Figure 4. Mitigation Acreages

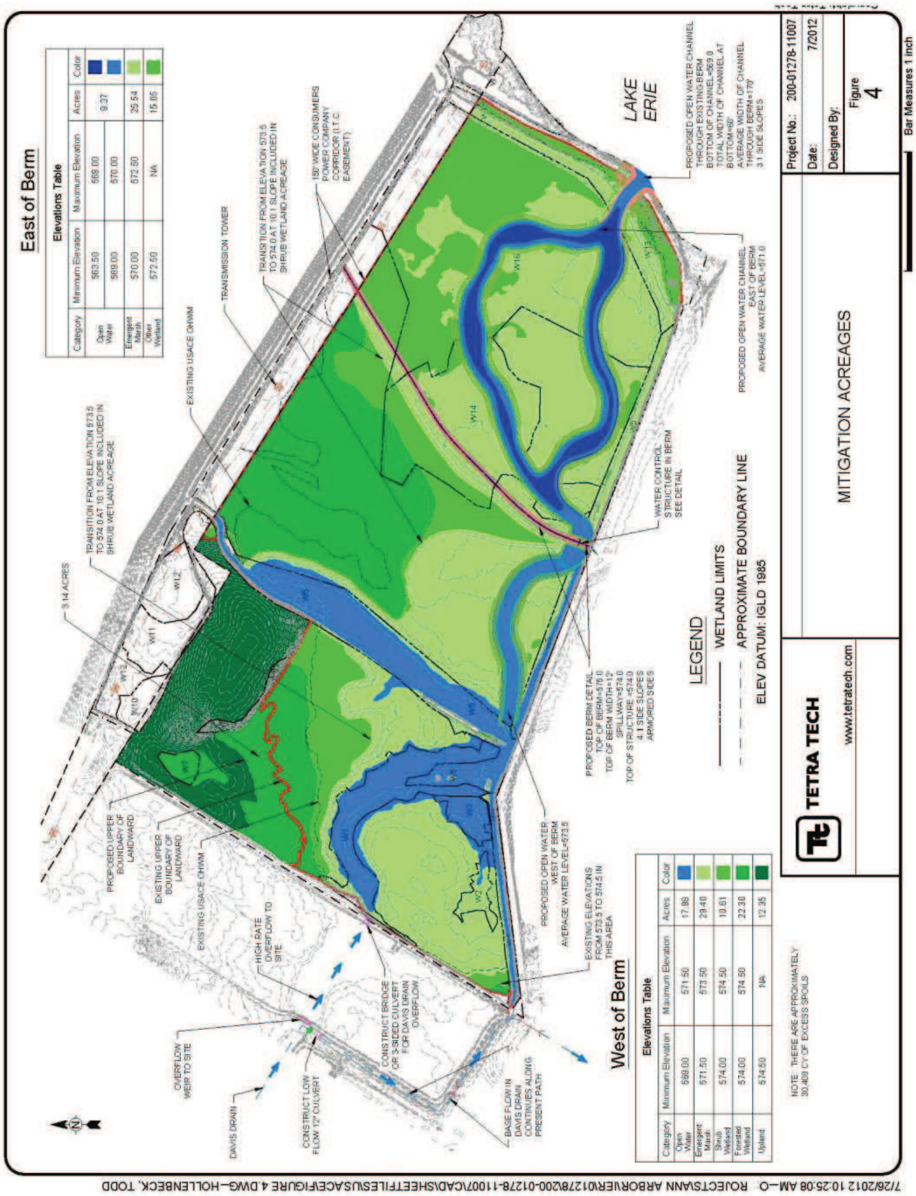

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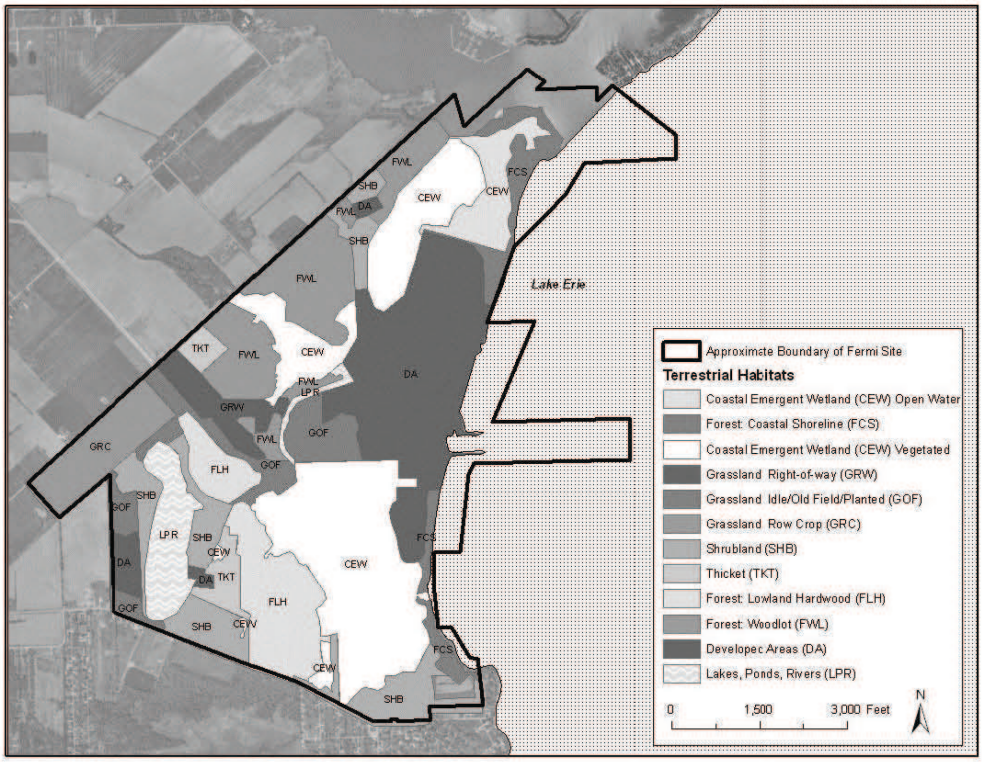
Figure 5. Land Uses on the Fermi Site



Source: Reference 7

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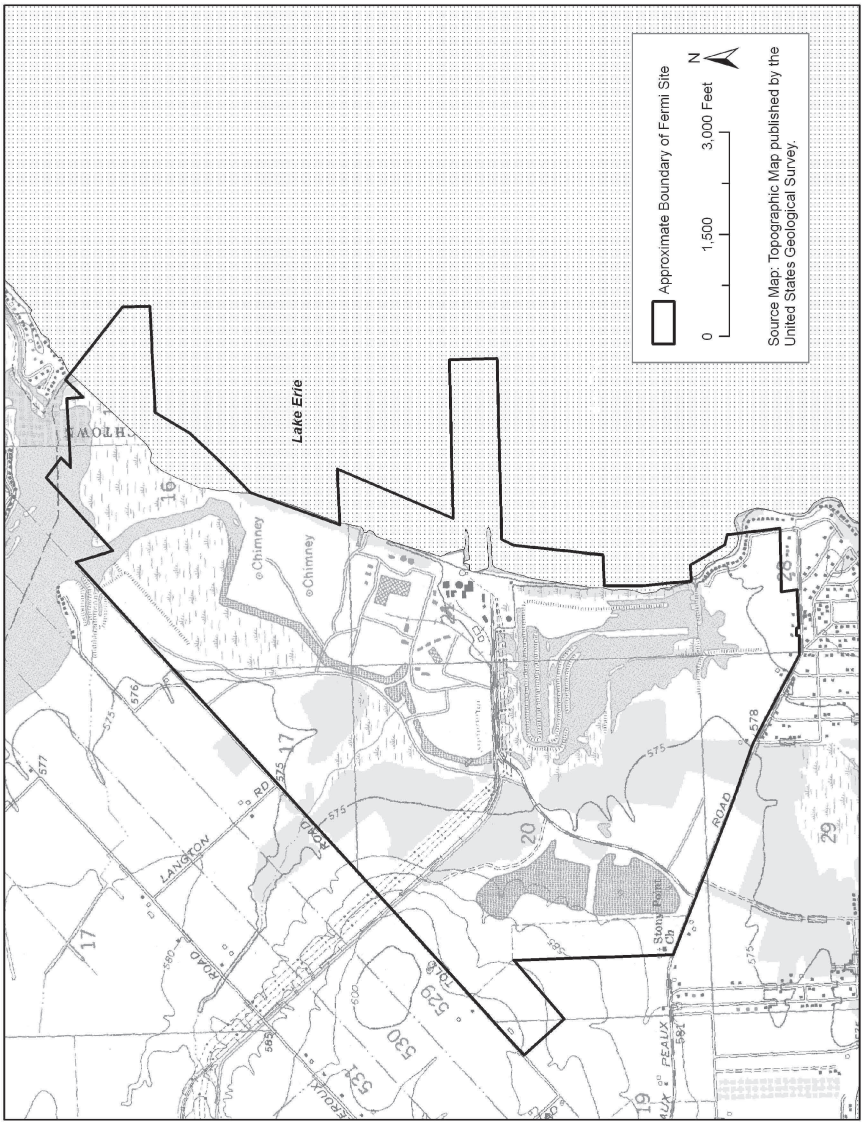
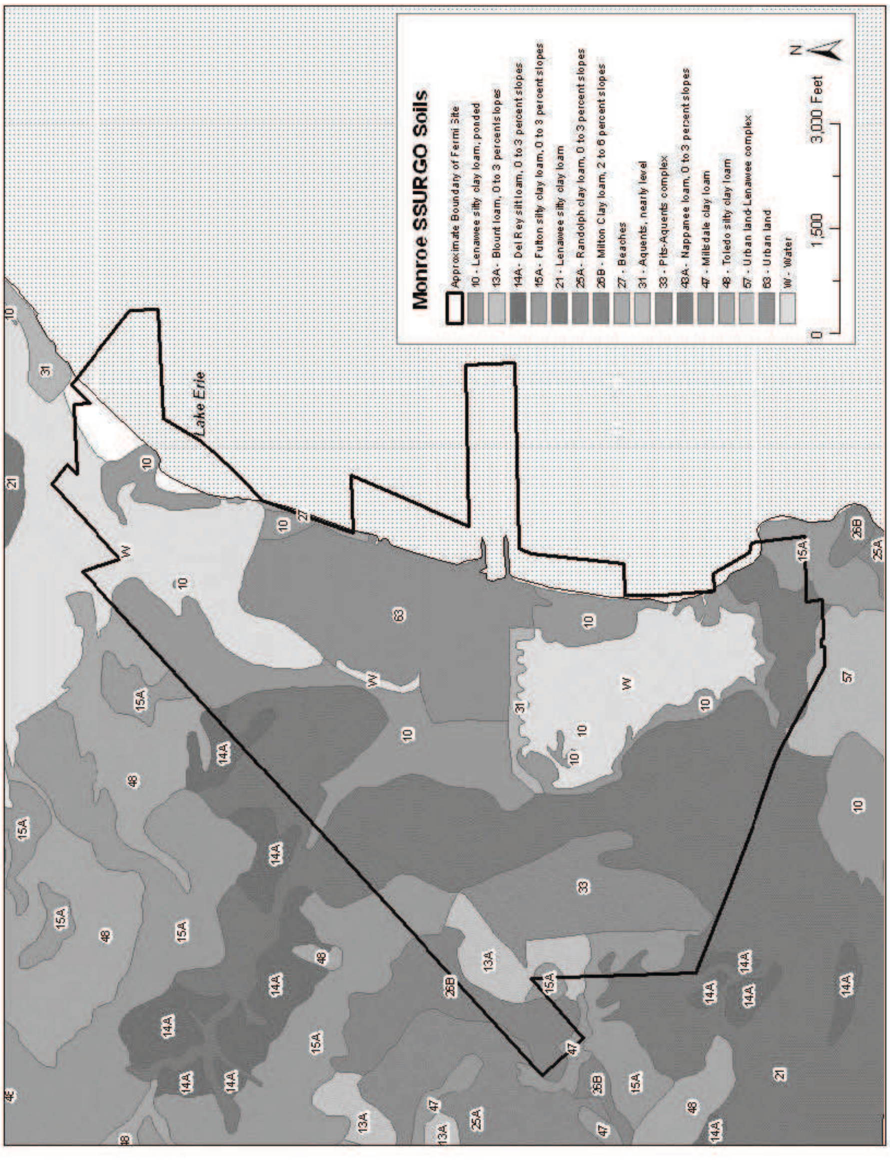
Figure 6. Topography of the Fermi Site



Source: Reference 29

56

Figure 7. Soil Types on the Fermi Site



Source: Reference 30

57

Figure 8. Observed Locations of American Lotus on the Fermi Site

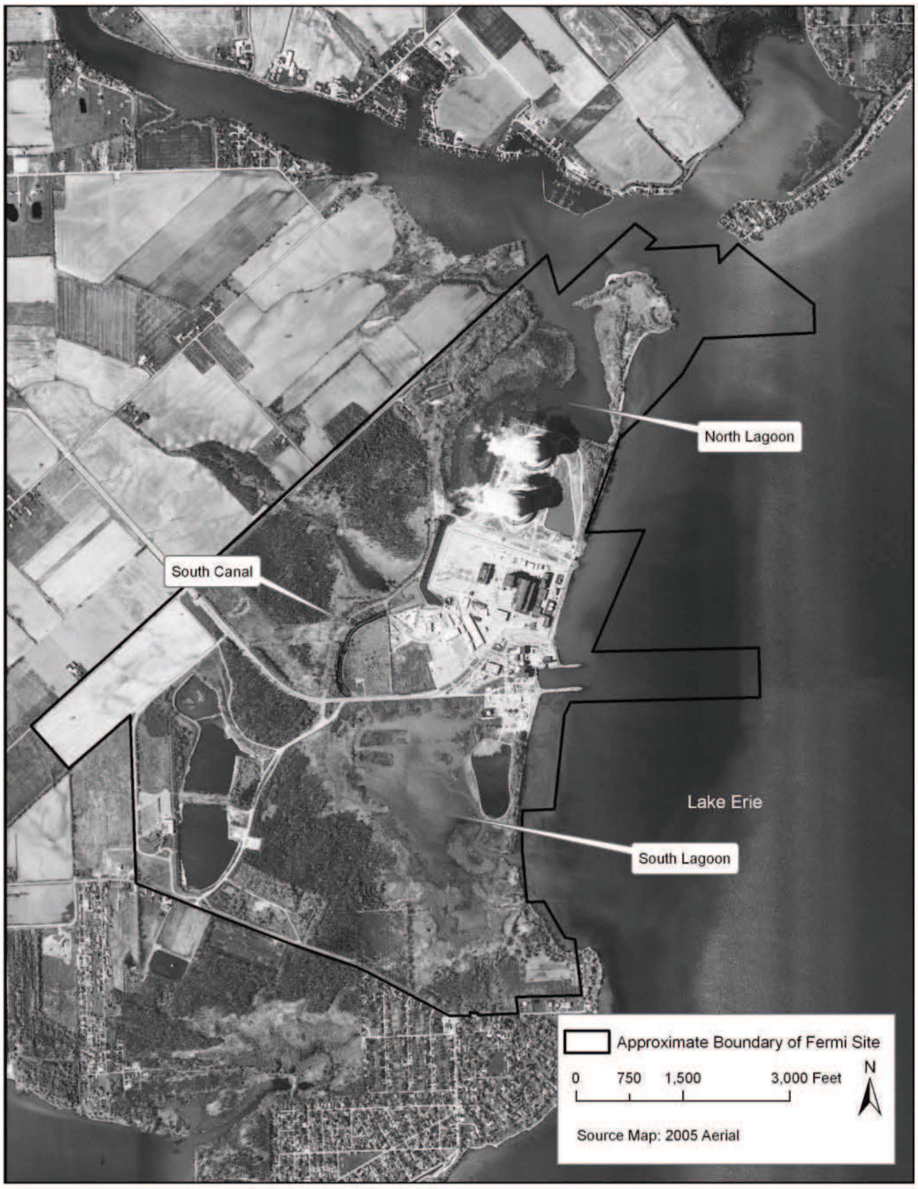


Figure 9. Culvert Locations on the Fermi Site

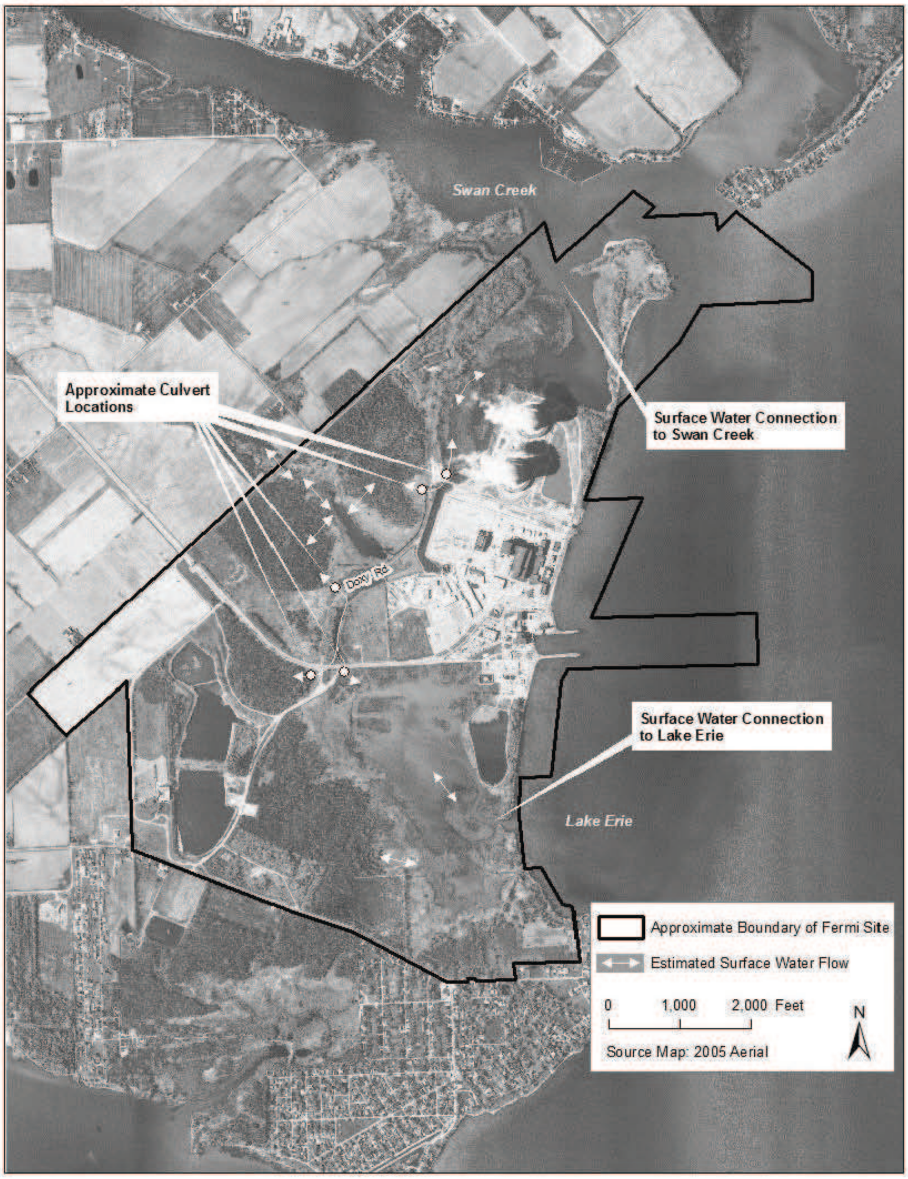


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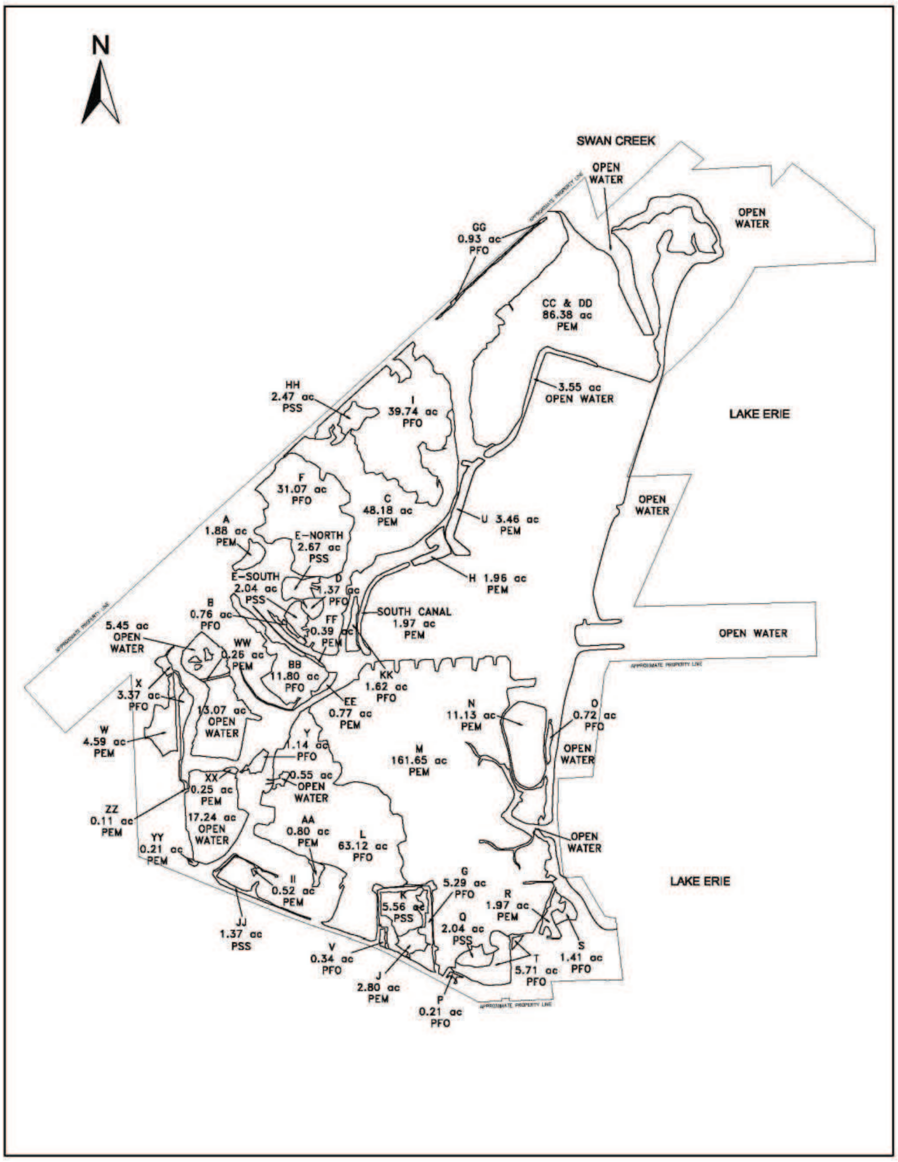
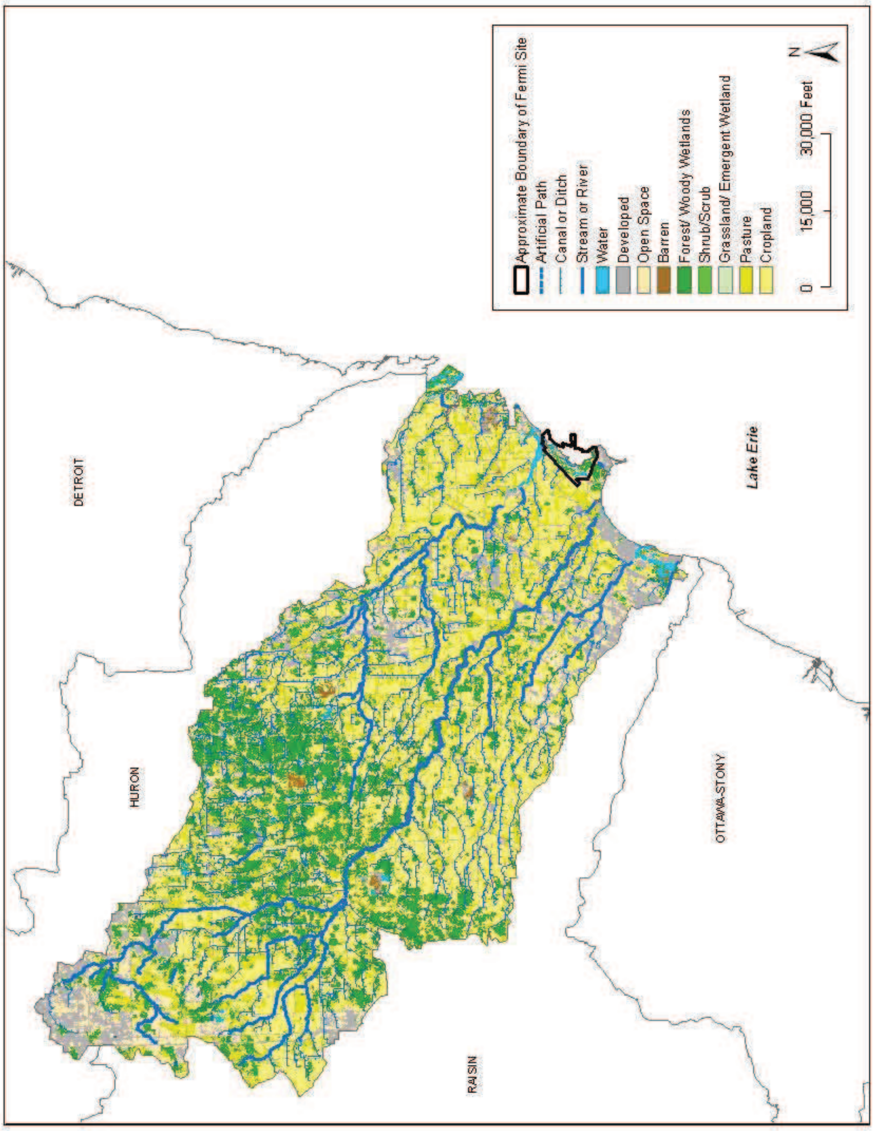
Figure 10. Fermi Site Delineated Wetlands



60

Figure 11. Land Use Land Cover (2001) in the Ottawa-Stony Watershed



Source: Reference 31 and Reference 32

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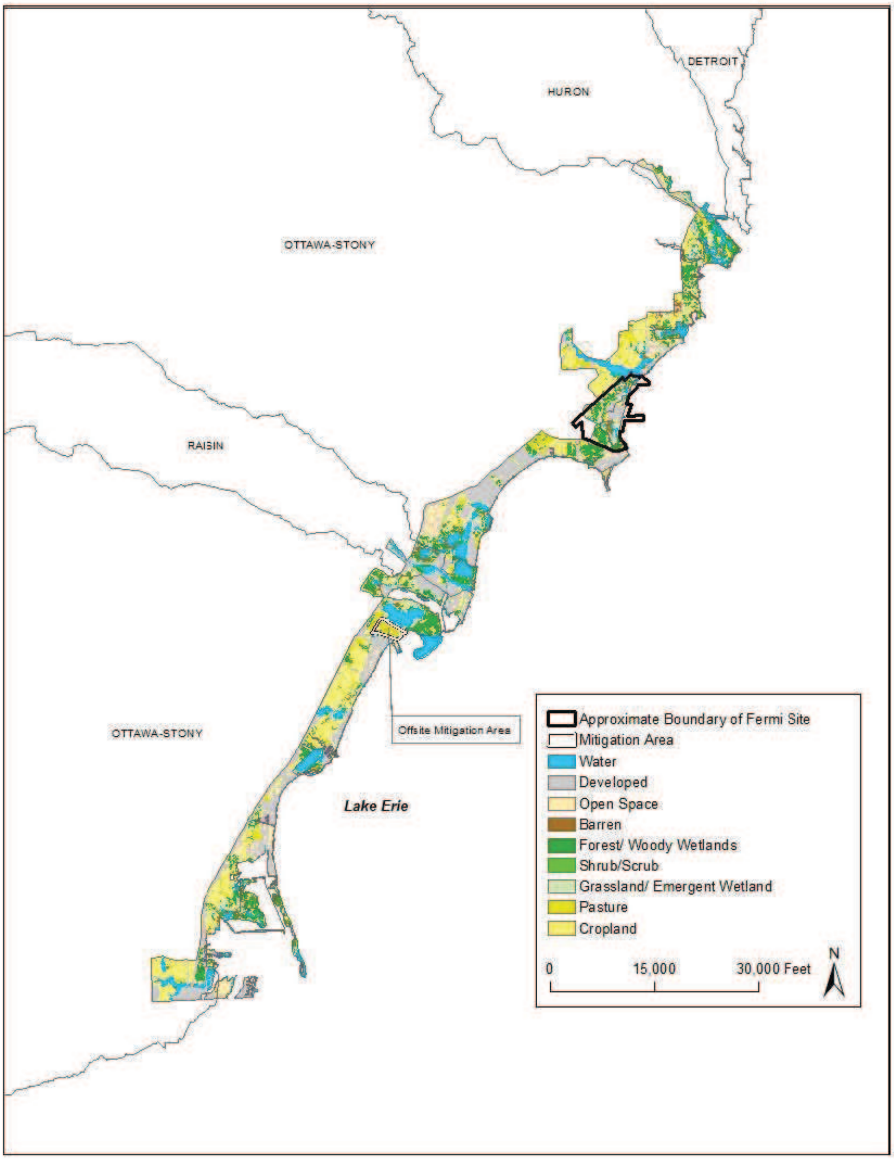
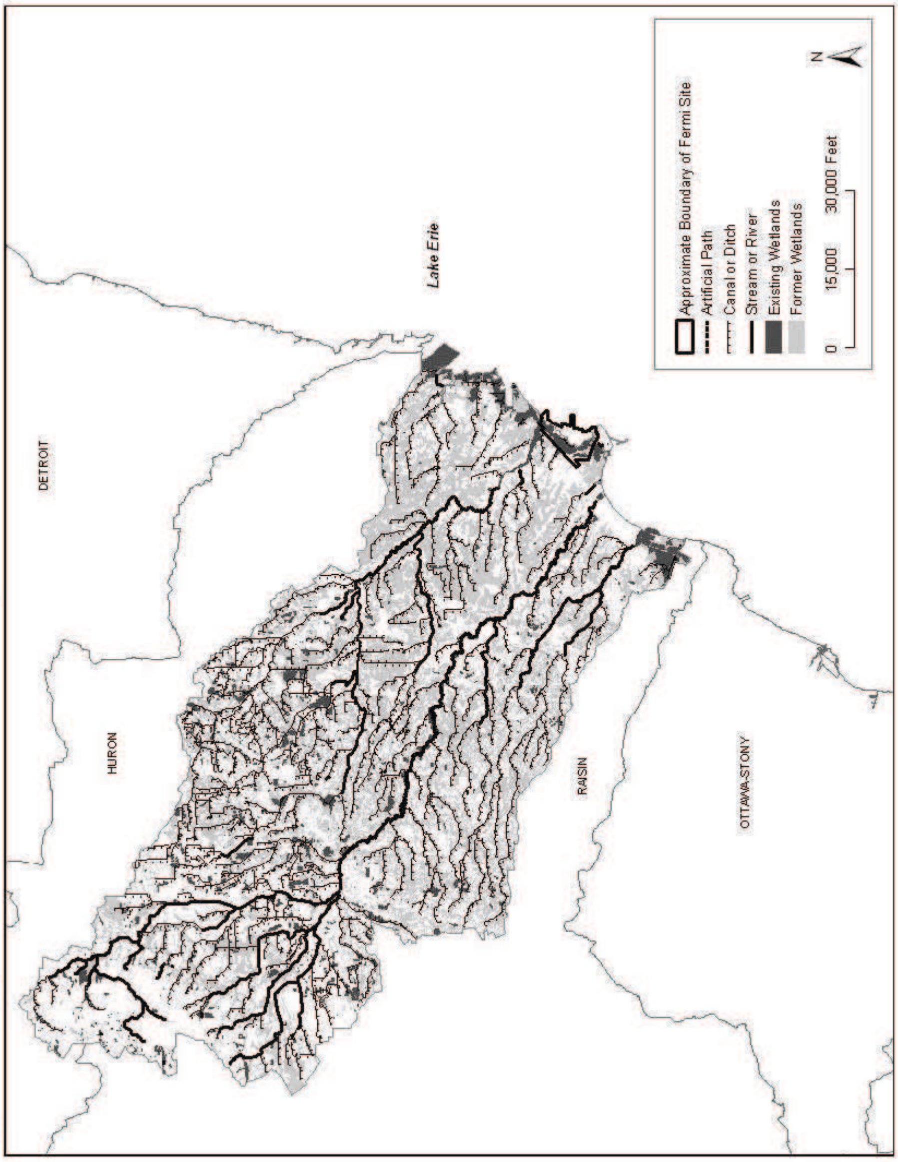
Figure 12. Land Use Land Cover (2001) in the Coastal Zone of Lake Erie



Source: Reference 32 and Reference 33

62

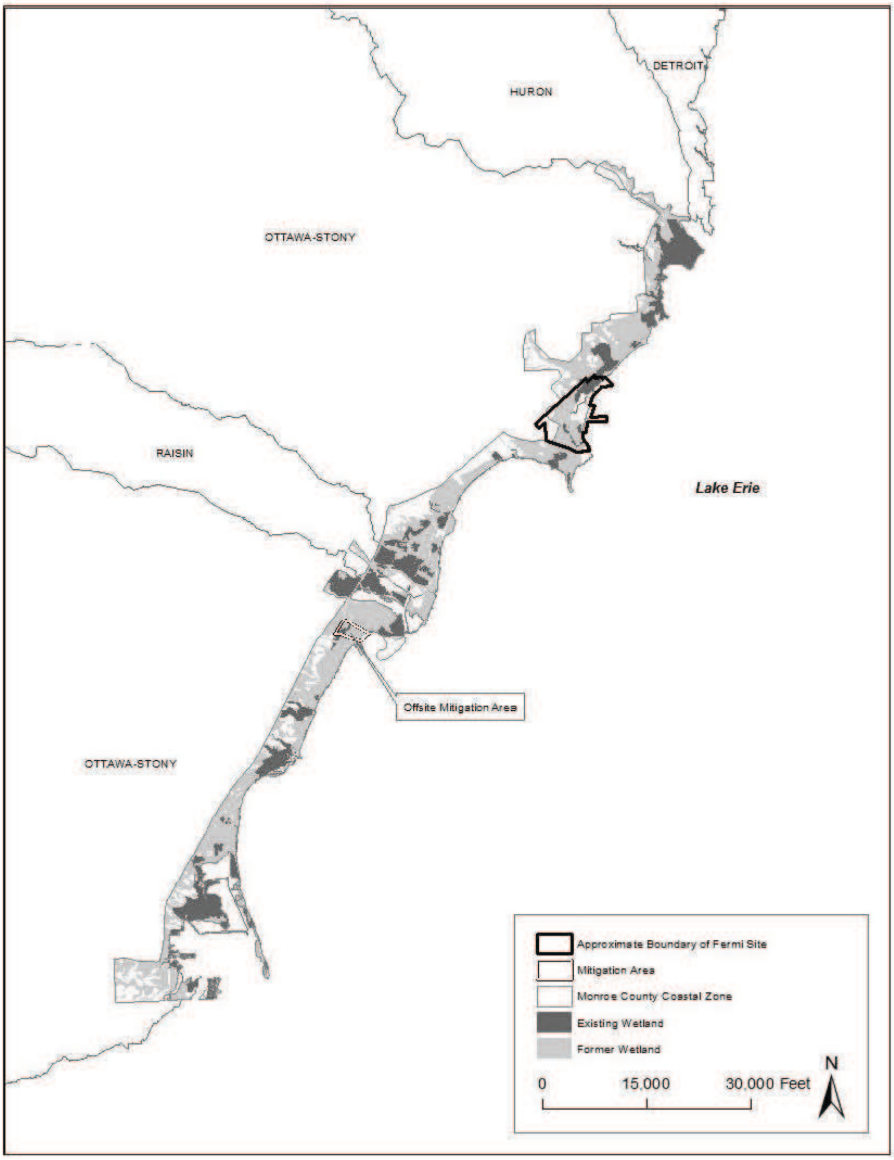
Figure 13. Existing and Former Wetlands in the Ottawa-Stony Watershed



Source: Reference 31 and Reference 34 through Reference 36

63

Figure 14. Existing and Former Wetlands in the Coastal Zone of Lake Erie



Source: Reference 33 and Reference 36

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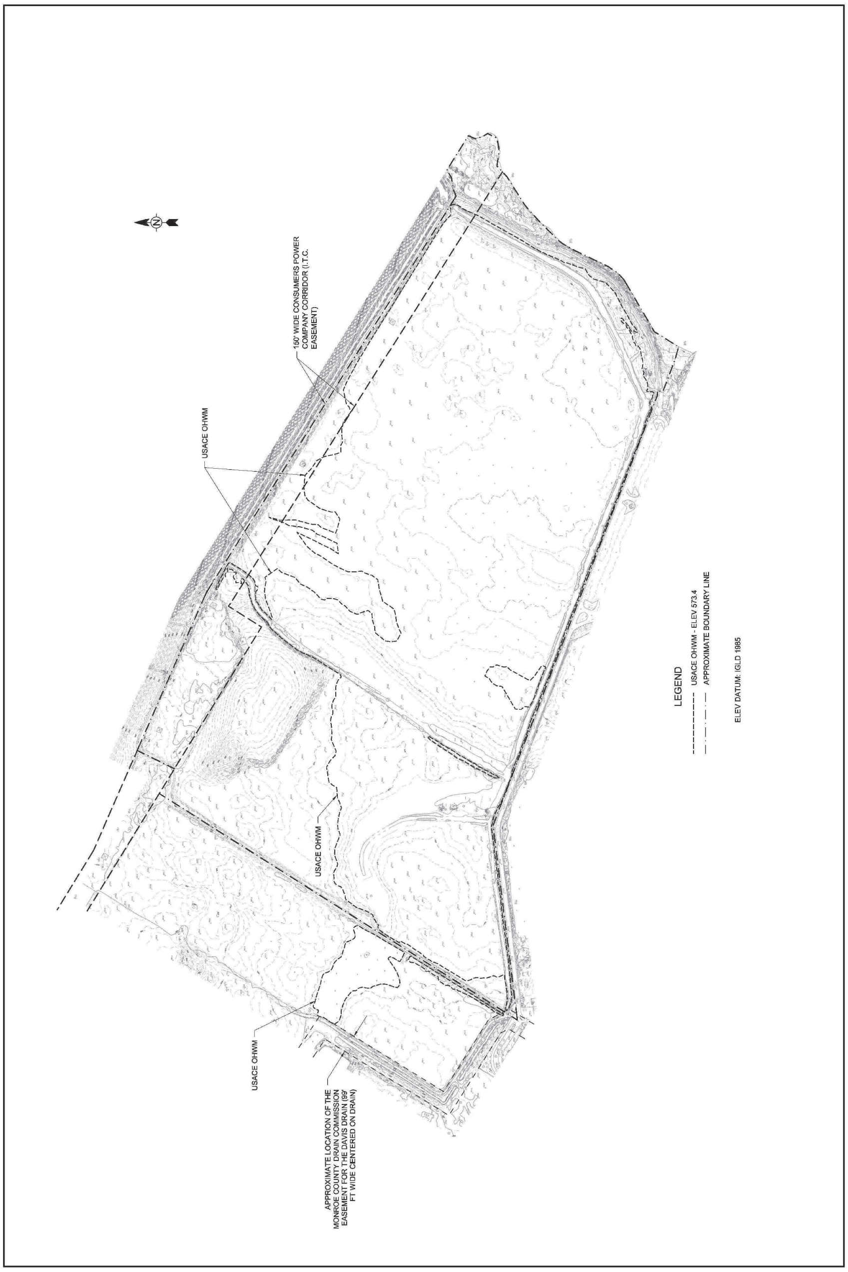

Figure 15. Mitigation Area Existing Conditions

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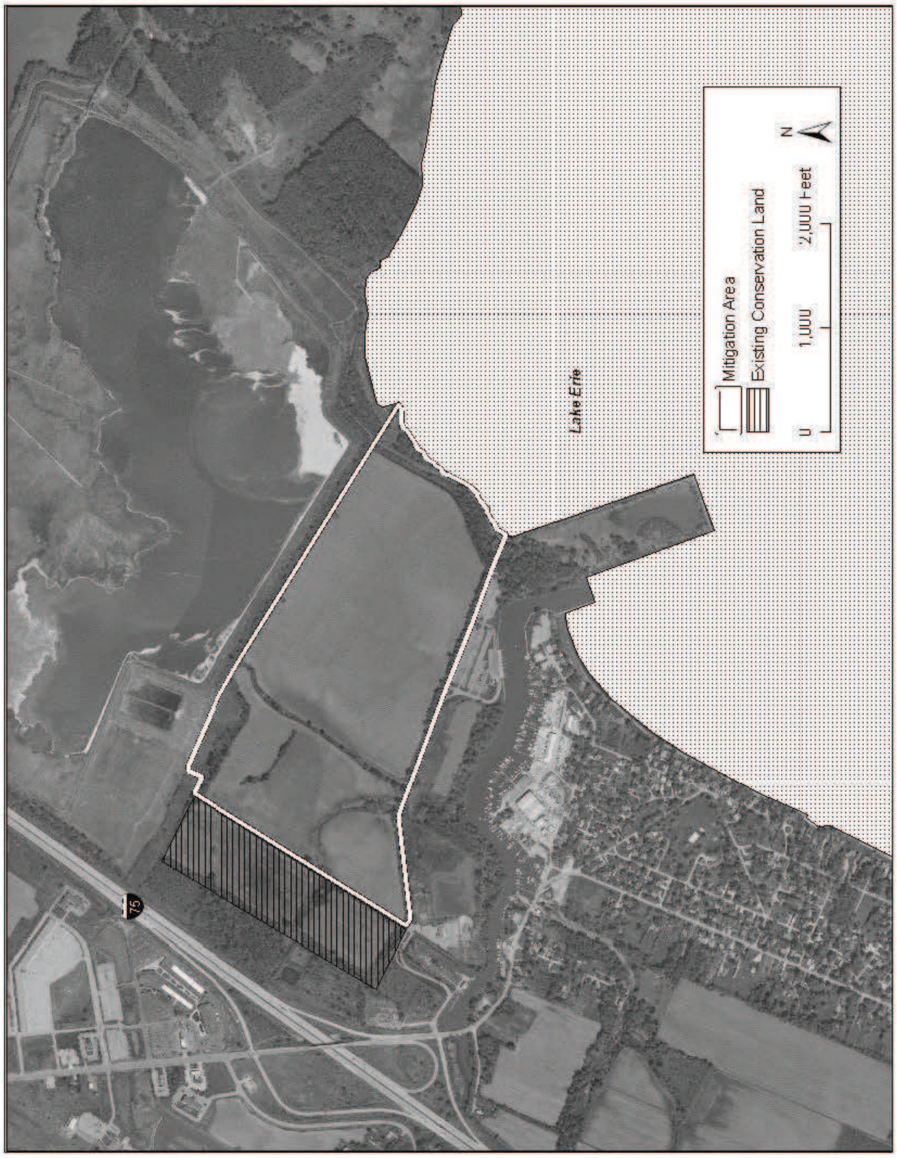
Figure 16. Mitigation Area Aerial Photo



Source: Reference 28

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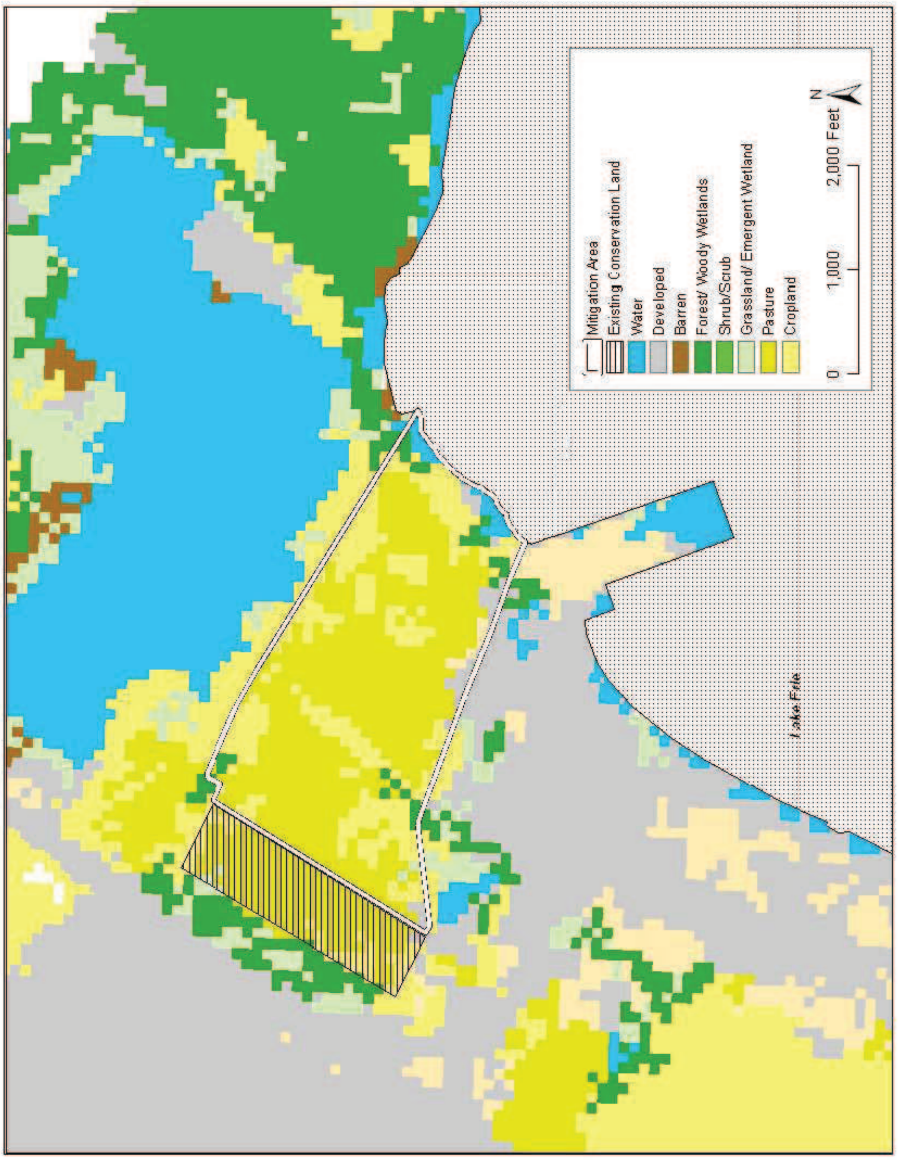
Figure 17. Mitigation Area Covertype Map



Source: Reference 32

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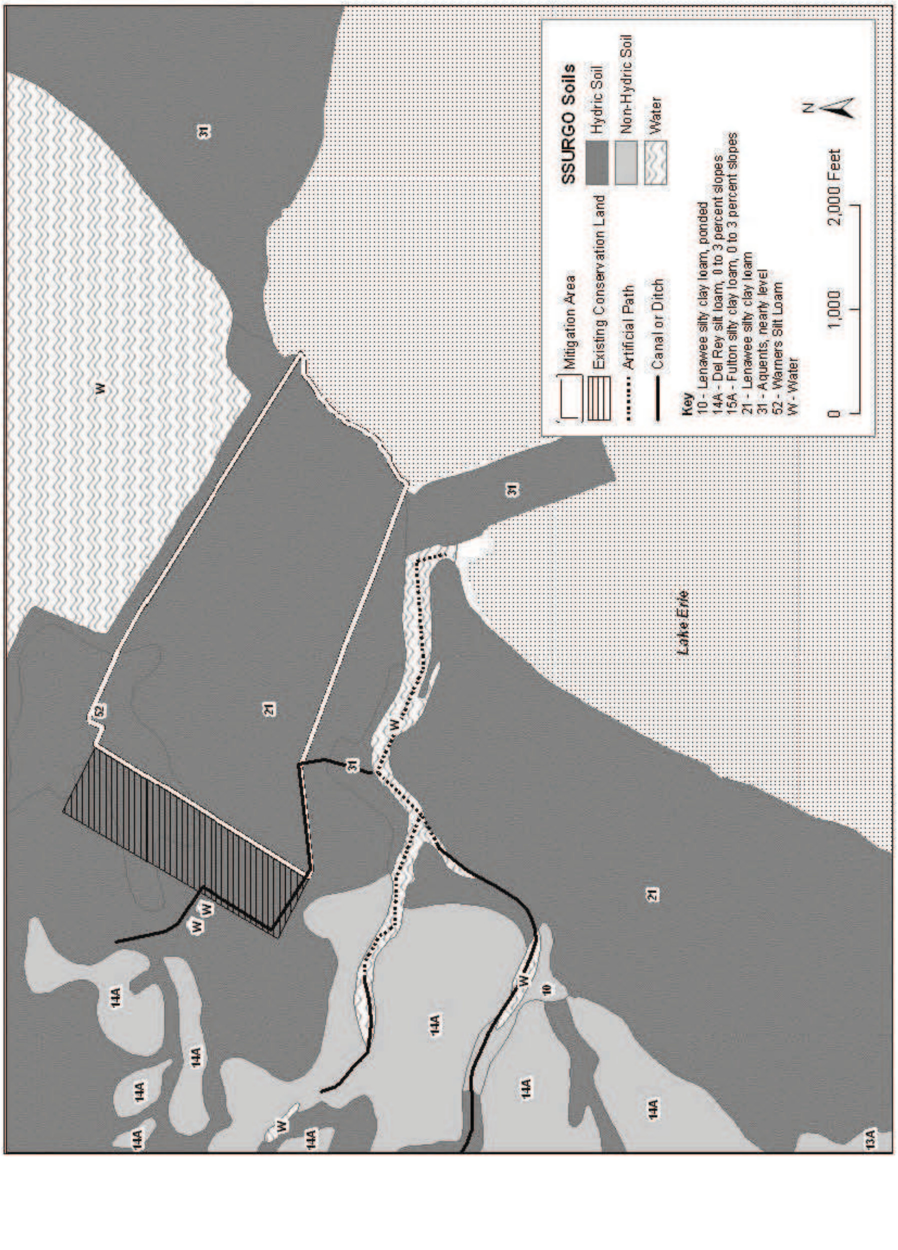
Figure 18. Mitigation Area Soils Map



Source: Reference 30 and Reference 31

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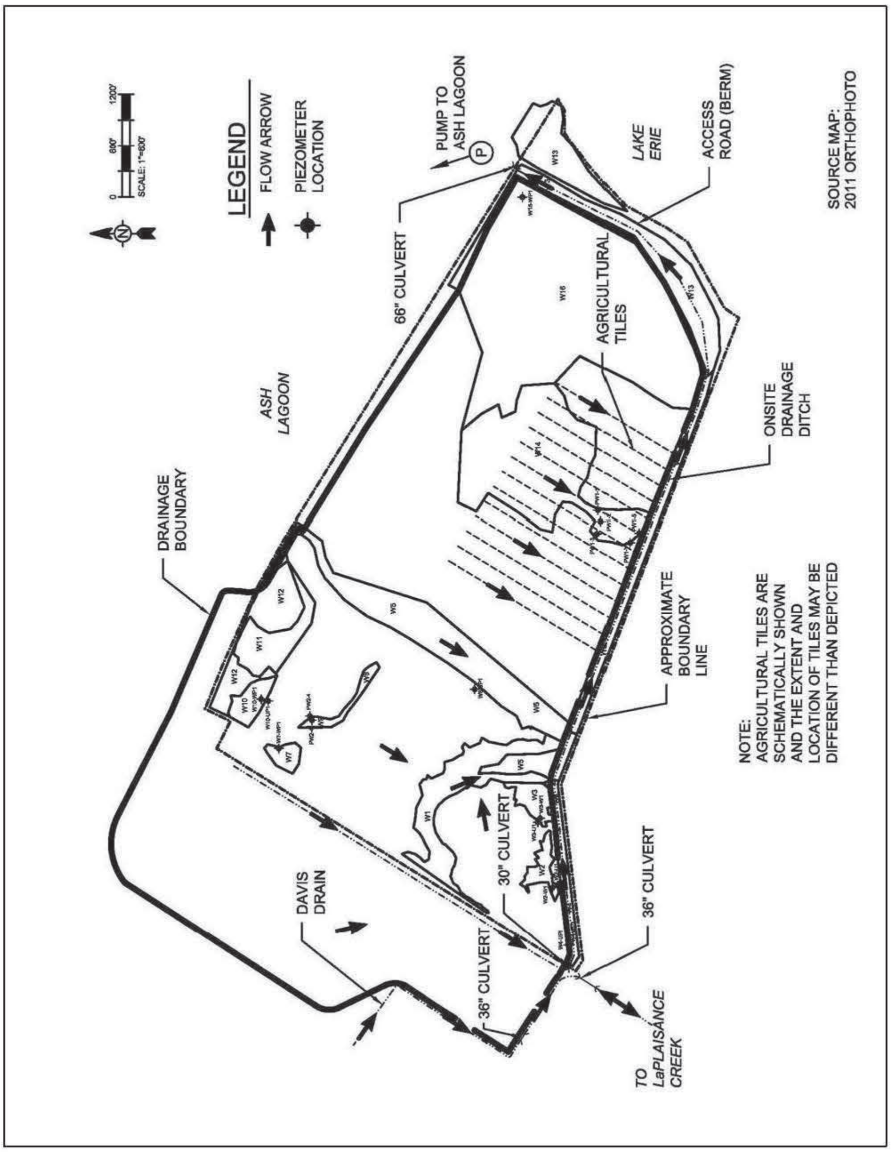

Figure 19. Mitigation Area Current Hydrologic Conditions

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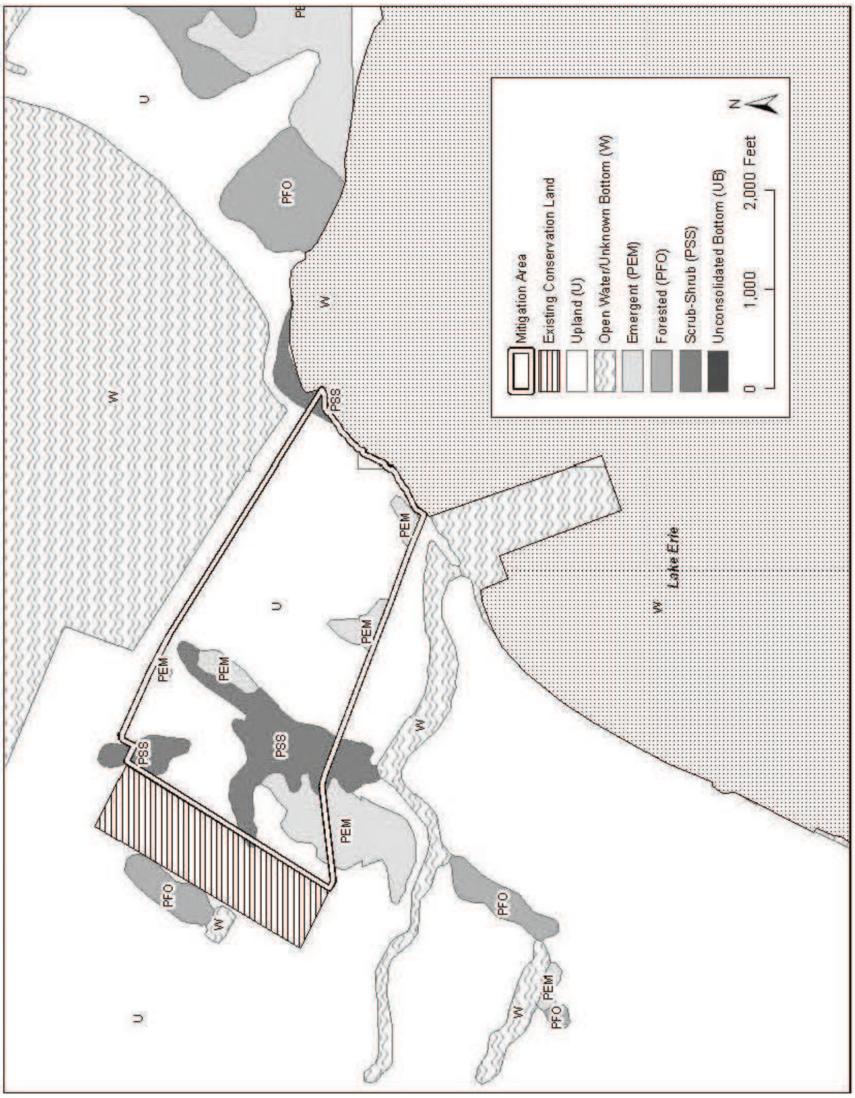
Figure 20. Mitigation Area Federal Mapped Wetlands



Source: Reference 36

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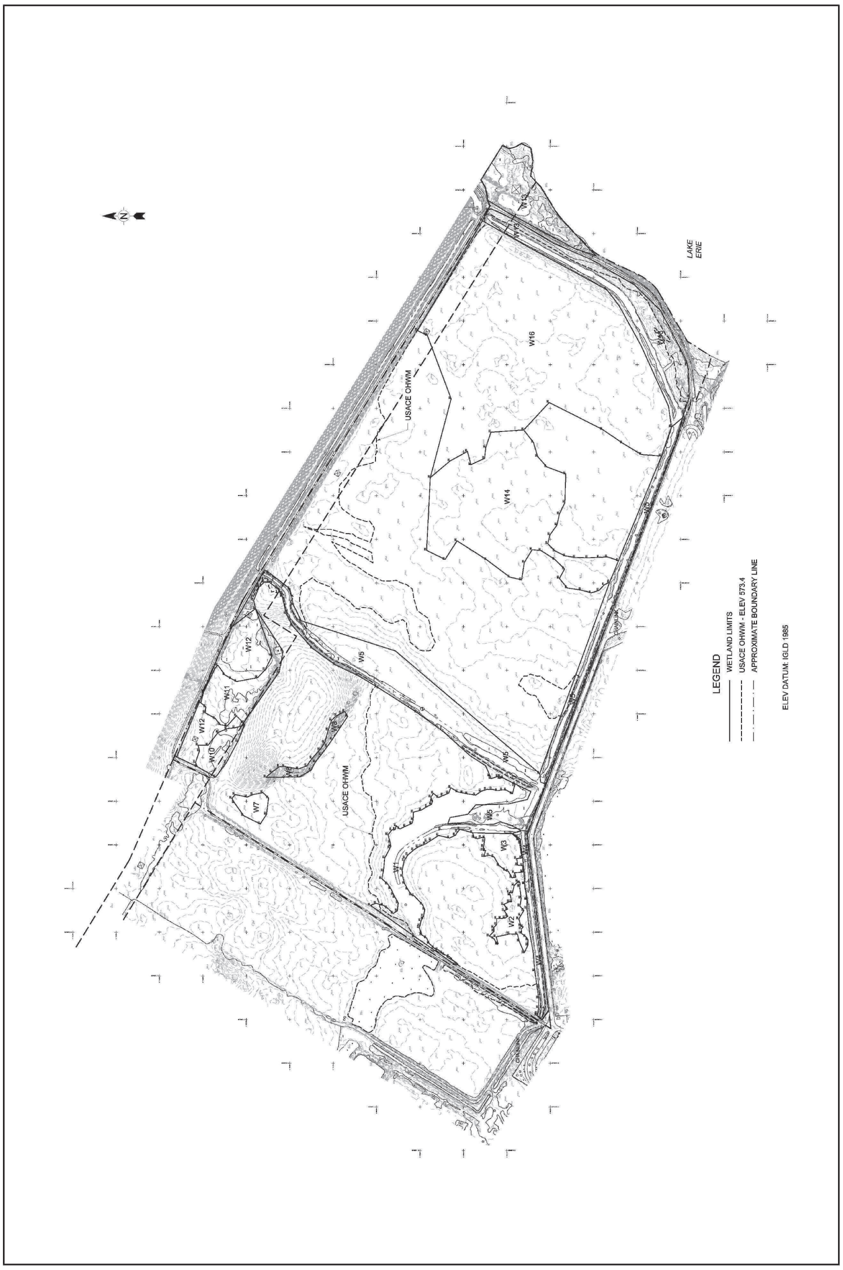

Figure 21. Mitigation Area Delineated Wetlands

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Figure 22. Mitigation Area Planting Plan

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Figure 23. Conservation Easement

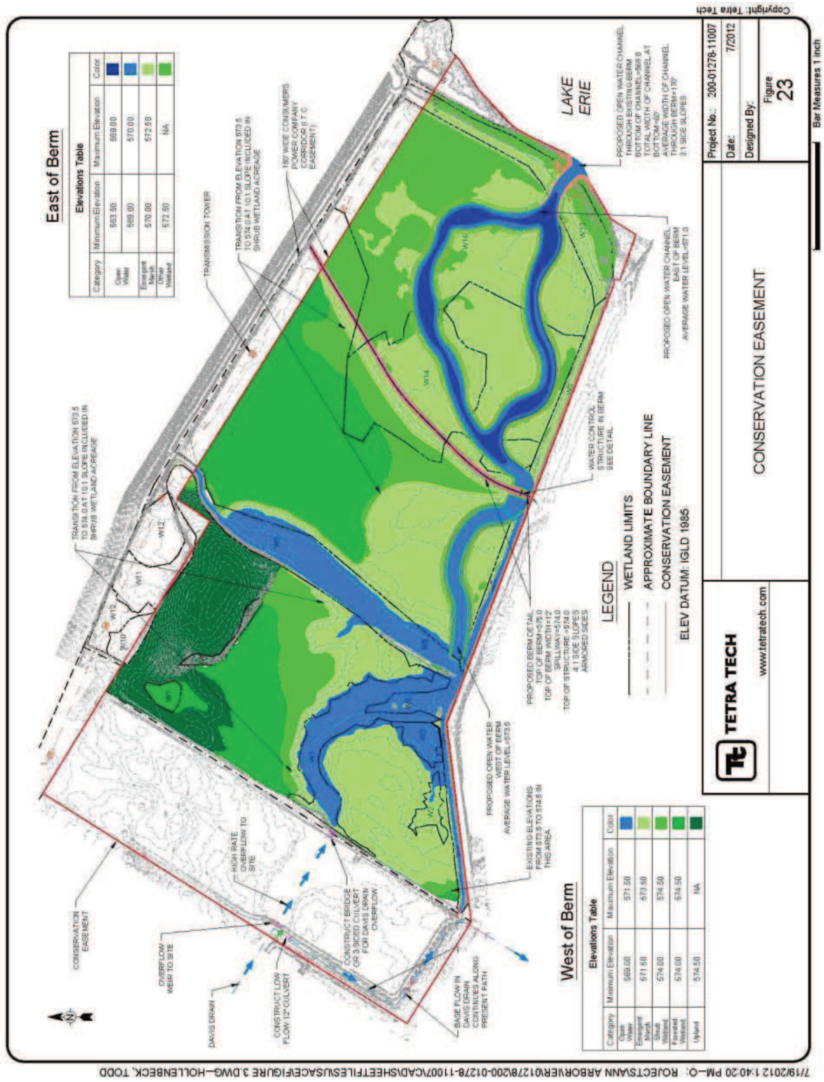

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Figure 24. Monitoring Locations

74

Reference

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Appendix L

Carbon Dioxide Footprint Estimates for a 1000-MW(e) Light Water Reactor (LWR)

Appendix L

Carbon Dioxide Footprint Estimates for a 1000-MW(e) Light Water Reactor (LWR)

The U.S. Nuclear Regulatory Commission (NRC) review team has estimated the carbon dioxide (CO_2) footprint of various activities associated with nuclear power plants, including building, operating, and decommissioning. The estimates include direct emissions from the nuclear facility and indirect emissions from workforce transportation and the uranium fuel cycle.

Construction equipment estimates listed in Table L-1 are based on hours of equipment use estimated for a single nuclear power plant at a site requiring a moderate amount of terrain modification. A reasonable set of emissions factors used to convert the hours of equipment use to CO_2 emissions is based on carbon monoxide (CO) emissions (UniStar 2007) scaled to CO_2 using a scaling factor of 165 tons of CO_2 per ton of CO. This scaling factor is based on emissions factors in Table 3.3-1 of AP-42 (EPA 1995). Equipment emissions estimated for decommissioning are one-half of those for construction.

Table L-1. Construction Equipment CO_2 Emissions (metric tons equivalent)

Equipment	Construction Total[a]	Decommissioning Total[b]
Earthwork and dewatering	1.1×10^4	5.4×10^3
Batch plant operations	3.3×10^3	1.6×10^3
Concrete	4.0×10^3	2.0×10^3
Lifting and rigging	5.4×10^3	2.7×10^3
Shop fabrication	9.2×10^2	4.6×10^2
Warehouse operations	1.4×10^3	6.8×10^2
Equipment maintenance	9.6×10^3	4.8×10^3
Total[c]	$\mathbf{3.5 \times 10^4}$	$\mathbf{1.8 \times 10^4}$

(a) Based on hours of equipment usage over 7-year period.
(b) Based on equipment usage over 10-year period.
(c) Total not equal to the sum due to rounding.

Workforce estimates are typical workforce numbers for new plant construction and operation based on estimates in various combined operating license applications; decommissioning workforce emissions estimates are based on decommissioning workforce estimates in NUREG-0586 S1, *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1 Regarding the Decommissioning of Nuclear Power Reactors* (NRC 2002). A typical construction workforce averages about 2500 for a 7-year period with a peak workforce of about 4000. A typical operations workforce for the 40-year life of the plant is assumed to be about 400, and the decommissioning workforce during a 10-year decontamination and dismantling period is assumed to be 200 to 400. In all cases, the daily commute is assumed to involve a 100-mi roundtrip with 2 individuals per vehicle. Considering shifts, holidays, and vacations, 1250 roundtrips per day are assumed each day of the year during construction; 200 roundtrips per day are assumed each day during operations; and 150 roundtrips per day are assumed 250 days per year for the decontamination and dismantling portion of decommissioning. If the SAFSTOR decommissioning option is included in decommissioning, 20 roundtrips each day of the year are assumed for the caretaker workforce.

Table L-2 lists the review team's estimates of the CO_2-equivalent emissions associated with workforce transport. The table lists the assumptions used to estimate total miles traveled by each workforce and the factors used to convert total miles to metric tons CO_2-equivalent. The CO_2-equivalent accounts for other greenhouse gases (GHGs), such as methane and nitrous oxide, which are emitted by internal combustion engines. The workers are assumed to travel in gasoline-powered passenger vehicles (cars, trucks, vans, and sport utility vehicles) that get an average of 19.7 mi per gallon of gas (FHWA 2006). Conversion from gallons of gasoline burned to CO_2-equivalent is based on U.S. Environmental Protection Agency (EPA) emissions factors (EPA 2007a, b).

Table L-2. Workforce CO_2 Footprint Estimates

	Construction Workforce	**Operational Workforce**	**Decommissioning Workforce**	**SAFSTOR Workforce**
Roundtrips per day	1250	200	150	20
Miles per roundtrip	100	100	100	100
Days per year	365	365	250	365
Years	7	40	10	40
Miles traveled	3.2×10^8	2.9×10^8	3.8×10^7	2.92×10^7
Miles per gallon[(a)]	19.7	19.7	19.7	19.7
Gallons fuel burned	1.6×10^7	1.5×10^7	1.9×10^6	1.58×10^6
Metric tons CO_2 per gallon[(b)]	8.81×10^{-3}	8.81×10^{-3}	8.81×10^{-3}	8.81×10^{-3}
Metric tons CO_2	1.4×10^5	1.3×10^5	1.7×10^4	1.3×10^4
CO_2-equivalent factor[(c)]	0.971	0.971	0.971	0.971
Metric tons CO_2-equivalent	1.5×10^5	1.3×10^5	1.7×10^4	1.3×10^4

(a) FHWA (2006).
(b) EPA (2007b).
(c) EPA (2007a).

Published estimates of uranium fuel cycle CO_2 emissions required to support a nuclear power plant range from about 1 percent to about 5 percent of the CO_2 emissions from a comparably sized coal-fired plant (Sovacool 2008). A coal-fired power plant emits about 1 metric ton (MT) of CO_2 for each megawatt hour generated (Miller and Van Atten 2004). Therefore, for consistency with Table S-3 of Title 10 of the Code of Federal Regulations (10 CFR 51.51), the NRC staff estimated the uranium fuel cycle CO_2 emissions as 0.05 MT of CO_2 per MWh generated. Finally, the review team estimated the CO_2 emissions directly related to plant operations from the typical usage of various diesel generators onsite using EPA emissions factors (EPA 1995). The review team assumed an average of 600 hr of emergency diesel generator operation per year (total for four generators) and 200 hr of station blackout diesel generator operation per year (total for two generators).

Given the various sources of CO_2 emissions discussed above, the review team estimates the total life CO_2 footprint for a reference 1000-MW(e) nuclear power plant with an 80 percent capacity factor to be about 18 million MT. The components of the footprint are summarized in Table L-3. The uranium fuel cycle component of the footprint dominates all other components. It is directly related to power generated. As a result, it is reasonable to use reactor power to scale the footprint to larger reactors.

Table L-3. 1000-MW(e) LWR Lifetime Carbon Dioxide Footprint

Source	Activity Duration (years)	Total Emissions (metric tons)
Construction equipment	7	3.5×10^4
Construction workforce	7	1.5×10^5
Plant operations	40	1.9×10^5
Operations workforce	40	1.3×10^5
Uranium fuel cycle	40	1.7×10^7
Decommissioning equipment	10	1.8×10^4
Decommissioning workforce	10	1.7×10^4
SAFSTOR workforce	40	1.3×10^4
Total		**1.8×10^7**

The review team considers the footprint estimated in Table L-3 to be appropriately conservative. The CO_2 emissions estimates for the dominant component (uranium fuel cycle) are based on 30-year-old enrichment technology, assuming that the energy required for enrichment is provided by coal-fired generation. Different assumptions related to the source of energy used for enrichment or the enrichment technology that would be just as reasonable could lead to a significantly reduced footprint.

Emissions estimates presented in the body of this environmental impact statement (EIS) have been scaled to values that are appropriate for the proposed project. The uranium fuel cycle emissions have been scaled by reactor power using the scaling factor determined in Chapter 6. Plant operations emissions have been adjusted to represent the number of large CO_2 emissions sources (diesel generators, boilers, etc.) associated with the project. The workforce emissions estimates have been scaled to account for differences in workforce numbers and commuting distances. Finally, equipment emissions estimates have been scaled by estimated equipment usage. As can be seen in Table L-3, only the scaling of the uranium fuel cycle emissions estimates makes a significant difference in the total carbon footprint of the project.

Sovacool (2008) also calculated GHG emission factors during the life cycle of nuclear power plants based on the statistical analysis from 19 qualified studies examined. Estimated GHG emission factors ranged from 1.4 g CO_2-equivalent per kWh to 288 g CO_2-equivalent per kWh, with a mean value of 66 g CO_2-equivalent per kWh (equivalent to 0.066 MT of CO_2-equivalent per MWh). The emission factor of 0.05 MT of CO_2 per MWh used in this analysis is about three-fourths the mean emission factor of 0.066 MT of CO_2-equivalent per MWh but is considered comparable, considering the wide range of emission factors (0.0014 to 0.288) estimated in that study.

L.1 References

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

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Appendix M

Environmental Impacts from Building and Operating Transmission Lines Proposed to Serve Fermi 3

Appendix M

Environmental Impacts from Building and Operating Transmission Lines Proposed to Serve Fermi 3

The final environmental impact statement (EIS) presents integrated evaluations of potential environmental impacts from the proposed Fermi 3 facilities, organized by environmental resource. The review team's evaluation of potential environmental impacts from building and operating electrical transmission lines that may be built to serve the proposed Fermi 3 facility is found in those places in the final EIS text that address environmental resources that would be affected by the proposed transmission lines. Offsite transmission lines are not part of the Fermi 3 COL application, and any such lines would be built by ITC*Transmission* rather than Detroit Edison. Under NRC regulations in 10 CFR 50.10(a)(2)(vii), building of transmission lines is a preconstruction activity not subject to the Nuclear Regulatory Commission's regulatory authority. However, many preconstruction activities are within the regulatory authority of local, State, or other Federal agencies, and certain preconstruction activities require a permit from the U.S. Army Corps of Engineers.

This appendix provides a brief roadmap to where in the final EIS environmental impacts from transmission lines are addressed. In the final EIS, the environmental impacts of transmission lines are primarily described in terms of the following resource areas: (1) land use, (2) terrestrial ecology, (3) aquatic ecology, (4) historical and cultural resources, and (5) nonradiological health. The proposed route for the new transmission lines is described in Section 3.2.2.3 and shown in Figure 3-8. Table M-1 lists the sections/subsections of Chapter 2 (Affected Environment), Chapter 4 (Construction Impacts at the Proposed Site), Chapter 5 (Operational Impacts at the Proposed Site), and Chapter 7 (Cumulative Impacts) that contain pertinent information related to the review team's evaluation of potential impacts from the transmission lines.

The review team considered transmission line impacts for all environmental resource areas addressed in Chapters 2, 3, 4, 5, and 7, not just those resources highlighted in Table M-1. However, the discussion for other resources is limited in the final EIS text because construction and operation of transmission lines have limited relevance to impacts on these resource areas.

Table M-1. Sections of the EIS in Which Potential Impacts from Transmission Lines Are Discussed

Resource Area	Affected Environment	Construction and Preconstruction Impacts	Operations Impacts	Cumulative Impacts
Land Use	2.2.2	4.1.2	5.1.2	7.1[(a)]
Terrestrial Ecology	2.4.1.2	4.3.1.2	5.3.1.2	7.3.1[(a)]
Aquatic Ecology	2.4.2.2	4.3.1.2	5.3.2.2	7.3.2[(a)]
Historic and Cultural Resources	2.7.3	4.6.2	5.6[(a)]	7.5[(a)]
Nonradiological Health	2.10.4	4.8.1.2[(a)]	5.8.3, 5.8.4	7.7[(a)]
Summaries/Conclusions	Figure 2-5, Table 2-9, Table 2-63	Table 4-22, Table 4-23	Table 5-35, Table 5-36	Table 7-3[(b)]

(a) Only certain parts of the indicated sections are specifically focused on transmission lines.
(b) Although Table 7-3 does not specifically mention transmission lines, the conclusions presented in the table account for transmission line impacts.

In addition, the review team considered the potential impacts of building and operating transmission lines associated with the use of each of the four alternative plant sites evaluated in Sections 9.3.3, 9.3.4, 9.3.5, and 9.3.6. The final conclusions and recommendations, summarized in Chapter 10 and in Tables 10-1, 10-2, and 10-4, regarding environmental impacts for the overall Fermi 3 project also account for potential transmission line impacts.

NRC FORM 335 (12-2010) NRCMD 3.7 **U.S. NUCLEAR REGULATORY COMMISSION** **BIBLIOGRAPHIC DATA SHEET** *(See instructions on the reverse)*	1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.) NUREG 2105, Vol. 4
2. TITLE AND SUBTITLE Environmental Impact Statement for Combined License (COL) for Enrico Fermi Unit 3 Final Report	3. DATE REPORT PUBLISHED MONTH: January YEAR: 2013 4. FIN OR GRANT NUMBER
5. AUTHOR(S) See Appendix A	6. TYPE OF REPORT Technical 7. PERIOD COVERED (Inclusive Dates)

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Division of New Reactor Licensing
Office of New Reactors
U. S. Nuclear Regulatory Commission
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9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above", if contractor, provide NRC Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address.)

Same as above

10. SUPPLEMENTARY NOTES

Docket No. 52-033

11. ABSTRACT (200 words or less)

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

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

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)	
Enrico Fermi Unit 3 National Environmental Policy Act, NEPA Final Environmental Impact Statement, FEIS Combined License, COL, COLA Environmental Review New Reactors	13. AVAILABILITY STATEMENT: unlimited 14. SECURITY CLASSIFICATION *(This Page)* unclassified *(This Report)* unclassified 15. NUMBER OF PAGES 16. PRICE

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

January 2013