included projections for demographics of the industrial, residential, and commercial electricity customer sectors and projected industrial activity levels (especially in auto and truck manufacturing, steel production, and other related industries) and major factors that resulted in forecasting uncertainties (e.g., weather and business cycles of major industrial users). Finally, energy efficiency and energy conservation can have significant impact on the growth in electricity demand. Additional details of how energy efficiency and energy conservation were considered in demand projects are provided below.

Four categories of energy efficiency were examined in detail in the MPSC Plan: (1) statewide energy efficiency programs, (2) electric utility load response programs, (3) commercial building energy efficiency code programs, and (4) State-specific energy efficiency standards for appliances. The MPSC Plan predicted that a reduction in the growth of power demand by as much as 50 percent over a 10-year period would result from the implementation of a comprehensive energy efficiency program and aggressive enforcement, resulting in statewide electric energy savings of between 6664 and 10,603 GWh (gigawatt hour) and reductions in peak electricity demand of between 876 and 1889 MW. Independently developed estimates by Detroit Edison and Consumer's Energy suggest that a 10-year load management programming effort could reduce peak electric demand by 569 MW and annual energy use by 35 GWh (Detroit Edison 2011b). The MPSC Plan estimates promulgation and enforcement of energy efficient commercial building codes could result in statewide electric energy savings over that same period of 477 GWh. The adoption of energy efficiency standards for certain electric appliances could result in additional significant savings. Assuming that all appropriate policies and standards will be adopted and enforced, comparing the projected energy savings against even the more conservative estimate for growth of energy demand contained in the MPSC Plan shows the collective impacts of all such programs would slow, but not completely reverse, the long-term trend of increasing electric power demand.

Table 8-1 displays the MPSC Plan's projected energy efficiency demand savings from 2007 to 2025 for the entire State of Michigan. Of the total 96,785,842 MWh of power generated by electric utilities in Michigan in 2008, Detroit Edison was responsible for 48,816,410 MWh, or approximately 50 percent of the total (DOE/EIA 2010b). To translate MPSC's projected energy efficiency savings in Table 8-1 to an appropriate level for the Detroit Edison service area, the review team made the simplifying assumption that Detroit Edison customers would contribute to the statewide DSM reductions in the same proportion as their contribution to the total power generated in the State of Michigan. Therefore, the review team assumed Detroit Edison would be able to reduce its system-wide generating capacity by at least half of the amount shown in Table 8-1, or about 1400 MW by 2025.

If pursued and successfully executed, energy efficiency and energy conservation programs would result in meaningful energy savings and reductions in electricity demand. However, even if comprehensively structured and aggressively implemented and enforced, energy efficiency programs would have only a limited influence on the rate of growth of Michigan's need for power. Identification of potential savings does not necessarily guarantee demand response programs will be successfully implemented or that all eligible customers will participate fully; consequently, there is no guarantee that the identified potential amounts of demand reduction will actually materialize.

The review team determined that the factors described above that were considered in developing forecasting uncertainties presented in the MPSC Plan and cited in Detroit Edison's ER were consistent with NRC guidance, were systematically developed, gave adequate consideration to historic trends in energy consumption, and were sufficiently sensitive to an appropriate array of forecasting uncertainties.

Table 8-1. Modeled Energy Efficiency Program Demand Savings

Year	Demand Savings (MW)
2007	385
2008	513
2009	640
2010	764
2011	886
2012	1069
2013	1250
2014	1429
2015	1609
2016	1787
2017	1902
2018	2016
2019	2130
2020	2243
2021	2356
2022	2468
2023	2579
2024	2690
2025	2801

Source: MPSC Plan Appendix – Volume II (MSPC 2007)

8.2.2 Independent Projections on Growth in Demand

A comprehensive transmission planning exercise, MISO Transmission Expansion Plan (MTEP), was completed in November 2008 (MISO 2008). Analyses performed in the context of that study were independent of the MPSC Plan, but nevertheless consistent with the MPSC Plan in their results. MISO assessed power resource adequacy from both resource availability (based on minimum reserve margin requirements of 14.5 percent established by State authorities) and a confidence (or risk) level over the period 2008 through 2017 over various scenarios to determine the onset of reliability problems (a level of risk defined as a Loss of Load Expectation [LOLE] of greater than 1 day in 10 years), assuming a reserve margin of 14.5 percent. Models were run for a Base Case (which assumes as much as 80 percent of capacities represented in the requested generator interconnection requests will come on-line) and for other factors deemed to have critical impacts on reserve margins. The results as shown in Table 8-2 indicate that without new generating capacity, current resource levels would put the MISO area at risk for a load disruption by 2014, and that under scenarios that approximate reasonably expected

Table 8-2. MISO Predicted Year of LOLE of One Day in 10 Years

Scenario	Onset of LOLE of 1 day in 10 years
Base Case[(a)]	2014
2-year delay for all projects in the queue	2014
Increased retirements of baseload units	2013
Increase in forced outage rates	2011
Elimination of production tax credit for wind energy	2014
No firm imports of power	2009
Reduction in demand-side management	2012

Source: MISO 2008

(a) The MISO Base Case assumes that 80 percent of interconnection requests currently on the queue for which an Interconnection Agreement has been signed will come on-line and that 20 percent of all other projects on the queue will ultimately come on-line.

changes in the MISO system, exposure to such disruption could begin even sooner. The 2008 MISO planning exercise predicts immediate exposure to loss of load if no power were to be imported, as displayed in Table 8-2.

8.2.3 Power Demand and Energy Requirements

Statewide, the customer base for retail electricity sales in 2008 included 32.4 percent residential, 36.8 percent commercial, and 30.7 percent industrial (DOE/EIA 2010b). The distribution of electricity sales between those three rate categories in the Detroit Edison service area over that same period was 32.6 percent residential, 39.8 percent commercial, and 27.6 percent industrial (DOE/EIA 2010b).

The review team notes that despite incorporation of the downward projections of demand provided by the State's utilities, the MPCS Plan projected a modest growth in electricity demand in Southeast Michigan of 1.2 percent annually over the planning horizon represented in the Plan (2006 to 2025). Table 8-3 shows the MPSC Plan's forecasted growth in peak demand in the Southeast Michigan Planning Area over the period 2005–2025 for each of the planning scenarios addressed in the MPSC Plan: Base Case, High Growth, and Low Growth.

The MPSC Plan projects a statewide growth rate for electricity consumption of 1.3 percent over the period 2006 to 2025, from 112,183 GWh to 143,094 GWh, and a growth rate in electricity consumption in Southeast Michigan of 1.2 percent. The MPSC Plan estimated a statewide summer peak demand of 23,756 MW in 2006 and 29,856 MW in 2025 (Base Case). Of this amount, 12,427 MW and 15,595 MW of peak summer demand were projected for Southeast

Table 8-3. Forecasted Annual Summer Non-Coincident Peak Electricity Demand (in MW) for the MPSC Southeast Michigan Planning Area

Year	Base Case	High Growth	Low Growth
2005	12,209	12,331	12,087
2006	12,427	12,676	12,178
2007	12,579	12,957	12,202
2008	12,682	13,190	12,175
2009	12,666	13,300	12,033
2010	12,806	13,574	12,038
2011	12,955	13,861	12,048
2012	13,144	14,196	12,092
2013	13,287	14,483	12,091
2014	13,442	14,786	12,098
2015	13,598	14,958	12,238
2016	13,728	15,101	12,355
2017	13,865	15,252	12,479
2018	14,031	15,434	12,628
2019	14,190	15,609	12,771
2020	14,414	15,856	12,973
2021	14,643	16,107	13,178
2022	14,875	16,362	13,387
2023	15,111	16,622	13,600
2024	15,351	16,886	13,816
2025	15,595	17,154	14,035

Source: MPSC Plan, Appendix – Volume II, Workgroup Reports, Tables 10, 11, and 12 (MPSC 2007)

Michigan in 2006 and 2025, respectively (MPSC 2007, Table 10, Appendix, Volume II, Workgroup Reports). In confirmation of the reliability of the MPSC Plan for this need for power assessment, the review team determined the MSPC Plan's projected growth rates are generally consistent with forecasts independently developed by MISO and incorporated into NERC's LTRA report (NERC 2008).

Table 8-4 displays the MPSC Plan's projected 2025 demand for electricity at summer peak in the Southeast Michigan Planning Area, adjusted to account for energy efficiency measures that reduce overall demand and to include the reserve margin additional capacity necessary to maintain grid stability. Based upon the MPSC Plan's Base Case estimate and the assumptions discussed above, the review team identified a net peak summer demand in 2025 of 14,649 MW.

Table 8-4. 2025 Projected Summer Peak Demand in Southeast Michigan Planning Area (in MW)

	Demand Component	2025
A	Peak Summer Demand[(a)]	15,595
B	(Less) Energy Efficiency Measures[(b)]	1400
C	Net Peak Summer Demand (A – B)	14,195
D	Reserve Margin (C × 0.145)	2058
E	Total Peak Summer Demand (C + D)	16,253

(a) Source: MPSC 2007 (Base Case Scenario)
(b) Value calculated as 50 percent of 2025 demand savings (MPSC 2007, Plan Appendix – Volume II).

8.3 Power Supply

This section assesses the evaluation by Detroit Edison of the adequacy of its existing power generating capability against current and expected future power demands. The fuel mix used in Michigan for electricity generation was outlined in Section 8.1. Within Southeast Michigan, the technology mix used by investor-owned utilities (primarily Detroit Edison) includes steam turbines supported by nuclear, coal, natural gas, and oil combined cycle plants consisting of natural gas-fired combustion turbines and combustion turbines and run-of-the-river and pumped-storage hydroelectric turbines. With a rated capacity of 1111 MW, the Fermi 2 nuclear reactor operated by Detroit Edison is the largest single generator among the 119 central station generating units operating within the region. Table 8-5 displays the electricity generating capacity within the Detroit Edison service area and the rest of the Southeast Michigan Planning Area.

Detroit Edison was the source for some of the data contained in the MPSC Plan regarding an inventory of existing generating capacity within the State (reported separately for each of the three major planning regions established in the MPSC Plan: Southeast Michigan, Balance of Lower Peninsula, and Upper Peninsula). The MPSC Plan lists central station power generating facilities in Southeast Michigan as consisting of: 32 natural gas-fired combustion turbines; 26 oil-fired combustion turbines; 3 run-of-river hydroelectric plants; 34 steam turbines (supported by 8 landfill gas-fired, 21 coal-fired, 5 oil-fired, and 1 refuse-fired boilers); and 1 nuclear plant (MPSC 2007). Although some minor changes may have occurred to the operating conditions or capacities of the listed units since these tabulations were developed, the review team has determined that these data represent a sufficiently reliable inventory of existing power generating capacity as suggested by NRC's ESRP guidance.

As outlined in Section 8.1, Detroit Edison power enters the transmission grid operated by ITC*Transmission*, a member of MISO. Detroit Edison continues to rely on the Generation Interconnection Request Queue maintained by MISO for a reliable and authoritative listing of

Table 8-5. Electricity Generation Capacity in Southeast Michigan (2005 Data)

Plant Type	Summer Capacity (MW)	Winter Capacity (MW)	Number of Units
Ownership: Investor Owned Utility			
Nuclear	1110	1125	1
Steam generator	8248	8275	26
Combined cycle/gas turbine	969	1188	31
Internal combustion	152	152	61
Subtotal	10,479	10,740	119
Ownership: Municipality/Cooperative/Public Authority			
Steam generator	470	472	8
Combined cycle/gas turbine	25	30	1
Internal combustion	39	40	36
Subtotal	534	542	45
Ownership: Non-Utility			
Steam generator	326	338	7
Combined cycle/gas turbine	1502	1515	23
Hydroelectric	5	6	5
Internal combustion	76	77	76
Subtotal	1909	1936	111
Southeast Total	12,922	13,218	275

Source: MPSC Plan, Appendix Volume II, Workgroup Reports, Chapter 2, Capacity Need Forum Update Workgroup Resource Assessment, Table 1 (MPSC 2007).

proposed new generating capacity. As of January 29, 2010, there were 47 active generator interconnection requests in the MISO interconnection queue for new generation sources in Michigan, representing a potential infusion of 8776 MW of new generating capacity (maximum summer capacity)[a] (including Fermi 3). A facility's presence on the interconnection queue does not guarantee that it will ultimately begin operation.[b] Consequently, only 4180 MW of new

(a) Data reported in the ER reflected the generator interconnection queue as of June 11, 2008. At that time, there were 28 active interconnection requests totaling 7015 MW maximum summer capacity. The ER did not distinguish between in-service or proposed generating units on the queue. The current MISO Generation Interconnection Request Queue can be viewed on the MISO Web site http://www.midwestiso.org/page/Generator%20Interconnection.

(b) MISO reports that historically only 20 percent of the projects in the interconnection queue for which a signed Interconnection Agreement has been executed actually go into service (MISO 2008).

capacity has actually become available to date. Future generation capacity must also account for power generated outside of Michigan and imported into the State. Although as much as 3000 MW of on-peak power transfer capability existed in 2009, firm reserves of 800 MW are in place for those likely sources of exported power from locations outside of Michigan. Consequently, reliable power import estimates used in forecasting performed in the MPSC Plan were limited to 2200 MW.

A number of other factors related to wholesale electricity markets contribute to uncertainties with respect to available future retail power in the Detroit Edison service area. Upgrades to the configurations and interconnections of ITC*Transmission* and METC transmission systems as well as various expansion projects under consideration can all dramatically change power import/export characteristics for the Detroit Edison service area. Finally, future estimates of available power must consider announced and expected retirement schedules of baseload units within the Detroit Edison service area. To anticipate retirements, the MPSC Plan assigned expected lifetimes to each type of baseload unit currently in operation: 65 years for coal, 60 years for nuclear, 40 years for combined cycle plants, and 30 years for combustion turbines. The review team concurs in the reasonableness of these lifetime assumptions. Twenty-nine fossil fuel units throughout the State are scheduled for retirement through 2024, representing a total generating capacity of 3755 MW. Table 8-6 displays the MPSC Plan's projected retirements for the State of Michigan from 2013 through 2024.

In the MPSC Plan's Southeast Michigan Planning Area, generating unit retirements are projected to total 2039 MW through 2024 (1877 MW from Detroit Edison, 93 MW from Lansing Board of Water and Light, 47 MW from the City of Detroit, and 22 MW from the City of Wyandotte). All of the units projected to be retired in Table 8-7 are currently supplying power to customers in the same area that would be served by the 1535-MW(e) Fermi 3. Introduction of Fermi 3 into the Detroit Edison power portfolio will potentially offset approximately 75 percent of the generation capacity represented by the projected unit retirements in Southeast Michigan and 82 percent of the generating capacity represented by retiring Detroit Edison-owned units.

8.4 Summary of Need for Power

The review team has examined the methodology employed in developing the short- and long-term electric power needs discussed in the MPSC Plan and has verified that it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty (NRC 2000). The evaluation also confirmed that the planning effort represented in the MPSC Plan extended beyond supply-side projections for construction of conventional generation, transmission, and distribution systems to consider a full complement of both supply-side and demand-side projections and extended beyond conventional energy resources to examine the feasibility and potential role of renewable energy resources. The review team also examined the scope of the MPSC Plan and has verified that it met the objectives of ensuring continued

Table 8-6. Aggregate Unit Retirements in Michigan

Year	Modeled Capacity Retired (MW)
2013	129
2014	0
2015	301
2016	226
2017	204
2018	439
2019	375
2020	180
2021	402
2022	584
2023	400
2024	515
Total	**3755**

Source: MPSC Plan Appendix – Volume II (MPSC 2007)

Table 8-7. Aggregate Retirements in Southeast Michigan

Plant Name	Owner	Retire Year	Capacity (MW)
TRNTNCHN	Detroit Edison	2015	210
MSTERSKY 5	City of Detroit	2015	39
CNNRSCRK	Detroit Edison	2016	215
STCLAIR 1	Detroit Edison	2018	153
STCLAIR 2	Detroit Edison	2018	162
STCLAIR 3	Detroit Edison	2019	171
STCLAIR 4	Detroit Edison	2019	158
ECKERT 1	Lansing BWL	2019	46
RVRROUGE 1	Detroit Edison	2021	242
RVRROUGE 2	Detroit Edison	2022	247
WYNDTTWY 5	Wyandotte	2022	22
RVRROUGE 3	Detroit Edison	2023	280
ECKERT 2	Lansing BWL	2023	47
MSTERSKY 6	City of Detroit	2023	47
TOTAL			**2039**

Source: MPSC Plan Appendix – Volume II (MPSC 2007) electricity reliability, controlling both short- and long-term costs, minimizing environmental impacts, and enhancing overall system security by decreasing reliance on imported energy resources and maximizing the use of locally available energy resources. Finally, the review team assessed the MPSC Plan and its supporting data and determined that the MPSC Plan's conclusions were reproducible and gave consideration to the influence of forecasting uncertainties to an appropriate extent.

In summary, power from Fermi 3 would largely offset the projected loss of 2039 MW of generating capacity in the Southeast Michigan Planning Area due to unit retirements. In addition to planned retirements, the MPSC Plan Base Case Scenario projected a growth in power demand throughout the State. According to data presented in the MPSC Plan, in the Southeast Michigan Planning Area, the 2005 baseload capacity of 12,922 MW would need to increase by 3331 MW to meet the projected 2025 peak demand of 16,253 MW while still preserving adequate spinning reserve and system reliability. Notwithstanding other changes to demand or supply, Fermi 3 would meet 46 percent of that required additional power capacity. Table 8-8 provides a summary of the need for power in Southeast Michigan in 2025.

The review team concurs with the MPSC Plan conclusion that the State will continue to experience growth in power demand into the foreseeable future. The review team also concurs with the MPSC Plan conclusion that new baseload capacity will be needed no later than 2015 to preserve adequate reserve margins, and that such needs exist irrespective of reductions in demand resulting from successful implementation of energy conservation programs or changes to power import/export conditions affecting the Detroit Edison service area.

The review team concludes, therefore, that introduction of new generating capacity or importing power in an amount at least equivalent to that projected for Fermi 3 is minimally necessary to meet the current loads within the Detroit Edison service area. The projected growth in power demand with time discussed above further emphasizes the need for new sources of power in the Detroit Edison service area.

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Docket No. 52-033

11. ABSTRACT *(200 words or less)*

This environmental impact statement (EIS) has been prepared in response to an application submitted by Detroit Edison Company to the U.S. Nuclear Regulatory Commission (NRC) for a combined licenses (COL) for Unit 3 at the Enrico Fermi AtomicPower Plant (Fermi) site in Monroe County, Michigan. This EIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action and mitigation measures for reducing and avoiding adverse impacts.

The NRC staff's preliminary recommendation to the Commission, considering the environmental aspects of the proposed action, is that the COL be issued. This recommendation is based on (1) the COL application, including the Environmental Report submitted by Detroit Edison Company; (2) consultation with Federal, State, Tribal, and local agencies; (3) the review team's independent review; (4) the consideration of public scoping comments; and (5) the assessments summarized in this EIS, including the potential mitgation measures identified in the ER and this EIS.

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