Table G-3. (contd)

Parameter	NRC Staff Value		Comments
	I-132	1.24×10^{0}	
	I-133	9.21×10^{-1}	
	I-134	2.27×10^{0}	
	I-135	1.27×10^{0}	
	H-3	3.24×10^{1}	
	C-14	1.43×10^{1}	
	Ar-41	3.78×10^{-2}	
	Cr-51	1.22×10^{-3}	
	Mn-54	8.11×10^{-4}	
	Co-58	1.35×10^{-3}	
	Co-60	1.35×10^{-3}	
	Fe-59	1.35×10^{-4}	
	Zn-65	8.11×10^{-3}	
	Sr-89	8.11×10^{-3}	
	Sr-90	2.70×10^{-5}	
	Zr-95	5.41×10^{-5}	
	Nb-95	8.11×10^{-6}	
	Mo-99	2.70×10^{-3}	
	Ru-103	6.76×10^{-5}	
	Sb-124	1.35×10^{-4}	
	Cs-134	2.70×10^{-4}	
	Cs-136	1.35×10^{-4}	
	Cs-137	1.35×10^{-3}	
	Ba-140	1.35×10^{-2}	
	Ce-141	1.35×10^{-2}	
New unit gaseous effluent source term – radwaste building (Ci/yr)[(a)]	Kr-89	1.76×10^{1}	Values from GEH ESBWR DCD Table 12.2-16 for a single unit (GEH 2010) and FSAR Table 12.2-206 (Detroit Edison 2012).
	Xe-133	1.35×10^{2}	
	Xe-135m	3.24×10^{2}	
	Xe-135	1.70×10^{2}	
	Xe-137	5.14×10^{1}	
	Xe-138	1.22×10^{0}	
	I-131	9.19×10^{-3}	
	I-132	8.11×10^{-2}	
	I-133	5.95×10^{-2}	
	I-134	1.49×10^{-1}	
	I-135	8.38×10^{-2}	
	Cr-51	9.46×10^{-4}	
	Mn-54	5.41×10^{-3}	
	Co-58	2.70×10^{-4}	

Table G-3. (contd)

Parameter	NRC Staff Value		Comments
	Co-60	9.46×10^{-3}	
	Fe-59	4.05×10^{-4}	
	Zn-65	4.05×10^{-4}	
	Zr-95	1.08×10^{-3}	
	Nb-95	5.41×10^{-6}	
	Mo-99	4.05×10^{-6}	
	Ru-103	1.35×10^{-6}	
	Sb-124	9.46×10^{-5}	
	Cs-134	3.24×10^{-3}	
	Cs-137	5.41×10^{-3}	
	Ba-140	5.41×10^{-6}	
	Ce-141	9.46×10^{-6}	
Population distribution	Tables 2.5-10 and 2.5-12 of the ER (Detroit Edison 2011)		Population distribution used by Detroit Edison and the NRC staff was for year 2060. Note that ESRP Section 5.4.1 requires use of "projected population for 5 years from the time of the licensing action under consideration." Assuming the ESRP licensing action occurred in year 2010, adding 5 years yields year 2015. See discussion of population dose in Section G.2.5.
Wind speed and direction distribution	Table 2.7-63 of the ER (Detroit Edison 2011)		Site-specific data provided by Detroit Edison for time periods from 2003 to 2007.
Atmospheric dispersion factors (sec/cubic meter [m^3])	Tables 2.7-87 through 2.7-95 and Tables 2.7-108 through 2.7-140 of the ER (Detroit Edison 2011)		Site-specific data provided by Detroit Edison for time periods from both 1985 to 1989 and 2003 to 2007.
Ground deposition factors (m^{-2})	Tables 2.7-87 through 2.7-95 and Tables 2.7-108 through 2.7-140 of the ER (Detroit Edison 2011)		Site-specific data provided by Detroit Edison for time periods from both 1985 to 1989 and 2003 to 2007.
Milk production rate within a 50-mi radius of the Fermi site (kg/yr)	6.043×10^8		Site-specific data from Table 5.4-3 provided by Detroit Edison (2011).
Vegetable/fruit production rate within a 50-mi radius of the Fermi site (kg/yr)	9.689×10^9		Site-specific data from Table 5.4-3 provided by Detroit Edison (2011).

Table G-3. (contd)

Parameter	NRC Staff Value	Comments
Meat production rate within a 50-mi radius of the Fermi site (kg/yr)	1.919×10^7	Site-specific data from Table 5.4-3 provided by Detroit Edison (2011).
Pathway receptor locations (direction and distance) – nearest site boundary, vegetable garden, residence, meat animal, milk animal	Tables 2.7-80 through 2.7-86 of the ER (Detroit Edison 2011)	Site-specific data provided by Detroit Edison (2011).
Consumption factors for milk, meat, leafy vegetables, and vegetables	Milk (L/yr) 310 (adult) 400 (teen) 330 (child) 330 (infant) Meat (kg/yr) 110 (adult) 65 (teen) 41 (child) 0 (infant) Leafy vegetables (kg/yr) 64 (adult) 42 (teen) 26 (child) 0 (infant) Vegetables (kg/yr) 520 (adult) 630 (teen) 520 (child) 0 (infant)	Table 5.4-2 of the ER (Detroit Edison 2011) and Regulatory Guide 1.109 (NRC 1977).
Fraction of year that leafy vegetables are grown	0.33	Site-specific value from Table 5.4-3 of the ER (Detroit Edison 2011).
Fraction of year that milk cows are on pasture	0.58	Site-specific value from Table 5.4-3 of the ER (Detroit Edison 2011).
Fraction of year that goats are on pasture	0.67	Site-specific value from Table 5.4-3 of the ER (Detroit Edison 2011)
Fraction of MEI vegetable intake from own garden	0.76	Default value of GASPAR II code (Strenge et al. 1987).
Fraction of milk-cow intake that is from pasture while on pasture	1	Default value of GASPAR II code (Strenge et al. 1987).
Fraction of goat intake that is from pasture while on pasture	1	Default value of GASPAR II code (Strenge et al. 1987).

Table G-3. (contd)

Parameter	NRC Staff Value	Comments
Average absolute humidity over the growing season (g/m^3)	11	Site-specific value from the Detroit Edison (2011), Table 5.4-3.
Average temperature over the growing season (°F)	None	Default value of GASPAR II code (Strenge et al. 1987).
Fraction of year that beef cattle are on pasture	0.58	Site-specific value from Table 5.4-3 of the ER (Detroit Edison 2011).
Fraction of year of beef cattle intake that is from pasture while on pasture	1	Default value of GASPAR II code (Strenge et al. 1987).

(a) To convert Ci/yr to Bq/yr, multiply the value by 3.7×10^{10}.

40 CFR Part 190. The NRC staff's calculations for cumulative dose confirmed the Detroit Edison estimates (Detroit Edison 2011, Table 5.4-8).

G.4 Dose Estimates to the Biota from Liquid and Gaseous Effluents

To estimate doses to the biota from the liquid and gaseous effluent pathways, the NRC staff used the LADTAP II code (Strenge et al. 1986), the GASPAR II code (Strenge et al. 1987), and input parameters supplied by Detroit Edison in its ER (Detroit Edison 2011).

G.4.1 Scope

The NRC staff estimated the doses to biota other than human beings using surrogate species; using the characteristics of surrogate species to represent a range of species is an accepted methodology. Fish, algae, and invertebrate species are used as surrogate aquatic biota species. Muskrats, raccoons, herons, and ducks are used as surrogate terrestrial biota species. The staff recognizes the LADTAP II computer program as an appropriate method for calculating doses to the aquatic biota and for calculating the liquid-pathway contribution to terrestrial biota. The LADTAP II code calculates an internal dose component and an external dose component and sums them for a total body dose. The NRC staff reviewed the input parameters used by Detroit Edison for appropriateness. Default values from Regulatory Guide 1.109 (NRC 1977) were used when site-specific input parameters were not available. The NRC staff concluded that all of the LADTAP II input parameters used by Detroit Edison were appropriate. These parameters were used by the NRC staff in its independent calculations using LADTAP II.

The LADTAP II code calculates only biota doses from the liquid effluent pathway. Terrestrial biota could also be exposed via the gaseous effluent pathway. The gaseous pathway doses would be the same as doses for the MEI calculated using the GASPAR II code. Detroit Edison

(2011) used the MEI doses at 0.25 mi from the release point to estimate onsite biota exposures. To account for the greater proximity of the main body mass of animals to the ground as compared to that of humans, the biota calculation assumed a ground deposition factor twice that used in the human MEI calculation. The gaseous pathway doses are summed and combined with the liquid pathway doses for the representative biota species. The NRC staff used the same approach in its calculations with one exception. The NRC staff included doses from ingestion of vegetation in the gaseous pathway estimates.

G.4.2 Resources Used

To calculate doses to the biota, the NRC staff used a PC version of the LADTAP II and GASPAR II computer codes entitled NRCDOSE Version 2.3.10 (Chesapeake Nuclear Services, Inc. 2008). NRCDOSE was obtained through the Oak Ridge RSICC.

G.4.3 Input Parameters

The NRC staff used the input parameters for LADTAP II and GASPAR II specified in Sections G.2.3 and G.2.4 to calculate biota doses.

G.4.4 Comparison of Results

Table G-4 compares Detroit Edison's biota dose estimates from liquid and gaseous effluents presented in the ER (Detroit Edison 2011, Table 5.4-9) with the NRC staff's estimates. The NRC staff's dose estimates were slightly higher than Detroit Edison's estimates for gaseous pathways because of the addition of the vegetation ingestion pathway.

Table G-4. Comparison of Dose Estimates to Biota from Liquid and Gaseous Effluents for Fermi 3

Biota	Pathway	Detroit Edison (2011, Table 5.4-9) (milliradian [mrad]/yr)	NRC Staff Calculation (mrad/yr)	Percent Difference
Fish	Liquid	2.31	2.31	0
	Gaseous[(a)]	NA	NA	–
Muskrat	Liquid	14.8	14.8	0
	Gaseous	11.15	12.7	12
Raccoon	Liquid	0.43	0.43	0
	Gaseous	11.15	12.7	12
Heron	Liquid	6.87	6.87	0
	Gaseous	11.15	12.7	12
Duck	Liquid	14.8	14.8	0
	Gaseous	11.15	12.7	12
Algae	Liquid	11.9	11.9	0
	Gaseous[(a)]	NA	NA	–
Invertebrate	Liquid	7.65	7.65	0
	Gaseous[(a)]	NA	NA	–

(a) Fish, invertebrate species, and algae would not be exposed to gaseous effluents.

G.5 References

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

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190 "Environmental Radiation Protection Standards for Nuclear Power Operations."

Chesapeake Nuclear Services, Inc. 2008. *NRCDOSE for Windows*. Radiation Safety Information Computational Center, Oak Ridge, Tennessee.

Detroit Edison Company (Detroit Edison). 2011. *Fermi 3 Combined License Application, Part 3: Environmental Report*. Revision 2, Detroit, Michigan. February. Accession No. ML110600498.

Detroit Edison Company (Detroit Edison). 2012. *Fermi 3 Combined License Application, Part 2: Final Safety Analysis Report*. Revision 4, Detroit, Michigan. February. Accession No. ML12095A119.

General Electric-Hitachi Nuclear Energy Americas, LLC (GEH). 2010. *ESBWR Design Control Document – Tier 2, Chapter 12 Radiation Protection.* Revision 9. December. Accession No. ML103440247.

Sagendorf, J.F., J.T. Goll, and W.F. Sandusky. 1982. *XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations*. NUREG/CR-2919, Pacific Northwest National Laboratory, Richland, Washington.

Strenge, D.L., R.A. Peloquin, and G. Whelan. 1986. *LADTAP II – Technical Reference and User Guide*. NUREG/CR-4013, Pacific Northwest Laboratory, Richland, Washington.

Strenge, D.L., T.J. Bander, and J.K. Soldat. 1987. *GASPAR II – Technical Reference and User Guide*. NUREG/CR-4653, Pacific Northwest Laboratory, Richland, Washington.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I*. Regulatory Guide 1.109, Office of Nuclear Reactor Regulation, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan*. NUREG-1555, Office of Nuclear Reactor Regulation, Washington, D.C. Available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555. Accessed July 13, 2008.

Appendix H

Authorizations, Permits, and Certifications

Appendix H

Authorizations, Permits, and Certifications

This appendix contains a list (Table H-1) of the environment-related authorizations, permits, and certifications potentially required by Federal, State, regional, local, and affected Native American Tribal agencies related to the combined license for the proposed Enrico Fermi Unit 3 (Fermi 3). The table is adapted from Table 1.2-1 of the Environmental Report (ER) submitted to the U.S. Nuclear Regulatory Commission (NRC) by the applicant, Detroit Edison Company (Detroit Edison).

Table H-1. Authorizations/Permits Required for Combined License

Agency[(a)]	Authority	Requirement	Activity Covered	Status[(b)]
Federal Authorizations				
NRC	10 Code of Federal Regulations (CFR) Part 52, Subpart C	Combined License	Construction activities associated with a nuclear power facility.	Submitted September 18, 2008
NRC	10 CFR Part 40	Source Material License	Approval to possess source material.	To be issued as part of COL
NRC	10 CFR Part 70	Special Nuclear Materials License	Approval to possess special nuclear material.	To be issued as part of COL
NRC	10 CFR Part 30	Byproduct License	Approval to possess fuel and source material.	To be issued as part of COL
NRC/U.S. Environmental Protection Agency	Resource Conservation and Recovery Act (RCRA), Atomic Energy Act, 40 CFR Part 266	Low-Level Mixed Waste Conditional Exemption	Allows the storage and treatment of low-level mixed waste.	Not yet submitted
Department of Energy (DOE)	Nuclear Waste Policy Act (42 USC 10101 *et seq*.) and 10 CFR Part 961	Spent Fuel Contract	The DOE Standard Contract for disposal of spent nuclear fuel contained in 10 CFR Part 961.	DE-CR01-11GC1126
Federal Aviation Administration (FAA)	14 CFR 77.13, Federal Aviation Act	Notice of Proposed Construction or Alteration	Construction of structures (>200 ft) affecting air navigation.	Not yet submitted
Department of Transportation (DOT)	49 CFR Part 107, Subpart G	Hazardous Materials Certificate of Registration	Shipment of radioactive and hazardous materials.	Reg. No. 061009 551 033RT[(c)]
U.S. Coast Guard	14 USC 81, 83, 85, 633 33 CFR Part 66	Authorization to Impact Navigation/Private Aids to Navigation	The interference of existing navigation aids or the placement and use of private aids to navigation in navigable waters of the United States.	Not yet submitted

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status[(b)]
U.S. Army Corps of Engineers (USACE)	Section 10 of the Rivers and Harbors Appropriation Act of 1899, 33 USC 403 *et seq.*	Section 10 Permit	Structures and/or work that may affect navigability of any navigable waters of the United States. Structural alterations may include barge slip construction and the installation of or modification to existing intake and outfall structures.	Included in Joint Permit Application submitted to USACE on September 9, 2011
USACE	Clear Water Act (CWA), Section 404, 33 USC 1344	Section 404 Permit	Discharge of dredge or fill material within waters of the United States, including wetlands.	Included in Joint Permit Application submitted to USACE on September 9, 2011
U.S. Fish and Wildlife Service (FWS)	Endangered Species Act (ESA) Section 7, 16 USC 1539	ESA Section 7 Consultation	Consultation regarding the potential impacts on Federally threatened and endangered species.	Biological Assessment submitted March 30, 2012; concurrence from FWS on June 8, 2012.
FWS	Bald and Golden Eagle Protection Act (BGEPA), 16 USC 668	BGEPA Consultation	Consultation regarding the potential impacts on bald and golden eagles.	Ongoing
FWS	Migratory Bird Treaty Act (MBTA), 16 USC 703	MBTA Consultation	Consultation regarding the potential impacts on protected migratory birds.	Ongoing
State Authorizations				
Michigan Department of Environmental Quality (MDEQ) Office of Great Lakes	CZMA, 16 USC 1451 *et seq*.	Coastal Zone Management Act (CZMA) consistency review	Obtaining a Federal license or permit.	Issuance of Permit Number 10-58-0011-P (January 24, 2012) provides CZMA consistency determination

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status[(b)]
MDEQ Water Resources Division	MCL 324.30306 *et seq.*; CWA, Section 404, 33 USC 1344	Wetlands Protection Permit	Any projects on or in wetlands regulated by the State of Michigan.	Permit Number 10-58-0011-P issued January 24, 2012
MDEQ Water Resources Division	MCL 324.32501 *et seq.*	Great Lakes Submerged Lands Permit	Dredging, filling, modifying, constructing, enlarging, or extending of structures in Great Lakes waters or below the ordinary high water mark of the Great Lakes; or connecting any natural or artificial waterway, canal, or ditch with any Great Lake including Lake St. Clair.	Permit Number 10-58-0011-P issued January 24, 2012 Permit Number 11-58-0055-P was issued April 25, 2012 (maintenance dredging)
MDEQ Water Resources Division	MCL 324.32723	Water Withdrawal Permit	Withdrawals from the Great Lakes and connecting waterways of over 5 MGD.	Not yet submitted
MDEQ Water Resources Division	MCL 324.32705	Water Withdrawal Registration	Development of the withdrawal capacity on the property of an additional 100,000 gal of water per day from the waters of the State.	Not yet submitted
MDEQ Water Resources Division	MCL 324.4101 *et seq.*	Wastewater Facilities Construction Permit/Part 41 Construction Permit	Construction or modification of sewers, pumping stations, force mains, and treatment plants.	Not yet submitted
MDEQ Water Resources Division	33 USC 1251 *et seq.* MCL 324.3101 *et seq.* MCL 324.3301 *et seq.*	National Pollutant Discharge Elimination System (NPDES) Permit	Discharge of waste, waste effluent, and certain categories of stormwater runoff into the surface waters of Michigan during operation of the facility.	Permit Number MI0058892 issued February 2, 2012
MDEQ Water Resources Division	MCL R323.2190	NPDES Permits, Stormwater Construction Permit	A Permit by Rule may be obtained to authorize stormwater discharges from a construction site greater than or equal to 5 ac.	Not yet submitted

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status[b]
MDEQ Water Resources Division	33 USC 1251 *et seq*. MCL 324.3101 *et seq*.	NPDES General Dredging Dewatering Water Permit	Discharges of dredging dewatering water resulting from the removal of uncontaminated sediment from a waterway.	General Permit Number MIG690000[c]
MDEQ Water Resources Division	33 USC 1251 *et seq*. MCL 324.3101 *et seq*.	NPDES General Hydrostatic Pressure Test Water	Discharges from the hydrostatic pressure testing of new and existing piping, tanks, vessels, and other associated equipment that have been physically cleaned and/or provided with effluent treatment.	Permit Number MIG6790000[c]
MDEQ Water Resources Division	CWA Section 401, 33 USC 1341	Section 401 Water Quality Certification	The construction and operation of a facility that may result in any discharge into the navigable waters that will require a Federal license or permit.	The Wetlands Protection Permit (January 24, 2012) for construction and the NPDES Permit (February 2, 2012) for operation provide the Section 401 Water Quality Certification
MDEQ Resource Management Division	MCL R299.9303 *et seq*.	Hazardous Waste Management, Site Identification Number	A generator shall not treat, store, dispose of, or transport or offer for transport hazardous waste without having received a site identification number from the regional administrator.	Permit Number MID 087 056 685[c]
MDEQ Resource Management Division	MCL 29.5c	Review, Approval, and Certification of Aboveground Storage Tank (AST) Systems	Regulation of installation of new AST systems with individual tanks having a storage capacity of more than 1100 gal of flammable liquid or combustible liquid.	Not yet submitted

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status[(b)]
MDEQ Resource Management Division	MCL R299.9822	Low-Level Mixed Waste Conditional Exemption	Low-level mixed waste storage and treatment conditional exemption eligibility and standards.	Not yet submitted
MDEQ Resource Management Division	MCL 333.13505	Radioactive Material Registration	Possession of radioactive materials.	Not yet submitted
MDEQ Air Quality Division	The Natural Resources and Environmental Protection Act (NREPA), Public Act 451 of 1994, as amended, Part 55 (Air Pollution Control) MCL R336.1201	Permit to Install	Construction of any air emission source.	Not yet submitted
MDEQ Air Quality Division	NREPA Part 55 (Air Pollution Control) MCL R336.1210-R336.1218 40 CFR Part 70	Air Permit	Operation of a source of air pollutants.	Not yet submitted
Michigan State Historic Preservation Office (SHPO)	National Historic Preservation Act of 1966, as amended (NHPA), Section 106, 36 CFR Part 800	Consultation with Michigan State Historic Preservation Office (SHPO), Federally recognized Indian Tribes, and other consulting parties	Consultation concerning the potential impacts on cultural resources.	Memorandum of Agreement executed March 20, 2012
Michigan Department of Natural Resources (MDNR)	MCL 324.36501 *et seq*.	Endangered Species Permit	Taking or harming of State-listed endangered species.	Not yet submitted

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status[b]
MDNR	MCL 324.36501 *et seq*.	Consultation	Consultation regarding the potential impacts on threatened and endangered species.	Ongoing
Michigan Department of Transportation (MDOT)	MCL 259.481 *et seq*.	Tall Structures Act Permit	Construction of an object that has the potential to affect navigable airspace (height in excess of 200 ft or within 20,000 ft of an airport).	Not yet submitted
MDOT	MCL 247.171 *et seq*.	Construction Permits (Right–of-Way [ROW] Permit)	Activities by businesses or private parties and utility companies wishing to use the highway ROW for operations other than normal vehicular or pedestrian travel are required to obtain a permit from MDOT.	Not yet submitted
MDOT	MCL 257.716 *et seq*.	Transport permit	Movement over state highways of vehicles or loads that exceed the size or weight limitations specified by law.	Not yet submitted
Michigan Department of Community Health	MCL 333.13522	X-Ray Equipment Registration	Possession of a radiation machine.	Not yet submitted
Local Authorizations				
City of Monroe, Michigan	33 USC 1251 *et seq*. Michigan Water Resource Act Codified Ordinances of Monroe, Michigan, Streets, Utilities and Public Services Code, Chapter 1042, Division 2 Section 1042.15	Monroe Metropolitan Water Pollution Control Facility Industrial Pretreatment Permit	Treatment of wastewater to comply with categorical pretreatment standards and local limits.	Permit No. 1020[c]

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status[(b)]
City of Monroe, Michigan/ Frenchtown Township	Codified Ordinances of Monroe, Michigan, Streets, Utilities and Public Services Code, Chapter 1042, Division 15 Section 1042.71	Sanitary Sewer Service Connection Permit	Required before a person uncovers, makes any connection with or opening into, uses, alters, or disturbs any public sewer or appurtenance to.	Not yet submitted
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 6, Section 6.04 and Article 27.00, Section 27.06	Site Plan and Development Approval	Review of planned construction activities. Requires submittal of application for Site Plan Approval, which requires review of items such as engineering. The approval process may also result in the issuance of permits such as a grading permit issued under the authority of the Building Official.	Not yet submitted
Frenchtown Township		Engineering Review	Review of detailed engineering construction plans addressing water, sanitary, stormwater drainage, grading, and paving for the site.	Not yet submitted
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200	Occupancy Permit	Occupancy of the building.	Not yet submitted
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 4, Section 4.40 and Article 24, Section 24.05	Building Permit	Permit authorizing the construction, removal, moving, alteration, or use of a building or construction of any driveway or parking lot constructed of hard surface materials.	Not yet submitted
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 20	Special Approval of Activities within Either the Floodway or Floodway Fringe	Approval of activities within the floodway area of floodway, fringe area of the floodway, or floodplain district.	Not yet submitted

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status[(b)]
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 4, Section 4.10	Temporary Building Used During Construction	Use of a portable structure as a temporary building during construction.	Not yet submitted
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 26, Section 26.04	Landscape Development Plan	Submittal of a landscape development plan that illustrates areas of existing trees or wood lots that will be removed and those that will be retained.	Not yet submitted
Frenchtown Township	Frenchtown Charter Township Zoning Ordinance No. 200 Article 4, Section 4.21.2	Excavation Permit	Activities that propose to fill an area of 20,000 ft^2 or greater or any excavation and removal regardless of area involved except for mineral mining operations, farm ponds, and landscape ponds.	Not yet submitted
Monroe County, Michigan, Office of On-site Water Supply/Frenchtown Township	Codified Ordinances of Monroe, Michigan, Monroe County Environmental Health/Sanitary Code, Chapter III – Water Supplies	Well Permit	Construction of water supply wells, irrigation wells, heat exchange wells, industrial wells for water supply, test wells to obtain information regarding groundwater quantity or quality, recharge well, dewatering well, fresh water well at oil or gas well-drilling site.	Not yet submitted
Monroe County, Michigan, Drain Commissioner	Local Ordinance	Engineering Review	Review of surface water flow during operation.	Not yet submitted
Monroe County, Michigan, Drain Commissioner	NREPA Part 91, of Act 451 of the Michigan Public Acts of 1994 MCL 324.9101 *et seq*.	Soil Erosion and Sedimentation Control (SESC) Permit	Any earth change that disturbs 1 or more acres or is within 500 ft of a lake or stream.	Not yet submitted

Table H-1. (contd)

Agency	Authority	Requirement	Activity Covered	Status[(b)]
Monroe County, Michigan, Drain Commissioner	Act No. 40 of 1956	Drain Culvert Permit	Permit to construct in a drain.	Not yet submitted
Monroe County, Michigan, Health Department/ Frenchtown Township	Monroe County Environmental Health/ Sanitary Code, Chapter III, Section 302 Part 127 of Michigan Public Health Code, 1978 PA 368, as amended	Water Supply Permit	Any new construction or extensive change affecting the basic unit or the suction line on any water supply system within Monroe County, Michigan.	Not yet submitted

(a) Federal, State, and local authorizations that are required for building or operational activities are included. There are no Native American tribes with jurisdictional authority over activities at the Fermi site.

(b) Detroit Edison states in the ER that all necessary permits will be applied for in a timely manner. New permits may not be obtained in certain instances due to potential authorization of construction and operational activities through the modification of existing permits possessed by the Fermi Station.

(c) Permit authorizing current activities associated with operations on the Fermi site. When practical, existing permits will be modified to authorize activities associated with the construction or operation of a new nuclear facility on site.

Appendix I

Severe Accident Mitigation Alternatives

Appendix I

Severe Accident Mitigation Alternatives

I.1 Introduction

The Detroit Edison Company (Detroit Edison) has submitted an application to construct a General Electric-Hitachi Nuclear Energy, LLC- (GEH-) designed Economic Simplified Boiling Water Reactor (ESBWR) at the Enrico Fermi Atomic Power Plant (Fermi) site. Current policy developed after the Limerick decision (Limerick Ecology Action vs. NRC 1989) requires that the U.S. Nuclear Regulatory Commission (NRC) staff consider alternatives to mitigate the consequences of severe accidents in a site-specific environmental impact statement (EIS). The severe accident mitigation alternative (SAMA) review presented here considers both severe accident mitigation design alternatives (SAMDAs) and procedural alternatives.

In Title 10 of the Code of Federal Regulations (CFR), specifically 10 CFR 52.79(a)(38), the NRC requires that applicants for combined licenses (COLs) include "a description and analysis of design features for the prevention and mitigation of severe accidents" in the Final Safety Analysis Report (FSAR). Detroit Edison provides this information in Part 2 of the COL application. The Environmental Report (ER) (Part 3 of the COL application) also includes information regarding the SAMA analysis (Detroit Edison 2011).

In 10 CFR 52.47(a)(23), the NRC requires that applications for a reactor design certification include "a description and analysis of design features for the prevention and mitigation of severe accidents…." In addition, 10 CFR 52.47(a)(27) requires a description of a "plant-specific probabilistic risk assessment (PRA) and its results," and in 10 CFR 52.47(b)(2) the NRC requires an Environmental Report (ER) that contains the information required by 10 CFR 51.55. GEH has submitted all this information in documents that are part of the application for certification of the ESBWR design. Specifically, GEH has provided technical documents covering Revision 6 of the ESBWR PRA (GEH 2010a) and Revision 4 of the ESBWR SAMDA (GEH 2010b).

The NRC staff conducted a review of the Detroit Edison SAMDA analysis specific to operation of an ESBWR at the Fermi site. The staff reviewed the input parameters and values used by Detroit Edison (Detroit Edison 2011) for appropriateness, including information prepared by GEH in support of the ESBWR design certification. The Detroit Edison analysis is based on (1) the Revision 4 PRA (GEH 2009) and SAMDA analysis (GEH 2007) for the ESBWR design certification, and (2) results of the analysis of probability-weighted risks of the ESBWR design at the Fermi site described in Section 5.11.2 of this EIS.

An analysis for an ESBWR at a generic site is presented first, and then the analysis is extended to include consideration of Fermi site-specific information. These analyses have been updated by the NRC staff based on ESBWR PRA Revision 6 (GEH 2010a). The SAMDA analysis for the proposed ESBWR design certification has been reviewed and accepted by the staff as part of the design certification process (76 FR 14437).

I.2 ESBWR SAMDA Review – Generic Site

This section addresses the generic analysis of SAMDAs conducted by GEH, the applicant for certification of the ESBWR design. The SAMA review in Section I.3 extends the generic SAMDA analysis to include Fermi site-specific factors including meteorology, population, and land use. Section I.3 also addresses SAMAs that were not included in the generic analysis because they do not involve reactor system design.

I.2.1 ESBWR PRA and Consequence Results

GEH, the applicant for certification of the ESBWR design, conducted Level 1, Level 2, and Level 3 PRAs to estimate the core damage frequencies (CDFs) and offsite risk consequences that might result from a large number of initiating events and accident sequences. Table I-1 lists these CDF estimates and estimates of the large release frequencies (LRFs). Releases other than technical specification limits, when the containment is intact, are considered to be large. Table I-1 also lists NRC staff goals related to CDFs and LRFs.

Although this table does not provide quantitative estimates of CDFs and LRFs for fire, flood, and high-wind events during shutdown, they are discussed in ESBWR PRA Chapter 17 (GEH 2010a). Chapter 15 of the ESBWR PRA presents the results of a seismic margins analysis in which PRA methods are used to identify potential vulnerabilities in the design and so corrective measures can be taken to reduce risk. Based on the design considerations, risks associated with the seismic events are considered to be insignificant by GEH.

Chapter 10 of the ESBWR PRA Revision 6 (GEH 2010a) of the design certification application for the ESBWR design provides the results of Level 3 PRA in terms of an estimate of the offsite risk to the population within a 10-mi radius of a generic ESBWR location with conservative siting characteristics. The baseline results of the PRA for internal events during full-power operation are presented and compared to the Commission's individual and societal safety goals in Table I-2.

Table I-1. Comparison of ESBWR PRA Results with the Design Goals

	NRC Design Goal[(a)]		ESBWR PRA Results[(b)]	
Event Type	Core Damage Frequency (per Ryr)	Large Release Frequency (per Ryr)	Core Damage Frequency (per Ryr)	Large Release Frequency (per Ryr)
Internal at-power events	1.0×10^{-4}	1.0×10^{-6}	1.7×10^{-8}	1.4×10^{-9}
At-power internal flood events	1.0×10^{-4}	1.0×10^{-6}	7.0×10^{-9}	4.1×10^{-9}
At-power fire events	1.0×10^{-4}	1.0×10^{-6}	1.3×10^{-8}	1.6×10^{-9}
At-power high-wind events	1.0×10^{-4}	1.0×10^{-6}	8.5×10^{-8}	1.2×10^{-9}
Internal shutdown events	1.0×10^{-4}	1.0×10^{-6}	1.7×10^{-8}	1.7×10^{-8}

(a) SECY-90-016 (NRC 1990).

(b) From Chapter 17 of the ESBWR PRA Revision 6 (GEH 2010a).

Table I-2. Comparison of ESBWR PRA Results for a Generic Site with the Commission's Safety Goals

Goal	Risk Goal	ESBWR 24 hours after Onset of Core Damage (ground release)	ESBWR 72 hours after Onset of Core Damage (elevated release)	Safety Goal Achieved 72 hours after the Onset of Core Damage
Individual risk (0–1 mi)	$<3.9 \times 10^{-7}$ (0.1%)	1.6×10^{-10}	1.6×10^{-10}	Yes
Societal risk (0–10 mi)	$<1.7 \times 10^{-6}$ (0.1%)	2.0×10^{-11}	2.6×10^{-11}	Yes
Radiation dose[(a)] probability at 0.25 Sv (0–0.5 mi)	$<10^{-6}$	2×10^{-9}	2×10^{-9}	Yes

Source: Table 10.4-2 of GEH 2010a

(a) The values listed are radiation dose probability at 0.20 Sv, which is more bounding.

These results indicate that the risk from severe accidents would be at least four orders of magnitude lower than the Commission's safety goals (51 FR 30028).

The ESBWR PRA Revision 6 includes values for all external events and shutdown modes except for seismic events. Table 10.4.2 of the ESBWR PRA provides results for the external event and shutdown modes similar to those presented in Table I-2. For example, the total individual risk from internal and external events, 24 hours after onset of core damage, at both power and shutdown, is approximately 1.8×10^{-8}, which is less than the risk goal.

I.2.2 Potential Design Improvements

In the ER submitted as part of the design certification application (GEH 2010b), GEH identified 177 candidate alternatives based on a review of alternatives for other plant designs, including those considered in license renewal environmental reports and in the General Electric Advanced Boiling-Water Reactor (ABWR) SAMDA study (GE 1994), and on consideration of plant-specific enhancements. The candidate alternatives were then screened to identify candidates for detailed evaluation. The categories used in screening were as follows:

- Not applicable
- Already incorporated into the ESBWR design
- Not a design alternative (not required for design certification)
- Alternative prevention or mitigation functions extant
- Very low benefit
- Excessive implementation cost
- Consideration for further evaluation.

The development of the ESBWR design has benefitted from insights gained in numerous PRAs. The low CDFs and LRFs in Table I-1 are attributable to the implementation of improvements already incorporated into the design. The following are examples of enhancement features currently included in the ESBWR design:

- Improved isolation condenser system design
- Depressurization valves
- Alternating current (AC) independent fire water pumps for makeup and injection
- Passive containment cooling system
- Basemat internal melt arrest and coolability device and gravity-driven cooling system deluge function
- Direct current (DC) power reliability
- Actuation logic reliability
- Motor-driven, feed-water pumps
- Water pool elevation above drywell head elevation
- Containment ultimate strength and maximum design pressure
- Incorporation of flood mitigation into design

- Reactor water cleanup system heat exchanger sized for decay heat removal
- 72-hr coping period for station blackout
- Upgraded low-pressure piping for the reactor coolant pressure boundary
- Digital instrumentation and control systems.

The screening process eliminated 40 candidate alternatives as being not applicable to the ESBWR design; 71 candidate alternatives were considered to be similar to those already included in the ESBWR design, and 27 candidate alternatives were identified as procedural or administrative rather than design alternatives (whose benefits were considered to be unlikely to exceed those alternatives evaluated relative to their potentially high costs). Of the remaining 39 candidate alternatives, 37 were ruled out for cases in which other design features already perform the proposed function or obviate its need, and 2 were considered to have very low benefit because their insignificant contribution to reducing risk did not outweigh their excessive implementation costs. No candidate alternatives were identified for further evaluation.

I.2.3 Cost-Benefit Comparison

GEH used the cost-benefit methodology guidance in NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997), to calculate the maximum attainable benefit associated with completely eliminating all risk for the ESBWR.

This methodology involves determining the net value for a SAMDA according to the following formula:

$$\text{Net Value} = (\text{APE} + \text{AOC} + \text{AOE} + \text{AOSC}) - \text{COE}$$

where:

APE = present value of averted public exposure ($)
AOC = present value of averted offsite property damage costs ($)
AOE = present value of averted occupational exposure costs ($)
AOSC = present value of averted onsite costs ($); this includes cleanup, decontamination, and long-term replacement power costs
COE = cost of enhancement ($).

If the net value of a SAMDA is negative, the cost of implementing the SAMDA is larger than the benefit associated with the SAMDA, and it is not considered to be cost-beneficial.

To assess the risk reduction potential for SAMDAs, GEH assumed that each design alternative would work perfectly to completely eliminate all severe accident risk from the events that were evaluated. This assumption is conservative because it maximizes the benefit of each design

alternative. GEH estimated the public exposure benefits for the design alternative on the basis of the reduction of risk expressed in terms of whole body person-rem per year received by the total population within a 50-mi radius of the generic ESBWR site.

Table I-3 summarizes the GEH's and NRC staff's estimates of each of the associated cost elements. The results are based on the approach, parameters, and data listed in NUREG/BR-0184. GEH's estimates in Table I-3 are based on the PRA Revision 5 CDF of 1.12×10^{-7} per reactor-year (Ryr) (GEH 2010c), which are similar to those in PRA Revision 6 (GEH 2010a). (The total CDF in the Revision 4 PRA is 1.2×10^{-7} per Ryr [GEH 2009].) The CDF is driven by high core damage frequencies from internal and high-wind events during shutdown. GEH used the results from the ESBWR Level 3 PRA, namely, an offsite population dose risk of 0.035 Sv/Ryr and an offsite cost risk of $1931/Ryr based on input from the Electric Power Research Institute Advanced Light Water Reactor Utility Requirement Document (GEH 2010c).

GEH provided the present value estimates for the various attributes using a 3 percent discount rate and the maximum parameter values provided in NUREG/BR-0184. Revision 4 of NUREG/BR-0058, *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission* (NRC 2004), reflects the agency's policy on discount rates. NUREG/BR-0058 Revision 4 states that two sets of estimates should be developed: one at 7 percent and one at 3 percent for sensitivity analysis.

The monetary present value estimate for each risk attribute does not represent the expected reduction in risk resulting from a single accident; rather, it is the present value of a stream of potential losses extending over the projected lifetime of the facility (in this case, projected to be 60 years). Therefore, the estimate reflects the expected annual loss resulting from a single accident, the possibility that such an accident could occur at any time over the licensed life, and the effect of discounting these potential future losses to present value.

GEH estimated the total present dollar value equivalent associated with complete elimination of severe accidents at a single ESBWR unit site to be $397,863 (see Table I-3 below). Therefore, for any SAMDA to be cost-beneficial, the enhancement cost must be less than $397,863. GEH assessed the capital cost associated with two design alternatives evaluated for the ESBWR. For both design alternatives, GEH stated that the implementation cost would be more than $1 million (GEH 2010b). Based on the averted cost estimate of $397,863, GEH concluded that none of the SAMDA candidates are cost-beneficial, because any design change costs would far exceed this value.

Table I-3. Summary of Estimated Averted Costs for a Generic Site

Quantitative Attributes		Present Value Estimate ($)		
		NRC Staff Best Estimate[(a)]	GEH Maximum[(b)]	NRC Staff Maximum[(c)]
Health	Public	100,000[(d)]	194,740	197,720[(d)]
	Occupational	56	249	250
Property	Offsite	27,200[(d)]	53,720	53,770[(d)]
	Onsite	NA[(e)]	NA	NA
Cleanup and decontamination	Onsite	1710	4674	4060
Replacement power		4520	144,480	148,020
Total		**133,486**	**397,863**	**403,820**

Source: GEH 2010b

(a) "Best estimate" is based on mean release frequency (from Revision 5 of the PRA), "best estimate" parameter values in NUREG/BR-0184, and 7 percent discount rate.

(b) Maximum estimate is based on mean release frequency (from Revision 5 of the PRA), high or upper estimate parameter values in NUREG/BR-0184, and 3 percent discount rate.

(c) NRC staff maximum is based on parameter values used in (b), and release frequency from Revision 5 of the PRA.

(d) Estimated using the applicant-provided Electric Power Research Institute Advanced Light Water Reactor Utility Requirement Document, property damage, and the new release category frequencies (GEH 2010a).

(e) NA = Not analyzed.

Note: PRA Revision 5 release frequencies are the same as those in PRA Revision 6.

I.2.4 Staff Evaluation

In 10 CFR 52.47(a)(27), the NRC requires that an applicant for design certification perform either a plant-specific or site-specific PRA. The aim of this PRA is to seek improvements in the reliability of core and containment heat removal systems that are significant and practical. The set of potential design improvements considered for the ESBWR includes those from generic boiling water reactor SAMA reports and from the ABWR design. The ESBWR design already incorporates many design enhancements related to severe accident mitigation. Such design improvements have resulted in a CDF that is about an order of magnitude less than that of the ABWR design. For example, the ESBWR design can cope with a station blackout (SBO) for 72 hr (i.e., no reliance on AC power for the first 72 hr), thus eliminating CDF sequences that contributed more than 40 percent of CDF in the ABWR design.

GEH's risk reduction estimates are based on mean values of release frequencies and maximum-estimate parameter values from NUREG/BR–0184, without consideration of uncertainties in CDF or offsite consequences. Even though this approach is consistent with that

used in previous design alternative evaluations, further consideration of these factors could lead to significantly higher risk reduction values, given the extremely small CDF and risk estimates in the baseline PRA. The uncertainties in CDF or in offsite radiation exposures are fairly large because key safety features of the ESBWR design are unique, and their reliability has been evaluated through analysis and testing programs rather than through operating experience.

The NRC staff's analyses of the total present value using the mean CDF and release frequencies from Revision 6 of the PRA and a 3 percent discount rate indicate a maximum value of about $403,820. NRC staff notes that the estimated averted public exposure is a major contributor. This arises from high release frequencies for internal and high-wind events during shutdown. For events during shutdown, the analysis conservatively assumes that core damage scenarios will lead to large releases. This is because, the containment is open during most of the shutdown period.

The second major contributor to the present value estimate is replacement power costs. The replacement power cost parameters recommended in NUREG/BR–0184 are based on a generic reactor operating at an average capacity factor of about 65 percent and on replacement energy costs in 1993 dollars, The total present dollar value would be even higher if the annual replacement power cost was adjusted for a future energy cost increase and the capacity factor was increased to 90 percent, which is the design operating assumption for the ESBWR. However, GEH used a very conservative approach in estimating the replacement power cost. GEH selected the parameter that corresponds to the 3 percent discount rate for the net present value of replacement power for a single event recommended in NUREG/BR-0184. Then GEH used this parameter as an input and estimated a new, more conservative net present value of the replacement power for a single event. This approach resulted in a net present value of replacement power that is about a factor of ten higher than the value estimated in NUREG/BR-0184. Even with this increase, which is more than what it would be if adjustments for the future energy cost increase and capacity factor were to be made, the present value estimate is still lower than the GEH's $1 million minimum cost estimate for a SAMDA. Also, the ESBWR CDF is very low on an absolute scale as compared to those of currently operating plants. Moreover, in view of the features already incorporated in the ESBWR design and the margin between the cost of SAMDAs evaluated and their potential benefits, any increase in benefits due to increased replacement power costs would not be significant enough to cause any SAMDAs to become cost-beneficial. Therefore, the NRC staff concludes that further evaluation of future energy cost and capacity factor increases is not warranted.

GEH indicated that any of the potential design modifications considered would cost a minimum of $1 million to implement, as indicated above. NRC staff considers the assertion of potential costs for the ESBWR acceptable, because it is reasonable to conclude that the cost of implementing (design, procurement, installation, testing, etc.) the design alternatives that were considered, such as constructing a building connected to the containment building or installing limit switches on all containment isolation valves, would far exceed GEH's $1 million minimum

cost estimate. Therefore, a minimum cost of $1 million is approximately 2.5 times the maximum benefit of $403,820. The NRC staff concludes that no single modification would eliminate the total CDF and that none of the potential design modifications could be justified on the basis of cost-benefit considerations.

I.3 Fermi Site-Specific SAMDA Review

The discussion above evaluates SAMDAs for the ESBWR at a generic site. The following discussion updates that evaluation to include consideration of Fermi site-specific factors, including meteorological conditions, population distribution, and land use. It also updates the evaluation to include the results and the approach in PRA Revision 4 for the generic design. The last part of this discussion deals with SAMAs for procedures and training.

I.3.1 Risk Estimates

NRC staff evaluated the potential risks associated with severe accidents for an ESBWR by using Fermi site-specific data. Detroit Edison provided a site-specific consequence analysis using the Revision 4 PRA CDF (Detroit Edison 2011). Table 5-32 of this EIS, gives a population dose and a cost risk of 0.032 person-rem/Ryr and $110/Ryr, respectively, for the at-power internal events with a CDF of 1.7×10^{-8} per Ryr. The total environmental risk associated with both shutdown and power operations, including consideration of internal events, fires, high winds, and floods, is provided in Table 5-33 of this EIS, which gives a total population dose and a cost risk of about 2.3 person-rem/Ryr and $4900/Ryr, respectively.

I.3.2 Cost-Benefit Comparison

In Section 7.3.2 of the ER (Detroit Edison 2011), Detroit Edison estimates the averted costs associated with eliminating all severe accident risks for an ESBWR at the Fermi site. The analysis is an update of the GEH SAMDA analysis (GEH 2007) to include site-specific information. Detroit Edison substituted population dose and offsite cost risks based on 2060 population projections for the Fermi site for the population dose and offsite property costs in the GEH analysis.

Detroit Edison provided a site-specific cost-benefit analysis using the Revision 4 PRA CDF (Detroit Edison 2011). Detroit Edison provided an estimated total present dollar value equivalent associated with complete elimination of severe accidents at a single ESBWR unit site to range between $139,446 and $280,189 and concluded that no design changes would be cost-effective to implement (Detroit Edison 2011).

NRC staff evaluated the risk reduction potential of design improvements for the ESBWR at the Fermi site based on the Detroit Edison's risk reduction estimates for the various design alternatives, in conjunction with an assessment of the potential impact of uncertainties on the

results. The staff performed the averted cost estimates with the parameters used by Detroit Edison and the upper bound values used in ESBWR SAMDA Revision 4 (GEH 2010b). The results of both the Detroit Edison and the NRC estimates of averted costs are presented in Table I-4. The NUREG/BR–0184 handbook provides two sets of parameters (best estimate and high estimate) for the parameters used in the calculations of the occupational dose after accident and during decontamination and cleanup, and for the replacement power costs. The NRC staff's maximum estimate is based on the use of "high or upper bound" estimated parameters in NUREG/BR-0184 and the ESBWR power rating of 1585 MW(e) that were used in ESBWR SAMDA Revision 4 (GEH 2010b). The major contributor to this estimate is the use of the GEH's high value for the long-term replacement power costs parameter for a 910-MWe "generic" reactor in NUREG/BR–0184. The use of the GEH's high value increases the replacement power costs by about a factor of 10 over the best estimate (see Table I-4, Columns 6 and 7). As stated in Section I.2.4, this increase replacement power cost is well above any potential change for adjustments in the future energy cost increase and capacity factor.

The NRC staff's analyses of the total present value using the mean CDF and release frequencies from Revision 6 of the PRA and a 3 percent discount rate indicate a maximum value of about $422,000. The NRC staff noted that any design modifications would be costly, and a single modification would not eliminate the total CDF. On the basis of results presented in Table I-4, the NRC staff agreed with Detroit Edison's conclusion that no design change would be cost-beneficial.

1.3.3 Procedural and Training SAMAs

The original list of 177 ESBWR SAMDAs included 27 candidate alternatives that were procedural or administrative in nature. These items were eliminated from consideration because they did not involve design changes. Examples of items removed from consideration for this reason are as follows:

- Enhance procedural guidance for use of cross-tied component cooling or service water pumps.
- Implement procedures for alignment of a spare diesel to shut down board after loss of offsite power and failure of diesel normally supplying it.
- Emphasize steps in recovery of offsite power after an SBO.
- Develop a severe weather conditions procedure.
- Develop procedures for replenishing diesel fuel.

Table I-4. Summary of Estimated Averted Costs for the Fermi Site

Quantitative Attributes		Present Value Estimate ($)				
		Detroit Edison[(a)]		NRC Estimates[(b)]		
		7% Discount	3% Discount	7% Discount	3% Discount	Maximum[(c)] Estimate
Health	Public	64,166	126,875	65,855	130,213	130,213
	Occupational	58	133	58	133	258[(c)]
Property	Offsite	68,950	136,335	68,247	134,943	134,943
	Onsite	NA[(d)]	NA	NA	NA	NA
Cleanup and decontamination	Onsite	1761	4184	1761	4183	4183
Replacement power		4512	12,668	4658	13,077	152,565[(c)]
Total		139,446	280,189	140,579	282,549	422,162

(a) From Fermi 3 Environmental Report support documentation, based on PRA Revision 4 CDF estimates.

(b) NRC staff estimates are based on PRA Revision 6 CDF estimates and Chapter 10, Table 10.3-3c, release category assignments (GEH 2010a), and the EBWR power rating of 1585 MW(e) used in ESBWR SAMDA Revision 4 (GEH 2010b). The ESBWR power rating in the Detroit Edison's analysis is 1535 MW(e). This change will affect only the replacement power cost.

(c) The maximum estimate is based on "high or upper bound" estimated parameters in NUREG/BR-0184 and the ESBWR power rating of 1585 MW(e) and on replacement power parameters in ESBWR SAMDA Revision 4 (GEH 2010b).

(d) NA = Not analyzed.

- Increase frequency for valve leak testing. Improve inspection of rubber expansion joints on the main condenser.

These candidate alternatives fall within the scope of the SAMA review that the NRC conducts as part of the environmental review of applications. However, such SAMAs generally involve operational and training procedures that have not been developed for a reactor and are typically not developed until construction has been completed and the plant is approaching operation.

The staff reviewed the candidate alternatives that were previously screened out because they did not involve design changes. 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 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 staff further concludes it is unlikely that these SAMAs would be cost-effective.

Detroit Edison states that it will consider the procedural and administrative SAMAs when it is developing its procedures, as long as they do not exceed the maximum averted cost. Detroit Edison makes this statement through a commitment (COM ER 7.3-002) which states (Detroit Edison 2011):

> 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.

Based on this statement, the staff expects that Detroit Edison will consider risk insights and mitigation measures in the development of procedures and training; however, this expectation is not crucial to the staff's conclusions because the staff already concluded procedural and training SAMAs would be unlikely to be cost-effective.

I.4 Conclusions

Based on the evaluation of the ESBWR PRA (GEH 2010a) and SAMDA analysis (GEH 2010b), the Fermi site-specific severe accident and SAMDA analysis (Detroit Edison 2011), and its own independent review, the staff concludes that there are no ESBWR SAMDAs that would be cost beneficial at the Fermi site. The staff expects that Detroit Edison will use risk insights and mitigation measures in the development of procedures and training; however, this expectation is not crucial to the staff's conclusions because the staff already concludes procedural and training SAMAs would be unlikely to be cost-effective.

I.5 References

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Appendix J

U.S. Army Corps of Engineers Public Interest Review Factors and Detroit Edison's Onsite Alternatives Analysis

Appendix J

U.S. Army Corps of Engineers Public Interest Review Factors and Detroit Edison's Onsite Alternatives Analysis

This appendix presents (1) a summary of the factors that are considered by the U.S. Army Corps of Engineers (USACE) in its public interest review of applications for a permit to perform regulated activities that would affect waters of the United States and (2) an onsite alternatives analysis prepared by Detroit Edison Company (Detroit Edison) to demonstrate that its proposed site layout chosen for the proposed new Enrico Fermi Unit 3 (Fermi 3) at the Enrico Fermi Atomic Power Plant (Fermi) site would minimize impacts to jurisdictional wetlands and waters of the United States. These topics are addressed in Sections J.1 and J.2 of this appendix, respectively.

J.1 Public Interest Review Factors

As set forth in Title 33 of the Code of Federal Regulations (CFR) Part 320, a public interest review must be completed prior to any Department of the Army (DA) permit decision by the USACE. The USACE decision on whether to grant or deny a permit is based, in part, on an evaluation of the probable impact of the proposed activity and its intended use on the public interest. This evaluation is referred to as the "public interest review." The public interest review requires a careful weighing of all relevant factors in a particular case. The specific weight of each factor is determined by its importance and relevance to the proposed project. Some public interest review factors may be given greater weight, while others may not be relevant or as important based on project characteristics. The USACE public notice (USACE 2011), the Draft EIS public comment process, DEIS public meetings, and the EIS public scoping process have been the primary methods used to solicit public comment on the project's effect on public interest factors. Full consideration and appropriate weight will be given to all comments, including those of Federal, State, and local agencies, and other experts on matters within their expertise. The benefits and detriments of a project are balanced by considering effects on such public interest factors as conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, 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. The conditions, including compensatory mitigation, under which a proposal would be allowed to go forward,

would be developed and incorporated within the public interest review process to the extent that such conditions are found to be appropriate and practicable by the USACE. However, only the measures required to confirm that the project is not contrary to the public interest may be required in this specific context. This required public interest review ensures that a USACE permit decision reflects the National concern for both protection and utilization of important resources. The public interest review described above can be found in 33 CFR 320.4 and will be completed by the USACE as part of its evaluation of the Fermi 3 proposal for a DA permit.

J.2 Detroit Edison's Onsite Alternatives Analysis and Proposed Least Environmentally Damaging Practicable Alternative (LEDPA)

Activities involving the discharge of dredged or fill material into waters of the United States, including wetlands, typically require authorization from the USACE under Section 404 of the CWA. The CWA Section 404(b)(1) Guidelines (40 CFR Part 230) (Guidelines) are the substantive criteria the USACE uses to determine a project activity's environmental impact on aquatic resources attributable to the discharge of dredged or fill material. Among other things, an applicant for a 404 permit must demonstrate to the USACE that proposed project-related dredge or fill activities satisfy the Guidelines and constitute the least environmentally damaging practicable alternative (LEDPA). An applicant would typically conduct analyses of the impacts of its proposed actions involving dredge or fill discharges into waters of the United States and of alternatives to avoid and minimize impacts to identify a proposed LEDPA that still allows accomplishment of the overall project purpose and demonstrates compliance with the Guidelines. As part of this process, an applicant would initially submit a conceptual plan to address the mitigation of any remaining unavoidable adverse impacts to aquatic resources that would still occur after all practicable avoidance and minimization measures were applied.

Based on guidance provided by the USACE regarding Guidelines compliance, Detroit Edison conducted an onsite alternatives analysis to identify a practicable alternative that would avoid and minimize adverse impacts to waters of the United States. This analysis includes Detroit Edison's proposed LEDPA and is included at the end of this appendix (Appendix J). USACE has not verified the adequacy of Detroit Edison's proposed LEDPA at this time. However, USACE is actively reviewing and coordinating with Detroit Edison regarding its proposed LEDPA. USACE could potentially identify additional practicable avoidance and/or minimization measures during its evaluation that could result in the USACE-identified LEDPA having fewer adverse impacts on waters of the United States than Detroit Edison's proposed LEDPA, as presented in its analysis. Any subsequent changes to the proposed site plan and/or activities as a consequence of the USACE-identified LEDPA would result in fewer adverse impacts on waters of the United States than identified in the Final EIS.

To offset the Detroit Edison-identified unavoidable adverse impacts on aquatic resources as a result of its proposed LEDPA, Detroit Edison initially proposed a conceptual mitigation strategy that was included in Appendix K of the Draft EIS. The USACE LRE-2008-00443-1-S11 public notice (USACE 2011) provided additional opportunity for public comment on Detroit Edison's proposed LEDPA and concept mitigation strategy. Detroit Edison subsequently refined its mitigation strategy, based on coordination with USACE, and produced the mitigation plan that is now contained in Appendix K of this Final EIS. Detroit Edison's mitigation plan proposes to compensate for the unavoidable loss of aquatic function on the Fermi site by reestablishing comparable aquatic functions at an offsite location at an average replacement ratio of 3:1. The evaluation of alternative energy sources (e.g., power purchases, demand-side management,

fossil-fuel alternatives, and renewable energy alternatives), alternative sites (Fermi, Belle River–St. Clair, Greenwood, Petersburg, and South Britton), and system design alternatives (including heat dissipation and cooling system alternatives) are discussed in Chapter 9 of this EIS.

Section 4 of Detroit Edison's Joint Permit Application (Detroit Edison 2011), which presents their onsite alternatives analysis and proposed LEDPA determination, is provided in the remainder of this appendix.

SECTION 4: PROPOSED PROJECT PURPOSE, INTENDED USE, AND ALTERNATIVES CONSIDERED

1) Purpose/Intended Use:

Detroit Edison proposes to construct and operate a new nuclear power plant at the Fermi site. The proposed unit is to be designated as Fermi 3. The purpose of the Fermi 3 project is fourfold:

1. Generate a net electrical output of approximately 1,535±50 megawatts (MWe) for sale that will reliably aid in satisfying the forecasted energy and capacity needs of Detroit Edison customers located in the Detroit Edison Service Area;
2. Provide new baseload electric generation capacity as early as 2021 to compensate for the expected retirement of existing, aging baseload generating units and diminishing availability of the midwest independent service operator region's baseload generation capacity;
3. Provide price stability by minimizing reliance on imported power into the Detroit Edison service territory; and
4. Utilize an electric generation technology that is less subject to price fluctuations resulting from either fuel or regulatory drivers, provides fuel diversity, and reduces reliance on fossil fuel and their attendant environmental impacts.

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

Construction of a new nuclear electric generating facility is needed to provide reliable, affordable power to address Michigan's expected future peak electric demand. Detroit Edison has evaluated the need for power and the related benefits to be generated by the proposed facility. The need for power was assessed by balancing the current and forecasted demand against the current and forecasted supply, while demonstrating that an adequate reserve margin is maintained. Detroit Edison's assessment considered information regarding factors such as marketing, location, and history that influence or constrain the nature, size, price, and class of the project.

The need for power assessment is derived from the "Michigan 21st Century Electric Energy Plan" (Plan).[1] The Plan was prepared and issued by the Michigan Public Service Commission pursuant to Executive Directive No. 2006-02. The Plan reached several significant conclusions, including the following:

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

The above conclusions were based upon key factors such as the current age of baseload units and newer electric generating units' reliance on natural gas. As indicated above, the Plan concluded that the state of Michigan has a current need for new baseload capacity and the need is projected to increase. Michigan's current baseload generating units are an average of more than 48 years old.

[1] See http://www.dleg.state.mi.us/mpsc/electric/capacity/energyplan/index.htm.

The average age of Detroit Edison's coal-fired generation units is 44 years old. The last new baseload plant in the state of Michigan began commercial operation more than 18 years ago. The assessment assumes that older, less efficient units, totaling 3,755 MW of capacity, will be retired by 2025.

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

Detroit Edison evaluated alternative means of meeting the baseload generation need. That analysis concluded that coal-fired or natural-gas fired generation provide reasonable alternatives to Fermi 3 for meeting the identified need for new baseload generation. However, after considering the potential environmental impacts associated with these alternative energy sources, Detroit Edison determined they would not be environmentally preferable to the proposed Fermi 3 nuclear power plant.

2) Alternatives Considered:

Detroit Edison sought to avoid and minimize impacts to waters of the United States, including wetlands, associated with the proposed Fermi 3 project by evaluating practicable alternatives that would fulfill the project's purpose and need. Detroit Edison's alternatives analysis included consideration of alternative locations for new nuclear electric production consistent with the purpose and need described above. After determining that the Fermi site was the practicable alternative project location that would result in the least potential impacts to aquatic resources, Detroit Edison considered site layout alternatives to minimize potential wetland impacts in terms of both quantity and quality. Both components of the alternatives analysis are summarized below. Detroit Edison's alternatives evaluation illustrates that the proposed use of the Fermi site is the least environmentally damaging practicable alternative (LEDPA) that fulfills the project's purpose and need. Detroit Edison has also proposed mitigation for the unavoidable impacts to waters of the United States.

a) Alternative Sites

Detroit Edison reviewed the eight candidate sites identified through the site selection process described in Section 9.3 of the Fermi 3 Combined License Application Environmental Report within the context of the CWA Section 404(b)(1) guidelines to identify a LEDPA site. The candidate sites were evaluated for practicability to construct and operate a nuclear generating facility. The sites that were found to be practicable were then evaluated for potential impacts on waters of the United States and adjacent wetlands to identify an environmentally preferable location.

The candidate sites included five greenfield sites, two existing fossil-fired sites, and one existing commercial nuclear site. The practicability assessment considered various technical, economic, safety, and environmental criteria that reflect the overall purpose of the project. The results of that evaluation are summarized in **Table 4-1**. Six sites (five greenfield sites and one existing fossil-fired site) that exhibited undesirable characteristics were judged to be impracticable as sites for locating a new nuclear plant and were excluded from further review. The two remaining candidate sites, the Greenwood Energy Center site and the Fermi site, were then evaluated for impacts on waters of the U.S. and adjacent wetlands.

Detroit Edison evaluated the potential wetland and stream impacts associated with construction of the nuclear generating facility and any required infrastructure such as transmission corridors and make-up water supply or blowdown discharge pipelines to support the closed-cycle cooling

system. The potential impacts associated with nuclear development at the Fermi and Greenwood sites are summarized in the **Table 4-2**. Based on the overall potential impacts to waters of the U.S., the Fermi site would be the LEDPA.

b) Site Layout Alternatives

Detroit Edison proposes to construct and operate a new nuclear power plant at the Fermi site. The proposed unit is to be designated as Fermi 3. The Fermi site (the area within the Fermi property boundary) consists of approximately 1260 acres in eastern Monroe County, Michigan. The existing Fermi 2 unit is in the northeast part of the site. Fermi 3 and associated facilities will be located in an area south of the existing Fermi 2 protected area. Most of the land that will be occupied by Fermi 3 and associated facilities was disturbed during construction of Fermi 1 and Fermi 2; however, some construction will occur in areas that have been undisturbed for longer periods of time. This section discusses the onsite layout alternatives considered and the relevant impacts to aquatic resources associated with those alternatives for the Fermi 3 project.

The Fermi 3 site layout includes the power block, cooling tower, switchyard, parking, construction laydown areas, transmission lines, access road, cooling water intake structure, discharge pipe, and barge docking facility. Detroit Edison applied as much repositioning of project components as possible within project practicability limits to avoid and minimize impacts to wetlands and other natural resources at the Fermi site. Four project layout alternative scenarios were evaluated. These alternative layouts are identified as Revision 0, Revision 1, Revision 2, and the Preferred Alternative.

The site layout was evaluated for potential environmental impacts to the Fermi site. This analysis focused on environmental categories that are protected under special-purpose environmental laws and that contain specific provisions for the avoidance and minimization of impacts. These categories include wetlands, archaeological resources, and protected species. Complete avoidance of some impacts to environmental categories, such as wetlands, associated with Fermi 3 may not be feasible due to the large area of land disturbance required. Efforts were made to avoid impacts to wetlands through consideration of several different project alternatives.

A process to avoid, minimize, or compensate impacts to waters of the United States, including wetlands, was completed for the Fermi 3 project. This process included the consideration of alternative onsite locations for major structures and changes in site configuration to minimize damages to waters of the United States.

Key Constraints

Several key constraints guided the process of determining locations for Fermi 3 Nuclear Power Plant and construction-related activities relative to the available property on the Fermi site and the location and operational needs of the Fermi 2 Nuclear Power Plant. As this discussion will illustrate, unavoidable impacts to wetlands resulted when the key constraints could not be satisfied without incurring those temporary or permanent impacts.

The key constraints are as follows:

1) The site layout must minimize impacts to the environment and to the Detroit River International Wildlife Refuge.
2) Fermi 3 construction cannot interfere with the operations of the existing Fermi 2 Nuclear Power Plant.
3) Fermi 3 construction cannot interfere with Fermi 2 security requirements or programs.
4) Fermi 2 operations must not interfere with Fermi 3 construction.
5) Fermi 2 operations must not interfere with federally mandated Fermi 3 security requirements, which are distinct from operating plant security requirements.

6) The location of the Fermi 3 power block must allow for both Fermi 2 and Fermi 3 plants to be combined into a single protected area security boundary after construction is completed that meets federally mandated security requirements. This will facilitate operational synergies such as sharing of personnel and common support facilities, the Primary Access Portal (PAP) to the protected area, warehouses, and maintenance shops.
7) The construction site must provide for a contiguous, unimpeded flow of personnel, equipment and materials.
8) The Fermi 3 construction site must have adequate, onsite space for the following: laydown and staging of materials; fabrication and assembly of modular components, and; construction support facilities. Nuclear power plant construction management consultants have advised Detroit Edison that a minimum of 100 acres of land should be available onsite, contiguous to or near the construction area, for these activities.
9) Placement of structures must satisfy nuclear safety requirements.

Constraint 1 has been a primary consideration throughout the site layout development process, however, as the project has moved forward, additional environmental studies and information have been developed which have been the principal driver for revisions to the proposed site layout to further minimize environmental impacts.

While the constraints have remained the same throughout the development of the site layout, as Detroit Edison's knowledge of site environmental conditions evolved, revised versions of the site layout were created in keeping with Constraint 1. Each of the four versions of the site layout satisfied the key constraints based upon the state of knowledge at the time the site revision was developed.

The method chosen to address Constraints 2 through 5 was to separate Fermi 2 operational activities from the Fermi 3 construction site the maximum extent. This separation resulted in Constraints 10 and 11, as follows:

10) All Fermi 2 operational activities will be on the north side of the Fermi site and all Fermi 3 construction activities will be on the south side of the site. The boundary separating Fermi 2 operations from Fermi 3 construction activities is roughly an east-west line extending across the site from the southern boundary of the Fermi 2 protected area. This constraint significantly reduces the amount of land available for building and construction because land north of the line will not be available for Fermi 3 construction.
11) Fermi 2 operations and the Fermi 3 construction site must have completely separate access roads, entrances and exits. Fermi 2 and Fermi 3 roads and activities must not cross each other. This is to avoid traffic impacting either site. This also relates to Constraint 7.

Constraints 2, 3, 4, 5, and 6 allow very little flexibility on where power block structures such as the reactor building can be located. The only location suitable is south of the existing Fermi 2 protected area on the opposite side of the imaginary east-west dividing line.

Constraints 7 and 8 require arranging the Fermi 3 site to ensure that there will be adequate space near the primary construction area to allow a free flow of personnel, materials and equipment. Fermi 3 requires a large construction workforce with up to 2900 construction workers at peak and 900 onsite workers when operational. Adequate staging and laydown area (temporary storage of construction materials) is needed to support the modular construction of nuclear power plants. Reactors such as the ESBWR proposed for Fermi 3, use standardized modules and certified designs to expedite the construction schedule. Nuclear power plant construction management consultants have advised Detroit Edison that a minimum of 100 acres of land should be available near the construction site for staging, laydown, and assembly of equipment and pre-assembled modules. A comparison of the amount of proposed land available for other United States nuclear

license applicants indicates that the Fermi 3 site, in the preferred site layout, is among the smallest sites in terms of acres used.

Constraint 9 requires a final review and approval of any proposed site layout arrangement by security subject matter experts with appropriate clearances to ensure that the layout is in compliance with all security plan requirements.

Efforts to minimize impacts in the alternatives development process included:

- Avoiding and minimizing impacts to all wetlands with priority given to avoiding impacts to the most valuable/functional wetlands;
- Where wetland impacts were unavoidable, the preference was for temporary wetland impacts over permanent wetland impacts, with the understanding that wetland mitigation implemented prior to, or concurrent with, the impact will still be required. A temporary impact means that the wetland will be restored to existing or better condition once the temporary land use for construction activities is completed, and;
- Placing the Fermi 3 power block in the largest contiguous upland area.

Efforts were made to avoid, to the extent practicable, adverse impacts associated with filling or modification of wetlands and new construction in wetlands wherever there is a practicable alternative. Impacts were only considered when there was no practicable alternative, and the proposed configuration for Fermi 3 includes all practicable measures to reduce impacts to wetlands and jurisdictional waters. Detroit Edison evaluated each of the onsite alternative layouts based on the approximate acreage, type, and value of wetlands that would be impacted. Alternatives that would minimize impacts to wetlands were preferred over alternatives that would result in greater impacts.

Wetland impacts of the Revision 0, Revision 1, and Revision 2 site layouts presented in the Fermi 3 Environmental Report, were evaluated using the updated Fermi site wetland delineation provided in this application (see Figure 2-2). Impacts to the open water areas H and U are treated as emergent wetland impacts. Therefore, the acres of impact presented here differ slightly from those presented in the Environmental Report.

Revision 0 Site Layout

Revision 0 is the site layout presented in the original Fermi 3 combined license application (COLA) submittal in September 2008. The Revision 0 layout was finalized in February 2008 using preliminary site wetlands information and was laid out along traditional concepts for large, long-term, construction sites.

Unchanged Site Layout Elements

The location of the Fermi 3 power block, which includes the reactor building, turbine building, control building, fuel building, radwaste building, diesel generators and other plant support systems, is fixed according to the requirements set out in Constraints 6 and 10. This location did not change in subsequent site-layout revisions.

Lake Erie will be used as the source for makeup water to the plant. The Fermi 3 makeup water intake will be adjacent to the intake for Fermi 2, i.e., located between the two existing groins that protrude into Lake Erie in the location of existing Fermi 1 structures. A barge slip for delivery of prefabricated modules, large components and building materials will be located between the two groins and adjacent to the south groin. These structures will be located in areas that have already been disturbed, in conformance with Constraint 1 and 10. The location of these structures did not change in subsequent revisions.

The Fermi 3 blowdown water outfall to Lake Erie will be offshore via an underwater discharge line in conformance to Constraints 1, 2 and 10. The configuration and discharge location of this line did not change in subsequent revisions. Four discharge locations were considered including two shoreline discharges (concrete, partially submerged, discharge structure along the shoreline) and

an inland location. The inland location into the south lagoon was eliminated due to environmental considerations according to Constraint 1. The warm blowdown water could potentially disturb the local aquatic ecosystem and wetlands in the south lagoon. The two shoreline discharge locations considered on the south side of the site, per Constraint 2, were also eliminated due to environmental considerations per Constraint 1 and potential Fermi 2 operational impacts per Constraint 2. One consideration with both shoreline locations was the possibility of variable, near-shore currents sending the warm blowdown water back into the Fermi 2 and Fermi 3 makeup water intakes, which could impact plant heat loads and water chemistry. The other consideration with both shoreline locations was that warm blowdown water discharged during a seiche event, with winds from the east, could flow back into the south lagoon, potentially disturbing the local aquatic ecosystem and wetlands. Shoreline discharge locations would pose greater impacts than the proposed offshore discharge, which is considered environmentally preferable.

Site Layout Elements that Changed in Subsequent Site Layout Revisions

The normal power heat sink for Fermi 3 is a single concrete natural draft cooling tower. The cooling tower location changed from Revision 0 to Revision 1. Several criteria were utilized in identifying the initial cooling tower location, as follows:

- The cooling tower must be at least 800 feet away from safety-related structures in conformance with Constraint 9 (the cooling tower must be located, at minimum, a distance equal to its height from any safety-related structures such as the reactor building. This is to eliminate the potential for damage to these structures, if the tower collapsed), and;
- The cooling tower must be at least 1000 feet away from the switchyard to minimize icing and salt drift impacts also in conformance with Constraint 9.

Other considerations included the following: minimizing the length of the circulating water piping; minimizing the distance to Lake Erie, minimizing wetland impacts according to Constraint 1; minimizing Fermi 2 system impacts, and; minimizing temporary impacts to Fermi 2 and Fermi 3 site access during construction according to Constraints 2, 10 and 11. Four locations were considered. The location chosen was south of Fermi 3 in an area that was considered to be forested upland. The location selected conformed with the above-mentioned constraints and had the smallest impact to wetlands, the shortest circulating water pipe length, and had the smallest Fermi 2 system impacts.

In conformance with Constraints 10 and 11, several Fermi 2 operational facilities (warehouses, administration and engineering offices, maintenance shops) were relocated from the Fermi 3 construction site to the Fermi 2 side of the site. These facilities were to be relocated in an area that was considered to be forested upland. The location of these facilities changed from Revision 0 to Revision 1 to minimize wetland impacts, in conformance with Constraint 1, based on additional wetlands delineation information.

In conformance with Constraint 11, the Fermi 2 site to the north, and the Fermi 3 construction site to the south, must have completely separate access roads, entrances and exits. This is to prevent traffic from either site affecting the operation of Fermi 2 or Fermi 3. The Fermi 2 access road followed the west property line along Toll Road, then turned west through an area that was considered to be forested upland. The access road was altered from Revision 0 to Revision 1 to minimize wetland impacts, in conformance with Constraint 1, based on additional wetlands delineation information. The Fermi 2 access road was slightly altered in Revision 2 to further reduce wetland impacts.

The Fermi 3 temporary construction parking lot was proposed to be located on the north side of Fermi Drive, beneath the existing transmission corridors in accordance with the Fermi 2 and Fermi 3 separation requirements per Constraint 10. A large area is needed for construction parking to accommodate 2900 workers at the peak of construction. This area is also directly connected to the construction site and meets the requirements of Constraint 7. The utility of this

area for other construction activities was limited due to the existing high-voltage overhead lines. The location of construction parking and the utilization of this field changed from Revision 1 to Revision 2.

Revision 1 Site Layout

Based on completion of the Ducks Unlimited wetland study in July 2008, Detroit Edison recognized that the cooling tower location and the location of the Fermi 2 facilities moved from the Fermi 3 construction site, had greater wetland impacts than originally assessed and that these placements would have to be modified. Therefore, at the U.S. Nuclear Regulatory Commission (NRC) environmental audit in February 2009, Detroit Edison informed the NRC, Michigan Department of Environmental Quality (MDEQ), and the U.S. Army Corps of Engineers (USACE), that the Revision 0 site layout would be revised to further minimize wetland impacts.

Through planning and consultation with natural resource professionals, stakeholders and subject matter experts (nuclear security, materials management, construction planning, operations, maintenance, environmental and licensing), Detroit Edison developed a Revision 1 site layout that reduced wetland impacts to only those areas where a practicable alternative could not be identified that would still fulfill the overall project purpose. All available land onsite with no wetland impacts and low wetland impacts, that also conformed to the key constraints, was identified on a figure, for use in reconfiguring the Fermi 3 site layout. The stakeholder team then worked to eliminate or minimize wetland impacts by redesigning the site layout utilizing those identified low-impact and no-impact areas, with a focus on relocating Fermi 3 structures and activities with the greatest wetland impacts (e.g., cooling tower location, Fermi 2/Fermi 3 PAP, parking, office buildings, warehousing, and shops). The Revision 1 site layout was submitted to the NRC in December of 2009.

One of the key changes made to the Revision 1 site layout was moving the cooling tower from the forested wetland, south of Fermi Drive, to land just west of the Fermi 3 power block. This location has several advantages such as shorter circulating water lines, no temporary disturbance to construction site roadways, and no wetland impacts (per the 2008 wetlands delineation). One consideration of this location was that it was close to safety-related structures such as the reactor building. According to Constraint 9, the cooling tower was positioned a distance greater than its height from safety-related structures to prevent damage to these structures, if the tower were to collapse. The South Canal is impacted by the new cooling tower location and by the need to maintain a free flow of personnel, equipment and materials to the construction site, according to Constraint 7. The intersection of Fermi Drive, Quarry Lake Road and Doxy Road is considered a pinch point to the free flow of personnel, equipment and materials. Bridging of the South Canal allows for an unconstrained connection between the field to the west and the construction site. Due to the considerations explained above regarding Constraints 7 and 9, the impact to the South Canal is unavoidable.

A disadvantage to locating the cooling tower adjacent to the Fermi 3 power block is the loss of a large expanse of land adjacent to the primary construction site needed for laydown, staging, fabrication and assembly of modular components, according to Constraint 8. This loss can be partially, but not completely, compensated by managing the construction sequence. To address this constraint, the area known as the “pork chop” located south of Fermi Drive and west of Quarry Lakes Road, was utilized in the Revision 1 site layout, in conformance with Constraints 7, 8, and 10. The “pork chop” provides approximately 30 acres of prime construction land that includes 11.80 acres of forested wetland near the construction site. Natural resource inventories suggested the forested wetland in this area was of lower value ecologically than the other large forested systems onsite. The wetland is connected hydrologically with culverts but fragmented from other wetland areas and Lake Erie due to multiple roadways completely surrounding the site. It also had a larger component of dead/dying ash trees and invasive species and was subject to ongoing disturbance.

The “pork chop” is an important feature of the Revision 1 site layout due to its proximity to the construction site; location adjacent to Fermi Drive and rail access; and, the absence of overhead

transmission lines that can present a safety hazard and barrier to movement and assembly of equipment, materials and modules. Construction warehouses, staging, assembly areas, and maintenance shops were planned for this location. Utilization of this area greatly facilitates the free flow of personnel, equipment and materials, further relieving the pinch-point concern at the Fermi Drive and Quarry Lakes Road intersection. Traffic through this area includes workers and materials coming from Dixie Highway, laydown and staging areas, the rail spur, and the barge slip.

The other key change to the Revision 1 site layout was removing the Fermi 2 operational structures (permanent parking lot, warehouses, an administration building and maintenance shops) from the forested wetland west of the Fermi 2 protected area. These structures were relocated in the Revision 1 site layout as follows:

- An administrative support campus outside the owner controlled area, associated with the Nuclear Operations Center/Nuclear Training Center (NTC), was created to move the Fermi 2/Fermi 3 Administration Building and the Fermi 3 Training Simulator out of forested Wetland I, in conformance with Constraint 1. Conformance to Constraints 4, 10 and 11 was evaluated for this location due to Fermi 2 operational support facilities being moved to the southern, Fermi 3 side of the site. Several considerations mitigate these constraint conformance issues, as follows: a bridge or tunnel will be utilized to cross Fermi Drive without affecting the construction site; personnel utilizing the training facility and administrative offices are generally at that location the entire day and would not need to cross to the Fermi 2 side of the site; and; increased use of technology such as video conferencing will minimize cross over. In addition, this arrangement reduces the need for additional operational parking at the PAP due to reduced personnel inside the protected area, which reduces the parking-structure foot print, thus minimizing environmental impacts in this area in conformance with Constraint 1.
- The flat operational parking was moved out of forested Wetland I and replaced by two multiple-level parking structures to minimize land use and wetland impacts, and to improve the overall site parking situation in conformance with Constraint 1. One parking structure is proposed near the NTC for permanent training and administration parking to support the new administrative campus. The other structure is located near the new PAP on the west side of the protected area boundary for protected area parking. A small wetland impact associated with a portion of this parking structure remains. This impact could not be avoided due to the proximity of existing and proposed structures in this area, along with nuclear security distance requirements in conformance to Constraint 9. The two parking garages will be sized to accommodate Fermi 2 and Fermi 3 operational parking.
- The combined Fermi 2/Fermi 3 warehouse was moved out of forested Wetland I in conformance with Constraint 1 and moved east to straddle the protected area boundary near the vehicle inspection building (VIB) and PAP. This location minimizes impacts, however some wetland impacts were unavoidable due to necessary sizing of the Fermi 2/Fermi 3 warehouse and the need for an access road along the west side of the structure. This arrangement will improve operational efficiency of the Fermi 2 and Fermi 3 sites. Other areas north and west of the protected area were considered, however, key stakeholder feedback, primarily from materials management and nuclear security, insisted on this location for secure protected area operations in conformance with Constraints 2, 3, 6 and 9. Two other smaller warehouses (32 and 34) were also moved out of forested Wetland I, to a location along the access road with no associated wetland impact.
- The Fermi 2 operational access road was moved to minimize environmental impacts in conformance with Constraint 1. The access road no longer cuts through forested Wetland I. The access road now follows the existing Toll Road, then transitions to existing site roads, which route around Wetland I to access the site. Wetland impacts were minimized, however some impacts were unavoidable, in conformance with Constraints 6, 10 and 11. The unavoidable impacts were associated with a new Fermi 2 operational security gate,

necessary road improvements and rerouting of the existing road along the west side of the new Fermi 2/Fermi 3 warehouse.

Other modifications reflected in the Revision 1 site layout include the following:

- The Fermi 2/Fermi 3 meteorological tower was relocated because the new Fermi 3 cooling tower location will interfere with the current meteorological tower location. The new meteorological tower is relocated in an area near the southeast corner of the site. This location was selected because there were no known wetland impacts in conformance with Constraint 1 and because it met NRC regulatory guidance for meteorological tower placement.
- Construction staging and laydown was added on the south site border in a low-wetland impact area, on the east side of Quarry Lakes Road and around Fox Road, in conformance with Constraints 8 and 10. Unavoidable, temporary impacts are incurred to several small, fragmented, low-value emergent and scrub shrub wetlands (Wetlands AA, JJ, II). Nuclear construction subject matter experts engaged by Detroit Edison indicated that more land was needed for construction activities (staging, laydown, temporary spoils storage, and component assembly) than was originally allocated in the Revision 0 site layout.
- The Fermi 3 switchyard was moved to the agricultural field at the far west side of the property, adjacent to the south side of Fermi Drive. In Revision 0, the Fermi 3 switchyard was adjacent to the Fermi 2 switchyard in the protected area. Further analysis of the Fermi 3 interconnection determined the available space adjacent to the Fermi 2 switchyard was not sufficient for the new Fermi 3 switchyard. In addition, in accordance with Constraint 2, the original location was an impediment to movement and a potential impact to Fermi 2 operations. The new location also places the switchyard outside the owner-controlled area to facilitate access by ITC*Transmission* (owner and operator of the switchyard).

Revision 2 Site Layout

After the Revision 1 site layout was finalized, terrestrial and aquatic studies continued on the site. The results indicated a greater diversity in the vegetative communities within the "pork chop," than was originally understood. Subsequently, in a meeting to discuss Fermi 3 wetland permitting in July 2010, the MDEQ and USACE indicated that the wetland impacts associated with the "pork chop," contained in the Revision 1 site layout, were problematic. In response to this feedback and in conformance with Constraint 1, Revision 2 of the site layout was developed to address the wetland impact to the "pork chop" area.

Construction activities were moved out of the "pork chop" (Wetlands BB, EE, and FF) and the contiguous forested upland associated with that parcel, in accordance with Constraint 1. Site elements were rearranged to eliminate the "pork chop" impact, in conformance with Constraints 1, 7, 8 and 10. Most of the construction activities planned for the "pork chop," were moved to the north side of Fermi Drive. Some of the construction activities were also moved into areas designated for construction laydown located around the Quarry Lakes. Construction parking originally planned for the field north of Fermi Drive, was moved into the farmer's field located along the western property line. The use of the field on the north side of Fermi drive was limited in the previous site layout because of existing overhead transmission lines, so in Revision 2, the 345 kV lines are rerouted.

The resulting changes are summarized as follows:

- The 345 kV transmission lines that serve Fermi 2 and the proposed Fermi 3 were rerouted to open up the field on the north side of Fermi Drive for all necessary construction activities to satisfy Constraints 7, 8 and 10. The transmission is rerouted due west through emergent Wetland C, then south along Toll Road, to the Fermi 3 switchyard, which was moved into the field at the corner of Toll Road and Fermi Drive. This change eliminates impacts to a large parcel of rare and imperiled wetland (the "pork chop") and incurs unavoidable impacts to approximately 2 acres of forested wetland (the impacts will change the edge of Wetland F

below the transmission lines from a forested wetland to a emergent wetland) and small, unavoidable, permanent and temporary impacts to an emergent Wetland C.

- Land surrounding the Quarry Lakes, designated as laydown, was added for various construction activities in conformance with Constraints 7, 8 and 10, to replace loss of laydown and staging areas from the "pork chop" area and from moving construction parking into the farmer's field. Some temporary, unavoidable impacts are incurred to small, fragmented, low-value forested and emergent wetlands in these areas (Wetlands W and Y).
- The Fermi 3 switchyard was moved from the south side to the north side of Fermi Drive to facilitate the transmission corridor rerouting in conformance with Constraints 1, 7 and 8. Construction parking, previously located in the field north of Fermi Drive, is moved into the farmer's field.
- The Fermi 2 access road was realigned to further minimize impacts to forested Wetland I in conformance with Constraint 1. The new alignment will follow Toll Road further north, just past Langton Road, prior to transferring onto the Fermi site access road.
- The meteorological tower was moved southeast of the Revision 1 location to eliminate any potential wetland impacts. When the Revision 1 location was identified, the understanding was that cutting trees in a wetland did not require a wetland permit. At the July 2010 meeting with the MDEQ and USACE, the staff clarified that cutting trees from forested wetland areas in association with the meteorological tower would require a permit for the conversion of wetland type. In conformance with Constraint 1, the Revision 2 site layout identified a location that was consistent with the recommendations of the meteorological tower siting study and did not require tree cutting in wetland areas.
- In Revision 2, construction boundaries were refined to eliminate unintended impacts in the Revision 1 site layout associated with construction along Quarry Lake Road and the Dredged Spoils Disposal Basin.
- Operations and maintenance dredging authorized under existing Fermi 2 permits was eliminated as an impact attributed to Fermi 3 construction (reduction of 7.32 acres of open water impacts). The incremental change in the extent of dredging within Lake Erie required to support Fermi 3 construction was included.

Preferred Site Layout

Refinements to the Revision 2 site layout were made during the development of the joint permit application. Detroit Edison modified the alignment of the new operations access road to avoid potential wetland impacts in the area west of the existing Toll Road. This change resulted in a small increase in the forested and emergent wetland impacts on the Fermi property side of the access road. The shift in the access road alignment altered the path of the onsite transmission, resulting in an increase of 1 acre (from 1.53 acres to 2.53 acres) in the forested wetland that would be cleared within the transmission corridor. The proposed roadway, security gate, and box culvert design were modified to minimize the encroachment into the wetland areas as much as practicable. Overall the wetland impacts associated with the road increased by 0.53 acre. The wetlands west of the existing Toll Road have not been formally delineated. Based on federal wetland mapping and field observations, Detroit Edison believes equal or greater wetland impacts would have resulted from the previous access road alignment.

Summary of Project Alternatives and LEDPA Analysis

Table 4-3 compares potential impacts to wetlands on the Fermi site of the four alternative site layouts discussed above. Wetland impacts were further characterized by Michigan Natural Communities to illustrate impacts to higher valued wetlands.

Detroit Edison minimized potential project impacts to waters of the United States, including wetlands. The site layout for the Fermi 3 project was based on an iterative approach to determine a layout that would most practicably avoid and minimize impacts to USACE jurisdictional waters and wetlands. Areas of the Fermi site that represented no, or minimal, impacts to wetland functions and values were identified. Stakeholders were engaged to identify constraints on the site layout, including integration of Fermi 3 with the ongoing operations of Fermi 2. Those constraints were used to identify locations for the proposed Fermi 3 and associated construction. Efforts were made to avoid, to the extent possible, impacts associated with the destruction or modification of wetlands and streams and new construction in wetlands and streams wherever there was a practicable alternative.

The Fermi 3 power block was located in the largest contiguous upland area consistent with Constraints 1, 2, 3, 4, 5, 6, 7, 9 and 10. The cooling tower was also located in this upland area at a distance from the power block that satisfies nuclear safety considerations, per Constraint 9. The minimum separation distance precludes siting the cooling tower entirely within the available upland adjacent to the Fermi 3 power block area.

A combined Fermi 2/Fermi 3 warehouse, parking, VIB, and PAP located on the west side of the protected area boundary, offers significant efficiency advantages over the operational life of the plants. A multi-level parking structure connected to the PAP addresses the need for parking for an additional 900 staff when Fermi 3 is operational while minimizing impact to the adjacent wetlands. The location of these facilities supports the integration of the Fermi 2 and Fermi 3 protected areas when construction is completed and satisfies other nuclear security considerations per Constraints 2, 3, 6, 9 and 10.

Construction of the Fermi 3 intake structure, discharge pipe, and barge slip within the existing Fermi 2 intake embayment reduces the cumulative area of lake bottom that will be disturbed per Constraint 1. The discharge pipe and fish return pipe are the only Fermi 3 components that will require dredging beyond the operations and maintenance dredging currently authorized for Fermi 2 under MDEQ and USACE permits.

Adequate laydown area is needed to support the modular construction that is a key component of modern nuclear power plants, as described in Constraint 8. Reactors such as the ESBWR proposed for Fermi 3 use standardized modules to expedite the construction schedule. With the relocation of the 345kV transmission, the field to the west, and immediately adjacent to the power block, along the north side of Fermi Drive, possesses the attributes necessary for key construction activities consistent with Constraints 7 and 8. Use of this area includes some unavoidable impacts to wetland areas that will be restored following completion of construction of Fermi 3.

The design iterations reduced the potential wetland impacts from over 150 acres to approximately 40 acres. Overall impacts to wetlands were reduced in the Preferred Alternative. Open water impacts were also reduced in the Preferred Alternative. The Preferred Alternative also reduces the total impact to those Michigan Natural Communities that are considered rare and imperiled. These include Great Lakes marsh and southern swamp (southern hardwood swamp). All the permanent and temporary wetland impacts in the preferred site layout were unavoidable given the ten constraints previously outlined. The preferred alternative presents significantly less impact to the high functioning, high value wetland communities at the Fermi site. Based on the results of the alternative site layout analysis, the Preferred Alternative was selected as the proposed site layout that best addresses avoidance and minimization of wetland impacts.

Table 4-1. Candidate Site Practicability Review (Sheet 1 of 2)

	Site A – Petersburg	Site C – South Britton	Site F – Greenwood	Site M – Fermi	Site N – Belle River	Site W1 – Port Austin	Site W2 – Caseville	Site W3 – Bay Port
Land Acquisition	**Impracticable** 32 private owners, few houses.	**Acceptable** 14 private owners, 15-25 houses/ facilities. May need to acquire additional land for EAB	**Acceptable** Detroit Edison. Would need to acquire additional land for EAB	**Acceptable** Detroit Edison. Fermi 3 EAB entirely within existing Fermi property and security zone	**Acceptable** 81% Detroit Edison / 19 % Michigan Public Power Authority	**Impracticable** 85 private owners. Many houses/ facilities	**Impracticable** 90 private owners. Many houses/ facilities	**Impracticable** 120 private owners. Many houses/ facilities. May need to acquire additional land for EAB
Transmission Lines	**Acceptable** 345-kV lines with available capacity 1.2 miles north of site	**Acceptable** 345-kV line with available capacity 1 mile north of site	**Marginal** 345-kV line onsite but congested	**Acceptable** 345-kV line with available capacity onsite	**Marginal** 345-kV line onsite but congested	**Impracticable** Nearest 345-kV line is approximately 48 miles from the site	**Impracticable** Nearest 345-kV line is approximately 41 miles from the site	**Impracticable** Nearest 345-kV line is approximately 35 miles from the site
Water Supply	**Impracticable** 15.4 miles inland from Lake Erie	**Impracticable** 24.4 miles inland from Lake Erie	**Acceptable** 11 miles inland from Lake Huron	**Acceptable** On the shore of Lake Erie	**Acceptable** 2 miles west of St. Clair River	**Acceptable** 1.4 miles inland from Lake Huron	**Acceptable** 2.8 miles inland from Lake Huron	**Acceptable** 1.4 mile inland from Saginaw Bay

Table 4-1. Candidate Site Practicability Review (Sheet 2 of 2)

	Site A – Petersburg	Site C – South Britton	Site F – Greenwood	Site M – Fermi	Site N – Belle River	Site W1 – Port Austin	Site W2 – Caseville	Site W3 – Bay Port
Hazardous Land Uses	Impracticable Petroleum product pipeline 2 miles south. Two natural gas pipelines traversing the site from southwest to northeast within ½ mile of plant	Impracticable Two natural gas pipelines traversing the site from southwest to northeast. Would require relocation of a 30-inch line to avoid conflicts with the plant	Marginal Oil-fired peaking unit and three gas turbines onsite	Acceptable Two limestone quarries 3 miles northeast.	Impracticable Multiple large natural gas transmission lines, gas storage field and compressor station within 2 miles. Bulk petroleum facility 3 miles north of the site	Acceptable No hazardous land use sites within 5 miles.	Acceptable No hazardous land use sites within 5 miles.	Acceptable Limestone quarry and anhydrous ammonia facility within 3 miles of the site.
Railroad Access	Acceptable Indiana & Ohio Railroad 1.5 miles west of the site.	Acceptable Norfolk Southern Railway 1.9 miles east of the site.	Acceptable PVTX Railway spur on site.	Acceptable Canada National Railway spur on site.	Acceptable CSX Transportation spur on site.	Acceptable Huron & Eastern Railway 1.4 miles southeast of the site.	Marginal Huron & Eastern Railway 6.7 miles south of the site.	Acceptable Huron & Eastern Railway 5.4 miles south of the site.
Overall Conclusion	Impracticable	Impracticable	Acceptable	Acceptable	Impracticable	Impracticable	Impracticable	Impracticable

Table 4-2. Comparison of Wetland/Water Impacts from Alternative Sites

Onsite Wetlands/Waters	Proposed Site Fermi		Alternative Site Greenwood	
Delineated Property Acreage	1106		1729	
Wetlands Acreage	513		386	
Open Water Acreage	40		NA	
Streams Linear Feet (LF)	0		30,303	
Wetlands Affected Acreage	40		39	
Streams Affected LF	0		401	
Open Water (Lake Erie) Affected Acreage	0.08		NA	
Open Water (inland) Affected Acreage	NA		NA	
Offsite Wetlands/Waters	**Wetlands (acreage)**	**Streams (LF)**	**Wetlands (acreage)**	**Streams (LF)**
Makeup Water Intake (acreage)[a]	-	-	NA	NA
Water Pipeline ROW	-	-	3.1	4378
Transmission Line ROW	121	7304	257	29,648
Blowdown Pipeline ROW	-	-	0	273
Total Wetlands/Waters Affected				
Wetlands Affected Acreage	161		300	
Streams Affected LF	7304		34,701	
Open Water (Lake Erie) Affected Acreage	0.08		NA	
Open Water (inland) Affected Acreage	NA		NA	

[a] Impacts within Lake Huron for the construction of an intake structure for the Greenwood site alternative were not evaluated.

Table 4-3. Comparison of Impacts for Alternative Site Layouts

Type	Revision 0	Revision 1	Revision 2	Preferred Alternative
Wetland Impacts (acres) by Type				
PEM wetland[a]	54.84	18.79	26.08	26.40
PFO wetland	96.66	18.97	6.84	8.03
PSS wetland	7.00	4.10	5.28	5.28
Total wetlands	158.49	41.86	38.19	39.71
Open water	8.87	7.40	0.08	0.08
Wetland Impacts (acres) by Michigan Natural Community[b]				
Rare and imperiled: Great Lakes marsh	47.53	10.38	12.86	13.19
Rare and imperiled: southern hardwood swamp	92.19	14.08	1.95	3.15
Southern shrub carr	7.00	3.92	3.91	3.91
PEM wetland – coastal	0	0.80	0.80	0.80
PEM wetland[a]	7.31	7.61	12.42	12.42
PFO wetland	4.47	4.89	4.89	4.89
PSS wetland	0	0.18	1.37	1.37
Open water	8.87	7.40	0.08	0.08

[a] Includes 1.88 acres of nonjurisdictional PEM wetland impacts.

[b] Chapter 324, Section 303.01(t) of the Michigan Natural Resources and Environmental Protection Act lists Michigan Natural Communities that are considered rare and imperiled. These include Great Lakes marsh and southern swamp (southern hardwood swamp). Any wetland considered "other" that is connected hydrologically to Lake Erie or is within 1000 feet of the ordinary high water mark (elevation 571.6 feet IGLD 1955) is considered coastal.

J.3 References

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

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."

Detroit Edison Company (Detroit Edison). 2011. *Detroit Edison Fermi 3 Project, U.S. Army Corps of Engineers and Michigan Department of Environmental Quality, Joint Permit Application.* Revision 1, Detroit Michigan. August. Accession No. ML112700388.

U.S. Army Corps of Engineers (USACE). 2011. "Public Notice: Proposed Structures and Dredge and Fill Activities Associated with the Proposed Enrico Fermi Unit 3 Nuclear Power Plant in Lake Erie and/or Adjacent Wetlands at Frenchtown Charter Township, Monroe County, Michigan." Accession No. ML12180A374.

Appendix K

Detroit Edison's Proposed Compensatory Mitigation Plan for Aquatic Resources

Appendix K

Detroit Edison's Proposed Compensatory Mitigation Plan for Aquatic Resources

This appendix presents Detroit Edison Company's (Detroit Edison's) proposed plan to compensate for its proposed unavoidable adverse impacts to aquatic resources associated with the building of Enrico Fermi Unit 3 (Fermi 3), as presented in its onsite alternatives analysis (Appendix J).

Based on guidance provided by the U.S. Army Corps of Engineers (USACE) during pre-application coordination regarding Clean Water Act Section 404(b)(1) Guidelines compliance, Detroit Edison conducted an onsite alternatives analysis (Detroit Edison 2011), contained in Appendix J, and identified its proposed least environmentally damaging practicable alternative (LEDPA) to avoid and minimize impacts on waters of the United States. Since Detroit Edison's proposed LEDPA would result in unavoidable adverse impacts to aquatic resources, Detroit Edison initially developed a conceptual-level mitigation strategy (Detroit Edison 2011) as a starting point to address the required compensatory mitigation for the unavoidable losses attributable to its LEDPA. Detroit Edison's proposed LEDPA and conceptual mitigation strategy were made available for public review and comment in Appendices J and K, respectively, of the Draft EIS. The USACE LRE-2008-00443-1-S11 public notice ending January 23, 2012 (USACE 2011), provided additional opportunity for public comment on both the proposed LEDPA and the conceptual mitigation strategy.

As discussed in Appendix J, USACE is actively reviewing and coordinating with Detroit Edison regarding its proposed LEDPA. This is part of the ongoing USACE process to identify and verify the USACE LEDPA and determine compliance with other restrictions of the Guidelines and public interest review. Subsequent to the Draft EIS and USACE public notice, and based on USACE comments and coordination regarding its conceptual mitigation strategy, Detroit Edison refined and detailed its mitigation strategy and produced the proposed mitigation plan that is now contained in this appendix. USACE is actively evaluating this proposed plan in conjunction with the proposed LEDPA. The final mitigation plan must be approved by the District Engineer prior to USACE issuance of a permit for the proposed work related to the Fermi 3 project. A USACE permit, if issued, would include special conditions that would state the compensatory mitigation requirements including the amount and type of compensatory mitigation; identify the responsible party for providing the compensatory mitigation; incorporate, by reference, the final

mitigation plan approved by the USACE District Engineer; and unless provided in the approved final mitigation plan, describe, for the compensatory mitigation project, the required financial assurances and long-term management provisions, plan objectives, required monitoring, and performance standards, which include Detroit Edison's confirmation that the mitigation meets the Federal wetlands criteria as discussed in Section 1.1.3 of this EIS.

Fermi 3
U.S. Army Corps of Engineers Mitigation Strategy and Final Design

MDEQ/USACE Joint Permit Application

PREPARED BY:

CONSERVATION CONNECTS

TETRA TECH

July 2012

Fermi 3 USACE Mitigation Strategy and Final Design

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1.0 INTRODUCTION

Detroit Edison has developed the following mitigation strategy to compensate for proposed impacts to aquatic resources associated with construction of Fermi 3 (Proposed Development) at the Enrico Fermi Atomic Power Plant (Fermi site). The Proposed Development site is located on the western shore of Lake Erie at Newport, Monroe County, Michigan on a 1,260-acre parcel owned and managed by Detroit Edison (Figure 1).

A full description of the Proposed Development was presented in the associated Joint Permit Application [Michigan Department of Environmental Quality (MDEQ) File Number 10-58-0011-P, U.S. Army Corps of Engineers (USACE) File Number LRE-2008-00443-1-S11]. Proposed impacts include 35.55 acres of mixed wetland types within the coastal zone of Western Lake Erie and the northern portion of the Ottawa-Stony Watershed, USGS Cataloging Unit and Hydrologic Unit Code (HUC): 04100001. Wetland types are classified broadly according to the U.S. Fish and Wildlife Service (USFWS) Cowardin classification and more specifically according to the Michigan Natural Community classification. Potential impacts include approximately 10.90 acres of palustrine emergent marsh (PEM; Great Lakes marsh), 3.15 acres of palustrine forested wetland (PFO; southern hardwood swamp), 3.91 acres of palustrine scrub shrub (PSS; southern shrub carr), 0.80 acres of PEM (coastal emergent wetland), 10.53 acres of PEM (other emergent wetland), 4.89 acres of PFO (other forested wetland) and 1.37 acres of PSS (other scrub shrub wetland).

To compensate for the wetland impacts, Detroit Edison proposes to restore wetlands offsite in the coastal zone of Western Lake Erie. This mitigation strategy is based on data collected onsite, existing databases, the attributes of potentially impacted wetlands, watershed priorities, feedback from natural resource professionals and ongoing communication with the regulatory and conservation community.

2.0 MITIGATION GOALS AND OBJECTIVES

The principal goal of this mitigation strategy is to restore and protect wetland functions and services of equal or greater value than those impacted by construction of the Proposed Development (Figure 2). This goal will be achieved through offsite wetland mitigation activities within the coastal zone of Western Lake Erie. The specific objectives listed below were developed based on an in-depth evaluation of the natural resources at the impact site and the mitigation site, and the condition and conservation needs of the surrounding watershed (see Section 3.1). A watershed analysis allowed for integration of watershed attributes including history, current condition, land use trends, stressors, conservation priorities and other conservation efforts in the Ottawa-Stony watershed and the coastal zone of Western Lake Erie in Monroe County, Michigan (Section 3.1.9). Site level and landscape level perspectives were combined with feedback from regulatory and conservation agency staff to develop an integrated compensation strategy, consistent with guidance from the USACE contained in 33 CFR Part 332 – Compensatory Mitigation for Losses of Aquatic Resources, the Environmental Protection Agency guidance contained in 40 CFR Part

230 – Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material, and the MDEQ Technical Guidance for Wetland Mitigation (Reference 1).

2.1 Mitigation Overview

Over 500 acres of wetlands are present at the Fermi site. Wetlands potentially impacted by the Proposed Development have been avoided and minimized to the maximum extent practicable. Aquatic resources on the Fermi Site were identified, evaluated and considered throughout the design process. The first consideration was to determine if wetland impacts could be avoided entirely. The second consideration was to minimize potential impacts in terms of both quantity and quality to the maximum extent possible. The third consideration was to develop a mitigation strategy that would compensate for all unavoidable impacts. Design iterations reduced potential wetland impacts from over 150 acres to approximately 35.55 acres of regulated[1] wetlands requiring mitigation (21.4 acres of which will be restored post-construction). In addition to reducing total acreage of impacts, wetland location and quality were taken into consideration as discussed below and in Section 3.1.

To compensate for the loss of wetlands at the Proposed Development site, Detroit Edison will restore wetlands of similar ecological type within the same coastal zone. For the purposes of this document, restoration implies re-establishing conditions under which the natural functions of a pre-existing wetland can recover. To achieve the mitigation goal stated above Detroit Edison will restore wetlands offsite in the coastal zone of Western Lake Erie (Figure 3).

This comprehensive mitigation strategy is unique in that it proposes mitigation that will ultimately restore significant coastal wetland resources with direct connection to lake hydrology along Lake Erie. Detroit Edison proposes to implement these conservation measures to satisfy the site-specific compensation requirements for impacts to wetlands and address critical watershed needs and priorities as described below in Section 3.1.9. Mitigation activities will commence prior to or concurrent with wetland impacts at the Fermi site to reduce temporal losses of aquatic functions.

Under Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, MDEQ may require compensatory wetland mitigation to replace unavoidably lost wetland resources with created or restored wetlands, with the goal of replacing as fully as possible the functions and public benefits of the impacted wetlands. A functional assessment was conducted to evaluate individual wetlands potentially impacted by the Proposed Development and to define appropriate compensation. A wetland mitigation and monitoring plan detailing the proposed mitigation activities has been submitted to MDEQ in accordance with Permit 10-58-0011-P. The proposed wetland restoration described herein satisfies the MDEQ requirements for wetland mitigation as set forth in the permit.

[1] Regulated wetland acreage includes those wetlands regulated by USACE and/or MDEQ.

2.2 Functional Replacement and Functional Lift

Restoration activities emphasize heterogeneity in microtopography, vegetation and hydrology to maximize diversity and ecological resilience of wetland habitat. Wetland mitigation has been designed to specifically replace the functions and values provided by wetlands with proposed impacts at the Fermi site. These functions and values include varying degrees of flood flow attenuation and storage, sediment, nutrient and toxicant retention, and fish and wildlife habitat. Section 3.1.8 details the wetland conditions, functions and values of impacted wetlands. Wetland mitigation has also been designed to significantly increase aquatic functions at the mitigation site over the level currently provided by existing wetlands. Existing wetlands are actively farmed or exhibit varying degrees of disturbance to hydrology, invasive species and disturbance from adjacent agricultural activities. Section 3.2 and Reference 38 describes the existing conditions of the mitigation site. The final mitigation design targets functions and values of high priority to the surrounding watershed including food chain support, breeding and migration habitat for migratory birds, breeding and over-wintering habitat for amphibians, increased nutrient cycling, increased connectivity of habitat types, and water quality improvements for surface outflow to Lake Erie.

The Evaluation of Planned Wetlands (EPW) method (Reference 2) was used to quantify the expected functional replacement of wetlands and the functional lift expected at the mitigation site. The EPW method focused on two comparisons. The first comparison describes and estimates how wetland functions provided by the planned wetland restoration (planned wetland) at the mitigation site compares to the lost functions of wetlands at the Fermi 3 site (impact wetlands). The second comparison quantifies the projected functional lift at the mitigation site by comparing projected wetland functions provided by the planned wetland to existing wetland functions at the mitigation site (Monroe Wetlands, Reference 37).

The EPW method was selected for several reasons. First, in the absence of a quantitative or scoring wetland assessment method for the Detroit District, the EPW provides a rapid assessment method based on a generic ecological model with the intention that it be applied to wetlands in the United States regardless of location. Second, the EPW method was developed specifically to evaluate projected functional values for planned wetlands. This evaluation provides guidance on final design and determines the degree of likelihood that mitigation requirements will be met. Finally, the EPW has been used by USACE and other state and federal agencies to evaluate wetland restoration and mitigation projects in New York, Maryland, Delaware and Virginia, many of which were as large and complex as Fermi 3.

Wetland functions and conditions of impact wetlands and current conditions of the mitigation site as assessed in the field compared with the targeted functions of the planned mitigation wetland demonstrate that the planned wetland is designed to specifically replace lost functions at the impact area and significantly improve on functions currently provided by wetlands at the mitigation site. The EPW method utilized previous assessment data and resulted in functional capacity calculations and comparisons that provide a clear, numerical description of how the mitigation action compensates for unavoidable impacts

to wetlands at the Fermi site and provides significantly increased benefits at the mitigation site. For each function evaluated (sediment stabilization, water quality, wildlife habitat, fish habitat, unique/heritage), the planned wetland matched or exceeded the functional capacity index of the impact wetlands and the existing conditions of the mitigation site. Weighted by area, the planned wetland is shown to significantly increase functional capacity over the impacted wetlands and over the functional capacity of the wetlands that currently exist at the mitigation site. The functional capacity of the planned wetland also exceeded the primary planned wetland goal which was to replace lost wetland functions of impact wetlands at an average replacement ratio of 3:1. The evaluation assumes the functional capacity of the impacted wetland is permanently lost; however, approximately 60% of the wetland impacts are temporary and the functions and values associated with those wetlands would be restored post-construction.

Based on field assessments and functional analysis, the mitigation plan is expected to exceed replacement goals for all wetland impacts and provide significant functional lift at the mitigation site. It is recognized that there is typically a time lag between loss of wetland functions due to wetland impacts and the gain of wetland functions at the mitigation site. As stated above, mitigation activities will commence prior to or concurrent with impacts to reduce temporal loss. The additional functional capacity projected for the planned wetland over and above impact wetlands, existing mitigation site wetlands and stated wetland goals will provide further compensation for temporal loss associated with both temporary and permanent impacts at the Fermi site.

2.3 Mitigation Acreages

A summary of wetland impacts and attributes is provided in Table 1. A more detailed description of the impacted wetlands is provided in Section 12 of the associated Joint Permit Application.

Wetland mitigation proposed here will replace wetland functions and values impacted on the Fermi site by restoring approximately 130 acres of wetlands of similar type offsite in the same watershed (coastal zone). Restoration will include approximately 97 acres of Great Lakes marsh (which includes 70 acres of emergent and 27 acres of open water), 22 acres of PFO (southern hardwood swamp), and 11 acres of PSS wetland. Table 2 provides the types and acreages of wetlands impacted and the proposed acreage of mitigation. Figure 4 shows the derivation of the mitigation acreages. In addition, the onsite restoration of 21.4 acres of the impacted wetlands post-construction will provide added ecological value and benefits above the required compensatory mitigation.

In summary, Detroit Edison recognizes the value of coastal wetland habitat along Lake Erie. Avoidance and minimization strategies were employed to minimize impacts to wetlands of high ecological value. Unavoidable impacts were restricted to low quality wetlands and wetland areas to the greatest extent possible. As described above, each acre of wetland impacted will be compensated for by the restoration of approximately 3 acres of high quality, intact wetland with a significantly greater projected functional capacity than impact wetlands and existing aquatic resources at the mitigation site. Additional compensation will be realized by post-construction restoration of approximately 60% of the impacted

wetlands onsite. This mitigation strategy satisfies regulatory mitigation requirements with proposed compensation at an appropriate level to achieve replacement of lost functions and values including temporal loss of aquatic resource functions. This mitigation strategy will also support Detroit Edison's corporate environmental stewardship initiatives through continued collaboration and partnership with USFWS and other conservation entities.

3.0 BASELINE INFORMATION

3.1 Impact Area

3.1.1 Location and Ownership

The Proposed Development is at the Fermi site, Latitude: 41.961 and Longitude: -83.261 on the western shore of Lake Erie at Newport, Monroe County, Michigan on a 1,260-acre parcel owned and managed by Detroit Edison (Figure 1). The impact site is within the coastal zone of Western Lake Erie and the northern portion of the Ottawa-Stony Watershed.

3.1.2 Land Use

Land use on the Fermi site is split mainly into developed areas and swamp or wetland areas. Most of the forested areas on the site are subject to flooding, and, therefore, are considered woody wetlands. The majority of the Fermi site that is not developed is included as part of the Detroit River International Wildlife Refuge (DRIWR), known as the Lagoona Beach Unit. The DRIWR encompasses a 656-acre portion of the Fermi site.

The 1260 acre Fermi site is composed of approximately 16.8% developed areas and 5.1% cropland. Terrestrial habitats account for 61% of the property. The remaining 17% are water bodies, e.g., Quarry Lakes and the main body of Lake Erie that lies east and north of the site. Figure 5 illustrates the extent and location of the habitats identified and the developed areas on the Fermi site. A summary of the acres of each habitat type on the site is provided below (Reference 7).

Habitat	Acres	Percent of Site
Coastal Emergent Wetland Open Water	35	2.8
Coastal Emergent Wetland Vegetated	238	18.9
Grassland: Right-of-Way	29	2.3
Grassland: Idle/Old Field/Planted	75	6.0
Grassland: Row Crop	64	5.1
Shrubland	113	9.0
Thicket	23	1.8
Forest: Coastal Shoreline	47	3.7
Forest: Lowland Hardwood	92	7.3
Forest: Woodlot	117	9.3
Developed Areas	212	16.8
Lakes, Ponds, Rivers	44	3.5
Lake Erie (main body)	171	13.6
Totals	1,260	100.0

3.1.3 Topography

Topography in the vicinity is fairly flat, with some lower elevation wetland areas along the Lake Erie shoreline, including the Fermi site (Figure 6). To prevent flooding of the developed areas, these areas were elevated during the construction of Fermi 2 using crushed limestone taken from the southwest portion of the Fermi site (Quarry Lakes). Site elevations range from the level of Lake Erie to approximately 25 feet above lake level on the western edge of the site (Reference 8). Topography on the Fermi site is relatively level in the undeveloped areas, with an elevation range of approximately 10 feet over the site according to U.S. Geological Service (USGS) topographic maps.

3.1.4 Soils

The overburden soils at the Fermi site consist of lacustrine deposits, glacial till, and rock fill (Figure 7). The rock fill is present only in the immediate area of the reactor; therefore, in the wetland areas, the overburden soils consist of lacustrine deposits and glacial till. The overburden is underlain by the Bass Islands Group dolomite bedrock. Groundwater is present in the overburden and the bedrock. The groundwater in the overburden is unconfined, while the Bass Islands Group aquifer is confined. The glacial till acts as an aquitard between the unconfined groundwater in the overburden and the confined groundwater in the Bass Islands Group aquifer.

The Monroe County Soil Survey (Reference 9) lists soil series Lenawee silty clay loam, ponded (Map Symbol 10) and Lenawee silty clay loam (21) as the primary mapped soil types on the Fermi site. Other soils found on the Fermi property include: urban land (63) on the eastern portion of the site where the

existing Fermi 1 and Fermi 2 buildings and infrastructure are located; urban land-Lenawee complex (57) on the southern edge of the Fermi site; Aquents complex (31) and Blount loam (13A) on the northwestern side of the site; Pits-Aquents complex (33) in the southeast portion of the site; water (W) primarily in the southeast and northeast portions of the site; and beaches (27) along the eastern edge of the Fermi property adjacent to Lake Erie. Figure 7 depicts the soil series identified.

3.1.5 Vegetative Communities

Vegetative communities and wetland habitats were evaluated during detailed terrestrial surveys conducted from 2008 through 2010. In 2008 and 2009, spring, summer and fall pedestrian surveys of flora and fauna were conducted in all habitat types including wetlands on the Fermi site (Reference 10). In 2010 individual wetlands were revisited to determine Michigan Natural Community classification and wetland condition and quality. Several upland and wetland vegetative communities have been distinguished at the Fermi site as listed in Section 3.1.2 - Land Use. An in-depth discussion of vegetative communities for wetland covertypes is provided in Section 3.1.8 - Wetlands.

Requests for data concerning known or potential occurrences of endangered, threatened, candidate, or special concern plant species on the Fermi site were submitted to the USFWS and the Michigan Natural Features Inventory. In addition, a list of threatened, endangered, or candidate species for Monroe County, Michigan was obtained online from the Michigan Natural Features Inventory. The American lotus (*Nelumbo lutea*) is a state threatened plant species. However, large local populations of American lotus are scattered in areas of southern Michigan, reaching an apparent peak in Monroe County (Reference 11). In the south lagoon, and to a lesser extent in the north lagoon, are large stands of American lotus. American lotus is also abundant in the South Canal (Figure 8).

3.1.6 Wildlife

As discussed in Section 3.1.5 and Section 3.1.8, the Fermi site includes several ecological communities, some of which are considered rare and imperiled. The Fermi site was extensively surveyed for wildlife in 1973 and 1974 (Reference 12) with updates to species occurrences in 2000 and 2002 as part of a wildlife habitat planning effort. The most recent terrestrial and aquatic wildlife surveys were conducted during 2008 and 2009 (References 13 and 14) to confirm data from earlier surveys and to further characterize the wildlife species using the Fermi property. Secondarily, the surveys aided in determining if important species use the site and to guide decisions concerning avoiding, minimizing or compensating for impacts to these species from the proposed expansion. As such, wildlife surveys focused on portions of the Fermi site where construction and operation of Fermi 3 could potentially impact wildlife, whether from habitat destruction, conversion to other habitat types or through general habitat degradation.

The USFWS was consulted concerning the occurrence or potential occurrence of species on or in the vicinity of the Fermi property that are protected under the Endangered Species Act. The USFWS stated that the project occurs within the potential range of some federally listed species, but that the USFWS

had no records of occurrence on the Fermi site or in the vicinity, nor was there any designated critical habitat in the area. The USFWS further stated that because of the types of habitat present at Fermi, no further action is required under Endangered Species Act. The USFWS did state that if more than 6 months pass before the project is initiated, then the USFWS should again be contacted to ensure there have been no regulatory changes. Detroit Edison will continue consultations with the USFWS per their recommendations.

The MDNR and the Michigan Natural Features Inventory (Reference 15) was consulted regarding the presence of known or potential occurrences of state-listed threatened or endangered species on the Fermi site. The only species in the USACE/MDEQ-regulated project areas is the Eastern fox snake (*Pantherophis gloydi*).

Based upon the review of the data collected in the terrestrial and aquatic surveys there were no occurrences of federally and/or state listed threatened or endangered species. Based on avian surveys conducted during 2006-2008, the bald eagle (*Haliaeetus leucocephalus*) is the only migratory species of note that has been observed on the Fermi site. None of the previously observed bald eagle nests were observed on the Fermi site as of January 2011. During 2008, while wetland surveys were being conducted, two fox snakes were observed on two separate occasions. In addition, fifteen separate sightings were made by Detroit Edison employees between 1990 and 2007 with 1-6 snakes identified on each occasion. In addition to minimizing wetland impacts, the fox snake's primary habitat, Detroit Edison has developed a mitigation plan which will be implemented to minimize the project's impact to the species.

3.1.7 Site Hydrology

Currently the hydrology of the area is influenced by the physical processes of Lake Erie. Lake Erie has a perfect seiche fetch. With a predominant southwest wind, specific locations on Lake Erie are susceptible to great fluctuations in water levels due to sustained winds pushing the lake water to the east, and then, as the winds subside, the water levelizes across the lake. This creates large waterless expanses followed quickly by water inundating creek and river mouths, resulting in a bathtub like “sloshing” effect. This creates unique opportunities for both plants and wildlife. Other local hydrological conditions are dictated by the Swan Creek.

Water is seasonally to permanently present throughout the majority of the Fermi site. Average annual precipitation is approximately 35 inches and generally well distributed throughout the year. The site receives direct, surface runoff from a 2,440 acre drainage basin with cropland, wetland and forest as the primary cover types. Surface water is received from Lake Erie during periods of high water and storm events.

The hydrology of the Fermi palustrine emergent (PEM) wetland areas is controlled almost entirely by the elevation of surface water in Swan Creek and Lake Erie. The surface water in Swan Creek and Lake Erie

is directly connected to the PEM areas on the Fermi site. Five sets of large-diameter culverts connect the majority of the inland PEM areas west of Doxy Road with the PEM areas that are directly connected with Swan Creek and Lake Erie. These culverts allow free flow of surface water throughout the interconnected PEM areas. Therefore, the surface water level in the majority of the PEM areas is directly controlled by the surface water elevation of Lake Erie and Swan Creek, rather than groundwater levels. Figure 9 shows the culvert locations and movement of surface water on the Fermi site.

Palustrine forested (PFO) and palustrine scrub-shrub (PSS) areas on the Fermi site are, for the most part, contiguous with the PEM areas. Therefore, these areas are hydraulically connected with the PEM wetlands, so the groundwater level in these areas is influenced by the surface water levels in Swan Creek and Lake Erie. With the exception of a few wetlands separated by berms or roads, the majority of wetland communities on the Fermi property are hydrologically connected and thus considered one wetland system.

3.1.8 Wetlands

Detroit Edison conducted assessments of wetland resources on 1,106 acres of undeveloped lands at the Proposed Development site between 2008 (Reference 16) and 2011. The purpose of these assessments is to identify and integrate natural resource considerations throughout the design and implementation phases of the Proposed Development and to guide mitigation measures including avoidance, minimization and the development of a high quality mitigation strategy to compensate for unavoidable impacts. The assessments are based on existing data and onsite data collection. Existing data include topographic maps, federal and state wetland maps, soil maps, aerial photos, land use data, and ecological survey data from previous studies. Onsite assessment data were collected in each year to delineate wetland boundaries, evaluate wetland functions and services, determine natural community types and assess wetland condition and quality. A jurisdictional determination was completed and minor edits to wetland boundaries were made in 2011 (Figure 10). Watershed assessments of the northern section of the Ottawa-Stony Creek watershed and the coastal zone of Western Lake Erie in Monroe County were completed to further inform development strategies and conservation priorities at the Proposed Development site. This section provides an overview of wetlands with potential impacts associated with the Proposed Development. Section 3.1.9 provides a summary of the watershed assessments.

A functional assessment based on the USACE New England Highway Method (Reference 17) was originally conducted during the 2008 field delineation (Reference 16). In 2010, field observations of wetlands with proposed impacts included a refined assessment of vegetation communities and other wetland characteristics to further describe the condition, functions and services of impact areas. Data collection and analysis methods were based on the Michigan Rapid Assessment Method for Wetlands (MiRAM, Reference 18) and the Delaware Rapid Assessment Procedure (Reference 19) and included metrics such as wetland size and connectivity, adjacent area use, hydrologic alterations and soil

disturbance, habitat structure, and presence of invasive species. The results of the 2008/2009 terrestrial surveys, 2010 field visits described above, and feedback from regulatory staff were used to further evaluate individual wetlands potentially impacted by the Proposed Development.

Over 500 acres of wetland were delineated at the Proposed Development site. The majority of wetlands at the Fermi site were ranked low to medium quality based on factors including hydrological disturbance, presence of invasive species, adjacent land use, fragmentation, human activity, deforestation, etc. There were several wetlands ranked high quality based on connectivity, presence of native, diverse vegetation communities, and wildlife habitat potential. Several other wetlands were given high ecological value based solely on their rare and imperiled status in Michigan even though condition ratings were low (MiRAM guidance, see below). Depending on condition, the principal functions and services provided by wetlands on the Fermi site include flood flow alteration, sediment/toxicant retention, nutrient removal, and fish and wildlife habitat.

Wetlands with proposed impacts and their associated covertypes are presented in Table 1. Mitigation is proposed for approximately 35.55 acres of potential impacts to regulated wetlands due to the Proposed Development. These potential impacts include approximately 10.90 acres of Great Lakes marsh, 3.15 acres of southern hardwood swamp, 3.91 acres of southern shrub carr, 0.80 acres of coastal emergent wetland, 10.53 acres of other emergent wetland, 4.89 acres of other forested wetland and 1.37 acres of other scrub shrub wetland.

3.1.9 Watershed Analysis

As part of the natural resource assessment effort, Detroit Edison conducted a watershed analysis to provide a broader geographic context to guide land use decisions at the Fermi site. The purpose of the watershed assessment is to provide an analysis of land use features of the inland and coastal watersheds that encompass the Fermi site and evaluate the connection between natural resources on the Fermi site and site-specific and watershed conservation priorities. The watershed assessment also provides a landscape level perspective useful in consideration of any land use changes, proposed impacts and proposed compensation strategies.

The Fermi site is located in the northern portion of the Ottawa-Stony watershed (OSW, Figure 11), USGS Cataloging Unit and Hydrologic Unit Code (HUC): 04100001 and the coastal zone of Western Lake Erie in Monroe County (CZM, Figure 12). The OSW drains areas to the north and west of Lake Erie and flows directly into the lake. The northern portion of the OSW has a drainage basin of approximately 182,733 acres and is dominated by agriculture (55%). Approximately 25% of the OSW land area is in natural cover and approximately 20% is developed (Figure 11). The CZM encompasses approximately 18,697 acres with an almost even interspersion of natural lands (38%), developed lands (38%) and agriculture (24%) (Figure 12). Protected lands for conservation and recreation make up approximately 4% of the OSW and 36% of the CZM.

Wetlands comprise approximately 6% of the OSW and 43% of the CZM. The OSW is dominated by vegetated wetlands. Forested wetlands comprise the majority of vegetated wetlands (60%) with the remainder being emergent (24%) and shrub/scrub (15%). The CZM has equal proportions of vegetated and non-vegetated (open water) wetlands. Emergent wetlands are the dominant type comprising 71% of the vegetated wetlands with the remaining wetlands being forested (17%) and scrub shrub (11%).

An approximation of historic wetlands for the OSW and the CZM was developed based on soils classified as >80% hydric (soils >80% of a soil map unit classified as hydric by the Natural Resources Conservation Service) and current mapped wetlands. Former wetlands were defined as areas that are mapped hydric soils (>80% of map unit) but not mapped as wetlands based on the latest wetland maps. The topography and landscape position of the OSW and CZM are ideal for the development of wetlands because the land is very flat and in close proximity to the coast of Lake Erie. Prior to European colonization, approximately 45% of the land area of the OSW was wetland (Figure 13). Based on the most recent wetland maps 6% of the OSW area is currently wetland which constitutes an 86% loss in the OSW. Historically, 77% of the land area of the CZM was wetland (Figure 14). Based on the most recent wetland maps, 43% of the CZM is wetland which constitutes a 44% loss in the CZM.

Watershed Conservation Priorities

Based on natural resource assessments conducted at the Fermi site and within the OSW and CZM, the following wetland-based conservation priorities were identified for this project:

1. Protect and restore existing high quality wetlands especially those that are directly connected to Lake Erie in the CZM and/or part of a larger wetland complex.
2. Improve a network of natural land use in the CZM and OSW by increasing the amount of large blocks (>50 acres) of natural lands and buffered streams to support ecosystem functions and services and establish corridors to connect large blocks.
3. Restore wetlands in the CZM to provide wildlife habitat and protect water quality in Lake Erie.
4. Restore wetlands and stream buffers in the OSW to re-establish large wetland complexes and riparian connections.

Because of the Fermi site's location in the lowest reaches of the OSW (in the CZM), any activity onsite will have the greatest local effects (either positive or negative) on coastal resources and Lake Erie itself. Based on the results of the watershed assessment, planned activities at Fermi have strategically avoided and minimized impacts to natural resources of high ecological value to the greatest extent possible. For unavoidable impacts, this mitigation strategy has been designed to address any loss of coastal habitat and the watershed conservation priorities listed above. Specifically, the proposed mitigation will restore approximately 130 acres of coastal wetland including Great Lakes marsh and southern hardwood swamp and reconnect this large block of natural land directly to Lake Erie via a restored and buffered stream channel. Approximately 21.4 acres of impacted wetlands will be restored post-construction on the Fermi

site. On- and offsite mitigation actions are in close proximity to existing conservation efforts to help establish connectivity and habitat corridors.

3.2 Mitigation Area

The following description of the mitigation area is based on field data and review of existing, available data including aerial photography, soil survey maps, USGS topographic maps, state and federal wetland mapping, Monroe County Drain Commissioner records, and as-built drawings for I-75. Field surveys were conducted for topography, soils, hydrology, and wetland communities between 2010 and 2012. Figure 15 provides a plan view of existing conditions including site boundary, surveyed topography, existing easements, and USACE Ordinary High Water Mark (OHWM). In Lake Erie, the OHWM extends approximately to the elevation contour of 573.4 feet referenced to the 1985 International Great Lakes Datum (IGLD 85).

3.2.1 Location and Ownership

The proposed offsite mitigation area, referred to as the Monroe site, is approximately 210 acres in size and 7.25 miles from the Fermi site on Detroit Edison's Monroe Plant, east of Interstate 75, north of La Plaisance Creek, immediately adjacent to Lake Erie (La Plaisance Bay), Town of Monroe, Monroe County, Michigan, in the Ottawa-Stony Watershed (HUC: 04100001, Figure 1). The mitigation site is owned and managed by Detroit Edison.

3.2.2 Land Use

The proposed mitigation targets a 173-acre agricultural field at the Monroe site (Figures 16 and 17). This portion of the site is currently farmed and includes small areas of remnant wetlands and dikes which separate the site from Lake Erie. Excess water is pumped from the fields to accommodate farming. Adjacent areas include a 36-acre conservation area with a wetland restored approximately 10 years ago and associated grassland buffer. Adjacent land uses also include active agriculture, early successional old field and shrub habitat, agricultural ditches, small forest patches, existing wetland habitat, industrial, residential and other developed areas, access roads, highways and Lake Erie. Historical maps and aerial photos indicate the land has been in agricultural use with no structures present.

3.2.3 Topography

The topography of the site is very flat with an average elevation of approximately 572 ft. Figure 15 provides surveyed elevations including OHWM as designated by USACE. The lowest elevations in existing ditches and swales are below 570 feet with the highest elevation located on the top of a small rise in the northwestern corner of the site at approximately 589 feet. The elevation of the dike separating the site from Lake Erie has an average elevation of approximately 578 feet. Average lake levels of Lake Erie are 571.5 feet with seasonal fluctuations and periodic seiches causing significantly higher and lower elevations.

3.2.4 Soils

The Monroe County Soil Survey soil mapping for the site shows the presence of two soil types within the site boundaries (Figure 18). These soil types include Warners silt loam and Lenawee silty clay loam. The Warners series consists of very deep, very poorly drained soils on nearly level floodplains and seepage areas of hillsides. The Lenawee series consists of very deep, very poorly drained soils in lacustrine deposits. These soils are on lake plains and in depressional areas on moraines, outwash plains, and glacial drainageways. Both mapped soils are hydric and suitable for wetland restoration/creation.

3.2.5 Vegetative/Wildlife Communities

Vegetative communities were observed at the mitigation site primarily during wetland delineation field visits. The dominant covertype is active agriculture (Figures 16 and 17). Other covertypes include a mix of wetlands such as emergent marsh, floodplain forest, southern shrub-carr and wet meadow, and uplands such as old field, successional shrub and forest. The MDNR and the Michigan Natural Features Inventory (Reference 15) was consulted regarding the presence of known or potential occurrences of state-listed threatened or endangered species on the mitigation site. Based on review of known or potential occurrences and observations during field data collection, there are no occurrences of federally and/or state listed threatened or endangered species at the site. The shallow waters of La Plaisance Bay, immediately adjacent to the site, support a population of American Lotus. Restoration of the site will likely provide additional habitat for this state-threatened species.

3.2.6 Site Hydrology

The mitigation site receives runoff from the 588-acre Davis Drain watershed. The Davis Drain, under the jurisdiction of the Monroe County Drain Commissioner, is located along the southwest corner of the site. The drain carries stormwater runoff from Interstate 75 and upstream property. Water is seasonally to permanently present in ditches, swales and small remnant wetlands on the project site. Average annual precipitation is 31.5 inches and generally well distributed throughout the year. The site receives direct runoff from a 250-acre drainage basin with cropland, wetland and forest as the primary covertypes. The hydrology of the site is influenced by extensive tile and ditching for the purpose of draining surface water to facilitate farming. Figure 19 illustrates the location of ditches, culverts, and direction of flow for surface water drainage. Excess water is pumped from the fields at the northeast corner of the site into the adjacent ash basin. There is currently no direct hydrological connection between the mitigation site and Lake Erie. Depth to groundwater has not been determined however soil borings up to 20 inches revealed a compact clay lens and no groundwater penetration: the mitigation site is primarily surface-water driven.

A hydrological study was conducted for the mitigation site and the drainage basin. A water budget was developed to support mitigation design. Two models were developed to estimate the average annual volume of water that could enter the mitigation site from the drainage basin and from the planned mitigation wetland itself. Models include estimates of peak flows and average rainfall volume of the Davis